Section IV – Cumulative Impact Assessment

PART OF PLAN

SECTION IV

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, or future projects?

Yes X No

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

The text and pages that follow provide a summary of past, present and future projects. It shows acres logged by silvicultural system and yarding method, percent of the watershed covered and describes the location within the watershed. This THP lies in the Big Pepperwood Creek Watershed (6,532 acres, 1113.850201), the Mouth of the Gualala River Watershed (5,305 acres, 1113.850202), the Little Creek Planning Watershed (5,869 acres, 1113.830004) and the Annapolis Planning Watershed (7,580 acres, 1113.840303). Collectively these four watersheds totaling 25,283 acres constitute the project's Watershed Assessment Area (WAA). Total flood prone area (FPA), also referred to as the floodplain, in the project WAA is 1,249 acres or 4.9% of the WAA. Within the FPA the THP proposes to harvest 278 acres or 22% of the FPA in the WAA.

1. Past and Present Projects-

In the past 12 years (2007 to 2018) timber operations have occurred on or were planned for the specified acreage within each of the following CAL WATER planning watersheds within the Watershed Assessment Area (WAA):
Big Pepperwood Creek: 1065 of 6532 acres, or 16.4% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of Big Pepperwood Creek: 211 of 530 acres or 39.8% of the FPA.
Mouth of the Gualala River: 1139 of 5305 acres, or 21.5% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of the Mouth of the Gualala River: 143 of 431 acres or 33.2% of the FPA.
Little Creek: 616 of 5869 acres, or 10.5% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of Little Creek Watershed: 44 of 121 acres or 36.4% of the FPA.
Annapolis: 1,543 of 7580 acres, or 20.4% of the watershed is under plan or has been harvested. Acres operated on or planned in the floodplain of Annapolis Watershed: 2 of 168 acres or 1.2% of the FPA.

Harvesting Within the Flood Prone Area (FPA)

Since the inception of the Forest Practice Act in 1973 most all of Dogwood flood prone area stands have been harvested at least 2 to 3 times, and for much of the plan's flood prone area this will be the third, if not fourth, harvest entry since 1975. This past harvest activity under the selection management system indicates that these stand areas can maintain a harvest reentry cycle of roughly 15 to 20 years. Timber harvesting in the late 1990's to 2000 became problematic for any timberland owner who had flood prone timber areas within their ownership. For various reasons State and Federal agencies were becoming increasingly concerned over perceived potential impacts to watercourses from operating under the Forest Practice Rules at the time; i.e., the regulatory agencies had concerns that the then-existing rules were not sufficiently protective of water resources with a primary focus on anadromous salmonid habitat, health and abundance. Hence, there was a 12-plus-year hiatus of harvesting the FPAs on the ownership

RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

until a more restrictive Forest Practice Rule proposal could be developed and approved by the Board of Forestry that had buy-in from all the regulatory agencies; i.e., the Anadromous Salmonid Protection (ASP) Rule Package of 2009.

The total timbered flood prone acreage within the GRT ownership encompasses approximately 2,000 acres of Site I timberlands. These floodplain areas have not been harvested since 1999/2000 as the previous owners had determined they would wait until implementation of the ASP Rules in 2010. Harvesting on the floodplains did not occur for 12 years or more until the approval and harvest of the Kestrel THP 1-11-087 SON (112 acres selection) in 2014-15 and the pending Dogwood THP 1-15-042 SON (290 acres selection & 52 acres no-cut) which was partially harvested in 2016 (these latter two plans being predominately located along the South Fork Gualala River); and the Plum THP 1-16-094 MEN (154 acres selection) located along the North Fork Gualala River where harvesting was initiated in 2017 and is to be completed in 2019. Because of the past decade and a half delay awaiting ASP Rule development, much of the floodplain areas within the GRT ownership are now at or are well past their normal selection harvest reentry schedule of 15-20 years. Thus, harvesting on GRT's FPAs is expected to continue into the next 5 to 10-year planning horizon.

Due to the highly restrictive measures required for harvesting practices by the ASP flood prone area (FPA) rules, the cumulative impacts of these harvests are expected to be insignificant. Sediment delivered from upstream watercourses during flood events that inundates the FPA will either continue to be passed downstream or be trapped by vegetation and deposited as flood water movement slows over the inundated area, allowing both coarse and fine sediments to settle out to be deposited on the floodplain surface. The FPA is a net receiver of sediment (acting as a deposition zone) due to this process during flood/inundation events. The amount of sediment deposition during flood/inundation events far exceeds any potential movement of sediment that could be generated from the harvest area as a result of site disturbance from harvest operations. Erosion and movement of sediment generated from the FPA is not anticipated under the restrictions of the ASP Rules and other limitations of the THP. The goals of the ASP Rules are to maintain high canopy levels for stream shading and adjacent streamside thermal temperature control, retain ground vegetative cover and avoid disturbance of critical flood prone area habitat including avoiding wet areas such as abandoned meanders, oxbow lakes and other features that could provide off channel habitat for fish during flood flows. In effect, harvest operations are severely constrained to reduce potential impacts to anadromous salmonids and the fluvial functions of the water flows on the FPA. Proper implementation of the ASP restrictions makes potential adverse effects of timber operations within floodplains in the WAA very unlikely to occur and cumulative impacts to beneficial uses of water are not expected.

Past and present project summary of the watershed harvested, by silviculture and by owner, is included in the THP history tables and maps that follow this section; pages 123 to 141.16.

2. *Future Projects-*

Dogwood THP and Future Projects

The harvest planned on the flood plain of the Gualala River under this THP is part of the normal timber management cycle scheduled for the property. The flood plain was originally clearcut at the turn of the 20th century and the old growth tree stumps re-sprouted and grew back into a dense second growth redwood stand. The area has been selectively harvested on a periodic basis since the 1950's. The flood plain has not been significantly impacted by recent harvests over the past five decades since the implementation of the Z'Berg Nejedly Forest Practice Act of 1973 due to required streamside protection buffers. This harvest operation was originally intended to occur on this

area in 1999 but was held off until the Anadromous Salmonid Protection (ASP) Rules were created and added to the Forest Practice Rules in 2009.

ASP rule implementation results in very light and limited harvests in the flood plains of Class I watercourses such as the Gualala River and the main Class I watercourse tributaries where the plan is located. The ASP rules require that no timber harvesting occur within 30 feet of the edge of the river within the riparian Core Zone. The rules also require leaving 13 of the largest trees per acre and 80% overstory canopy within the area from 30 feet out to 150 feet within the Inner Zone (Inner Zone A). Beyond this Inner Zone A the 13 largest trees per acre and at least 50% overstory canopy must be left in the next zone (Inner Zone B), which extends to the outer edge of the flood prone area at the toe of the slope. There are also strict limitations on road building, skid trail use, slash piling, and a requirement for retention of the larger trees in the flood plain stand with the goal of reducing stand density to 30 to 50 trees per acre of large overstory redwoods. During harvesting, identified wet areas must be avoided and soil impacts must be negligible so not to affect or alter the hydraulics of flood waters as it passes through the floodplain. The ASP Rules are designed to minimize impacts to insignificance. As a result, the harvest is so light that it can be imperceptible within a few years after harvesting. The shady flood plains rapidly revegetate with forbs, ferns and shrubs, quickly hiding and stabilizing any soil disturbances associated with harvesting.

The goal of the ASP Rules in the flood plains is to grow a forest that improves and restores anadromous salmonid habitat with retention of the largest trees that have the most structure and will provide a high, dense, shade canopy. Eventually the older big trees will topple and fall into the watercourse to provide large woody debris and increase stream habitat complexity, including developing deeper pools, better mixing of spawning gravels and increasing cover from predators for the benefit of anadromous salmonid spawning and rearing. Future entries on these floodplains are expected to occur every 15 to 20 years with light selection harvests that have the goal of restoring the stands to a condition more favorable to providing improved anadromous salmonid habitat.

The restoration type of commercial forestry being practiced on the flood plains by GRT is now becoming more common on redwood lands throughout the state. Similar forest restoration commercial harvesting practices are being used by a number of non-governmental organizations (NGOs) including the Sempervirens Fund and Peninsula Open Space Trust on the San Vincente Redwoods property in Santa Cruz County, the Redwood Forest Foundation on the Usal Forest in Mendocino County, and on a number of private tracts the Save the Redwoods League owns and manages as well as in a partnership with the National Park Service at Redwood National Park (in Humboldt County) called Redwoods Rising where younger stands are managed to decrease stand density and increase heterogeneity of forest structure. The Sempervirens Fund description of the Living Landscape plan for the San Vincente Redwoods states: *Our conservation plan reserves two-thirds of the property for restoration and recovery, so that young redwood trees – akin to a 4-year-old human — can live 2,000 years or more and help re-create a vibrant forest. The plan also identifies limited areas where selective timber harvesting may continue – only with great care, under strict sustainability standards – to generate money for ongoing management and restoration of the property.* https://sempervirens.org/protect-redwoods/success-stories/

A note regarding GRT's property ownership. In July of 2015 Gualala Redwoods Inc. (GRI) changed ownership, and Gualala Redwood Timber LLC (GRT) was formed. It is GRT's intent to manage the property in a manner similar to GRI's practices. However, GRT has not had time to fully review all aspects of GRI's future management program, and GRT may make changes in the future. References to GRI in the planning history are for informational purposes and for evaluation of past beneficial practices and impacts.

Future harvest acres and projects over the next 5-year planning horizon, excluding the Dogwood THP, that are planned within the four planning watersheds that make up the Watershed Assessment Area (WAA) on GRT are as follows (see "Dogwood Cumulative Impacts Assessment Area Map" for each of the four watersheds in the WAA):

Big Pepperwood Creek Watershed: 8 acres or 0.2% of the watershed area.
Mouth of the Gualala River Watershed: 83 acres or 1.6% of the watershed area.
Little Creek Watershed: 0 acres or 0% of the watershed area.
Annapolis Watershed: 10 acres or 0.1% of the watershed area.

Other non-harvest forest management activities can be expected to occur on GRT's ownership in the future. Those projects will or may include:

- **Gravel Mining**. The application process for renewal of the Bed Rock/GRT gravel mining permit on the mainstem South Fork Gualala River and the Wheatfield Fork will be initiated within the year to allow continued mining over the next 10-year permitting period. Averaged annual gravel extractions under the present 10-year plan within the WAA has been 9,745 cubic yards per year.

- **Road Rehabilitation**. Watershed restoration work and road storm proofing is an ongoing activity. In the last 15 years nearly 60% of the ownership's road system has been improved to reduce potential sediment delivery to the streams within the Gualala River Watershed. This has been accomplished through stream crossing replacements and improvements, removal of legacy earth fill crossings and undersized culverts, storm proofing roads by reconstruction to an outsloped running surface, and hydrologically disconnecting the road surface from nearby watercourses. In all, approximately 295,000 cubic yards of sediment have been prevented from being delivered to the tributaries and the main watercourses of the Gualala River and has been retained on the hillslopes through stabilization work. Within the next 10 years GRT will continue to address treatment of the remaining 40% of its road system through grant funding or as on-site project mitigation through the company's timber harvest management program.

- **Fish Habitat Improvement**. GRT plans to continue its grant funded work with the Gualala River Watershed Council (GRWC), the California Department of Fish and Wildlife, and NOAA Fisheries to improve the on-property fish habitat with additional instream large woody debris placement. To date it is estimated that more than 111 log truck loads of large wood has been placed in the fish bearing streams on GRT property within the Gualala River Watershed. This work was primarily accomplished through State grant funding and company cost share, and to a limited extent as off-site fish habitat mitigation related to the gravel extraction and mining permit. In 2018 eleven (11) large trees (nearly 14 MBF) were placed in the North Fork of the Gualala River by use of the Option 'v' process in the ASP Rules that allows for site-specific restoration work within the watercourse channel. GRT expects it will continue this work into the future in association with GRWC, California Department of Fish and Wildlife, the North Coast Regional Water Quality Control Board, and NOAA Fisheries.

All this past and expected future restoration and stabilization work as addressed above has been evaluated through monitoring efforts by the GRWC and found to be contributing significant improvements to the Gualala River Watershed. The regulatory agencies support continuing this work into the future as the work is resulting in measurable fish and water quality improvements to the Gualala River Watershed, the WAA and the THP area.

Timber Harvest Scheduling

Harvesting, for practical reasons due to historical past harvest entries, access availability, equipment and manpower

mobilization and staging, is often concentrated in one watershed for a period of time and reduced in another watershed. This varying harvest intensity must be addressed in a cumulative effects analysis. In the assessment of potential cumulative effects that may result from harvesting the percent watershed acres harvested is a poor indicator by itself because if all silviculture were even-aged then one would expect on a sixty-year rotation to only harvest 16.7% of a watershed within a ten-year period due to adjacent harvest unit constraints imposed by the Forest Practice Rules. However, if the landowner were to fully engage in uneven-aged silviculture over the entire watershed one could expect to selectively harvest 50 to 100% of the acres over a ten to fifteen-year period. Since there is a mixed employment of silvicultural prescriptions within a watershed the areas harvested in a ten to fifteen-year period become more complicated to decipher. This also does not take into account the fact that these are not fully regulated stands but have been harvested in bursts of activity in the past which has resulted in the majority of these stands becoming harvestable at approximately the same time in many cases. This pattern results in decades with higher harvest rates over an area followed by decades in which little to no harvesting occurs, so potential impacts can be periodic in nature.

For past and future plans within the Big Pepperwood Watershed at least 16.3% (1065 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years). Also, at least 59% of the acreage has been or will be harvested using selection silviculture or is within no-cut areas.

For past and future plans within the Mouth of the Gualala River Watershed at least 23.0% (1,223 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years). At least 59% of those acres have been or will be harvested using selection silviculture.

For past and future plans within the Little Creek Watershed at least 10.5% (616 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years), and at least 75% of those acres have been or will be harvested using selection silviculture.

For past and future plans within the Annapolis Watershed at least 20.5% (1,553 acres) of the watershed has been or will be harvested over the assessment period of the past 10 years and planning horizon of the next 5 years. This is less than what would occur at a sixty-year rotation rate if all silviculture was even-age (25% over fifteen years). At least 24% of those acres have been or will be harvested using selection silviculture or is within a no-cut area, and 38% is or will be harvested under the variable retention method.

At the present rate of harvest and because of harvest unit adjacency rules it is likely that many of the stands on the landowner's property will not be harvested until they are many decades older than the rules require for minimum stand age using even-aged management. Much of the ownership will continue to be managed using unevenaged selection silviculture, and older stands of mature timber will continue to exist because of a number of restrictions and considerations including watercourse protection rules, geological hazard set-asides, northern spotted owl habitat protection, as well as other plant and animal retention areas being left across the ownership.

Background and Conclusion Statement

The Timberland Productivity Act of 1982 restricts the use of lands zoned Timberland Production Zone (TPZ) to the growing and harvesting of timber and compatible uses, and establishes a presumption that timber harvesting is expected to and will occur on such lands. The RPF and the Director (Cal Fire) are to include the above legal

consideration regarding project feasibility while giving consideration to measures proposed to reduce or avoid significant adverse impacts of THPs on lands zoned TPZ. On TPZ lands, per 14 CCR Section 898 of the Forest Practice Rules (FPR), the harvesting per se of trees shall not be presumed to have a significant adverse impact on the environment. Per the same rule section, cumulative impacts are to be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness. After considering the rules of the Board and those mitigation measures proposed in the plan, the RPF is to indicate whether the proposed timber operation would have any significant adverse impact on the environment. With implementation of the FPRs and use of the multi-agency review process, it is the intent to mitigate the environmental impacts of a THP to a less-than-significant level; in most all cases this is achievable. Once done on an individual THP (project) basis, an evaluation needs to be conducted to determine whether multiple projects across the landscape would constitute or combine to create a cumulative adverse impact on the environment.

It is important to recognize that cumulative environmental effects can be either adverse or beneficial, and respectively significant or insignificant. Guidance under Addendum No. 2 of the FPRs is intended to meet the requirements of CEQA Guidelines CA Code of Regulations section 15130. Consistent with section 15130(a)(2), this project, when considered with other past, present and future projects will not have incremental cumulative impacts which could be considered significant.

There are several strategies to deal with potentially negative environmental impacts in the implementation of forestry projects:

Avoidance

- Avoid the impact altogether by not taking action or part of the action.

Minimization

- Minimize impacts by limiting the degree or magnitude of the action and its implementation.

Mitigation

- Repair, rehabilitate, or restore degraded environmental resources.

After it is determined which of these strategies to employ in any given situation, there are a number of practices to achieve avoidance, minimization, or mitigation. They are:

Best Management Practices

- Employ a predetermined suite of management practices that are known to avoid or minimize adverse impacts.

Site-Specific Practices

- Employ individual or a combination of practices, or techniques, that are tailored to avoid, minimize, or mitigate adverse impacts that are specific to the project and/or its implementation.

On-Site Mitigation

- Mitigation that is implemented within the footprint of the proposed project or is very closely associated to the project (e.g., correctional road points along an appurtenant road).

Off-Site Mitigation

- A mitigation that is implemented outside the project area. The mitigation measure can be at a far-removed location but is expected to address any unmitigated on-site impacts as an off-set to those remaining at the proposed project location (ex., mitigation banking).

The methods and practices used during the design and implementation of the present project to address cumulative effects include all the above, and selection of the final suite of practices varies by the resource requiring protection. Selection of final practices employed is an iterative process with feedback and adaptation as the project is developed and reviewed. Drawing upon the final practices to be implemented is not a linear process, but a circular one that may have to be done and redone several times during the course of project design. Often the end goal of the project proponent is not only to achieve the project objective(s) while preventing cumulative environmental effects, but to achieve a positive environmental outcome where feasible.

The cumulative impacts analysis is both a qualitative and quantitative process. It is based on the amount of information that is available at the time of project application and is built upon a level of perceived risk. Every attempt is made to compare the current condition with that of the desired outcome on the affected resource. From this comparison, one can gain an understanding as to whether a cumulative impact from past, present, and future projects will occur, and whether it can be expected to improve or degrade the present site and/or assessment area condition. The cumulative impacts assessment provided here in Section IV, with its developed suite of mitigation measures that are carried over to the operational portion of the plan (i.e., Section II), is our best effort to meet the intent of the Forest Practices Act and its rules, and to provide the most scientifically credible impacts analysis of forest projects that are implemented on lands zoned for timber production in the State of California.

Analysis of Recent THPs on GRT lands within the WAA:

German South THP (1-16-047 SON)

This was a recent THP within the WAA submitted while the Dogwood THP was in agency review. The German South THP was approved on November 3, 2016 and was harvested in 2017. As with all timber harvest plans conducted on GRT timberlands, the German South THP received a multi-agency review that included on-site inspection by staff from the North Coast Regional Water Quality Control Board, the Department of Fish and Wildlife, California Geological Survey, State Archaeologist, and Cal Fire's Forest Practice staff. The THP was found to be in compliance with the Forest Practice Act and the Forest Practice Rules, and like all previously approved harvest projects, was determined to be sufficiently mitigated by the State review team agencies so as not to have any measured adverse environmental impact on its own, or cumulatively when assessed in combination with other approved or ongoing projects within the various defined assessment areas, most specifically within the Mouth of the Gualala Planning Watershed.

The German South THP included in its cumulative impact assessment the Dogwood THP (THP 1-15-042 SON) that was approved roughly five months earlier by Cal Fire on July 1, 2016. The Dogwood plan was determined through on-site agency inspections to be sufficiently mitigated by requirements of the Forest Practice Rules and individually tailored mitigation measures so as not to create any measured adverse impact on the environment on its own, or in combination with other past, present, or future projects.

Past, Present, and 5-Year Foreseeable Future THP Assessment Periods 2005-2015 and 2007-2018

Two assessment time periods are being provided. The 2005-2015 period is what was known when the Dogwood (THP 1-15-042 SON) was first submitted and under agency review from May 14, 2015 to the plan's notice of

conformance on July 1, 2016. The 2005-2015 project table summary and maps include the omission of German South THP that was initiated while the Dogwood plan was in review. During 2015 all future planning was on hold because the Gualala Redwood Inc (GRI) property was listed for sale. The property was sold on July 1, 2015 to Gualala Redwood Timber LLC (GRT), and management and future planning resumed. From GRT's billing record the German South plan was first considered as a potential project and work was initiated in January of 2016.

More than two years have elapsed since initial approval of the Dogwood THP, as such it is incumbent on the project proponent to update the record as to what has transpired and is presently known in regard to past, present, and foreseeable future projects. The preceding text and attached 2007-2018 project table summary and maps that follow are provided as a current assessment that reflects changes that have occurred since original approval of the Dogwood THP on July 1, 2016.

Also, included with this assessment is a map showing the location of all GRT's planned (next 5 years) harvest projects within the Gualala River Watershed. Because all planned future projects are upstream of the Dogwood THP, each has the potential to create impacts additive to those of the Dogwood plan. Each of these projects will have to be evaluated in its own right and is expected to be sufficiently mitigated so as to have no adverse effect on the public trust resources. Any conclusions at this point as to what potential impacts these future projects may have would be speculative, but the information is being provided for full disclosure of GRT's planned activity within the Gualala watershed.

Maps and documents that follow are:

- Past, Present, and 5-Year Foreseeable Future Project Assessment, Period 2007-2018 (revised 11/26/18)
- Past, Present, and 5-Year Foreseeable Future Project Assessment, Period 2005-2015 (revised 08/18/17 to include the German South THP so as to represent it as a foreseeable future project in the assessment when the THP was first summitted on 05/04/15)
- Map – Dogwood THP Location Within the Gualala River Watershed
- Map – All GRT Future THP Projects Within the Gualala River Watershed
- Map – Dogwood Cumulative Impacts Assessment Area Map

DOGWOOD THP (1-15-042 SON)
Past, Present, and 5-Year Foreseeable Future
Project Assessment
Period 2007-2018

BIG PEPPERWOOD CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2007-2018					6532 acres
Past and Present Projects:					
Silviculture	**Acres**	**% of PWS**		**Silviculture Category**	
Clearcut	341.8	5.2%		evenaged	
Seed Tree Removal Step	75.5	1.2%		evenaged	
Shelterwood Removal	17.0	0.3%		evenaged	
Selection	631.1	9.7%		unevenaged	
Sub Total:	1065.4	16.4%			
Future Projects (next 5-years):					
Silviculture	**Acres**	**% of PWS**			
Selection	8.0	0.1%		unevenaged	
Sub Total:	8.0	0.1%			
	Acres	**% of PWS**			
Total:	1073.4	16.5%			
Last eleven years % of watershed unevenaged	**% of watershed evenaged**	**% of watershed special**	**% of watershed intermediate**	**totals**	
9.7%	**6.7%**	**0.0%**	**0.0%**	**16.4%**	

BIG PEPPERWOOD CREEK PLANNING WATERSHED THP HISTORY FROM 2007 - 2018 — **6,532 acres**

Past and Present Projects:

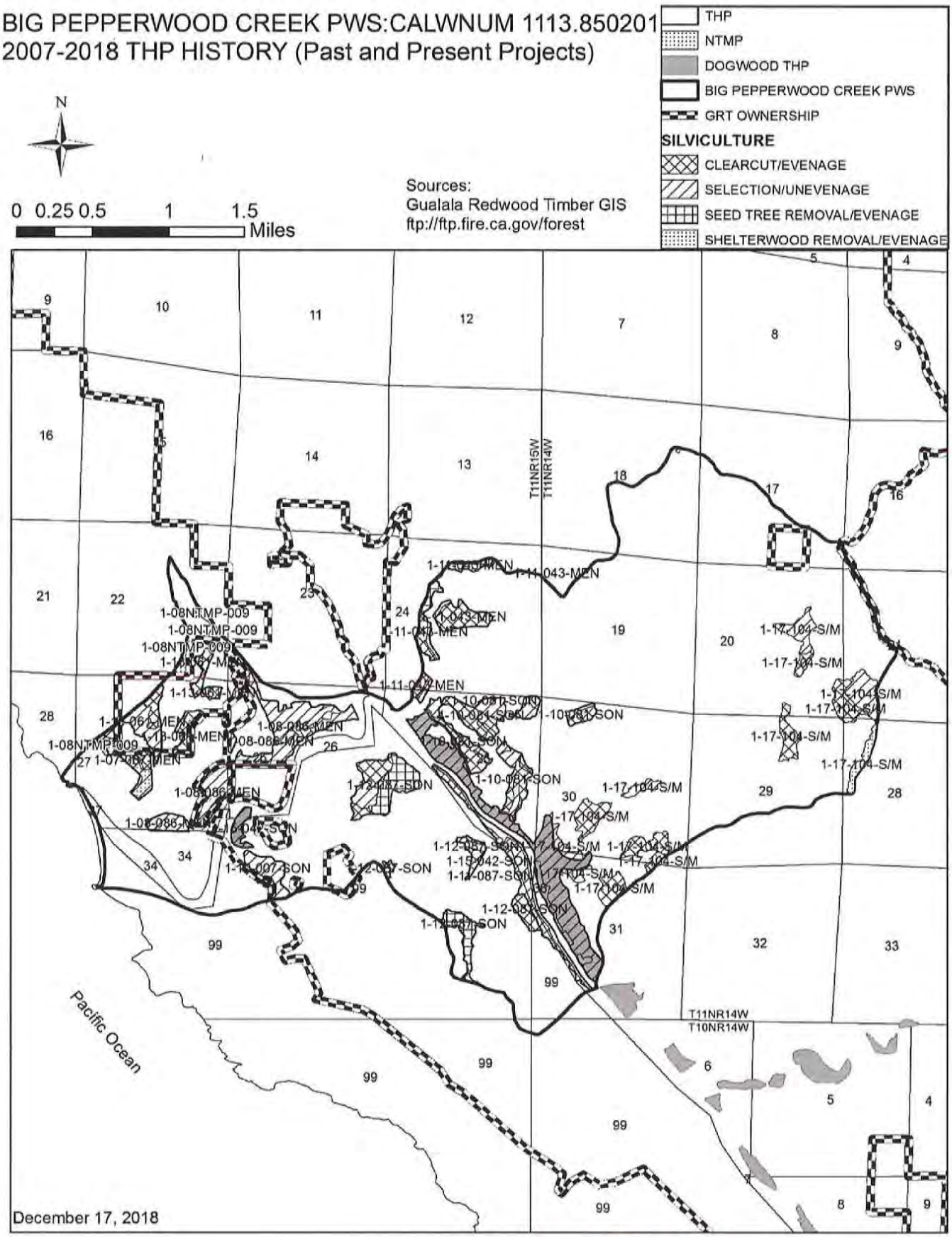
County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	of PWS	silviculture category
Mendocino	1-07-067-MEN	Clearcut	Tractor	Completed	Bower	1113.850201	10	0.2%	evenaged
Mendocino	1-07-067-MEN	Group Selection	Tractor	Completed	Bower	1113.850201	24	0.4%	unevenaged
Mendocino	1-07-067-MEN	Selection	Tractor	Completed	Bower	1113.850201	3	0.1%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor/Cable	Completed	GRI	1113.850201	10	0.2%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor	Completed	GRI	1113.850201	98	1.5%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor/Cable	Completed	GRI	1113.850201	25	0.4%	unevenaged
Mendocino	1-08-086-MEN	STA	Tractor	Completed	GRI	1113.850201	2	0.0%	special
Mendocino	1-08-086-MEN	STA	Tractor/Cable	Completed	GRI	1113.850201	13	0.2%	special
Mendocino	1-08NTMP-009	Group Selection	Tractor	Approved	Bower	1113.850201	49	0.7%	unevenaged
Sonoma	1-10-007-SON	Selection	Tractor	Completed	GRI	1113.850201	27	0.4%	unevenaged
Sonoma	1-10-081-SON	Clearcut	Cable	Completed	GRI	1113.850201	6	0.1%	evenaged
Sonoma	1-10-081-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850201	73	1.1%	evenaged
Sonoma	1-10-081-SON	Selection	Cable	Completed	GRI	1113.850201	2	0.0%	unevenaged
Sonoma	1-10-081-SON	Selection	Tractor	Completed	GRI	1113.850201	14	0.2%	unevenaged
Sonoma	1-10-081-SON	Selection	Tractor/Cable	Completed	GRI	1113.850201	33	0.5%	unevenaged
Mendocino	1-11-043-MEN	Clearcut	Tractor	Completed	GRI	1113.850201	10	0.2%	evenaged
Mendocino	1-11-043-MEN	Clearcut	Tractor/Cable	Completed	GRI	1113.850201	35	0.5%	evenaged
Mendocino	1-11-043-MEN	STRS	Tractor	Completed	GRI	1113.850201	17	0.3%	evenaged
Mendocino	1-11-043-MEN	Selection	Tractor	Completed	GRI	1113.850201	1	0.0%	unevenaged
Mendocino	1-11-043-MEN	Selection	Tractor/Cable	Completed	GRI	1113.850201	1	0.0%	unevenaged
Sonoma	1-11-087-SON	Selection	Tractor	Approved	GRI	1113.850201	42	0.6%	unevenaged
Sonoma	1-12-087-SON	Clearcut	Cable	Completed	GRI	1113.850201	21	0.3%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor	Completed	GRI	1113.850201	31	0.5%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850201	3	0.0%	evenaged
Sonoma	1-12-087-SON	STRS	Tractor	Completed	GRI	1113.850201	58	0.9%	evenaged
Sonoma	1-12-087-SON	Selection	Tractor	Completed	GRI	1113.850201	14	0.2%	unevenaged
Mendocino	1-13-061-MEN	Clearcut	Tractor/Cable	Approved	GRI	1113.850201	43	0.7%	evenaged
Mendocino	1-13-061-MEN	Selection	Tractor/Cable	Approved	GRI	1113.850201	29	0.4%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850201	151	2.3%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850201	12	0.2%	unevenaged
Son/Men	1-17-104-SON/MEN	Clearcut	Tractor	Approved	GRT	1113.850201	110	1.7%	evenaged
Son/Men	1-17-104-SON/MEN	Selection	Tractor	Approved	GRT	1113.850201	74	1.1%	unevenaged
Son/Men	1-17-104-SON/MEN	SRS	Tractor	Approved	GRT	1113.850201	17	0.3%	evenaged
# Plans	10				**Sub Total from 2007 to 2018:**		1057	16.2%	

Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	of PWS	
Sonoma	Rock THP	Selection	Tractor	In preparation	GRT	1113.850201	8	0.1%	unevenaged
# Plans	1				**Sub Total for next five years**		8	0.1%	
					Total:		1065	16.3%	

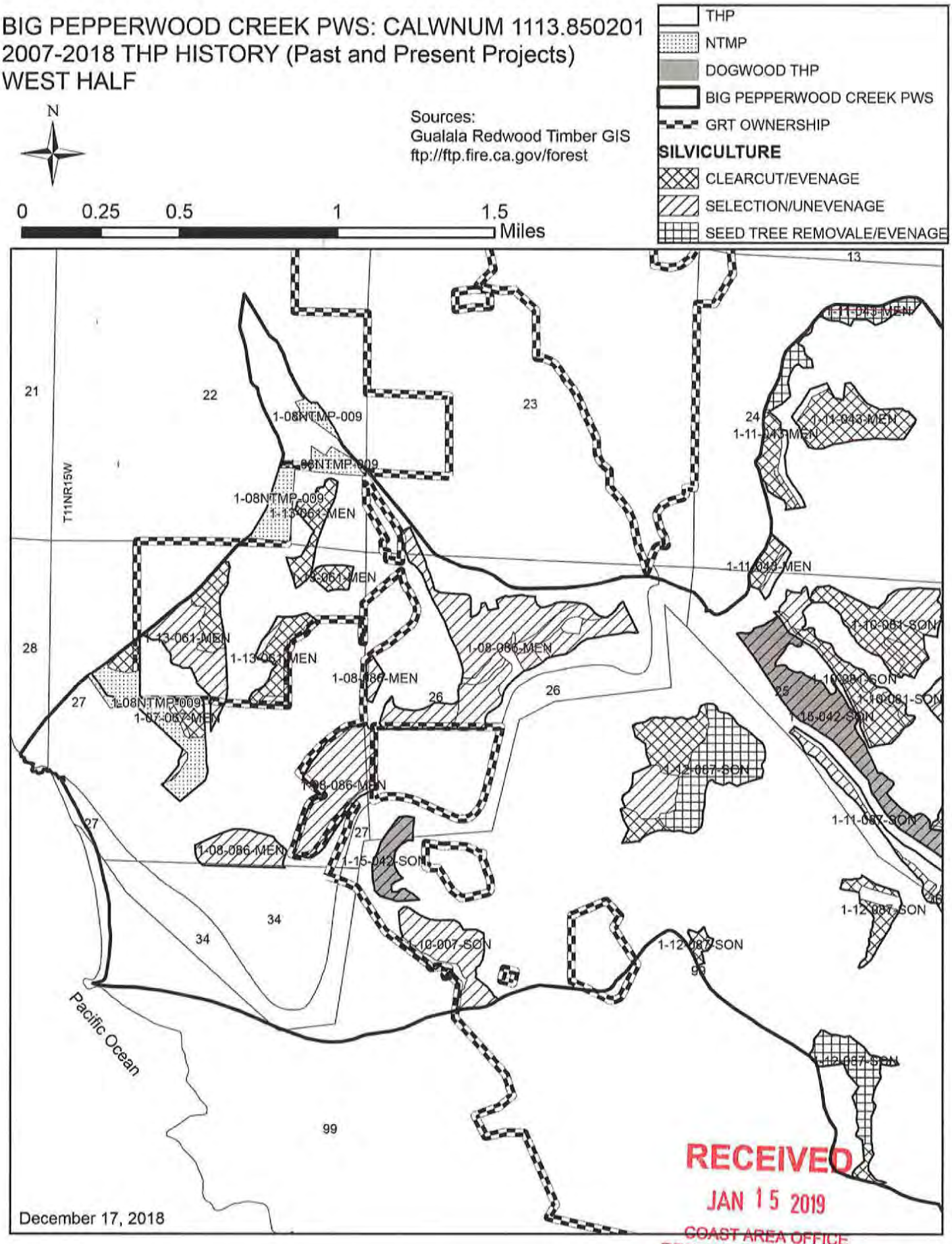
PART OF PLAN

BIG PEPPERWOOD CREEK PWS:CALWNUM 1113.850201
2007-2018 THP HISTORY (Past and Present Projects)



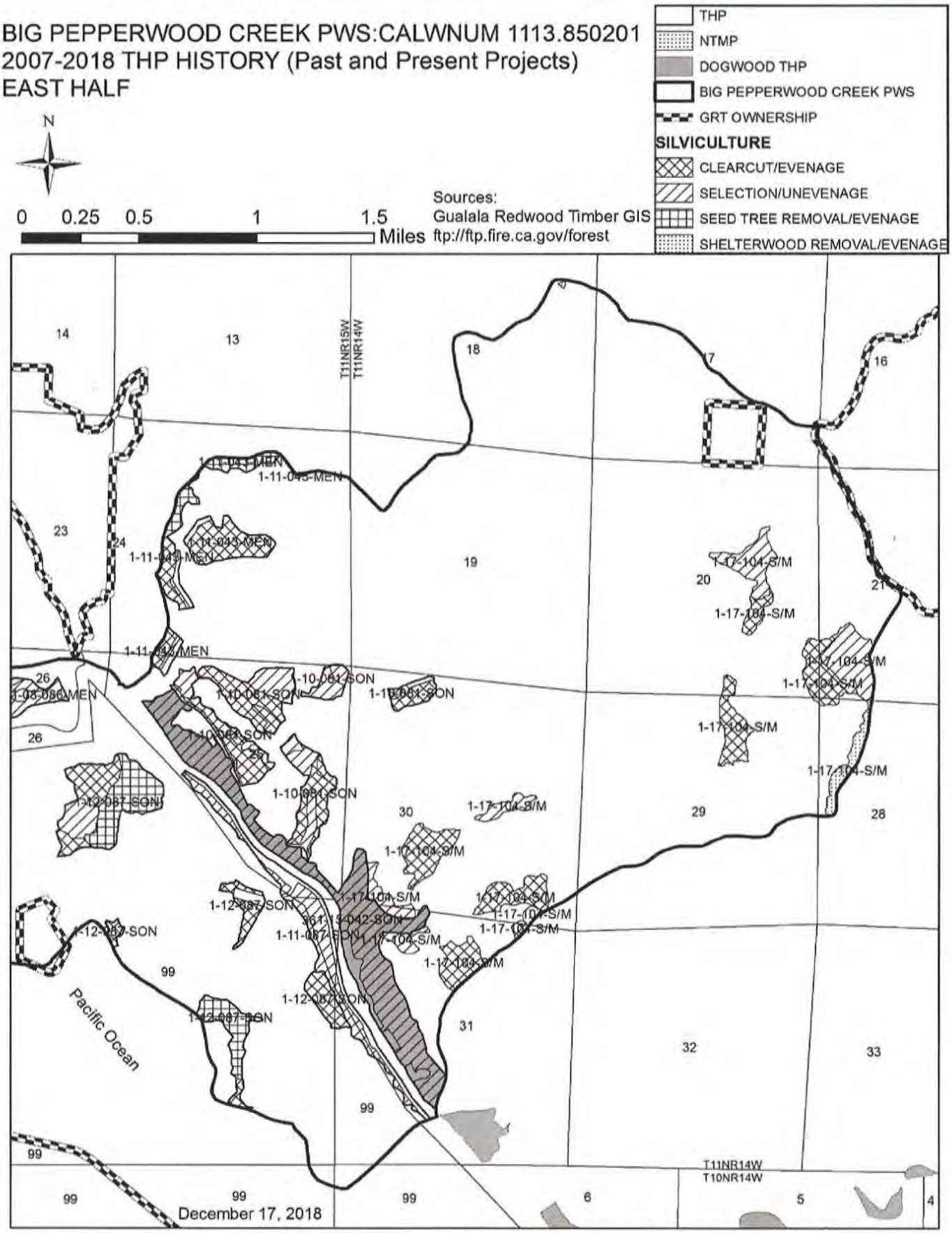
RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

BIG PEPPERWOOD CREEK PWS: CALWNUM 1113.850201
2007-2018 THP HISTORY (Past and Present Projects)
WEST HALF



PART OF PLAN

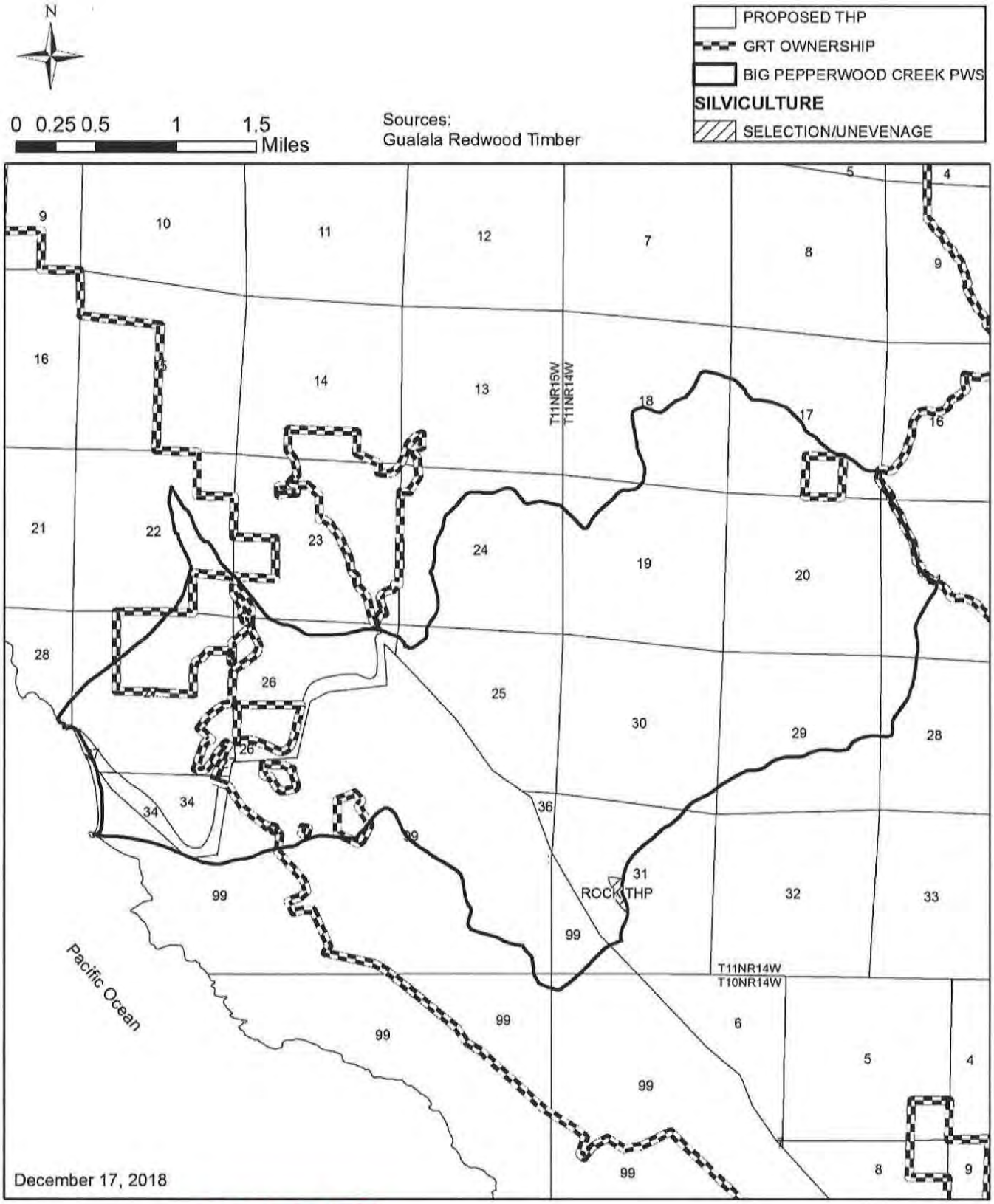
BIG PEPPERWOOD CREEK PWS:CALWNUM 1113.850201
2007-2018 THP HISTORY (Past and Present Projects)
EAST HALF



RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

PART OF PLAN

BIG PEPPERWOOD CREEK PWS: CALWNUM 1113.850201
FORESEEABLE PROJECTS WITHIN 5 YEARS



RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

MOUTH OF GUALALA PLANNING WATERSHED SILVICULTURE HISTORY FROM 2007-2018				5305 acres
Past and Present Projects:				
Silviculture	**Acres**	**% of PWS**		**Silviculture Category**
Clearcut	509.3	9.6%		evenaged
Rehabilitation of Understocked	5.0	0.1%		special
Seed Tree Removal Step	0.0	0.0%		evenaged
Selection	625.5	11.8%		unevenaged
Sub Total:	1139.8	21.5%		
Future Projects (next 5-years):				
Silviculture	**Acres**	**% of PWS**		
Selection	83.0	1.6%		unevenaged
Sub Total:	83.0	1.6%		
Total:	1222.8	23.0%		
Last eleven years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	total
11.8%	9.6%	0.1%	0.0%	21.5%

MOUTH OF GUALALA PLANNING WATERSHED THP HISTORY FROM 2007-2018 — 5,305 acres

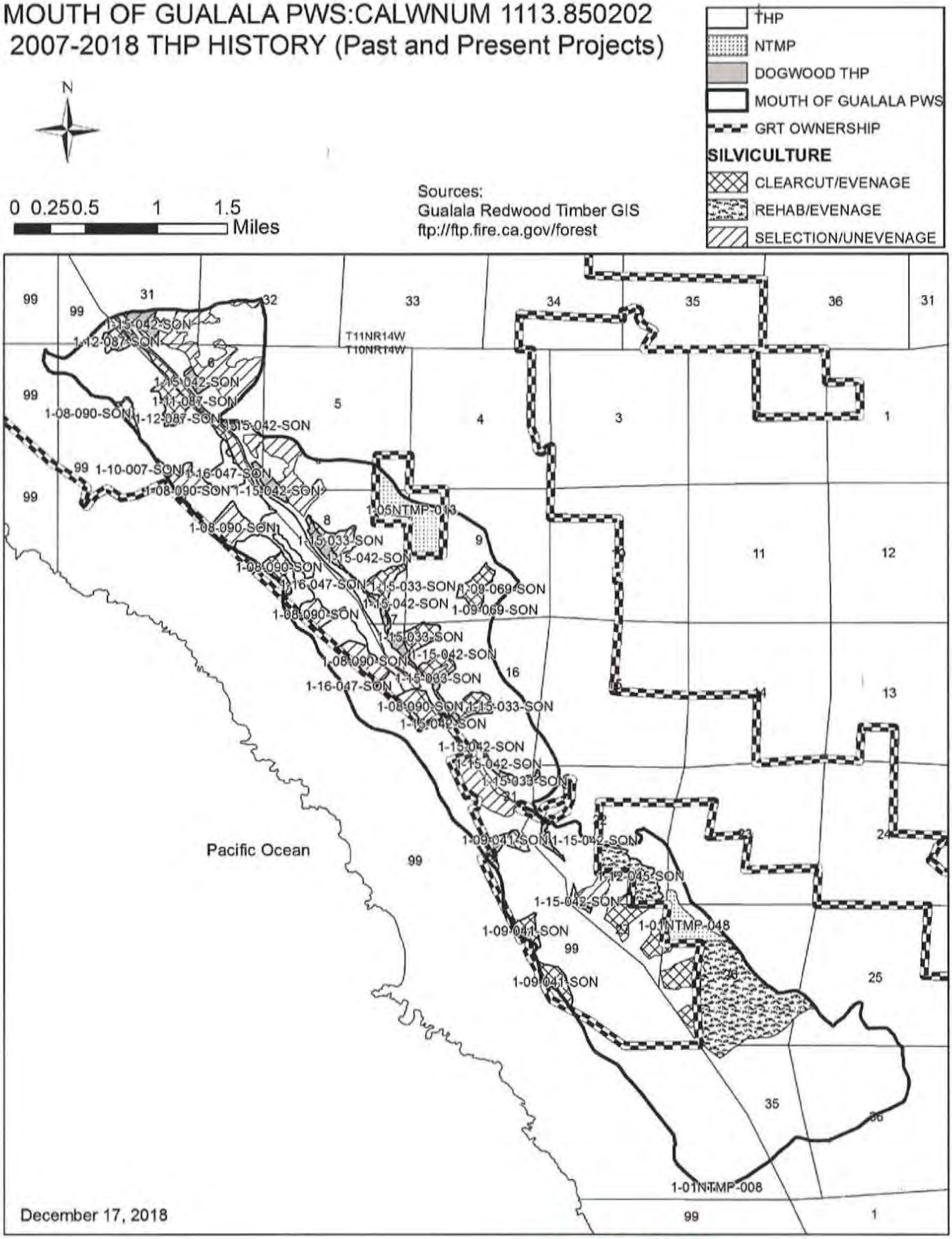
Past and Present Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	silviculture category
Sonoma	1-01NTMP-008	Selection	Tractor	Approved	Richardson	1113.850202	4	0.1%	unevenaged
Sonoma	1-01NTMP-048	Selection	Tractor	Approved	Garrett	1113.850202	43	0.8%	unevenaged
Sonoma	1-05NTMP-013	Selection	Tractor	Approved	Radtkey	1113.850202	94	1.8%	unevenaged
Sonoma	1-07-155-SON	Clearcut	Tractor	Completed	GRI	1113.850202	82	1.5%	evenaged
Sonoma	1-07-155-SON	Selection	Tractor	Completed	GRI	1113.850202	85	1.6%	unevenaged
Sonoma	1-08-090-SON	Clearcut	Tractor	Completed	GRI	1113.850202	133	2.5%	evenaged
Sonoma	1-08-090-SON	Selection	Tractor	Completed	GRI	1113.850202	30	0.6%	unevenaged
Sonoma	1-09-041-SON	Clearcut	Tractor	Completed	GRI	1113.850202	46	0.9%	evenaged
Sonoma	1-09-041-SON	Rehabilitation	Tractor	Completed	GRI	1113.850202	5	0.1%	special
Sonoma	1-09-041-SON	Selection	Tractor	Completed	GRI	1113.850202	4	0.1%	unevenaged
Sonoma	1-09-069-SON	Clearcut	Cable	Completed	GRI	1113.850202	13	0.2%	evenaged
Sonoma	1-09-069-SON	Clearcut	Tractor	Completed	GRI	1113.850202	14	0.3%	evenaged
Sonoma	1-09-069-SON	Selection	Cable	Completed	GRI	1113.850202	2	0.0%	unevenaged
Sonoma	1-10-007-SON	Selection	Tractor	Completed	GRI	1113.850202	4	0.1%	unevenaged
Sonoma	1-11-087-SON	Selection	Tractor	Approved	GRI	1113.850202	35	0.7%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Tractor	Completed	Garrett/Parks	1113.850202	61	1.1%	unevenaged
Sonoma	1-12-087-SON	Clearcut	Cable	Completed	GRI	1113.850202	15	0.3%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850202	31	0.6%	evenaged
Sonoma	1-15-033-SON	Clearcut	Cable	Approved	GRT	1113.850202	4	0.1%	evenaged
Sonoma	1-15-033-SON	Clearcut	Tractor/Cable	Approved	GRT	1113.850202	86	1.6%	evenaged
Sonoma	1-15-033-SON	Selection	Cable	Approved	GRT	1113.850202	0	0.0%	unevenaged
Sonoma	1-15-033-SON	Selection	Tractor/Cable	Approved	GRT	1113.850202	15	0.3%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850202	103	1.9%	unevenaged
Sonoma	1-16-047-SON	Clearcut	Tractor	Approved	GRT	1113.850202	86	1.6%	evenaged
Sonoma	1-16-047-SON	Selection	Tractor	Approved	GRT	1113.850202	99	1.9%	unevenaged
Sonoma	1-16NTMP-001 SON	Selection	Tractor	In review	Sea Ranch Assoc. and Sea Ranch Water Company	1113.850202	47	0.9%	unevenaged
# Plans	15				Sub Total from 2007 to 2018:		1140	21.5%	

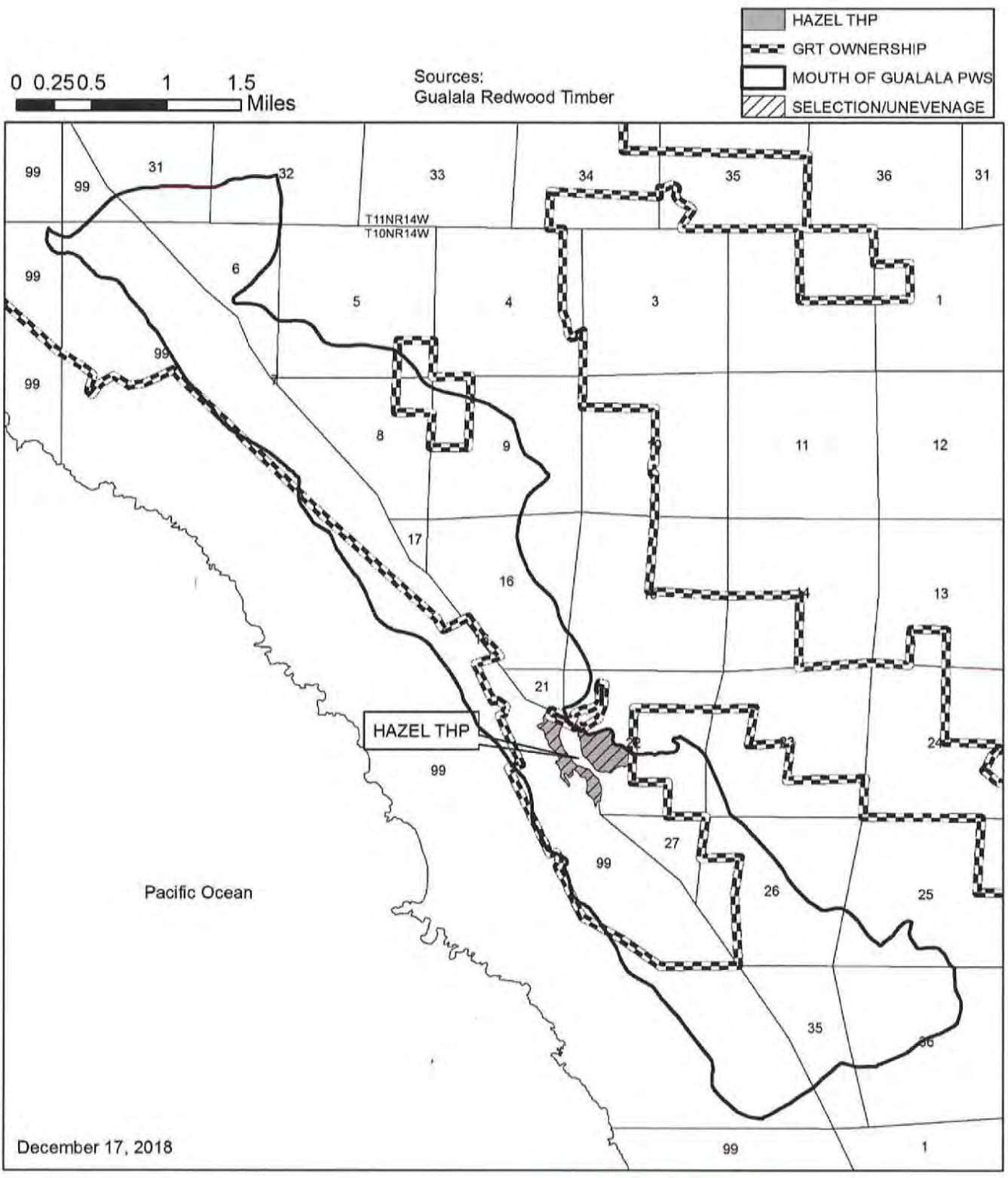
Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	
Sonoma	Hazel THP	Selection	Tractor	In Preparation	GRT	1113.850202	83.0	1.6%	unevenaged
# Plans	1				Sub Total for next five years		83	1.6%	
					Total		1223	23.0%	

MOUTH OF GUALALA PWS:CALWNUM 1113.850202
2007-2018 THP HISTORY (Past and Present Projects)



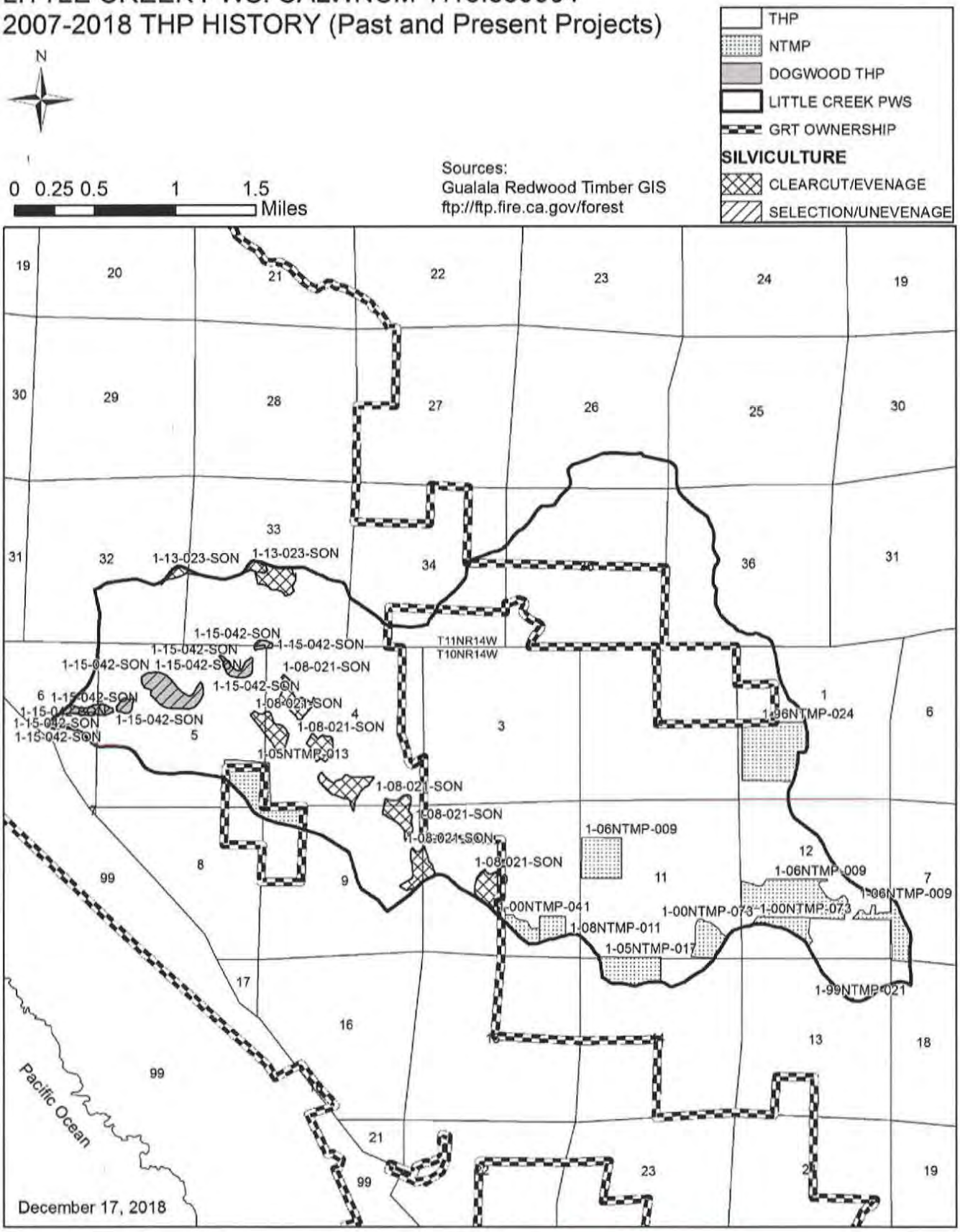
MOUTH OF GUALALA PWS: CALWNUM 1113.850202
FORESEEABLE PROJECTS WITHIN 5 YEARS



LITTLE CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2007 - 2018				5869 acres
Past and Present Projects:				
Silviculture	**Acres**	**% of PWS**		**Silviculture Category**
Clearcut	146.5	2.5%		evenaged
Group Selection	150.2	2.6%		unevenaged
Rehabilitation	4.5	0.1%		special
Selection	276.6	4.7%		unevenaged
Unevenaged	37.8	0.6%		unevenaged
Sub Total:	615.6	10.5%		
Future Projects (next 5-years):				
Silviculture	**Acres**	**% of PWS**		
None	0.0	0.0%		
Sub Total:	0.0	0.0%		
	Acres	**% of PWS**		
Total:	615.6	10.5%		
Last eleven years % of watershed unevenaged	**% of watershed evenaged**	**% of watershed special**	**% of watershed intermediate**	**Total**
7.9%	**2.5%**	**0.1%**	**0.0%**	**10.5%**

LITTLE CREEK PLANNING WATERSHED THP HISTORY FROM 2007 - 2018							5,869 acres		
County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	silviculture category
Sonoma	1-96NTMP-024	Selection		Approved	JHM Properties	1113.830004	85	1.5%	unevenaged
Sonoma	1-99NTMP-021	Selection	Tractor	Approved	Todd & Jamie Curlee	1113.830004	0	0.0%	unevenaged
Sonoma	1-00NTMP-041	Selection	Tractor	Approved	Michael & Tonna Wilkins	1113.830004	14	0.2%	unevenaged
Sonoma	1-00NTMP-073	Selection	Tractor	Approved	Darrell Rogers	1113.830004	41	0.7%	unevenaged
Sonoma	1-05NTMP-013	Selection	Tractor	Approved	Rae Radtkey	1113.830004	64	1.1%	unevenaged
Sonoma	1-05NTMP-017	Unevenaged		Approved	Lester Gray	1113.830004	38	0.6%	unevenaged
Sonoma	1-06NTMP-009	Group Selection	Cable	Approved	Raul Hernandez et al	1113.830004	30	0.5%	unevenaged
Sonoma	1-06NTMP-009	Group Selection	Tractor	Approved	Raul Hernandez et al	1113.830004	121	2.1%	unevenaged
Sonoma	1-08-021-SON	Clearcut	Tractor	Completed	GRI	1113.830004	122	2.1%	evenaged
Sonoma	1-08NTMP-011	Selection	Tractor	Approved	Darrell Rogers	1113.830004	14	0.2%	unevenaged
Sonoma	1-13-023-SON	Clearcut	Tractor	Approved	GRI	1113.830004	25	0.4%	evenaged
Sonoma	1-13-023-SON	Rehabilitation	Tractor	Approved	GRI	1113.830004	5	0.1%	special
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.830004	58	1.0%	unevenaged
# Plans	11				Sub Total from 2007 to 2018:		616	10.5%	
Foreseeable Future Projects:									
County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	
Sonoma	None				GRT	1113.830004	0	0.0%	
# Plans	0				Sub Total for next five years		0	0.0%	
					Total			10.5%	

LITTLE CREEK PWS: CALWNUM 1113.830004
2007-2018 THP HISTORY (Past and Present Projects)

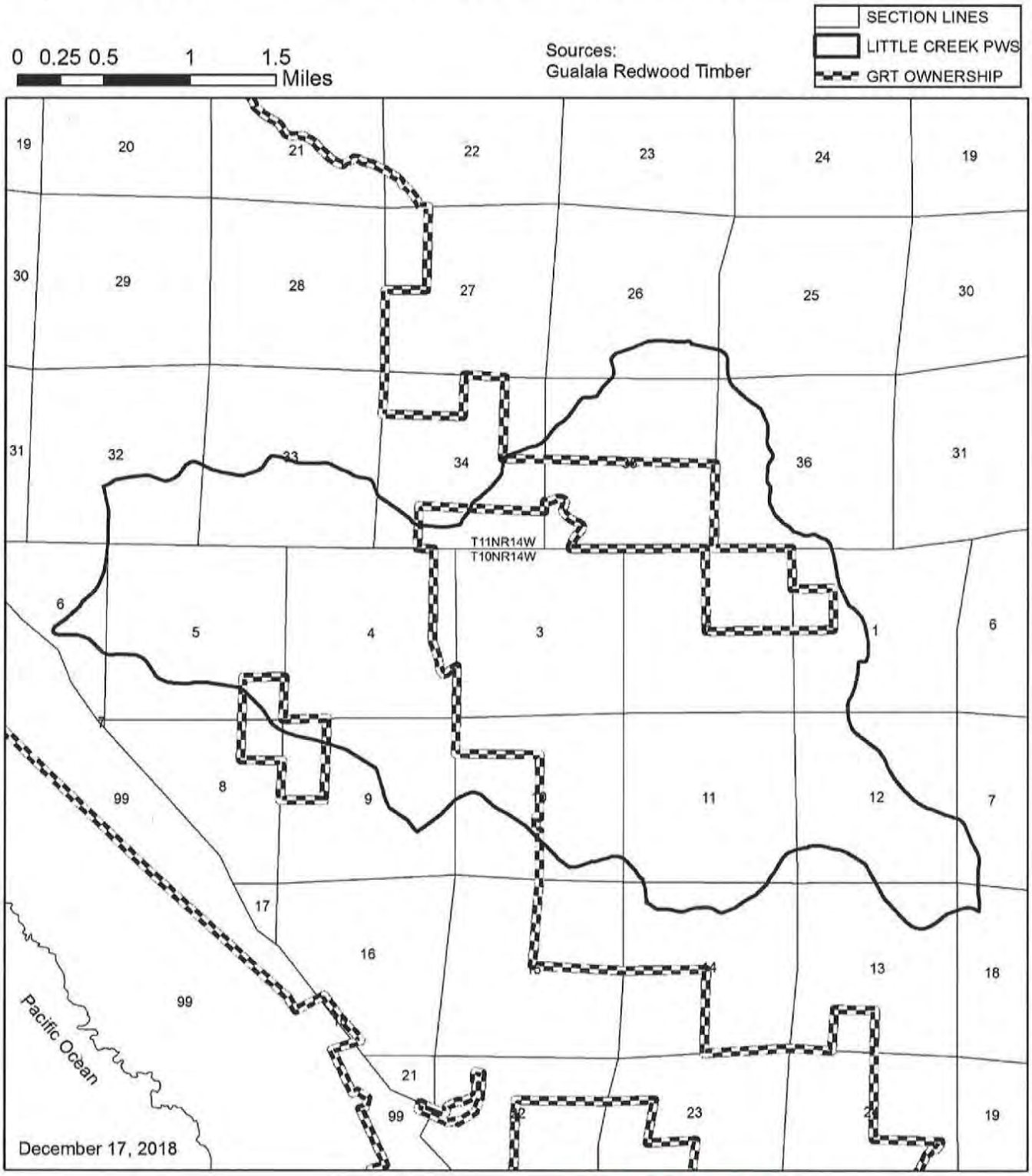


PART OF PLAN

LITTLE CREEK PWS: CALWNUM 1113.830004
FORESEEABLE PROJECTS WITHIN 5 YEARS

N

NO FORESEEABLE PROJECTS WITHIN THE NEXT 5 YEARS



RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

ANNAPOLIS PLANNING WATERSHED SILVICULTURE HISTORY FROM 2007-2018				7580 acres
Past and Present Projects:				
Silviculture	**Acres**	**% of PWS**		**Silviculture category**
Clearcut	208.7	2.8%		evenaged
Group Selection	48.2	0.6%		unevenaged
Rehabilitation of Understocked	95.3	1.3%		special
Seed Tree Removal Step	108.1	1.4%		evenaged
Selection	425.2	5.6%		unevenaged
Shelterwood Seed Step	0.0	0.0%		evenaged
Transition	153.0	2.0%		unevenaged
Unevenaged Management	86.2	1.1%		unevenaged
Variable Retention	418.5	5.5%		special
Sub Total:	1543.1	20.4%		
Future Projects (next 5-years):				
Silviculture	**Acres**	**% of PWS**		
Selection	10.0	0.1%		
Sub Total:	10.0	0.1%		
Total:	1553.1	20.5%		
Last eleven years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	total
9.4%	**4.2%**	**6.8%**	**0.0%**	**20.4%**

ANNAPOLIS PLANNING WATERSHED THP HISTORY FROM 2007-2018 — 7,580 acres

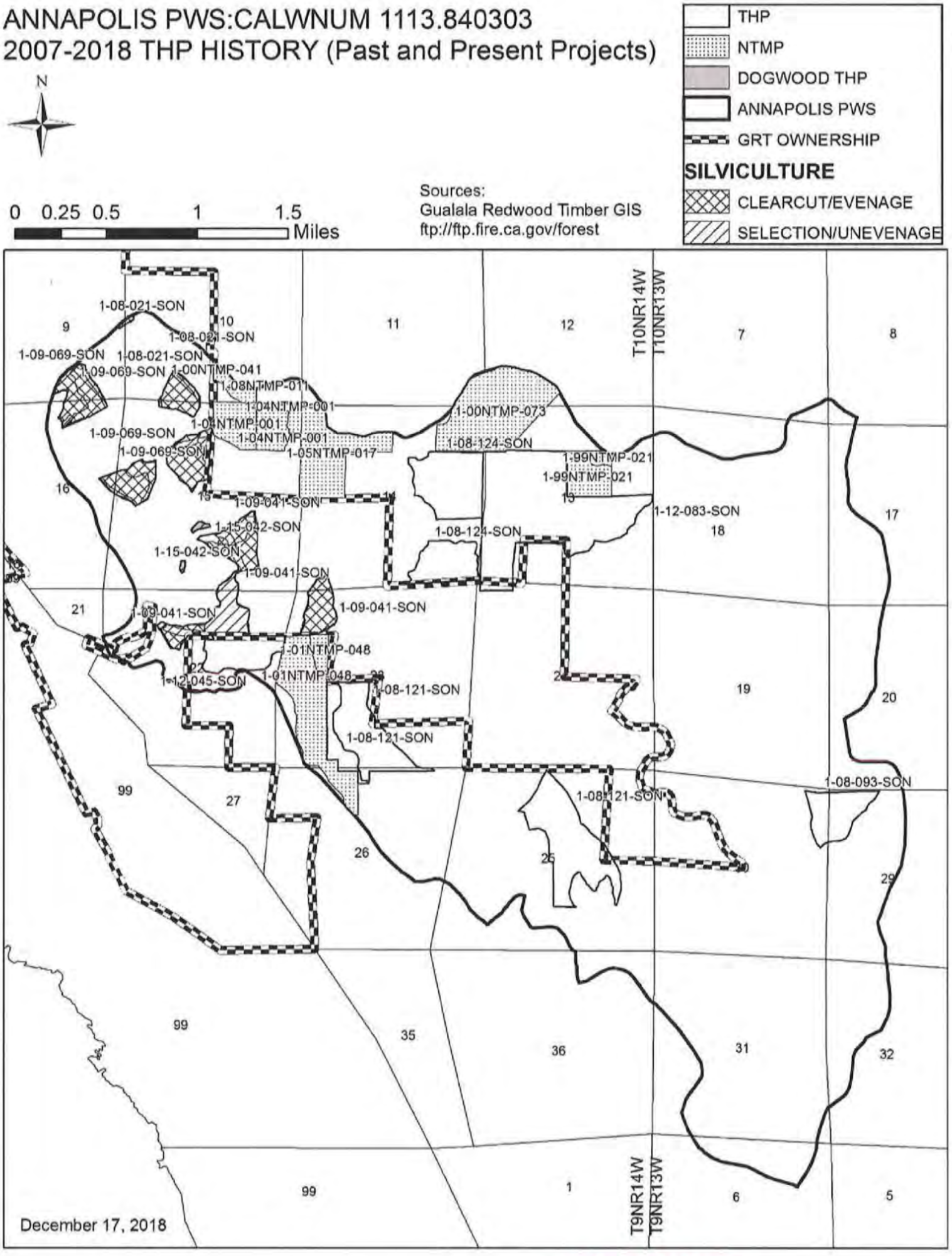
Past and Present Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	Acres	% of PWS	silviculture category
Sonoma	1-99NTMP-021	Selection	Tractor	Approved	Curlee	39	0.5%	unevenaged
Sonoma	1-00NTMP-073	Selection	Tractor	Approved	Rogers	132	1.7%	unevenaged
Sonoma	1-00NTMP-041	Selection	Tractor	Approved	Wilkins	13	0.2%	unevenaged
Sonoma	1-01NTMP-048	Selection	Tractor	Approved	Garrett	101	1.3%	unevenaged
Sonoma	1-01NTMP-048	Transition	Tractor	Approved	Garrett	12	0.2%	unevenaged
Sonoma	1-04NTMP-001	Selection	Cable	Approved	Ragle	9	0.1%	unevenaged
Sonoma	1-04NTMP-001	Selection	Tractor	Approved	Ragle	63	0.8%	unevenaged
Sonoma	1-05NTMP-017	Unevenaged	Tractor	Approved	Gray	86	1.1%	unevenaged
Sonoma	1-07-028-SON	Alternative (CC)	Cable	Completed	MRC	41	0.5%	evenaged
Sonoma	1-07-028-SON	Alternative (Transition)	Tractor/Cable	Completed	MRC	52	0.7%	unevenaged
Sonoma	1-07-028-SON	Rehabilitation	Cable	Completed	MRC	40	0.5%	special
Sonoma	1-07-028-SON	Rehabilitation	Tractor/Cable	Completed	MRC	56	0.7%	special
Sonoma	1-08NTMP-011	Selection	Tractor	Approved	Rogers	0	0.0%	unevenaged
Sonoma	1-08-124-SON	STRS	Tractor	Completed	Brenner, Carroll, Vollman	108	1.4%	evenaged
Sonoma	1-08-124-SON	Selection	Tractor	Completed	Brenner, Carroll, Vollman	18	0.2%	unevenaged
Sonoma	1-08-021-SON	Clearcut	Tractor	Completed	GRI	2	0.0%	evenaged
Sonoma	1-08-093-SON	Variable Retention	Cable	Completed	MRC	20	0.3%	special
Sonoma	1-08-093-SON	Variable Retention	Tractor	Completed	MRC	27	0.4%	special
Sonoma	1-08-121-SON	Variable Retention	Cable	Completed	MRC	155	2.0%	special
Sonoma	1-08-121-SON	Variable Retention	Tractor	Completed	MRC	58	0.8%	special
Sonoma	1-09-041-SON	Clearcut	Cable	Completed	GRI	18	0.2%	evenaged
Sonoma	1-09-041-SON	Clearcut	Cable/Tractor	Completed	GRI	3	0.0%	evenaged
Sonoma	1-09-041-SON	Clearcut	Tractor	Completed	GRI	32	0.4%	evenaged
Sonoma	1-09-041-SON	Selection	Cable	Completed	GRI	3	0.0%	unevenaged
Sonoma	1-09-041-SON	Selection	Cable/Tractor	Completed	GRI	1	0.0%	unevenaged
Sonoma	1-09-041-SON	Selection	Tractor	Completed	GRI	35	0.5%	unevenaged
Sonoma	1-09-069-SON	Clearcut	Cable	Completed	GRI	55	0.7%	evenaged
Sonoma	1-09-069-SON	Clearcut	Tractor	Completed	GRI	56	0.7%	evenaged
Sonoma	1-09-069-SON	Selection	Cable	Completed	GRI	5	0.1%	unevenaged
Sonoma	1-09-069-SON	Selection	Tractor	Completed	GRI	3	0.0%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Cable	Completed	Garrett/Parks	2	0.0%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Tractor	Completed	Garrett/Parks	46	0.6%	unevenaged
Sonoma	1-12-083-SON	Transition	Tractor	Completed	MRC	89	1.2%	unevenaged
Sonoma	1-12-083-SON	Variable Retention	Cable/Helicopter	Completed	MRC	48	0.6%	special
Sonoma	1-12-083-SON	Variable Retention	Tractor	Completed	MRC	110	1.5%	special
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	3	0.0%	unevenaged
# Plans	17				Sub Total from 2007 to 2018:	1543.0	20.4%	

Foreseeable Future Projects:

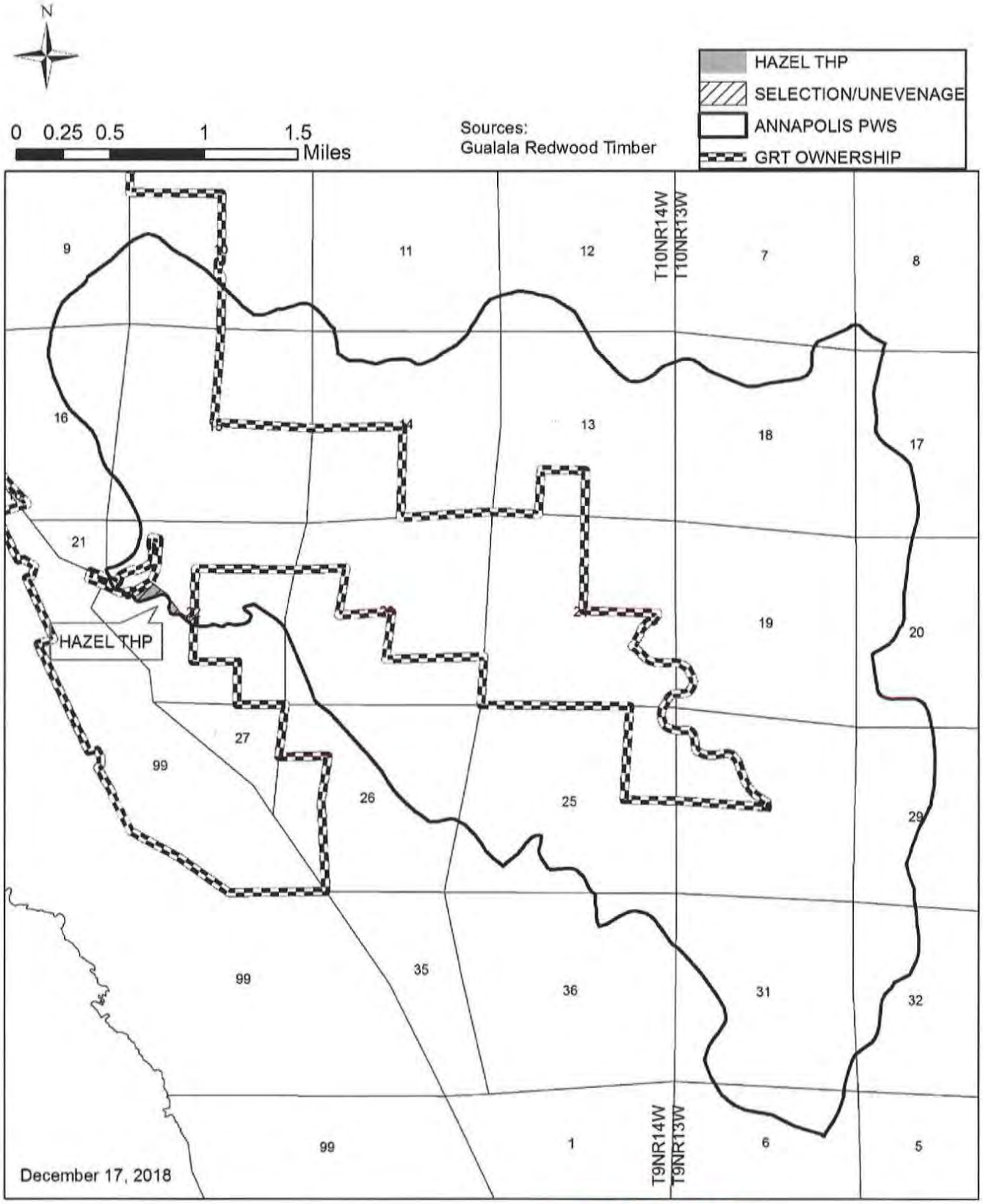
County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	Acres	% of PWS	
Sonoma	Hazel THP	Selection	Tractor	In Preparation	GRT	10.0	0.1%	unevenaged
# Plans	1				Sub Total for next five years:	10.0	0.1%	
					Total	1553.0	20.5%	

ANNAPOLIS PWS:CALWNUM 1113.840303
2007-2018 THP HISTORY (Past and Present Projects)



PART OF PLAN

ANNAPOLIS PWS: CALWNUM 1113.840303
FORESEEABLE PROJECTS WITHIN 5 YEARS



RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT

DOGWOOD THP (1-15-042 SON)

Past, Present, and 5-Year Foreseeable Future Project Assessment

Period 2005-2015

BIG PEPPERWOOD CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2005-2015 **6532 acres**

Past and Present Projects:

Silviculture	Acres	% of PWS	Silviculture Category
Clearcut	338.0	5.2%	evenaged
Seed Tree Removal Step	75.5	1.2%	evenaged
Selection	712.3	10.9%	unevenaged
Sub Total:	1125.8	17.2%	

Future Projects:

Silviculture	Acres	% of PWS
	0.0	0.0%
Sub Total:	0.0	0.0%

	Acres	% of PWS
Total:	1125.8	17.2%

Last ten years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	totals
10.9%	0.1	0.0%	0.0%	17.2%

Revised 2/23/18

BIG PEPPERWOOD CREEK PLANNING WATERSHED THP HISTORY FROM 2005 - 2015 **6,532 acres**

Past and Present Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	silviculture category
Mendocino	1-05-023-MEN	Clearcut	Tractor	Completed	GRI	1113.850201	75	1.2%	evenaged
Mendocino	1-05-023-MEN	Selection	Tractor	Completed	GRI	1113.850201	12	0.2%	unevenaged
Mendocino	1-05-151-MEN	Selection	Tractor	Completed	Foster	1113.850201	10	0.2%	unevenaged
Sonoma	1-05-146-SON	Selection	Tractor	Completed	GRI	1113.850201	88	1.3%	unevenaged
Mendocino	1-06-163-MEN	Clearcut	Cable	Completed	GRI	1113.850201	31	0.5%	evenaged
Mendocino	1-06-163-MEN	Selection	Cable	Completed	GRI	1113.850201	5	0.1%	unevenaged
Sonoma	1-06-009-SON	Selection	Tractor/Cable	Completed	GRI	1113.850201	49	0.7%	unevenaged
Sonoma	1-06-010-SON	Selection	Tractor	Completed	GRI	1113.850201	0	0.0%	unevenaged
Mendocino	1-07-067-MEN	Clearcut	Tractor	Completed	Bower	1113.850201	10	0.2%	evenaged
Mendocino	1-07-067-MEN	Group Selection	Tractor	Completed	Bower	1113.850201	24	0.4%	unevenaged
Mendocino	1-07-067-MEN	Selection	Tractor	Completed	Bower	1113.850201	3	0.1%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor/Cable	Completed	GRI	1113.850201	10	0.2%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor	Completed	GRI	1113.850201	98	1.5%	unevenaged
Mendocino	1-08-086-MEN	Selection	Tractor/Cable	Completed	GRI	1113.850201	25	0.4%	unevenaged
Mendocino	1-08-086-MEN	STA	Tractor	Completed	GRI	1113.850201	2	0.0%	special
Mendocino	1-08-086-MEN	STA	Tractor/Cable	Completed	GRI	1113.850201	13	0.2%	special
Mendocino	1-08NTMP-009	Group Selection	Tractor	Approved	Bower	1113.850201	49	0.7%	unevenaged
Sonoma	1-10-007-SON	Selection	Tractor	Completed	GRT	1113.850201	27	0.4%	unevenaged
Sonoma	1-10-081-SON	Clearcut	Cable	Completed	GRI	1113.850201	6	0.1%	evenaged
Sonoma	1-10-081-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850201	73	1.1%	evenaged
Sonoma	1-10-081-SON	Selection	Cable	Completed	GRI	1113.850201	2	0.0%	unevenaged
Sonoma	1-10-081-SON	Selection	Tractor	Completed	GRI	1113.850201	14	0.2%	unevenaged
Sonoma	1-10-081-SON	Selection	Tractor/Cable	Completed	GRI	1113.850201	33	0.5%	unevenaged
Mendocino	1-11-043-MEN	Clearcut	Tractor	Completed	GRT	1113.850201	10	0.2%	evenaged
Mendocino	1-11-043-MEN	Clearcut	Tractor/Cable	Completed	GRT	1113.850201	35	0.5%	evenaged
Mendocino	1-11-043-MEN	STRS	Tractor	Completed	GRT	1113.850201	17	0.3%	evenaged
Mendocino	1-11-043-MEN	Selection	Tractor	Completed	GRT	1113.850201	1	0.0%	unevenaged
Mendocino	1-11-043-MEN	Selection	Tractor/Cable	Completed	GRT	1113.850201	1	0.0%	unevenaged
Sonoma	1-11-087-SON	Selection	Tractor	Approved	GRI	1113.850201	42	0.6%	unevenaged
Sonoma	1-12-087-SON	Clearcut	Cable	Completed	GRI	1113.850201	21	0.3%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor	Completed	GRI	1113.850201	31	0.5%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850201	3	0.0%	evenaged
Sonoma	1-12-087-SON	STRS	Tractor	Completed	GRI	1113.850201	58	0.9%	evenaged
Sonoma	1-12-087-SON	Selection	Tractor	Completed	GRI	1113.850201	14	0.2%	unevenaged
Mendocino	1-13-061-MEN	Clearcut	Tractor/Cable	Approved	GRI	1113.850201	43	0.7%	evenaged
Mendocino	1-13-061-MEN	Selection	Tractor/Cable	Approved	GRI	1113.850201	29	0.4%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850201	151	2.3%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850201	12	0.2%	unevenaged
# Plans	15				**Sub Total from 2005 to 2015:**		1126	17.2%	

141

Revised 2/23/18

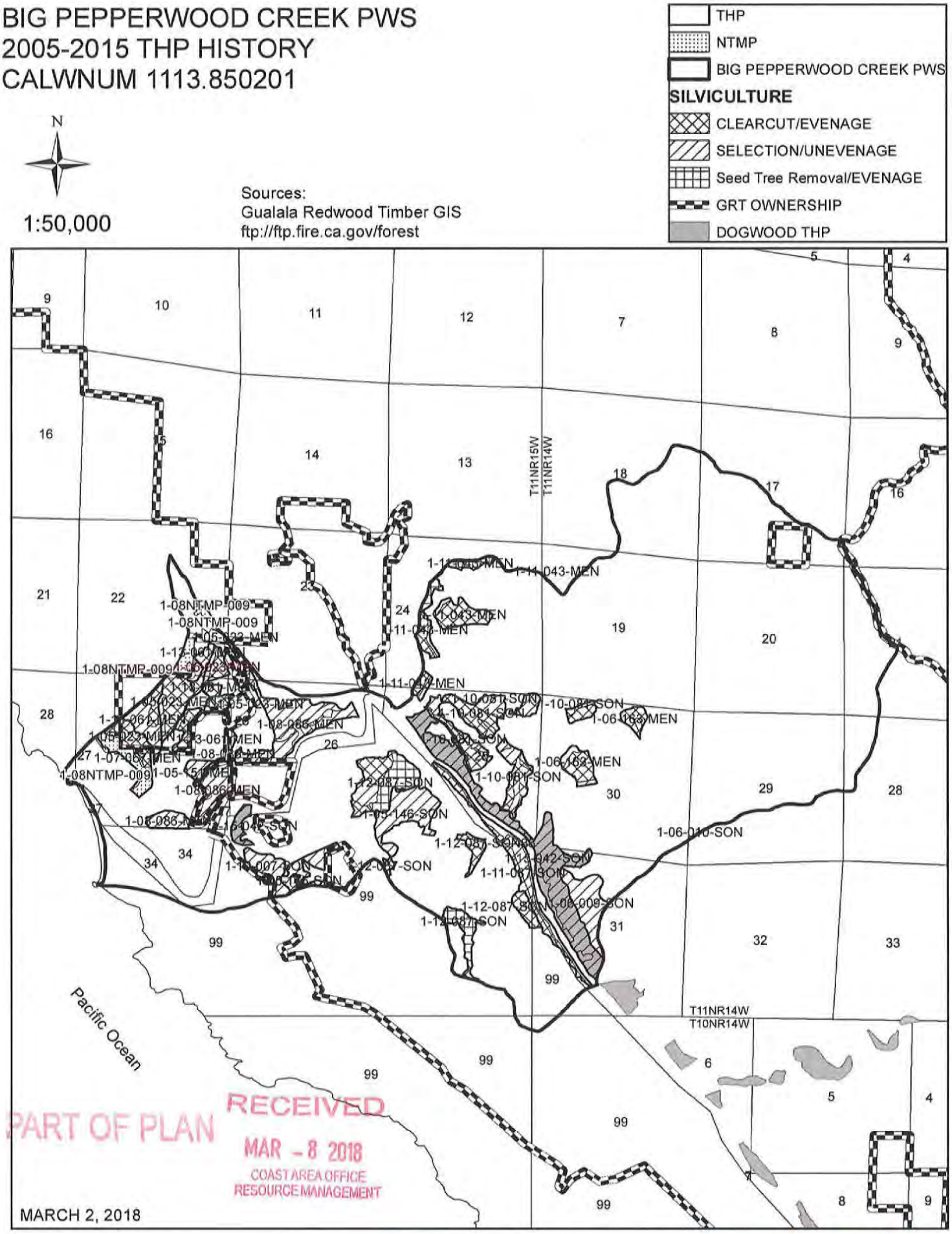
Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS
							0	0.0%
# Plans	0				**Sub Total for next five years**		0	0.0%
					Total:		1126	17.2%

RECEIVED
MAR - 8 2018
COAST AREA OFFICE
RESOURCE MANAGEMENT

PART OF PLA

BIG PEPPERWOOD CREEK PWS
2005-2015 THP HISTORY
CALWNUM 1113.850201

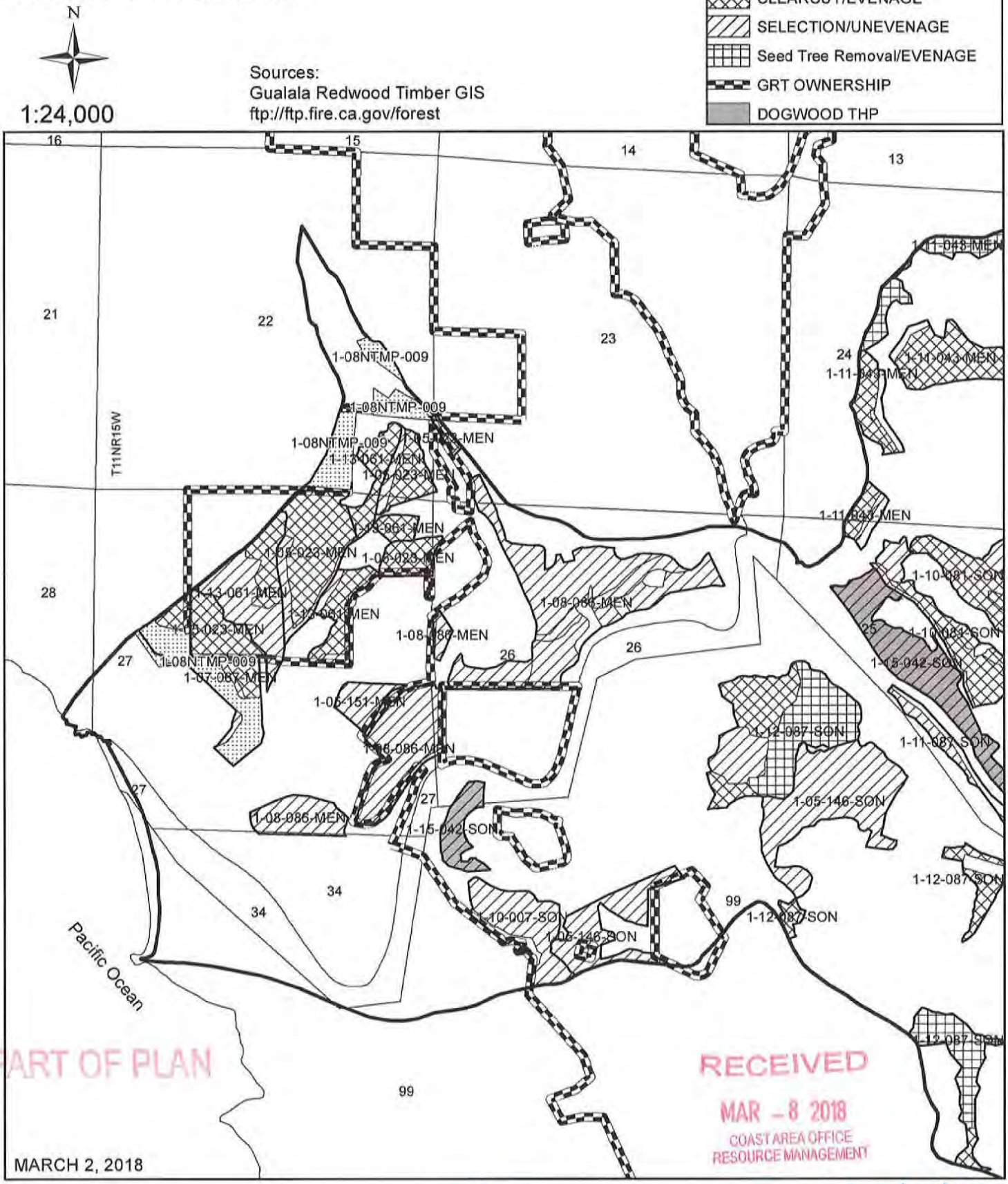


MARCH 2, 2018

141.1

Revised 2/23/18

BIG PEPPERWOOD CREEK PWS
2005-2015 THP HISTORY
WEST HALF
CALWNUM 1113.850201



141.2

Revised 2/23/18

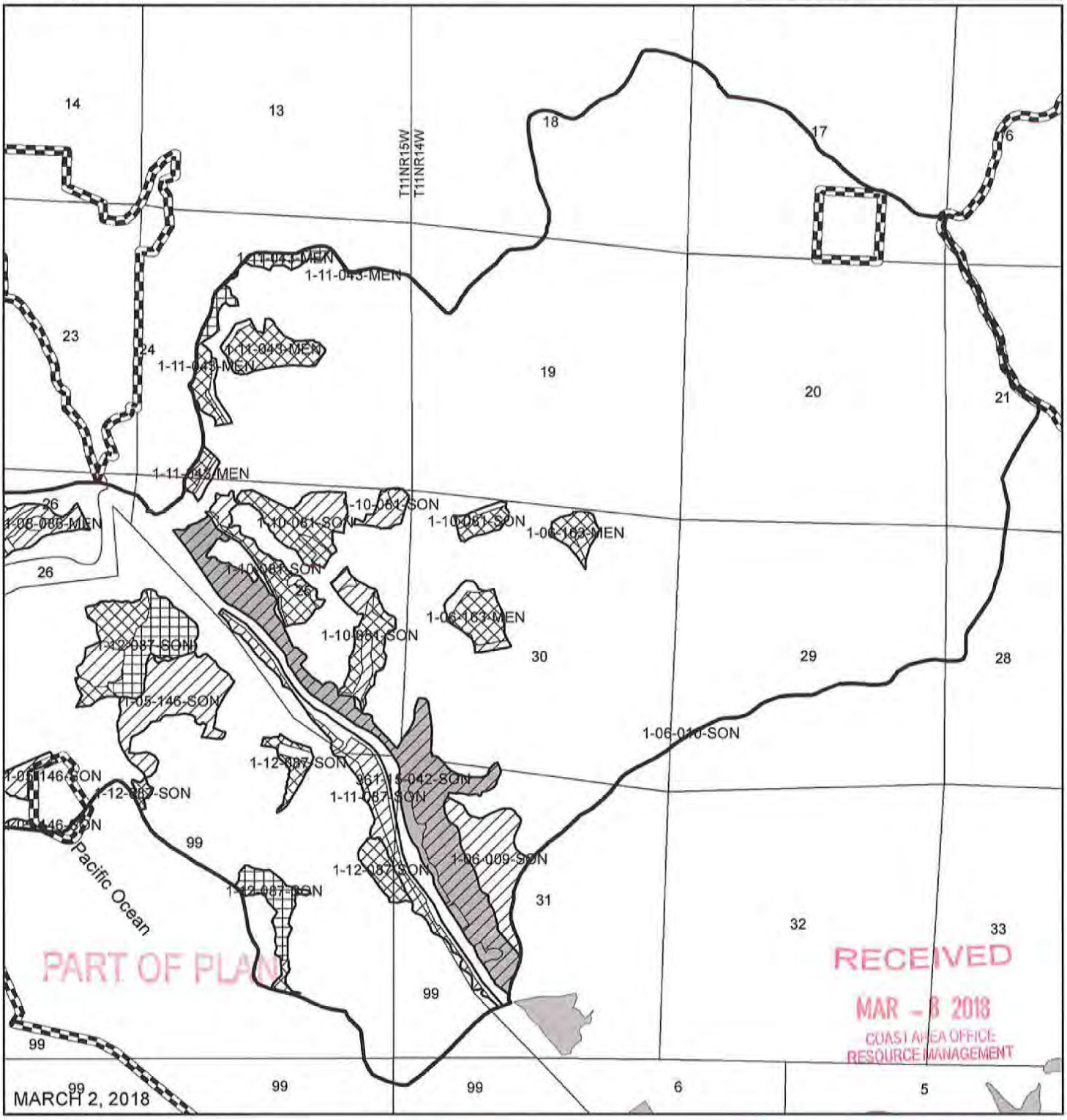
BIG PEPPERWOOD CREEK PWS
2005-2015 THP HISTORY
EAST HALF
CALWNUM 1113.850201

N

1:32,000

Sources:
Gualala Redwood Timber GIS
ftp://ftp.fire.ca.gov/forest

THP
NTMP
BIG PEPPERWOOD CREEK PWS
SILVICULTURE
CLEARCUT/EVENAGE
SELECTION/UNEVENAGE
Seed Tree Removal/EVENAGE
GRT OWNERSHIP
DOGWOOD THP

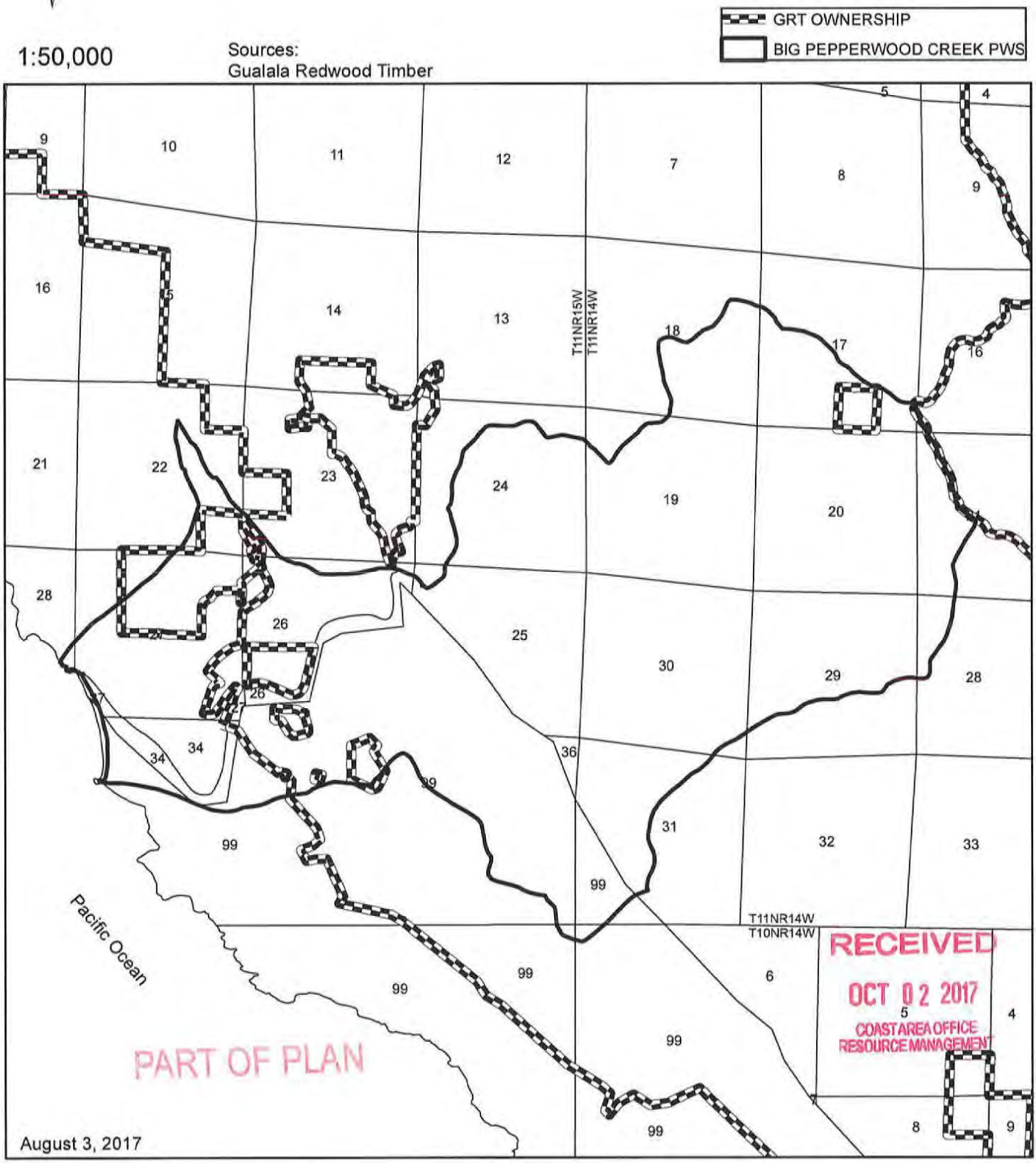


141.3

Revised 2/23/18

BIG PEPPERWOOD CREEK PWS: CALWNUM 1113.850201
FORESEEABLE PROJECTS WITHIN 5 YEARS

NO FORESEEABLE PROJECTS WITHIN THE NEXT 5 YEARS



RECEIVED
OCT 02 2017
COAST AREA OFFICE
RESOURCE MANAGEMENT

MOUTH OF GUALALA PLANNING WATERSHED SILVICULTURE HISTORY FROM 2005-2015 **5305 acres**

Past and Present Projects:

Silviculture	Acres	% of PWS	Silviculture Category
Clearcut	423.7	8.0%	evenaged
Rehabilitation of Understocked	5.0	0.1%	special
Seed Tree Removal Step	2.8	0.1%	evenaged
Selection	940.1	17.7%	unevenaged
Sub Total:	1371.6	25.9%	

Future Projects:

Silviculture	Acres	% of PWS	
clearcut	85.0	1.6%	evenaged
Selection	96.0	1.8%	unevenaged
Sub Total:	181.0	3.4%	
Total:	1552.6	29%	

Last ten years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	total
17.7%	8.0%	0.1%	0%	25.9%

MOUTH OF GUALALA PLANNING WATERSHED THP HISTORY FROM 2005-2015

5,305 acres

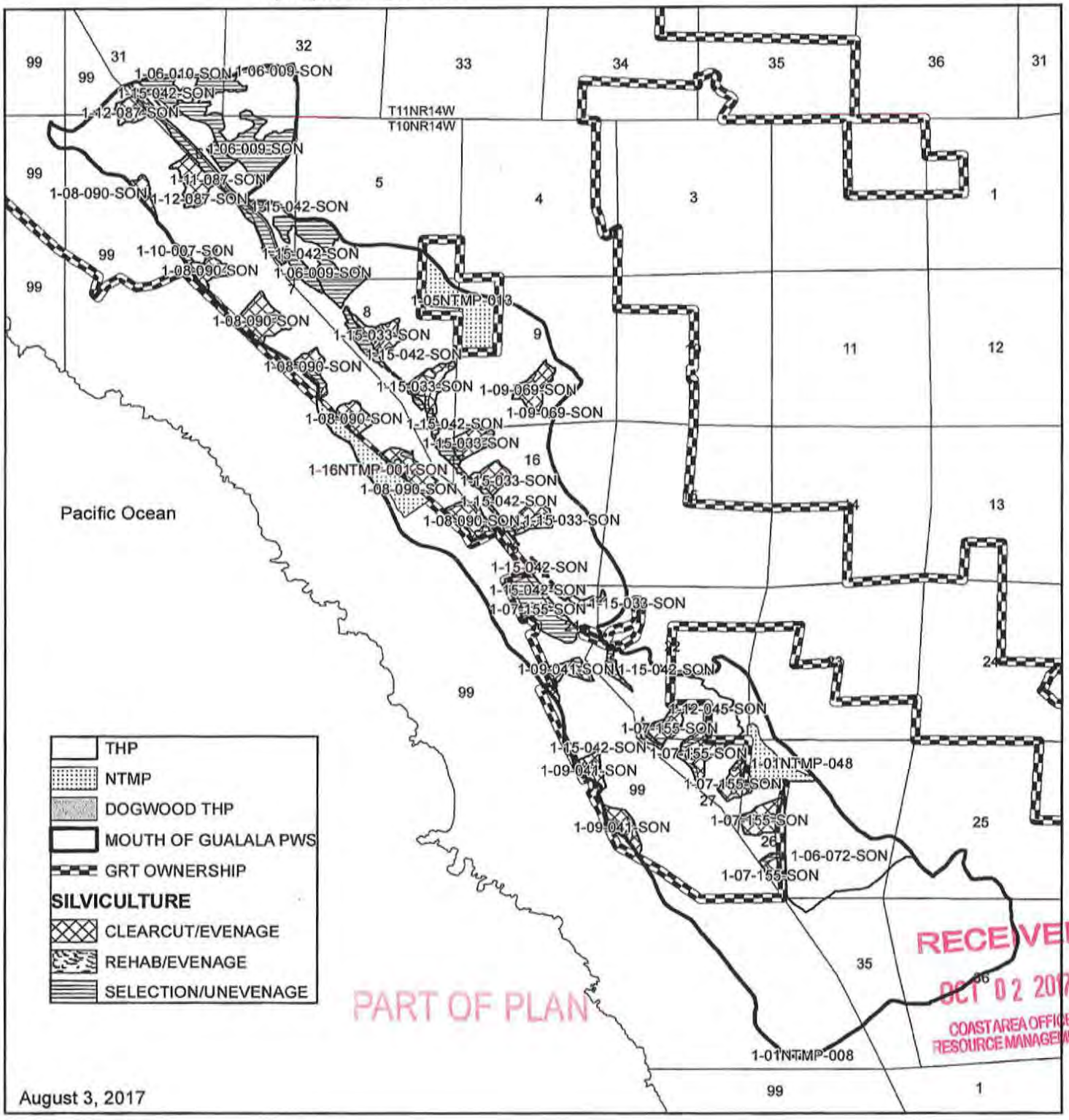
Past and Present Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	silviculture category
Sonoma	1-01NTMP-008	Selection	Tractor	Approved	Richardson	1113.850202	4	0.1%	unevenaged
Sonoma	1-01NTMP-048	Selection	Tractor	Approved	Garrett	1113.850202	43	0.8%	unevenaged
Sonoma	1-05NTMP-013	Selection	Tractor	Approved	Radtkey	1113.850202	94	1.8%	unevenaged
Sonoma	1-06-009-SON	Selection	Tractor/Cable	Completed	GRI	1113.850202	178	3.4%	unevenaged
Sonoma	1-06-010-SON	Selection	Tractor	Completed	GRI	1113.850202	1	0.0%	unevenaged
Sonoma	1-06-072-SON	STRS	Tractor	Completed	Richardson Trust	1113.850202	3	0.1%	evenaged
Sonoma	1-06-072-SON	Selection	Cable	Completed	Richardson Trust	1113.850202	34	0.6%	unevenaged
Sonoma	1-06-072-SON	Selection	Tractor	Completed	Richardson Trust	1113.850202	201	3.8%	unevenaged
Sonoma	1-07-155-SON	Clearcut	Tractor	Completed	GRI	1113.850202	82	1.5%	evenaged
Sonoma	1-07-155-SON	Selection	Tractor	Completed	GRI	1113.850202	85	1.6%	unevenaged
Sonoma	1-08-090-SON	Clearcut	Tractor	Completed	GRI	1113.850202	133	2.5%	evenaged
Sonoma	1-08-090-SON	Selection	Tractor	Completed	GRI	1113.850202	30	0.6%	unevenaged
Sonoma	1-09-041-SON	Clearcut	Tractor	Completed	GRI	1113.850202	46	0.9%	evenaged
Sonoma	1-09-041-SON	Rehabilitation	Tractor	Completed	GRI	1113.850202	5	0.1%	special
Sonoma	1-09-041-SON	Selection	Tractor	Completed	GRI	1113.850202	4	0.1%	unevenaged
Sonoma	1-09-069-SON	Clearcut	Cable	Completed	GRI	1113.850202	13	0.2%	evenaged
Sonoma	1-09-069-SON	Clearcut	Tractor	Completed	GRI	1113.850202	14	0.3%	evenaged
Sonoma	1-09-069-SON	Selection	Cable	Completed	GRI	1113.850202	2	0.0%	unevenaged
Sonoma	1-10-007-SON	Selection	Tractor	Completed	GRT	1113.850202	4	0.1%	unevenaged
Sonoma	1-11-087-SON	Selection	Tractor	Approved	GRI	1113.850202	35	0.7%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Tractor	Completed	Garrett/Parks	1113.850202	61	1.1%	unevenaged
Sonoma	1-12-087-SON	Clearcut	Cable	Completed	GRI	1113.850202	15	0.3%	evenaged
Sonoma	1-12-087-SON	Clearcut	Tractor/Cable	Completed	GRI	1113.850202	31	0.6%	evenaged
Sonoma	1-15-033-SON	Clearcut	Cable	Approved	GRT	1113.850202	4	0.1%	evenaged
Sonoma	1-15-033-SON	Clearcut	Tractor/Cable	Approved	GRT	1113.850202	86	1.6%	evenaged
Sonoma	1-15-033-SON	Selection	Cable	Approved	GRT	1113.850202	0	0.0%	unevenaged
Sonoma	1-15-033-SON	Selection	Tractor/Cable	Approved	GRT	1113.850202	15	0.3%	unevenaged
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.850202	103	1.9%	unevenaged
Sonoma	1 1-16NTMP-001 SON	Selection	Tractor	in review	Sea Ranch Assoc. and Sea Ranch Water Company	1113.850202	47	0.9%	unevenaged
# Plans	16				Sub Total from 2005 to 2015:		1372	25.9%	

Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	
Sonoma	1-16-047-SON	Selection	Tractor	Approved	GRT	1113.850202	96	1.8%	unevenaged
Sonoma	1-16-047-SON	Clearcut	Tractor	Approved	GRT	1113.850202	85	1.6%	evenaged
# Plans	1				Sub Total for next five years		181	3.4%	
					Total		1553	29%	

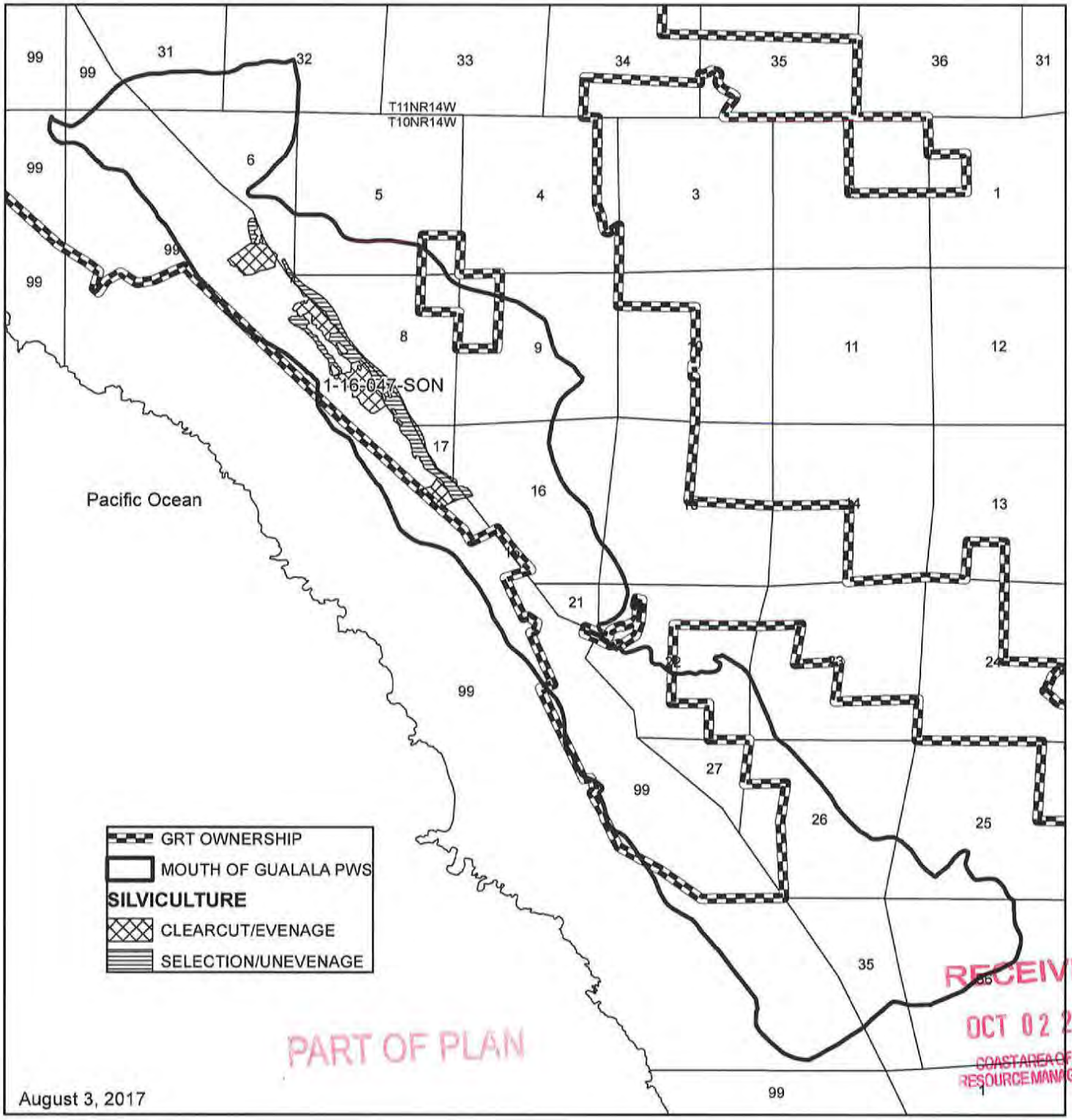
MOUTH OF GUALALA PWS 2005-2015 THP HISTORY
CALWNUM 1113.850202



MOUTH OF GUALALA PWS: CALWNUM 1113.850202
FORESEEABLE PROJECTS WITHIN 5 YEARS

1:54,000

Sources:
Gualala Redwood Timber



LITTLE CREEK PLANNING WATERSHED SILVICULTURE HISTORY FROM 2005 - 2015 — 5869 acres

Past and Present Projects:

Silviculture	Acres	% of PWS	Silviculture Category
Clearcut	146.5	2.5%	evenaged
Group Selection	150.2	2.6%	unevenaged
Rehabilitation	4.5	0.1%	special
Selection	367.8	6.3%	unevenaged
Unevenaged	37.8	0.6%	unevenaged
Sub Total:	706.8	12.0%	

Future Projects:

Silviculture	Acres	% of PWS
None	0.0	0.0%
Sub Total:	0.0	0.0%

	Acres	% of PWS
Total:	706.8	12.0%

Last ten years % of watershed unevenaged	% of watershed evenaged	% of watershed special	% of watershed intermediate	Total
9.5%	**0.0**	**0.1%**	**0.0%**	**12.0%**

LITTLE CREEK PLANNING WATERSHED THP HISTORY FROM 2005 - 2015

5,869 acres

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS	silviculture category
Sonoma	1-96NTMP-024	Selection		Approved	JHM Properties	1113.830004	85	1.5%	unevenaged
Sonoma	1-99NTMP-021	Selection	Tractor	Approved	Todd & Jamie Curlee	1113.830004	0	0.0%	unevenaged
Sonoma	1-00NTMP-041	Selection	Tractor	Approved	Michael & Tonna Wilkins	1113.830004	14	0.2%	unevenaged
Sonoma	1-00NTMP-073	Selection	Tractor	Approved	Darrell Rogers	1113.830004	41	0.7%	unevenaged
Sonoma	1-05NTMP-013	Selection	Tractor	Approved	Rae Radtkey	1113.830004	64	1.1%	unevenaged
Sonoma	1-05NTMP-017	Unevenaged		Approved	Lester Gray	1113.830004	38	0.6%	unevenaged
Sonoma	1-06-009-SON	Selection	Tractor/Cable	Completed	GRI	1113.830004	91	1.6%	unevenaged
Sonoma	1-06NTMP-009	Group Selection	Cable	Approved	Raul Hernandez et al	1113.830004	30	0.5%	unevenaged
Sonoma	1-06NTMP-009	Group Selection	Tractor	Approved	Raul Hernandez et al	1113.830004	121	2.1%	unevenaged
Sonoma	1-08-021-SON	Clearcut	Tractor	Completed	GRI	1113.830004	122	2.1%	evenaged
Sonoma	1-08NTMP-011	Selection	Tractor	Approved	Darrell Rogers	1113.830004	14	0.2%	unevenaged
Sonoma	1-13-023-SON	Clearcut	Tractor	Approved	GRI	1113.830004	25	0.4%	evenaged
Sonoma	1-13-023-SON	Rehabilitation	Tractor	Approved	GRI	1113.830004	5	0.1%	special
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	1113.830004	58	1.0%	unevenaged
# Plans	12				Sub Total from 2005 to 2015:		707	12.0%	

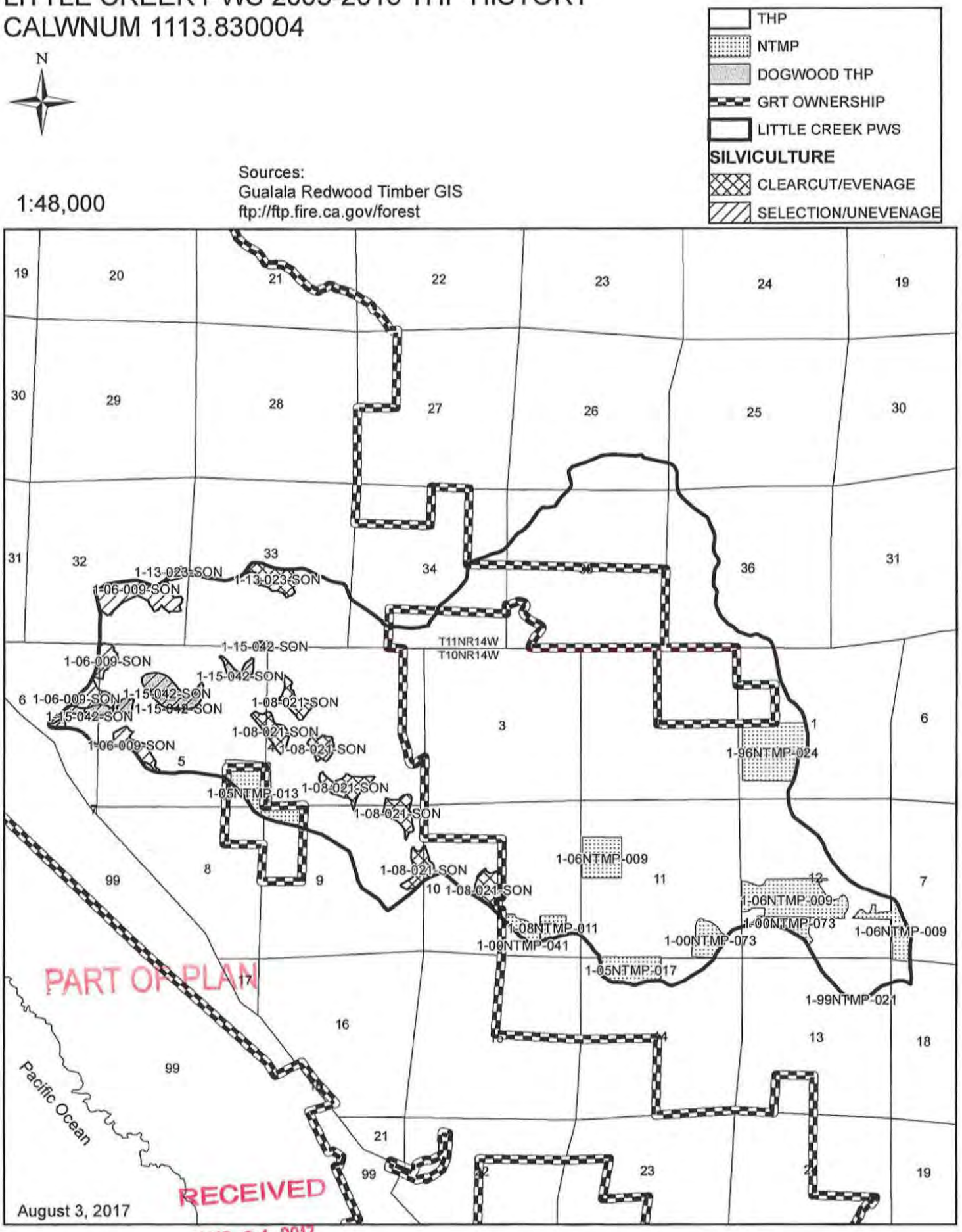
141.10

REVISED 9/18/17

Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	CALWNUM	Acres	% of PWS
					GRT	1113.830004	0	0.0%
# Plans	0				Sub Total for next five years		0	0.0%
					Total			12.0%

LITTLE CREEK PWS 2005-2015 THP HISTORY
CALWNUM 1113.830004



PART OF PLAN

RECEIVED
AUG 31 2017
COAST AREA OFFICE
RESOURCE MANAGEMENT

141.11

REVISED 8/18/17

LITTLE CREEK PWS: CALWNUM 1113.830004
FORESEEABLE PROJECTS WITHIN 5 YEARS

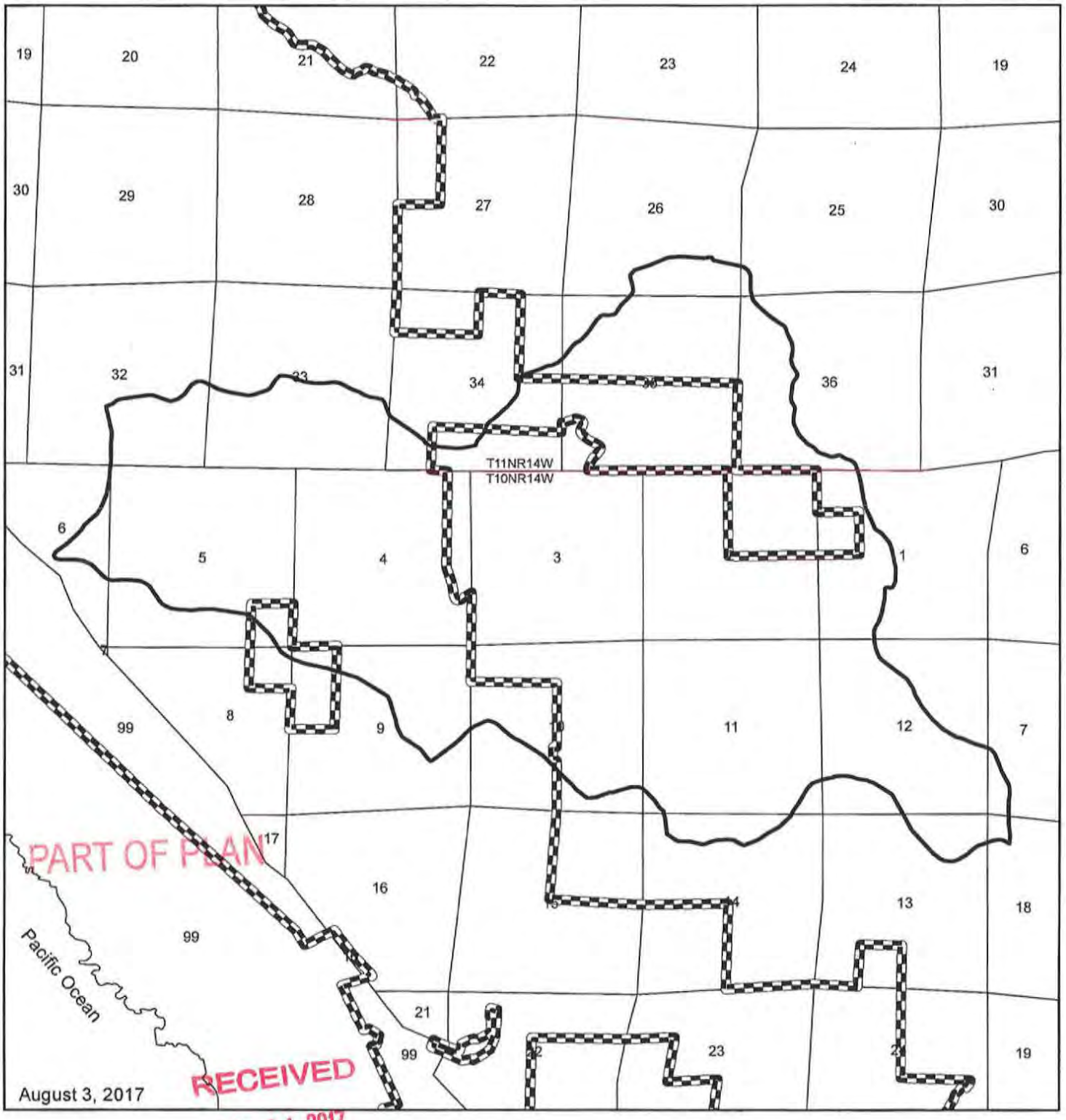
N

NO FORESEEABLE PROJECTS WITHIN THE NEXT 5 YEARS

SECTION LINES
LITTLE CREEK PWS
GRT OWNERSHIP

1:48,000

Sources:
Gualala Redwood Timber



PART OF PLAN

August 3, 2017

RECEIVED
AUG 31 2017
COAST AREA OFFICE
RESOURCE MANAGEMENT

141.12

REVISED 8/18/17

ANNAPOLIS PLANNING WATERSHED SILVICULTURE HISTORY FROM 2005-2015

Past and Present Projects:

Silviculture	Acres	% of PWS	Silviculture category
Clearcut	208.7	2.8%	evenaged
Group Selection	48.2	0.6%	unevenaged
Rehabilitation of Understocked	128.5	1.7%	special
Seed Tree Removal Step	256.0	3.4%	evenaged
Selection	442.2	5.8%	unevenaged
Shelterwood Seed Step	196.5	2.6%	evenaged
Transition	285.8	3.8%	unevenaged
Unevenaged Management	86.2	1.1%	unevenaged
Variable Retention	418.5	5.5%	special
Sub Total:	2070.5	27.3%	

Future Projects:

Silviculture	Acres	% of PWS
	0.0	0.0%
Sub Total:	0.0	0.0%
Total:	2070.5	27.3%

ANNAPOLIS PLANNING WATERSHED THP HISTORY FROM 2005-2015

7,580 acres

Past and Present Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	Acres	% of PWS	silviculture category
Sonoma	1-99NTMP-021	Selection	Tractor	Approved	Curlee	39	0.5%	unevenaged
Sonoma	1-00NTMP-073	Selection	Tractor	Approved	Rogers	132	1.7%	unevenaged
Sonoma	1-00NTMP-041	Selection	Tractor	Approved	Wilkins	13	0.2%	unevenaged
Sonoma	1-01NTMP-048	Selection	Tractor	Approved	Garrett	101	1.3%	unevenaged
Sonoma	1-01NTMP-048	Transition	Tractor	Approved	Garrett	12	0.2%	unevenaged
Sonoma	1-04NTMP-001	Selection	Cable	Approved	Ragle	9	0.1%	unevenaged
Sonoma	1-04NTMP-001	Selection	Tractor	Approved	Ragle	63	0.8%	unevenaged
Sonoma	1-05NTMP-017	Unevenaged	Tractor	Approved	Gray	86	1.1%	unevenaged
Sonoma	1-06-072-SON	STRS	Tractor	Completed	Richardson Trust	148	2.0%	evenaged
Sonoma	1-06-072-SON	Selection	Tractor	Completed	Richardson Trust	17	0.2%	unevenaged
Sonoma	1-06-110-SON	Alternative (SSS)	Cable	Completed	MRC	36	0.5%	evenaged
Sonoma	1-06-110-SON	Alternative (SSS)	Tractor	Completed	MRC	160	2.1%	evenaged
Sonoma	1-06-110-SON	Rehabilitation	Tractor	Completed	MRC	33	0.4%	special
Sonoma	1-06-192-SON	Alternative (Transition)	Tractor/Cable	Completed	MRC	133	1.8%	unevenaged
Sonoma	1-07-028-SON	Alternative (CC)	Cable	Completed	MRC	41	0.5%	evenaged
Sonoma	1-07-028-SON	Alternative (Transition)	Tractor/Cable	Completed	MRC	52	0.7%	unevenaged
Sonoma	1-07-028-SON	Rehabilitation	Cable	Completed	MRC	40	0.5%	special
Sonoma	1-07-028-SON	Rehabilitation	Tractor/Cable	Completed	MRC	56	0.7%	special
Sonoma	1-08NTMP-011	Selection	Tractor	Approved	Rogers	0	0.0%	unevenaged
Sonoma	1-08-124-SON	STRS	Tractor	Completed	Brenner, Carroll, Vollman	108	1.4%	evenaged
Sonoma	1-08-124-SON	Selection	Tractor	Completed	Brenner, Carroll, Vollman	18	0.2%	unevenaged
Sonoma	1-08-021-SON	Clearcut	Tractor	Completed	GRI	2	0.0%	evenaged
Sonoma	1-08-093-SON	Variable Retention	Cable	Completed	MRC	20	0.3%	special
Sonoma	1-08-093-SON	Variable Retention	Tractor	Completed	MRC	27	0.4%	special
Sonoma	1-08-121-SON	Variable Retention	Cable	Completed	MRC	155	2.0%	special
Sonoma	1-08-121-SON	Variable Retention	Tractor	Completed	MRC	58	0.8%	special
Sonoma	1-09-041-SON	Clearcut	Cable	Completed	GRI	18	0.2%	evenaged
Sonoma	1-09-041-SON	Clearcut	Cable/Tractor	Completed	GRI	3	0.0%	evenaged
Sonoma	1-09-041-SON	Clearcut	Tractor	Completed	GRI	32	0.4%	evenaged
Sonoma	1-09-041-SON	Selection	Cable	Completed	GRI	3	0.0%	unevenaged
Sonoma	1-09-041-SON	Selection	Cable/Tractor	Completed	GRI	1	0.0%	unevenaged
Sonoma	1-09-041-SON	Selection	Tractor	Completed	GRI	35	0.5%	unevenaged
Sonoma	1-09-069-SON	Clearcut	Cable	Completed	GRI	55	0.7%	evenaged
Sonoma	1-09-069-SON	Clearcut	Tractor	Completed	GRI	56	0.7%	evenaged
Sonoma	1-09-069-SON	Selection	Cable	Completed	GRI	5	0.1%	unevenaged
Sonoma	1-09-069-SON	Selection	Tractor	Completed	GRI	3	0.0%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Cable	Completed	Garrett/Parks	2	0.0%	unevenaged
Sonoma	1-12-045-SON	Group Selection	Tractor	Completed	Garrett/Parks	46	0.6%	unevenaged
Sonoma	1-12-083-SON	Transition	Tractor	Completed	MRC	89	1.2%	unevenaged
Sonoma	1-12-083-SON	Variable Retention	Cable/Helicopter	Completed	MRC	48	0.6%	special
Sonoma	1-12-083-SON	Variable Retention	Tractor	Completed	MRC	110	1.5%	special
Sonoma	1-15-042-SON	Selection	Tractor	Approved	GRT	3	0.0%	unevenaged
# Plans	20				Sub Total from 2005 to 2015:	2070	27.3%	

Foreseeable Future Projects:

County	THP Num	Silviculture	Yarding	Status of Plan	Landowner	Acres	% of PWS
						0	0.0%
# Plans	0				Sub Total for next five years:	0	0.0%
					Total	2070	27.3%

0

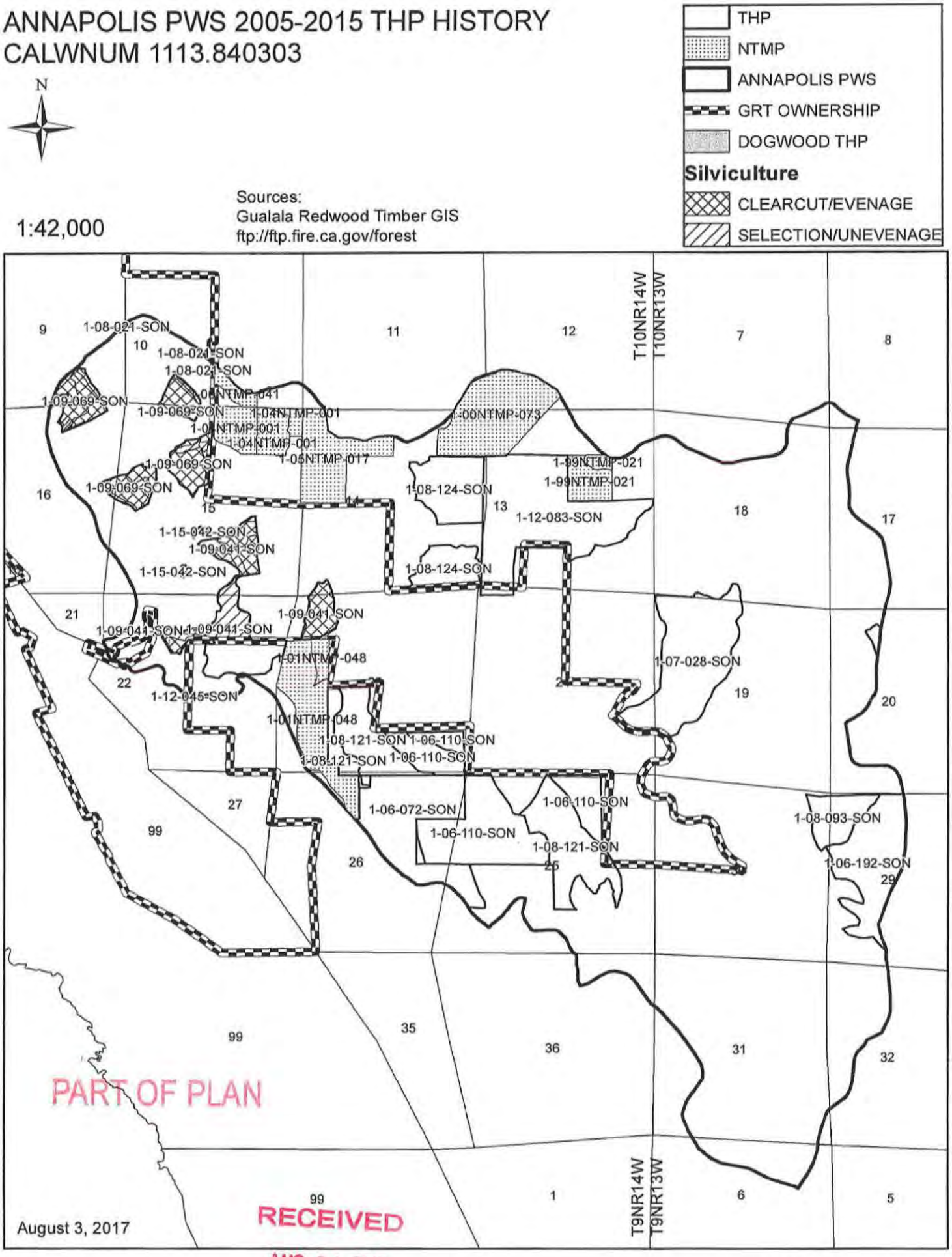
141.14

REVISED 9/18/17

RECEIVED
OCT 02 2017
COAST AREA OFFICE
RESOURCE MANAGEMENT

PART OF PLAN

ANNAPOLIS PWS 2005-2015 THP HISTORY
CALWNUM 1113.840303



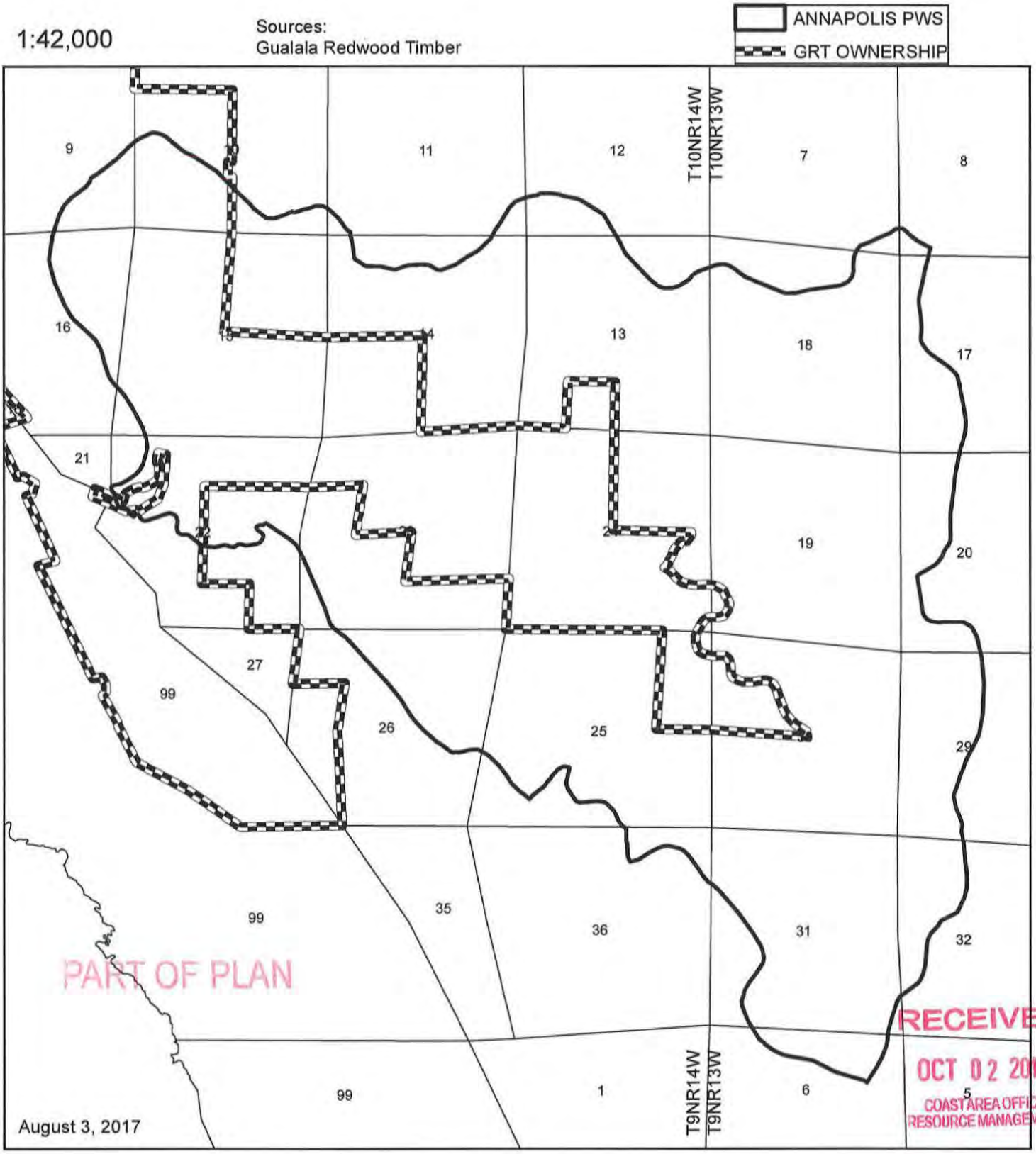
ANNAPOLIS PWS: CALWNUM 1113.840303
FORESEEABLE PROJECTS WITHIN 5 YEARS

N

NO FORESEEABLE PROJECTS WITHIN THE NEXT 5 YEARS

1:42,000

Sources:
Gualala Redwood Timber



PART OF PLAN

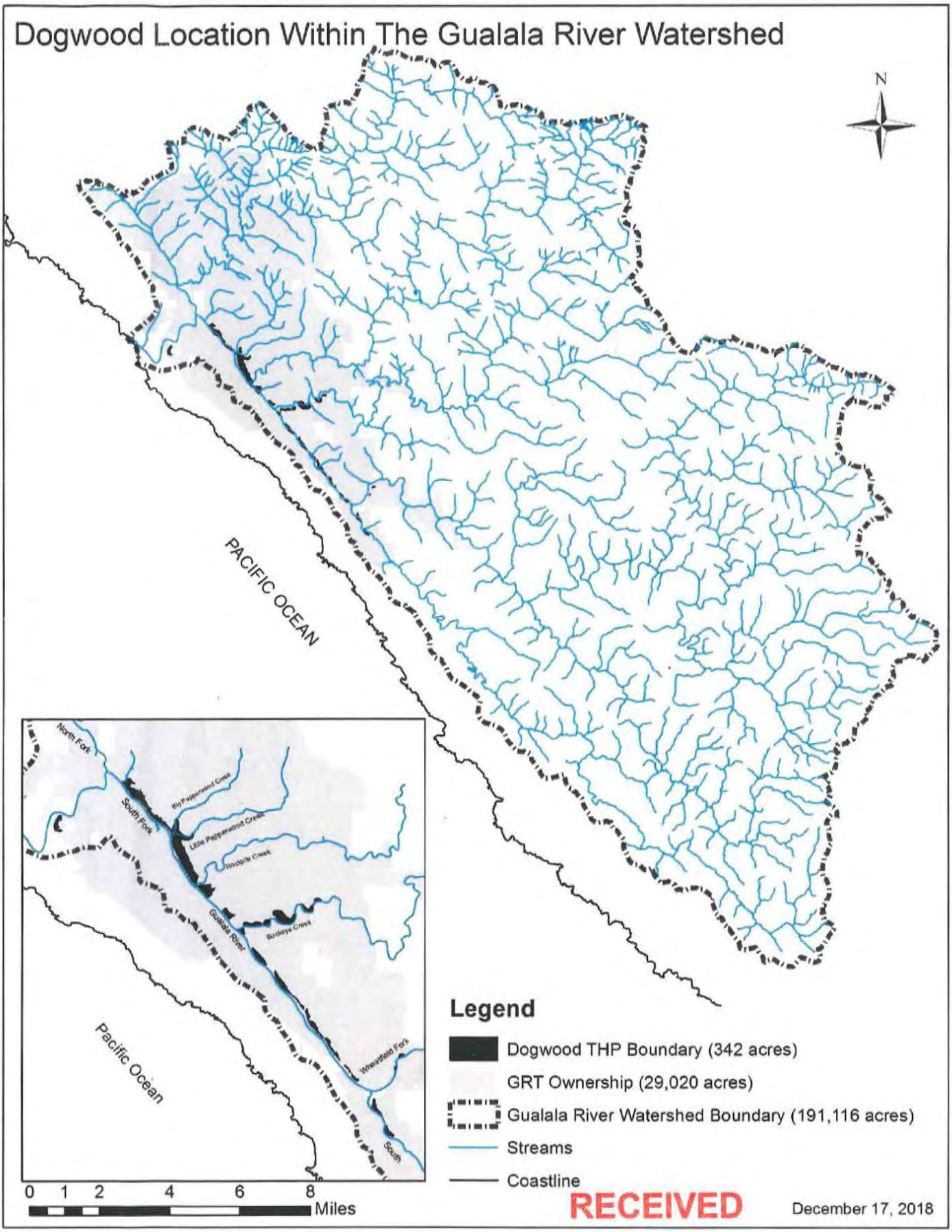
RECEIVED
OCT 02 2017
COASTAREA OFFICE
RESOURCE MANAGEMENT

August 3, 2017

141.16

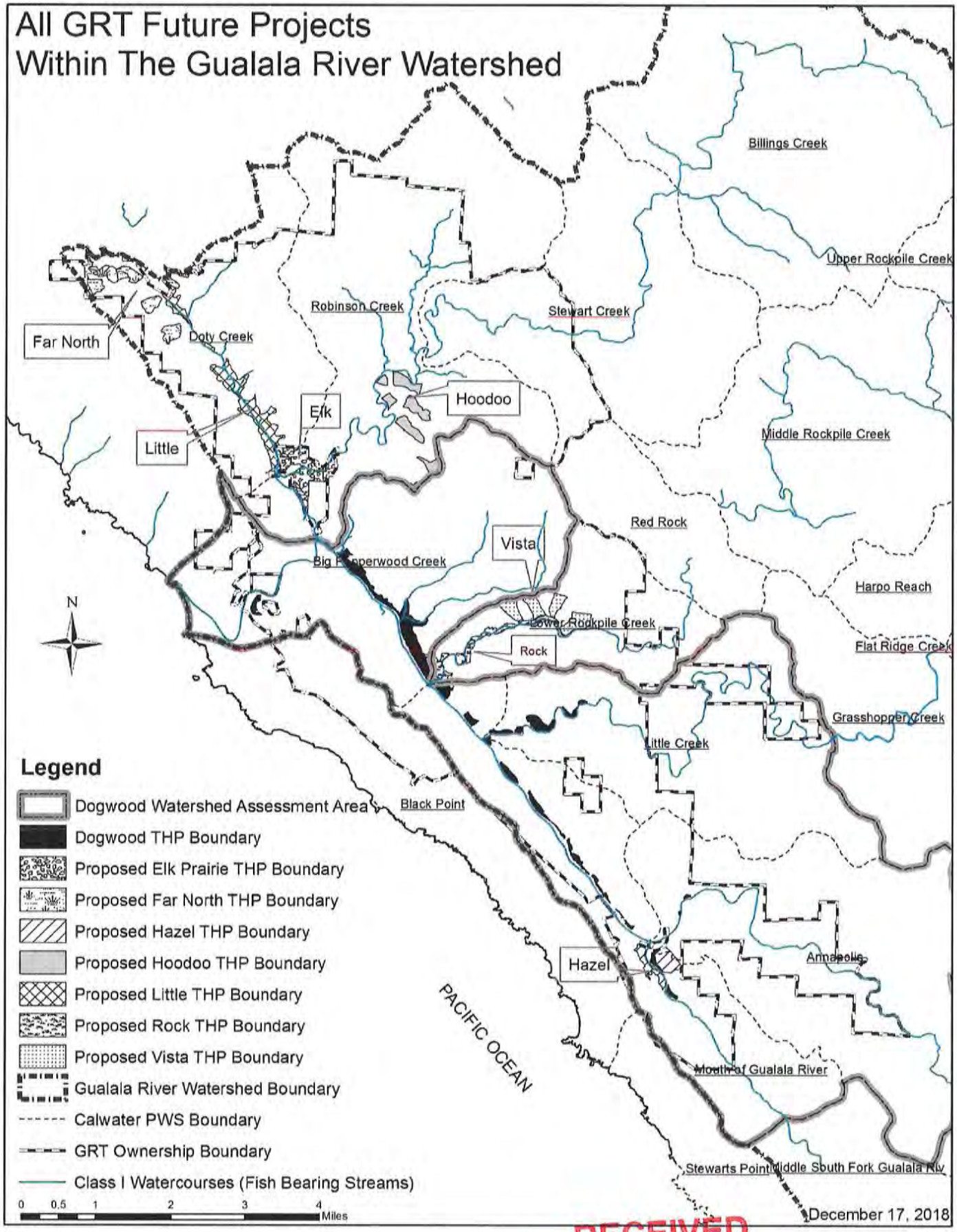
REVISED 9/18/17

Dogwood Location Within The Gualala River Watershed

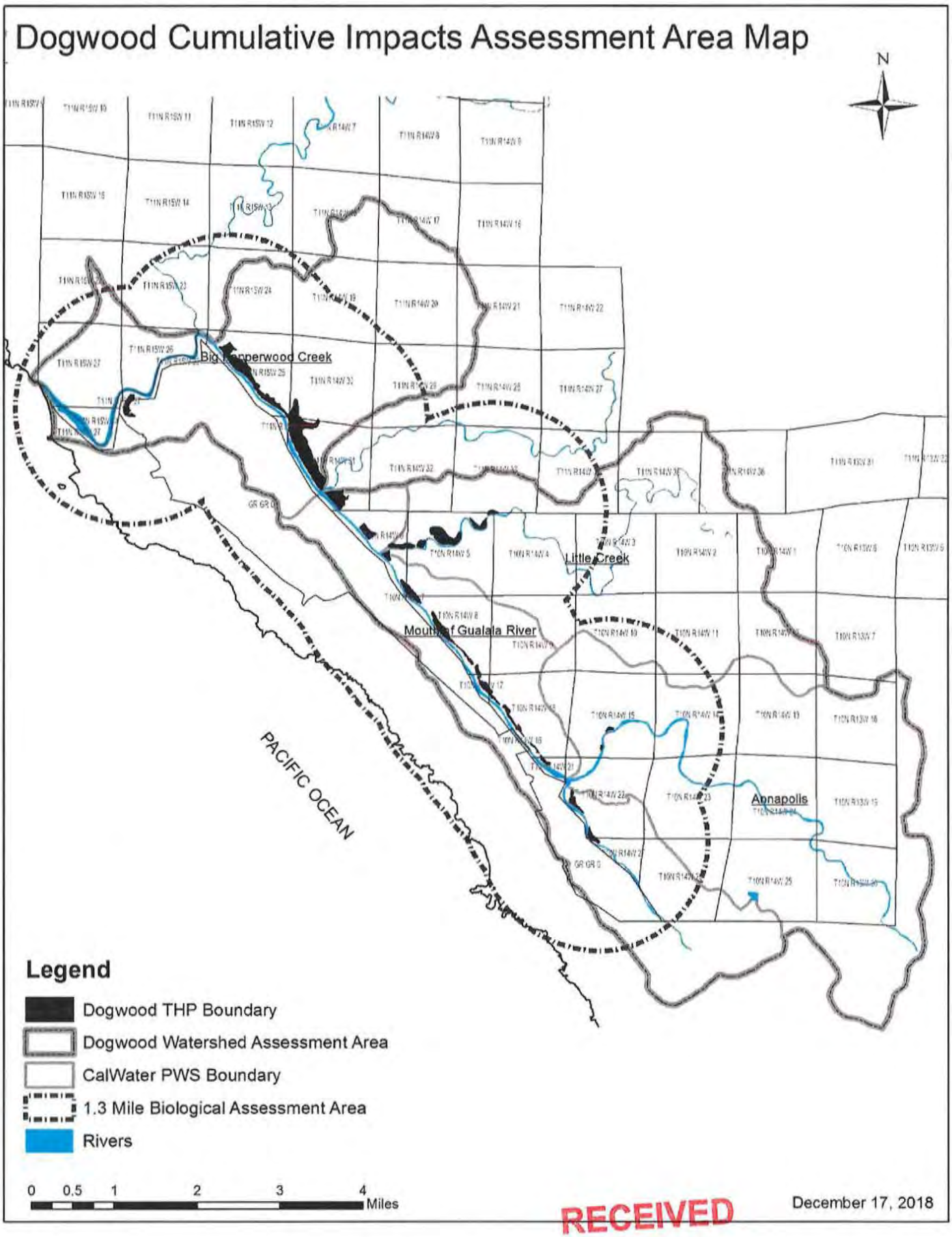


December 17, 2018

PART OF PLAN



RECEIVED
JAN 15 2019
COAST AREA OFFICE
RESOURCE MANAGEMENT



The resources that are possibly affected by the projects listed above are Watershed, Soil, Biological, Recreational, Visual, Noise and Traffic.

The planned levels of harvesting, when mitigated with the procedures prescribed by the rules, will not create significant adverse cumulative impacts to these assessment areas.

(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 activities, describing their locations, impacts and affected resource subject(s).

The following cumulative effects analysis reference the following documents: the Gualala River Watershed Council (GRWC) Monitoring Plan Report 2000-2005 (GRWCMPR) and from the North Coast Watershed Assessment Program (NCWAP March 2003). The GRWCMPR is the most comprehensive analysis available and summarizes the data that has been collected as part of the Gualala River Watershed Monitoring Program Plan and includes a Quality Assurance Project Plan (QAPP) vetted by the California Department of Fish and Wildlife and the North Coast Regional Water Quality Control Board. It is part of the ongoing development of a Watershed Management and Enhancement Plan (WMEP) for the Gualala River Watershed. This monitoring plan was funded by grants from the State Water Resource Control Board (State WRCB) 319(h) program and the California Department of Fish and Game (CDFG) SB271 program.

The GRWCMPR and NCWAP reports were published in 2006 and 2003 respectively and contain the most comprehensive and scientifically valid information to date regarding existing conditions and how those conditions relate to past land use practices. NCWAP was developed through cooperative efforts with landowners, government agencies and public cooperators.

The Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board in 2001 as supporting documentation for the TMDL analysis by the EPA was also reviewed for this cumulative impacts analysis. The primary objective of the GRWTSD is to identify and quantify sources of sediment in a way that allows a relative comparison of those sources and to provide information for non-point source erosion control measure prioritization and implementation.

Additional references are THP reports prepared for GRI by fisheries experts, in particular a report by fisheries biologist Dennis Halligan of Natural Resources Management Corporation (Halligan 2000). Mr. Halligan's report contained valuable analysis of the available watershed information and some of his conclusions are included in this analysis. The archives at Department of Fish and Wildlife have previously been examined for information regarding the Gualala River and most of that information was summarized in the NCWAP report.

Watershed analysis is currently being conducted by the Gualala River Watershed Council (GRWC). The GRWC stream monitoring program revisits specific stream reaches on a periodic basis to evaluate trends in water temperature, stream channel characteristics such as depth, width, and thalweg, riparian shade cover, and presence and absence of anadromous salmonids. GRWC crews have been annually monitoring stream reaches since the two reports sited above were published in 2003. GRT is continuing these monitoring programs on its property in the Gualala River Watershed.

Past Watershed Impacts-

Prehistorically, the greatest impact to the watercourses within these watersheds was landslide activity. This resulted in the delivery of sediment into watercourses through large mass wasting events over the course of geologic time. Tim Best, a consulting State Licensed Engineering Geologist studied the Gualala Redwood property for unstable areas and wrote a report on his findings in 1998. This information was updated and reassessed in 2006 by Mr. Best. In that analysis he quantified landslides by time period using aerial photos. Smaller landslides that are found during THP preparation are added to the unstable area database for the property. This unstable area database can be found on the pages titled "Landslide Sites" in Section V (misc. addendums). All known landslides, both historic and prehistoric, are listed on these pages. Although prehistoric slides are not considered "past land use activity" they have been included in the database to be assessed in terms of potential additional watershed impacts.

Historically, timber harvesting (with its associated activities) and road building for timber purposes have been the human activities occurring within this watershed with the greatest potential for impacting watershed resources. The first logging in this watershed occurred approximately 100+ years ago. In the early part of the last century when logging was just beginning, most of the skidding was by cable logging systems that dragged logs on the surface of the ground, typically downhill to railroad spurs. The logging patterns in the earlier part of this century made heavy use of draws and watercourse channels as skid and haul roads. Around the early 1940's, timber harvesting methods began to be converted to tractor logging. The seasonal roads within the planning watersheds were sometimes constructed on the old railroad grades. During the early tractor logging operations and up to the early 1970's, roads and skid trails were mostly constructed by cut and fill methods on the slopes and in and around watercourse channels to provide a means to remove the timber. In some cases, water was diverted out of natural watercourse channels or was channeled under the skid trails and roads by means of Humboldt crossings using log chunks with and earth cap as fill material. Between 1952 and 1965 aerial photos show that extensive harvesting took place in the inland portions of the Gualala River Watershed however, existing age classes of trees indicate that the majority of harvesting of old growth on this property took place earlier than this, (1890-1910), probably because of the property's close proximity to the coast.

Within the assessment area these old fills at skid trail and road crossings have long since been washed out, stabilized, or replaced by more storm proofed crossings. Eroded sediments have mobilized through and out of the Gualala watershed or have become deposits on flatter downstream reaches of the Class I and II watercourses. The majority of the sediment effects associated with the old logging before the modern Forest Practice Rules in the mid-1970's occurred shortly after the original logging took place. Long term impacts from the old logging tend to decrease with time after the activities occurred. Over time, impacted watercourse channels have reached greater levels of stability as sediments have moved downstream and stream banks have revegetated, though there is still likely to be some watercourse bank erosion where old fills and soil depositions are still actively eroding due to downcutting or bank cutting. Natural inner gorge slumping will be an on-going process. Known specific present and past impact locations are described in the "Landslide Sites" and "Completed Road Work" document summaries present in Section V of the THP. Also see THP Road Work database in Section II with the accompanying maps.

Recent Past and Present Watershed Impacts

Negative Impacts-

The recent recession of 2008 and the collapse of the housing bubble caused a dramatic reduction in timber

harvesting across the state with many mills closing and remaining mills working at reduced rates. This is likely a short-term temporary state of affairs, however medium term trends (i.e. over the last couple of decades) show a steady dropping off in THPs submitted and acres and volume being harvested statewide.

Not all negative environmental impacts can be attributed to pre-forest practice rule operations. Roads have continued to be constructed during the last forty years (although often the reason has been to switch from tractor logging, which requires roads at the bottom of slopes, to cable logging which needs roads at the top of slopes). Even with much more restrictive rules regarding the placement of roads and the construction and maintenance of watercourse crossings, new roads can still have potential sediment impacts if they are not designed properly to handle peak flow events or if the crossing is not properly sized and maintained. Culverts have the potential to create negative impacts through failure and the diversion of water onto unstable or erodible ground unless critical dips are placed to prevent diversions.

Surface erosion may occur where bare ground has been exposed and waterbars potentially can fail on roads and skid trails if not constructed properly or maintained. Prior to the 1973 Forest Practice Rules (FPR), skid trails were frequently built on steep slopes by large tractors and were constructed by pushing fill onto the steep slope below the trail. Some of these skid trails have had fill failures over time and usually during peak rain events as fill materials became saturated. Many of these skid trails and the associated fill failures have revegetated with thick conifer reproduction and potential fill failure has since stabilized or fill leaving the slopes has settled out onto lower gradient reaches. More of a problem pre-FPR, road and skid trail fill failure is the concentration and diversion of the surface flow of water (and sometimes subsurface flow) onto hill side slopes creating eroded rills and gully erosion. Diversions of watercourses on pre-FPR constructed roads and skid trails has also been a major source of human caused erosion in the past.

The practice of storm-proofing roads by outsloping road surfaces and installing rolling dips, armoring watercourse crossings, replacing culverts with rock armored fords or dips whenever feasible has become a standard industry practice in the last decade. Gualala Redwoods has storm-proofed more roads as a percentage of their entire road system than any other north coast timber company (personal comm. Pacific Watershed Associates). To date nearly 60 percent of GRT's management service roads and old legacy roads have been treated to reduce erosion and/or to prevent any measured sediment delivery to a watercourse. GRT intends to continue this road storm-proofing program for the remainder of the roads that have not yet been treated. Storm-proofed roads can withstand the peak flow events that in the past would wash out culverts and road fill or overtop waterbars and inside ditches. This new way of designing or reconstructing road systems is having a significant calculable positive effect. Breached waterbars resulting in deep road gullying are no longer a common site on roads that have been storm proofed. Inside ditches that need constant maintenance no longer exist on these roads and washed out culverts are becoming a rarity. This watershed improvement activity within the Gualala River Watershed on GRT lands is correcting decades of man caused problems, and it often has a noticeable affect the first winter after storm-proofing with associated streams running clearer of sediment.

Other potential impacts that have occurred within these watersheds in the recent past have been 1) the increased use of even-aged silviculture over uneven-aged silviculture by the landowner, which has potential watershed impacts, both negative and positive, 2) trespassers by all-terrain vehicles and motorcycles using roads and skid roads in the winter period which impacts the road system by damaging waterbars and creating small gullies that channel water down the roads, 3) climate change is a serious potential impact, the effects of

which are more intense storms and wildfires that can increase soil erosion, and since the main stem of the Gualala River is in the upper range of temperature that is suitable for salmonids, a warmer climate could have serious negative impacts on salmonid health and regeneration, and 4) the potential conversion of land to other uses such as housing or vineyards is an issue in this watershed as societal and economic pressures increase.

Positive Impacts

1) The landowner is involved in an ongoing project to evaluate and rehabilitate their entire road system in order to offset any sediment impacts that result from their timber harvesting activities. GRI improved 55.4% of their road system at their own cost of $3,433,000.00 not including grant money and prevented at least 295,000 cubic yards of sediment from being delivered into watercourses through work completed on their lands in the Gualala River Watershed from the period 2003 to 2017. The average cost of road upgrading has been $17,900.00 per mile. GRT has a goal of assessing their remaining road system over the next ten years and upgrading all roads to a storm-proofed condition over the next twenty years as money is available. In addition, roads are inspected annually and most road erosion sites that develop during the winter that are found and are accessible are repaired immediately so that small problems do not develop into big problems. Under miscellaneous addendums in Section V is a listing of "Completed Road Work" projects for each watershed. In these "Competed Road Work" addendums "Yards Stabilized" were only provided if a qualified person addressed the site, and many of the stabilization sites were repaired but actual quantitative sediment savings has not or is yet to be documented.

2) New Forest Practice Rules implemented since 2000, and especially the Anadromous Salmonid Rules of 2009 have resulted in significant amounts of sensitive areas being designated as no-harvest areas for resource protection. Additionally, WLPZs now have higher canopy and Large Woody Debris (LWD) retention requirements. These include areas in Class I watercourse floodplains, areas adjacent to Class I watercourses that contain listed salmonids, inner gorge areas, unstable areas, areas for wildlife protection, areas for botanical protection, archaeological sites, and areas on steep slopes near Class I and Class II watercourses. Many areas with difficult access near Class I watercourses end up as virtual no-cut zones because of high canopy retention standards. These areas will continue to age and develop into mature successional stands. Many of these areas on the GRT property already contain a stand cohort that is 100 plus years old. These protection measures have been developed by interdisciplinary teams and are constantly being assessed for effectiveness.

3) Wildlife and botanical surveys that have occurred for harvest plans have resulted in the discovery of many rare plants, listed birds, and frogs that otherwise would not be protected. Numerous areas designated for protection have been flagged out or designated as no-cut as a result of these surveys.

Other Impacts

Surface gravel mining of the open bars above the Gualala River summer flow may have an impact on the river but its extent is unknown as to whether the impact is positive or negative. Gravel mining opponents argue that any activity in the stream channel is potentially disruptive by destabilizing stream banks, exposing areas of fine sediment, damaging riparian vegetation or in some cases affecting the water table. Gravel mining advocates argue that removal of gravel actually enhances downstream habitats by reducing the oversupply of gravel in depositional reaches of the river thereby reducing the chance of flooding, increasing pool depth and creating greater channel diversity. State and County permitting requires that measurements are taken annually to ensure that gravel bars are replenished each year and in low replenishment years gravel removal is reduced or stopped altogether.

Potential Biological Impacts-

The major biological impacts in the Biological Assessment Area, which includes all of the WAA and is dominated by timberland that has been under active management for the last 100 years would primarily be 1) erosion of the soil with the resulting loss of forest productivity and the sedimentation of the watercourses affecting downstream fisheries and instream habitat for aquatic species; 2) change of habitat for certain groups of species through the conversion of existing eighty to one hundred year old timber stands to younger age classes and a reduction in the diversity of hardwood tree species as forest management favors growth of conifers; 3) the loss of snag recruitment trees and the unintentional knocking down of existing snags (snags being important for a number of species); 4) disturbance of animal species in the summer time through logging and trucking activity; and 5) directly killing certain slow moving or non-mobile plant and animal species through falling, skidding, logging, trucking and road building activities.

Potential Offsetting Actions

1) Forestry related: Increased canopy retention and large woody debris standards near watercourses along with no-cut areas implemented for a number of reasons (i.e. avoidance of unstable areas, wildlife protection, botanical protection, archaeological site avoidance, etc.) will result in increasingly older forests adjacent to watercourses and in random locations, resulting over time in development of late seral corridors and islands. As this trend continues it is likely that a significant amount of the property, estimated at 20%, will eventually end up as forests with late seral type characteristics with only light selection taking place into the future. Flood plains are part of this forest type due to the restrictions of the ASP Rules. These areas are often adjacent to linear features that are contiguous with other no-cut areas and have an added benefit of creating wildlife corridors and islands across the property.

2) Evenage management results in the temporary establishment of low growing vegetation that is different from vegetation in a closed canopy forest, and this shrubby and brushy vegetation increase forage and habitat for a different set of wildlife species and creates edge effect along margins of evenaged units. The impacts of evenaged management are temporary in nature and tend to mimic natural disturbance events such as fire that create variations in age, size and structure of forests. Openings and gaps created by timber management are where rare plants are typically found on the property, and this is often a result of these species preferring recent soil disturbance where invasive and non-native plants have not yet become established.

3) The 2009 ASP rules expanded Watercourse and Lake Protection Zones with increased canopy retention requirements and increased Large Woody Debris (LWD) retention requirements adjacent to salmonid streams which is expected to result in cooler stream temperatures favorable to salmonids and more structure in the streams which increases pool depths, spawning habitat, and provides cover from predators.

4) GRT is also involved in the facilitation of ongoing stream reach, stream cross sectional, and LWD placement monitoring being conducted annually by the Gualala River Watershed Council (GRWC) on GRT's property in the WAA and within the Gualala River Watershed in order to offset any potential impacts that result from their timber harvesting activities. See biological section below for discussion of the monitoring and rehabilitation efforts that have been conducted for the past decade.

(3) Will the proposed project as presented, in combination with past, present, and reasonably 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)
A. Watershed			X
B. Soil Productivity		X	
C. Biological			X
D. Recreation			X
E. Visual			X
F. Traffic			X
G. Noise			X
H. Global warming			X

a) Yes, means that potential significant adverse cumulative 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 or add to significant adverse cumulative impacts has been substantially reduced to insignificance or avoided by mitigation measures or alternatives proposed in the THP and application of the forest practice rules.

c) No reasonable potential significant cumulative effects mean that the operations proposed under the THP do not have a reasonable potential to join with the impacts of any other project to cause, add to, or constitute significant adverse cumulative impacts.

If column (a) is checked in (3) above, describe why the expected impacts cannot be feasibly mitigated or avoided and what mitigation measures or alternatives were considered to reach this determination. If column (b) is checked in (3) above, describe what mitigation measures have been selected which will substantially reduce or avoid reasonably potential cumulative impacts except for those mitigation measures or alternative mandated by application of the rules of the Board of Forestry.

Current harvesting and forest management practices in combination with adherence to regulations of the Forest Practice Rules and beneficial actions developed in this THP should reduce the risk of significant adverse cumulative impacts to the resources. See below for specific beneficial actions.

(4) Project Description –For a description of the current project see the beginning of Section III (preceding the impacts analysis).

(5) A Description of the Assessment Area used for each Resource Subject

WATERSHED ASSESSMENT AREA (WAA):

The watershed assessment area is the Big Pepperwood Creek Watershed (6,532 acres, 1113.850201), the Mouth of the Gualala River Watershed (5,305 acres, 1113.850202), the Little Creek Watershed (5,869 acres, 1113.830004) and the Annapolis Watershed (7,580 acres,1113.840303). Total acreage of the assessment area is 25,283 acres which is 13.2 percent of the total Gualala River Watershed comprised of 191,116 acres.

Rationale: The THP area is located within these CAL WATER planning watersheds and operations from this THP have the most potential to affect water quality within these watersheds. These planning watersheds include a variety of topographic aspects, a variety of slope inclinations from steep to flat, a variety of soil types from very stable to highly unstable, and a variety of watercourses that range from large Class I salmonid bearing watercourses to small ephemeral Class III watercourses. They also include flood prone areas within the Gualala River Watershed and significant reaches of the Main Fork and South Forks of the river as well as some of their larger tributaries.

SOIL PRODUCTIVITY ASSESSMENT AREA (SAA):

Assessment Area: The area within the THP boundary will be the assessment area.

Rationale: All effects on the soil will occur within the THP area.

BIOLOGICAL RESOURCES ASSESSMENT AREA (BAA):

Assessment Area: The Biological assessment area will be the same as the watershed assessment area plus an additional 1.3 miles perimeter around the THP boundary which is the area assessed for Northern spotted owls and other mobile non-aquatic species. For aquatic species the assessment area is the Class I and II watercourses, springs, ponds and wet areas within the planning watersheds of the WAA.

Rationale: This area encompasses a large enough area to account for wildlife movement and includes a variety of habitat types representative of the area.

RECREATION ASSESSMENT AREA (RAA):

Assessment Area: Within 300 feet of the THP boundary will be the assessment area.

Rationale: All effects on recreation are most likely to occur within this area.

VISUAL ASSESSMENT AREA (VAA):

Assessment Area: The assessment area for impact to visual aesthetics is the area within 3 miles of the THP.

Rationale: Beyond three miles forestry activities are difficult to discern.

TRAFFIC ASSESSMENT AREA (TAA):

Assessment Area: The assessment area for traffic is the private road system west or east of the THP to the Annapolis Road and from there to Hwy 1 or from the private road system to county road 501 and from there to Old State Hwy and then to Hwy 1; see appurtenant road map in Section II.

Rationale: These are the first roads not part of the logging area on which logging traffic must travel.

NOISE ASSESSMENT AREA (NAA):

Assessment Area: The area north and west of the northern most part of THP; approximately up to ½ mile depending on topography.

Rationale: These are the only populated areas that could conceivably be affected by the noise of the logging operations.

GLOBAL WARMING ASSESSMENT AREA (GWAA):
Assessment Area: The area within the THP boundary will be the assessment area.

Rationale: Virtually all effects relating to the sequestration of carbon will occur in the immediate vicinity of the growing trees on the THP.

(6)- For a listing of the individuals, organizations, and records consulted please see the end of this CWE analysis.

A. Watershed Resources Assessment

1. Beneficial Uses of Water

The watershed resources that are affected by potential adverse impacts of this project are the beneficial uses of water in the Gualala River which are designated in the Water Quality Control Plan for the North Coast Region (Section 2, Table 4) as: municipal supply and domestic supply, agricultural supply, industrial service supply, water contact recreation, non-water contact recreation, commercial and sport fishing, cold freshwater habitat, wildlife habitat, groundwater recharge, navigation, migration of aquatic organisms, spawning, reproduction and/or early development, estuarine habitat, rare, threatened, or endangered species, water quality enhancement, flood peak attenuation/flood water storage, wetland habitat, water quality enhancement and subsistence fishing. The following table indicates estimated cubic feet per second (cfs) diversions during the year from the entire Gualala River Watershed as determined by the Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board (2001).

Estimated Water Uses in the Gualala River Watershed

Water Use	Estimated Maximum Withdrawal Rate (cfs)
SWRCB appropriative rights	8
Vineyards—dry and frost	27-100
Rural Residential	2.5
North Gualala Water Company	2
Sea Ranch	2.8
Potential total diversion amount	**42.3 – 115.3**

2. Watershed Description

The Gualala River Watershed produces high volumes of sediment due to the geology and the topography. "The combination of the underlying pervasively sheared and often folded Franciscan rocks, recent uplift, and a distinctive climate accounts for the large sediment yields." (Kelsey et al 1981). The THP area is located within the floodplain of the South Fork Gualala River and lower Wheatfield Fork Gualala River. These Class I watercourses have extensive alluvial flats or floodplains which support a productive second and third growth redwood forest. These alluvial flats act as a buffer between the steeper upslope areas, from which sediment is migrating, and the major watercourse channels. During peak flows sediment that is carried from transport reaches in steep Class I, II and III watercourses at the headwaters of the watersheds drop out of suspension as they cross the lower gradient storage reaches, and deposit sediment on the alluvial flats, that occur adjacent to the river. Some smaller Class III watercourses that feed directly into the alluvial flats disappear into the sandy soil without contributing their sediment load directly to higher order watercourses. Numerous low spots

within the flats along the river also act as sediment catch basins when the main tributaries of the Gualala River periodically overflow their banks during peak flow events during the winter and spring seasons. The slopes above the floodplain of the Gualala River are well vegetated with redwood, Douglas-fir, bishop pine, buckeye, tan oak, madrone, big leaf maple, California bay, and several other hardwood species in small amounts. Floodplains are dominated by coastal redwood with intermixed hardwoods of California bay and red alder, all of which can tolerate short term water inundation.

Precipitation within these watersheds average around 40 inches per year, which comes mainly in the form of rain. Much of the year the area has coastal fog that provides moisture to the redwood forests from leaf drip and reduces evaporation by providing cover from solar radiation.

The lower reaches of the Gualala River system, where the plan is located has limited ability to retain large woody debris because of the width and size of the channels. The bank vegetation, although thick, is incapable of shading the entire watercourse in many locations due to the wide channel. Sediment that is washed down, often from many miles upstream during peak flow events will drop out of suspension on the alluvial flats due to the slower low gradient flows that occur there. Consulting Fisheries Biologist Dennis Halligan describes the South Fork of the Gualala channel characteristics as "...contained entirely within the San Andreas Fault in a 100-200 foot wide aggraded alluvial channel with less than 1% gradient. The summer low flow wetted channel is approximately 25 feet wide. The substrate is composed exclusively of small gravel and sand. The stream banks are 20 – 30 feet high and have a 50% slope prior to transitioning onto the terrace. Spawning habitat quality is poor due to the heavily embedded nature of the substrate. Rearing habitat quality is fair and located primarily in corner pools or LWD scour pools. LWD averages 3 pieces per 100 feet, but much of it is small size and relatively unstable. The riparian zone is composed of moderately to densely spaced 2nd growth redwoods in the 12 to 36 inch dbh size classes. Due to channel width, the shade canopy is less than 20%. There is no evidence of the type of bank erosion that would indicate active channel migration. However, the thalweg does meander within the stable active channel banks. The continuing development of these floodplains (those adjacent to the Gualala River) is predicated on the fact that they are sediment deposition areas, not source areas. GRI has documented an increase in floodplain elevation between 1953 and 1986 of approximately 3.5 feet. This equates to an average of 17 cubic yards per acre per year." (Halligan 2000)

3. Potential Specific Watershed Impacts

There are four CAL WATER planning watersheds that are included in WAA. The Annapolis Planning watershed contains less than 1% of the plan area, and the area to be harvested is less than 0.05% of this planning watershed. The area where the greatest potential impacts could occur are the Big Pepperwood Creek watershed where 61% of the plan area is located, the Mouth of the Gualala watershed where 22% of the plan area is located, and the Little Creek watershed where 15% of the plan area is located, therefore the following analysis will focus primarily on these watersheds.

Section 916.4 (a)(1) of the Forest Practice Rules states that the RPF or supervised designee shall evaluate areas near, and areas with the potential to directly impact, watercourses and lakes for sensitive conditions including, but not limited to, existing and proposed roads, skidtrails and landings, unstable and erodible watercourse banks, unstable upslope areas, debris jam potential, inadequate flow capacity, changeable channels, overflow channels, flood prone areas, and riparian zones wherein the values set forth in 14 CCR §§ 916.4(b) are impaired. The RPF shall consider these conditions, and those measures needed to maintain, and restore to the extent feasible, the functions set forth in 14 CCR §§ 916.4(b), when proposing WLPZ widths and protection measures. The plan shall identify such conditions, including where they may interact with proposed timber operations, that individually or cumulatively significantly and adversely affect the beneficial uses of water, and shall describe measures to protect and restore to the extent feasible the beneficial uses of water.

This field assessment was done by the RPF and the following characteristics of the plan area were determined.

1. **Existing and proposed roads, skidtrails and landings** - There are no proposed roads in this plan. In Section II a work order that contains road points and skid trail points has been prepared. These points contain beneficial actions for a number of items. Probably no aspect of logging has more potential to negatively impact watercourses than the improper creation and maintenance of the road systems. Elsewhere in this analysis information has been given on the efforts being made to stormproof GRT's road system. On the road system that is specific to this plan the following points that relate to Section 916.4 (a)(1) can be made. The majority of the road system is at the edge of the WLPZ but some portions of it do fall into the WLPZ. Between the road system and the major watercourse of concern (the Gualala River) there is a flat, sometimes back tilted buffer of heavily vegetated ground. A small number of class II watercourse crossings do exist as part of this plan and this is partly a result of the length of the plan. The timber on this THP in the alluvial flats will be long lined from the existing haul road and existing flagged skid roads. The use of skid trails that enter the WLPZ is usually only requested in those cases where the alluvial flat is very wide and then all skid trails have been pre-flagged. The use of the landings that fall into the WLPZ also have the advantage of being existing and therefore not requiring new excavation. The use of these landings also reduces the amount of skidding that will be needed on the haul road which reduces the production of fines. Many logs will be skidded to the edge of the road and will be loaded with a shovel loader directly onto trucks without further skidding down the main haul road. Overall the road system in this plan has a low probability of creating negative impacts because of the location of the main haul roads on the alluvial flat which has a wide flat buffer between the main Class I watercourses and the roads, and the low gradient crossings of watercourses that are required. The skid trails and landings are similarly buffered, and any generated sediment will be filtered or trapped prior to entering the watercourses.

2. **Unstable and erodible watercourse banks** - The banks of the Gualala River within the WAA that are within the flood plain slope down at 50% for approximately 40 feet and are composed of alluvium from past flooding. These banks often have conifers growing right down to the water's edge and in general these banks appear quite stable. The conifers that exist in this zone are usually quite large in diameter and height and a number are leaning out over the river which will be the main source of future large woody debris. Aerial photos show that the banks have not changed noticeably in the last fifty years. The transition slope between the top of the alluvial flat and the wetted channel is the main source of large instream woody debris and no trees will be harvested from this zone. In addition, the new Anadromous Salmonid Protection (ASP) rules of 2009 designate a core zone in which no harvesting will occur. This zone runs from the watercourse transition line back for 30 feet. Outside the core zone within the flood plan the ASP rules require that the thirteen largest trees per acre be left and that the silviculture be uneven aged or commercial thinning which promotes growth of larger trees. These provisions will allow for continued stability of watercourse banks within the THP area the majority of which is within the floodplain. Peak flows can cause some bank erosion, but the large tree retention and absence of harvest in the core zone will act to prevent that in most locations.

3. **Unstable upslope areas** - The California Geological Service geologic features map shows that the majority of upslope areas adjacent to the alluvial flats are part of ancient mass wasting features. These steeper areas adjacent to this THP should not be affected as no harvesting or road work will be taking place along the base of these features that could potentially destabilize them as part of this THP. The few unstable areas that are in the plan are all in Unit #1 which is an upslope harvest area. Within Unit #1 the unstable areas have been mapped and all skid trails have been flagged so as to avoid equipment entry onto unstable area(s). Impacts from unstable upslope areas will be minimal in terms of sediment impacts.

4. **Debris jam potential** - The South Fork Gualala River has a low to non-existent potential for debris jams as the river is too wide and shallow with high powerful flows for debris to lodge in the channel.

Anything but the largest trees are swept away by the wide powerful river flows. The smaller Class I watercourses in this plan, Big Pepperwood, Little Pepperwood and Buckeye Creek have a greater potential for debris jams. The small jams that have occurred are the result of a permitted large woody debris placement program being conducted by GRT and the Gualala River Watershed Council on the GRT property using grant funding. These small log jams are seen as positive developments for fish habitat as this large wood acts to help sort spawning gravels, increase pool depth and decrease stream temperature as well as provide cover for fish from predators.

5. **Flood prone areas and inadequate flow capacity** - During the winter the alluvial flats in this plan periodically flood which indicates inadequate flow capacity in the active channel. Inadequate capacity is sometimes caused by increased deposition which raises the channel bottom causing the banks to flood. The portion of the Gualala River and its tributaries that are within the THP area have low gradient depositional reaches and bed load is transported from high gradient reaches and drops out of suspension in these areas of the river during peak flows when the river flows rise up out of the main channel. Permanent plots that were put into the stands adjacent to the Gualala River several decades ago show that portions of these flats have had as much as three and a half feet of sediment deposited on them in recent decades. Some of this sediment is undoubtedly also coming from upslope Class II and Class III watercourses that drain directly onto these flats and often disappear into the sandy soil without ever reaching the river. Although this process may have been accelerated in the past century due to increased upslope erosion, the process of alluvial flat flooding and aggradation has been going on for thousands of years according to the NCWAP watershed assessment report. Implementation of the THP under the ASP rule prescriptions will have no measurable adverse impact on the flood prone area or alter the flow capacity of the river.

6. **Changeable channels and overflow channels** - On these alluvial flats evidence can be found where Class IIs and Class III watercourses on the sideslopes have changed channel locations once they hit the alluvial flat. This is not a common occurrence but as sediment builds up in these smaller watercourses there is the possibility of these channels migrating. There are also small bays that sometimes extend into the alluvial flats from the main Class I watercourse channel. These areas may be important for small fish that are trying to escape out of the main stream for refuge during high flow periods. It is unusual for these features to extend more than 50 feet away from the wetted channel and since this plan only proposes very limited harvesting this close to the Class I watercourse it is not likely to affect the stability of these features. The new ASP rules require the protection of these overflow and changeable channels, and in fact they are already protected by their location within the WLPZs of the watercourses. The migration of the Class IIs and Class III watercourses is a process that occurs as a result of upslope sediment inputs. This has the potential to release sediment through the creation of a new channel and it is the result of the alluvial flats continual trapping more and more sediment. Usually the old channel that has dried up has trapped so much sediment it has returned almost to a flat state with the channel filled. The net result of sediment entering the river from these migrations is low as downcutting is not occurring as flows cross the alluvial flats. The WLPZ extends up to the edge of the alluvial flats and can be over 900 feet wide. The skid trails and skid trail crossings that are proposed for use on the alluvial flats are minimal and carefully located to reduce changes in flows and will not affect the occurrence or likelihood of channel migration. The relatively flat ground on the flood plains further reduces the likelihood of erosion or significant channel migration as a result of skidding logs to landings in the WLPZ.

7. **Riparian zones** -The majority of this plan falls into the riparian zone of the South Fork Gualala River (which is listed for sediment and temperature), therefore it is of potential concern and any negative effects that operations in this unit could have on the river are required to be mitigated. In the following sections temperature and sediment concerns and beneficial actions are addressed. In order to mitigate any effects on the riparian zone a number of steps are being taken including 1) a very conservative determination of the watercourse transition line which results in extending the starting edge of the 30

foot no-cut Core Zone adjacent to the main channel to the widest width possible, 2) a light harvest using thinning from below that will result in concentration of growth on the larger trees that are capable of shading the watercourse within the Inner Zone A (next 150 feet), 3) use of uneven age silviculture in the alluvial areas in the Inner Zone B (the remainder of the flood plain), 4) reduced use of existing WLPZ skid trails 5) voluntary upgrading of several watercourses from Class III to Class II designation to increase protection zones. Additionally, the ASP rules require no removal of LWD in the WLPZs and very high canopy closure standards throughout the flood prone portions of the plan.

Finding: This plan is not likely to adversely affect existing watershed conditions within the WAA due to the very light harvest, the soil erosion protection measures, the design of the log skidding landing and road system, and the seasonal restrictions on operations. Over time it will provide for enhanced diversity in forest structural development by concentrating growth on the larger trees, trees that will extend a shaded canopy over the watercourse to a greater extent and be in a more favorable position to contribute LWD to the watercourse channel.

4. Watershed Effects General Discussion

The Gualala River is 303d listed for sediment and temperature.

In attempting to analyze and mitigate watershed effects, several sources of information have been reviewed and an attempt to summarize this information is made on the following pages. The most comprehensive study to date, The North Coast Watershed Assessment Program (NCWAP), has been extensively reviewed and cited as a pertinent source of watershed conditions in this harvest plan. Additional information is taken from reports written for previous harvest plans such as the report by consulting Fisheries Biologist Dennis Halligan of Natural Resources Management Corporation (Halligan 2000). Mr. Halligan's report contained valuable analysis of the available information and some of his conclusions are included on the following pages. The archives at the California Department of Fish and Wildlife have previously been examined for information regarding the Gualala River system and most of that information has also been included in the NCWAP report. Of particular value was the white paper titled Flood Prone Area Considerations in the Coast Redwood Zone dated November 2005.

The Gualala River Watershed Technical Support Document (GRWTSD) prepared by the Water Quality Control Board as supporting documentation for the TMDL analysis by the EPA was also reviewed. The primary objective of the GRWTSD for sediment is to identify and quantify sources of sediment in a way that allows a relative comparison of those sources and to provide information for non-point source assessment, project planning, and implementation.

The North Coast Watershed Assessment Program (NCWAP) provides a description of the Lower South Fork Gualala River.

> "Downstream of the confluence with Wheatfield Fork, the South Fork Gualala consists of an aggraded channel leading to the estuary. Substrate in the flood plain is almost completely gravel, with some pockets of sand and silt. During low summer flow, the active channel up to 25 feet wide shifts to each side of the gravel basin over 200 feet wide in some areas. Pools greater than 2 ft. in depth between Wheatfield Fork and Big Pepperwood Creek comprise less than 10% total survey length. Photos from 1936 and 1942 show this same pattern with over 80% of the watershed in an old growth, undisturbed condition at this time. This further substantiates a basic finding of the study that geologic processes define habitat conditions (at least in the lower Gualala River). The basin is filled with probably more than 100 feet of alluvium deposited probably over many thousands of years, presumably in-step with sea level rises since the last Ice Age. The estimated thickness of the alluvium is collaborated in places

with drillers logs that show alternating sequences of sand, silt, and clay sediment probably indicating repeated transitions between estuarine and fluvial conditions. Natural conditions favor aggradation in the lower reaches of the South Fork. Major disruptions along the San Andreas Fault and tributary faults bisecting the South Fork subbasin basically define sediment sources over geologic time. Sediment sizes in the lower basin reaches are largely controlled by declining stream gradient. This decline in gradient occurs as the Gualala River encounters deep alluvial valley fills that have been deposited over geologic time in response to rising sea levels".

"Two land use eras characterize the Lower South Fork (1) steam donkey, redwood old growth harvesting between 1868 and 1911, and (2) tractor/cable harvesting 1991 to present. Most of the entire Lower South Fork basin (downstream of the Wheatfield confluence) was cleared of old growth timber by 1911. After this time, the Lower South Fork was inactive up to the late 1980s. Midcentury tractor operations mostly avoided the area. This minimized overall construction of in stream landings and streamside roads in this part of the watershed".

The NCWAP report is a significant amount of data collected and analyzed by qualified licensed professionals. NCWAP was published in March 2003 and contains the most comprehensive and scientifically valid information to date in regard to the existing conditions and how it relates to past land use practices. NCWAP was developed through cooperative efforts with Gualala Redwoods Inc., government agencies and public cooperators. The NCWAP report and executive summary was studied as part of this analysis. GRI and cooperators collected most of the data that relates to the watersheds affected by this plan.

The following important points have been taken from the executive summary of the NCWAP report.

1) Most of the Gualala River Watershed has improved from 1984 to 1999/2000, based on aerial photo interpretation of accumulations of sediment that were interpreted as indicative of channel disturbance. Specifically, since 1984 total erosion from upslope areas has not resulted in a net increase of sedimentation within the majority of the tributaries to a degree discernable in 1999/2000 aerial photos.

2) Pool habitat, escape and ambush shelter/cover, and water depth are unsuitable for salmonids in some mainstem and tributary stream reaches in the Gualala River Watershed. Large woody debris function in the channel is low throughout the watershed. Increasing the instream habitat complexity is the top recommendation category for all of the sub-basins.

3) Water temperatures are suitable in the smaller tributaries for which we had data. In contrast mainstem temperatures were in the unsuitable range in most of the sub-basins.

4) Gravel and substrate suitable for salmonids is limited in some streams and abundant in others.

5) Harvest of coastal redwood and Douglas-fir actively occurs today, but with substantially improved practices. While some areas of the watershed experienced more improvement than others during this period, an overall trend towards improvement in the transport reaches was observed.

Also, according to NCWAP-

Based on the information available for the Gualala River Watershed, salmonid populations are currently being limited by

1- General watershed-wide lack of instream habitat complexity;
2- Instream sediment conditions in some areas;
3- High summer water temperatures in the mainstems; and
4- Reduced watershed-wide coho salmon and steelhead trout populations over those observed in the 1960s.

What habitat improvement activities would most likely lead to more desirable conditions in a timely and cost-effective manner?

A restoration plan that targets the general areas identified below.

1- Reduce sediment delivery and deposition.
2- Improve riparian canopy density and diversity
3- Continue road assessments, storm proofing, improvements and decommissioning.
4- Evaluate and address non-road sediment sources.
5- Add more large organic debris and shelter structures. (Pool depth and shelter consistently were limiting)
6- Protect high quality habitat from degradation.
7- Reduce livestock and feral pig entry.
8- Evaluate fish rescue activities.
9- Continue in-channel characteristics and stream flow monitoring.
10- Expand aerial photo interpretation of channel characteristics.
11- Expand temperature monitoring into eastern portions of watershed.

Findings: After having studied the information that is available a conclusion can be made that the 303d listing for sediment for the Gualala River was not based on scientific evidence that the river was in fact impaired. The 303d listing was based on limited anecdotal evidence. In contrast to past information, the NCWAP report is a significant amount of new data collected and analyzed by qualified licensed professionals.

(The following quotation taken from NCWAP applies to the whole Gualala watershed, **emphasis added**)
"The consequence of active timber harvesting conducted in the watershed since 1990 indicates that contemporary timber operations did not preclude recovery in both fluvial geomorphic stream channel characteristics and riparian canopy cover. Between 1991 to 2001, 45,070 acres or 24% of the watershed has been subject to Timber Harvest Plans... Timber harvest operations include road building, use, and maintenance associated with the active Timber Harvest Plans. **These operations have taken place during the period where CGS NCWAP mapping documents a 30-40 percent improvement in detrimental sediment storage or source attributes between 1984 and 1999/2000. Similarly, riparian canopy cover continued to improve from the midcentury bank to bank clearance operations. By the end of the tractor era in 1968, a range of 40 to 70 percent bank exposure gradually improved to approximately 25% by 1999/2000".**

"The study documented long term trends in overall watershed conditions. None of the improving trendlines have been reversed by any concentration of Timber Harvest Plan activities between 1991 and 2001. This contradicts certain projections of recent land use for cumulative effects by which a high density of Timber Harvest Plans may trigger adverse cumulative impacts in excess of the individual potential contributions from each project alone. No such cumulative processes from any collection of Timber Harvest Plans were realized in the Gualala watershed".

Another conclusion that can be drawn with some degree of certainty is that salmon are not as common today as they have been in the past. This conclusion is derived from reports in NCWAP, GRWTSD and Gualala River Watershed Literature Search and Assimilation by Patrick Higgins. Studies made in the 1960s noted the presence of coho throughout the watersheds studied, but this was during an active fish stocking program that eased in 1999. Fish surveys conducted in the 2006 indicate that coho have fallen to dangerously low levels or were absent entirely from many streams. Similar conclusions cannot be drawn from the data for steelhead even though such a conclusion is tentatively made in the GRWTSD. NCWAP reports that steelhead distribution does not appear to have changed over the past 37 years. Natural radical fluctuations in salmon populations have been noted as early as the turn of the century, however, it is a conservative approach to assume that the present declines are man caused and corrective measures are being taken by the landowner to reduce potential man caused impacts while still maintaining the land as an active tree farm.

As a proactive measure, the landowner is investing money in beneficial actions to reduce sediment impacts through extensive road upgrading and storm-proofing. Under miscellaneous addendums in Section V there is a listing of the numerous road upgrades that have occurred within the WAA watersheds involved. The landowner is also foregoing a considerable amount of present and future income from the harvesting of timber in the WLPZs of Class I, II and III watercourses and in the protection zones around wet areas, sumps, ponds, wildlife and botany set-asides, unstable features and archaeological sites. Most of these areas (except for wildlife, botany and archaeology sites) are being protected for two reasons. The first reason is to prevent, or at least reduce, the amount of sediment delivered to the fish bearing watercourses and the second is to recover tree canopy over all watercourse classes in an effort to reduce water temperatures so as to maintain acceptable fish habitat.

Water Temperature Effects:

The Gualala River has been 303d listed as impaired for temperature (Feb. 4, 2003). The range of the calculated mean weekly average temperatures (MWAT) recorded in most of the major watercourses within these watersheds is shown in the stream report tables attached in Section V of the THP. "Temperature ranges indicate temperatures in excess of preferred rearing temperatures for coho and steelhead on the Gualala River. Seasonal daily maximum temperatures in excess of the upper lethal temperature for rearing coho and steelhead are also noted. Big Pepperwood, Little Pepperwood and Groshong Creeks have some of the most favorable temperature ranges for salmonids on the GRT ownership, however, these are the tributaries where spawning and rearing are likely to occur within the Big Pepperwood planning watershed. Although Big Pepperwood and Groshong were listed along with the rest of the river as 303d impaired they were not included in the original list of tributaries recommended for listing. NCWAP states, "Overall watershed-wide riparian shade canopy has improved since the 1960s, but still falls short of the 1942 levels of canopy density and coverage." The 1942 levels showed 95% canopy coverage. It is also noted that overstory canopy cover in the lower reaches of the watershed are the highest (this happens to be the area of GRT ownership). It should be noted that while summer water temperatures along the main river (which is transporting water from many other upstream ownerships) is higher than desirable, the temperature of the tributaries in Big Pepperwood planning watershed are good to excellent. These tributaries are more representative of GRT conditions and are less diluted by other upstream ownerships. Another way of looking at it is that GRT owns less than 30,000 acres out of the 191,116 acres comprising the Gualala River Watershed. Less than 20% potential management caused adverse effects on the Gualala River system is therefore caused by GRT activities. In retrospect, GRT owns all of the Pepperwood Creek and Groshong tributaries and these tributaries show significantly better temperature numbers than the mainstem South Fork Gualala River. Most of the creeks that originate off

property have higher temperatures where they enter GRT's land than they do when they hit the main stems, which shows that GRT practices are probably not a cause of high temperatures, but stream temperatures are actually decreasing or at least not warming as they pass through GRT property.

Halligan states, "Increasing water temperatures in a downstream direction has been identified in streams and rivers throughout the world except where the watercourses become influenced by coastal weather conditions that can result in a cooling pattern. The general tendency for incremental increases in temperature has been attributed to increasing channel width reducing the effectiveness of shading from riparian vegetation, increasing air temperature, increasing stream depth and decreasing proportion of cooling groundwater inflow. This reach of the Gualala River receives water from approximately 157,400 acres upstream. A review of water temperature data appears to show a river in equilibrium with regard to water temperatures. "

The fact that stream temperatures moderate as they pass through GRT lands may not have as much to do with management and as it has to do with the zone of coastal influence (fog belt). Besides the zone of coastal influence, the Forest Science Project out of Humboldt State University found in their study titled "Regional Assessment of Stream Temperatures Across Northern California and their Relationship to Various Landscape-Level and Site Specific Attributes" (Lewis et.al 2000) that water temperature has a positive correlation between watershed size, distance from watershed divide, bank full width and canopy cover. Watershed size and distance from watershed divide are often related as are bank full width and canopy cover. In the case of the GRTs holdings we have a river in a large watershed at the furthest point from the watershed divide and with a very wide bank full width. Therefore, you would expect higher temperatures. This is modified by the coastal zone of influence for macro air temperatures.

It may be that the local larger streams naturally have temperatures above the 60° F, above which is stress inducing threshold for local salmonids. To test this, Gualala temperatures were compared with temperatures collected in old growth watersheds in Humboldt Redwood State Park. The old growth watersheds, by increasing acreage, are Cow Creek (93% uncut old growth), Squaw Creek (61% uncut old growth) Canoe Creek (62% uncut old growth) and Bull Creek, where the stream flows through 3 miles of uncut old growth, including the Rockefeller Grove, before it gets to the Bull Creek temperature station. The trend line equation for the old growth (y=2.2886Ln(x)+43.713) was almost identical to the equation for the Gualala trend line (y=2.2707Ln(x)+43.683).

The most comprehensive study regarding shade canopy and its relationship to water temperature changes was done by Cajun James in 2003 and the following quotation is taken from the abstract of that study.

"Data collected before and after timber harvest operations in years 2000, 2001, and 2002 was analyzed to determine changes in response variables to wider (175 ft.) or narrower (100 ft.) riparian buffers. Angular canopy cover was measured to be 85% at mid-stream and no less than 80% within the riparian buffer regardless of buffer width. Vertical canopy cover was measured to be 50% within the riparian buffer for each harvest unit following the first phase of timber operations. Microclimate results show that edge effects from the adjacent upslope clearcut harvest units had no discernible impact within 40 ft. of the stream bank. In this experiment, no practical difference in the canopy cover, near-stream microclimate, or water temperature patterns were found between the wider 175-ft. and the narrower 100-ft. buffers. Results from this study show that 100-ft. vegetative buffers that maintain at least 50% vertical or 80% angular canopy cover minimize potential negative impacts to the temperature of stream water and the near-stream microclimate from adjacent upslope clearcut harvest operations."

Findings: Canopy and temperature on Class I watercourses will not be measurably altered since no harvesting will take place within 30 feet of the watercourse transition line of the Class I watercourse as part of this plan. The ASP rules also require that the thirteen largest trees per acre are to be left so the maximum canopy height will not change significantly post harvest. Also, a minimum of 80% canopy will be maintained within Inner Zone A (which is variable in width but is the area between 100 and 150 feet of the transition line) and 50% canopy will be maintained throughout the rest of the flood prone area (Inner Zone B). The prescribed practices in silviculture use and canopy retention by the ASP rules amounts to a requirement of leaving all the dominant trees within Inner Zone A, and only conducting tree removal by thinning/selection from below. All of the Class II watercourses within this plan will maintain at least 50% canopy cover. However, since most of the Class II watercourses are also within the Class I watercourse WLPZ the higher Class I watercourse canopy retentions standards shall apply. The slight canopy reduction on Class II watercourses is not expected to have a significant effect on adjacent stream water temperatures.

Organic Debris Effects:

Organic debris entering a watercourse can have both positive and negative effects. Medium to large debris can act as a stabilizing agent. However, the introduction of large amounts of unstable debris can obstruct stream flow. Large quantities of small debris introduced into small streams can lower dissolved oxygen content and increase water acidity. FPRs require the removal of organic material delivered to watercourses during felling operations. Therefore, there is not expected to be any increase in acidity or reduction in dissolved oxygen from the proposed project. Acidity and dissolved oxygen levels of water generated from the project watershed will not interact with current or reasonably foreseeable acidity or dissolved oxygen levels within the WAA to create or add to a significant adverse cumulative effect. Nutrients derived from decaying organic debris, especially leaves and small twigs, is an important source of food for small aquatic insects, which form a substantial portion of food for fish populations.

The portion of this plan that is adjacent to the Gualala River presents a unique situation. The transition line for an unconfined channel is considered to be the edge of soil development. In a practical, on the ground sense, the regulatory agencies have interpreted this to be the area closest to the wetted channel where conifers or other hardwood species have managed to become established for 25 years or more. On this plan GRT has taken a more conservative approach. One hundred year old redwoods are extensively established right up to the edge of the wetted channel, however, the slope between the channel and the top of the alluvial flat which can reach up to 40 feet in width is being considered in this plan to be part of the channel. Thus, the transition line for establishment of the 30 foot no cut Core Zone has been measured from the top edge of the slope as it rolls over onto the alluvial flats in many cases. No harvesting will be taking place within the first thirty feet adjacent to this conservative transition line (approximately 70 feet on average from the wetted channel). As a result, the largest trees in this plan area are being left to provide shade canopy and provide future recruitment trees for large woody debris (LWD).

Halligan states that the reason for low LWD in the South Fork Gualala River is that "the width of the stream channel exceeds 100 feet throughout the project area. It is likely that all but the largest trees in the WLPZ are too small to provide stable LWD. The project reach is protected from wind patterns, generated during storm events, by the ridge behind it that runs in a general southeast to northwest direction. No blowdown was observed... including along the edge of the river where there would be lesser wind protection than that afforded trees in the interior of the stands. The alluvial flats are not the type of topography that are conducive to landslides, therefore LWD from this mechanism would naturally be lacking... in addition there appeared to be very little bank erosion which would indicate this LWD input process is not very significant."

Working with the grants obtained by the Gualala River Watershed Council (GRWC), the owners of the property have placed a large number of large woody debris in Class I watercourses; over 560,000 board feet of logs into watercourses on the property to date. GRT intends to continue this program. The placement of these logs has been photographed, mapped and numbered. By doing this it will be possible to record the downstream movement of these pieces (and learn how to place them more effectively) and to record the creation of pools. These logs have also been placed so that, besides creating pools, they provide shade, armor unstable banks, and redirect water flow away from potential sediment sources while creating refugia for both large and small fish. Preliminary measurements indicate that there is substantial pool creation even after the first year of placement and it is expected that these pools will continue to deepen over time. Through this process it is possible to create in a few years the positive impacts of large woody debris that would otherwise take decades from natural windthrow.

Findings: This THP proposes buffers and tree retention that will retain high levels of potential organic debris recruitment to watercourses, and it contains provisions to remove accidental deposition of small, potentially harmful debris. A 30-foot or more no-cut tree retention corridor adjacent to the Class I watercourse shall provide for future large tree (LWD) recruitment. GRT's active LWD recruitment placement program off and above the mainstem South Fork Gualala River will continue to provide future enhancements to instream fish habitat on the property moving forward and accelerates the improvement of fisheries habitat with anticipated increases in numbers of fish in the river and upstream tributaries from that work.

Chemical Contamination Effects:

Chemical contamination of watercourses can occur with the introduction of chemicals or petroleum products. Chemical contamination is not known to be a significant impact to watercourses within the WAA. Potential chemical pollution sources associated with this THP are accidental spills or releases of fuels or oils from equipment or vehicles. The LTO shall adhere to 14 CCR 936.3, which states that "...the timber operator shall not place, discharge of or deposit in such a manner as to permit to pass into the water of this state, any substances or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, or the quality and beneficial uses of water." The RPF does not propose to use any oil or chemical dust retarding materials on truck roads. Watercourse buffers limit equipment use adjacent to watercourses. Helicopter yarding (a potential source of chemical contamination due to on-site fuel storage) is not proposed as part of this THP. The major concern regarding chemical contamination would be from accidental release of equipment fuels and oils during refueling, servicing or operations. Equipment operators will be required to service their equipment at least 150 feet from a Class I watercourse and 100 feet from a Class II watercourse. Maps to help the LTO know where it is safe to service equipment have been added to the THP.

Herbicide use is not proposed in this THP. Herbicides will not be used for site preparation in order to achieve stocking. If herbicides were applied on this ownership, it would occur post-harvest under a regulated, best management practices process. Herbicide application is used to favor survival and growth of forest seedlings by reducing competition with other plant species, and is only prescribed when, and if, appropriate.

Although the plan submitter may utilize herbicides on their land following timber harvest as part of their vegetative management strategy, such use is conducted over a very small proportion of any given watershed in any one year. Herbicides are not applied near the active watercourses because of restrictions on their application and, to an even greater extent, because little or no harvest has taken place in these areas and

vegetation management is unnecessary. Best Management Practices ensure protection of water quality. Waters passing down and through the project area are not expected to interact with any current or reasonably foreseeable chemical use issues in WAA or contribute to a significant adverse cumulative effect.

No slash pile or broadcast burning which is a potential source of nutrients being released into watercourses during runoff events is proposed. Another source of chemical contamination is the practice of people to use the Gualala River gravel bars as an all-terrain vehicle path and/or off-road access to swimming holes along the river. These vehicles could conceivably puncture an oil pan or gas tank on a rock and pollute the river. They also contribute small amounts of oil every time they drive through the water. GRT personnel notify the sheriff's department when this type of activity is observed.

Findings: Because there are currently no known chemical contamination problems within the assessment area and this project proposes no chemical use, and any future project proposing chemical use would require unique permits for that purpose and be regulated to prevent chemical contamination, no significant adverse cumulative watershed effects caused by chemical contamination are expected.

Peak Flow Effects:
When soils become saturated and excess water is present, the result is run-off. Every watercourse has a maximum limit to which it may deliver run-off before the peak flow results in flooding. The factors that determine flooding are the timing, intensity, and duration of the rainfall or water source; soil properties and topographic controls that affect the volume and timing of available runoff, and the depth or carrying capacity of the channel.

Timing refers to the intervals between storms. Intensity is a measure of the rate of rainfall (i.e. inches per hour). Duration is a measure of how long the rain continues to fall. Depth is the total amount of rain that fell (in inches). It is recognized that there is no reasonable control over the timing, intensity, depth, or duration of rainfall. Simply put, if it rains hard enough and long enough, flooding will result in almost any watercourse.

Cutover watersheds generally have higher peak flows than uncut watersheds from storms occurring early in the season. This is a result of less interception and evapotranspiration. Research in a local coastal watershed shows that early season storm events result in higher peak flows following disturbance from timber harvesting. As soil moisture deficits are satisfied changes in peak flow become insignificant. Large peak flows usually occur after rain on snow events. Since snow is a rare event in this area the chance for a large peak flow event is unlikely. Also, this THP's proximity to the mouth of the Gualala means that any increase in peak flow would have a minor effect. The very low level of disturbance from the proposed harvest will not significantly add to past operations within the watersheds, such that no impacts from increased peak flow events such as increased erosion of channel banks downstream shall occur.

Findings: The watercourses in the plan area have been walked, ocular evaluations have been weighed, and peak flows on this property have been considered. Due to the selection method, ground and vegetation disturbance shall be minimal and impacts from peak flows are not likely to increase due to the harvest of the THP. Peak flows fed from water generated from the project area will not interact with current or reasonably foreseeable timing or intensity of peak flows in the WAA to create or add to a significant adverse cumulative effect.

Fog Drip:
Timber stands close to the coast receive significant amounts of moisture from fog drip. Dawson (1996) determined that 8-34% of water used by coastal redwood trees and 6-100% of water used by under-story vegetation originated as fog drip. The closer to the coast the more pronounced the effect since more days have significant fog. The removal of canopy by harvesting would necessarily reduce the amount of fog interception and therefore reduce fog drip (at least temporally until the canopy closes).

The effect on ground water and stream flow is less clear since although fog drip is reduced by removal of canopy through logging, evapotranspiration is also reduced by the removal of the tree. Loss of evapotranspiration from forest harvest may be a more significant variable to changes in watershed hydrology than fog drip (Keppeler 1998).

Findings: Since this THP is close to the coast vegetation receives a significant amount of moisture from fog drip, according to these studies. This is balanced by the fact that most of the plan is on the flood prone area of the Gualala River and the water table is significantly more available to the standing timber than in upslope areas. In addition, the high canopy retention standards mean that the overstory canopy will only be reduced by approximately 20% at most in the Inner Zone A and at most 50% in the Inner Zone B and will only have a short term effect on the amount of fog drip water available as the canopy will soon close back in. Any reduction in timber growth from less fog drip will probably be more than made up for by the increase in sunlight available to the residual stand. No significant effects on stream flow either positive or negative would be expected from this light harvest where only approximately 17% of the basal area of conifers is being removed in the FPA.

5. Watercourse Conditions Assessment (Stream Morphology):
The major watercourses in the WWA are the South Fork Gualala River, Main Stem Gualala River, Wheatfield Fork of the Gualala River, Groshong Gulch, Buckeye Creek, Rockpile Creek and Big and Little Pepperwood Creeks. One of the problems with the NCWAP document is that the Big Pepperwood watershed was included in the South Fork Subbasin and the Big Pepperwood watershed is atypical for this subbasin. Data for the Pepperwood Creeks and Groshong Gulch are notably deficient from this subbasin in the NCWAP report.

Embeddedness - Halligan states that it is a problem on the Gualala River. The GRWTSD states that the Regional Board Staff was able to observe 6 miles of stream during their random sample field work and they observed a thin to non-existent armor layer underlain and embedded with fine sediment. The absence of an armor layer is indicative of an oversupply of sediment (Dietrich et al. 1989). The available statistics show a wide variability across the range and are sometimes worse and sometimes better than similar sized old growth watersheds. Although the D50 data set falls below the 38mm level as determined by Knopp 1993 for healthy watercourses the Gualala is a depositional reach that falls at 1% or less. Data collected from the Knopp study is mostly taken from watercourses with a 2% or greater grade. You would expect to find more fine sediment falling out of suspension as the watercourse gradient decreases.

Stream Aggradation – NCWAP report indicates that aggradation may not have occurred. The conclusion of the NCWAP report is that "Instream sediment depositions indicative of disturbance occur along 33 of 140 miles of blue line streams, representing a 42 percent reduction from 1984 observations." Similar degrees of streambed aggradation were observed in aerial photos from 1942 and 1999/2000. Gravel mining records indicate that the lower South Fork may have down cut between 1921 and 1993, suggesting sediment transport exceeding supply in the lower reaches." Several years of thalweg profiles taken by GRI and cooperators now tentatively supports a conclusion that stream aggradation is not now occurring. Evidence from monitoring

reaches measured by the Gualala River Watershed Council shows thalwegs are increasing in average pool depth.

Stream Channel Characteristics - Tables showing stream habitat adjacent to this plan have been included in Section V. Pool depth and frequency have been reported in NCWAP as lacking in almost all of the sub-basins including this one, and it is hoped that the placement of large woody debris that GRI has been conducting for several years will speed up the development of stream bed structure. Preliminary follow-up studies on this large woody debris indicates that logs placed have already had a dramatic impact on increasing pool depth.

Temperature and Canopy Cover - The stream temperatures on the Class I watercourses in the Gualala watershed other than the South Fork Gualala River are among the lowest within the ownership which is partly related to the fact that these creeks have over 90% canopy cover (at least in the entire lower reaches where densiometer measurements have been taken). Big Pepperwood mean weekly average temperature (MWAT) is 14.3 C, Little Pepperwood MWAT is 14.6 C, Little Creek (Buckeye Hydrologic Unit) MWAT is 17.5 C, the upper South Fork Gualala River Hydrologic unit MWAT was 15.7 C although the Mainstem South Fork Gualala River itself and Wheatfield Fork are higher at 19.4C and 19.1C respectively. No temperature data is available for Class II watercourses.

Attached 'Stream Monitoring Reports' in Section V of the THP indicate that the preharvest canopy closure within the riparian zone along Big Pepperwood WLPZ averages 92% and along the South Fork Gualala River it is 95%. Riparian canopy cover for Buckeye Creek is about 80% and 85% for the Wheatfield Fork. Riparian Class II watercourse canopy closure within the THP area is generally 90% to 100%. These are high levels of canopy cover and are conducive to keeping stream temperatures lower.

Pool Filling - Evidence suggests that pool filling has occurred on the Gualala River. Improvement of the thalweg profiles on the main Class I's flowing into the South Fork Gualala River has definitely occurred as a result of the LWD placement program as shown by the monitoring reach data. Pools have deepened and been created in places where they didn't previously exist. Evidence of this is presented in the stream addendums attached in Section V.

Bank Cutting and Bank Mass Wasting - The banks of the Gualala River appear stable north of the confluence with the Wheatfield Fork. Aerial photos for the past fifty years have been studied and the location of the main watercourses appear to have remained stable except for meandering back and forth between the main banks. The banks of the Big and Little Pepperwood Creeks are vertical in some areas and therefore are likely unstable at these locations, although few bank mass wasting events were noted. Class II watercourses show evidence of bank mass wasting where they cross pressure ridges that were formed by movement of the San Andreas fault.

Scouring and Downcutting - NCWAP aerial photo interpretation and gravel mining records states that downcutting may have occurred in the South Fork Gualala River. However, no recent areas of scouring have been noted in this portion of the Gualala. Downcutting appears to have occurred in the downstream end of the Little Pepperwood Creek. The Class II watercourses that run through the alluvial flats appear to be quite stable with little sign of downcutting or scouring. Class II watercourses show some evidence of downcutting where they cross the pressure ridges.

Woody Debris – Class I watercourses have been discussed earlier. Class II watercourses in this THP have average, or moderate, amounts of large woody debris and this level is expected to increase as stands age within the associated WLPZs.

Bank Vegetation (includes understory and low-lying vegetation) – Unvegetated areas adjacent to the main watercourses are very rare. WLPZ protections require mulching and seeding any bare areas created by timber operations greater than 100 square feet at close of operations. Canopy retention standards and no-cut zones in some locations maintain a large tree canopy adjacent to Class I and II watercourses. An analysis of aerial photos by NCWAP notes that there has generally been a significant increase in stream side canopy in the last thirty years in the Gualala River Watershed in general. NCWAP notes that "overall, watershed-wide riparian shade canopy has improved since the 1960's but still falls short of the 1942 levels... however riparian zones in the western portion have largely recovered from the first round of logging". Class II watercourses in this THP generally have dense bank vegetation cover.

Recent Floods – The Gualala River regularly floods its banks in this extreme downstream end of the river. A rise in elevation of the alluvial flood plain adjacent to the river (a sediment trap) has been documented. It has been estimated that the alluvial flats have risen up to 3.5 feet in the last thirty years due to sediment depositions. These flats therefore act as sediment traps during flooding.

6. Beneficial Efforts Specific to the Plan –

Beneficial Efforts for Sediment Reduction:

1) The timberland owner has stabilized hundreds of thousands of yards of sediment sources in the last decade within their ownership. It is estimated that more than 295,000 cubic yards have been prevented from delivery to watercourses in the Gualala River Watershed on the property through GRI/GRT's road storm proofing efforts.
2) Potential sediment sources on the road systems have been identified and are being stabilized and mitigated. See maps and road database. Also see planned road stabilization work and completed road storm-proofing work databases in Section V of the plan.
3) Longlining of trees from the main haul road will occur when possible. WLPZ skid trails are existing, have all been flagged by the RPF and the LTO will be limited to using these existing trails. This will require extra effort and expense on the part of the landowner and LTO. During the PHI for this THP the NCRWQCB representative asked for the following stipulation in order to minimize soil disturbance and it has been incorporated into the plan **"In order to ensure minimal ground disturbance from ground based yarding, tractors may not drive with their blade lowered, except as needed to move debris. No excavation shall occur on flood prone areas except at watercourse crossings described in Section II of the plan or as needed to improve drainage or resolve access problems resulting from previous logging operations."**
4) Bare mineral soil created by timber operations within the Class II Watercourse and Lake Protection Zones (WLPZ) and within the Class III ELZs equal to or greater than 100 contiguous square feet shall be stabilized with a minimum of 90% coverage of either mulch or slash prior to October 15 during the year of operation except as modified by Item 27a and f, Part 2 in Section III of the plan. Such areas created after October 15 during the year of operation shall be treated as described above within ten (10) days of creation.
5) No log hauling shall occur when turbid water is running in the inside ditch or when water is running across the road that has direct access to a watercourse. Seasonal roads and landings shall be used only during dry rainless periods when they are generally firm and easily passable.

6) No winter operations are proposed for the period between Nov 15th and April 1st.
7) The LTO shall install waterbars on skidtrails and unrocked landings prior to the next working day, extended periods of shutdown, or weekends whenever the national Weather Service forecasts a 30% or greater chance of rain within any 24-hour period. LTO shall be responsible for monitoring the weather forecasts.
8) All Class III watercourses will have a 25' or 50' ELZ. Soil deposited in Class III watercourses during timber operations shall be removed, and debris deposited during timber operations shall be removed or stabilized before the conclusion of timber operations or before October 15 per 14 CCR 936.4(c)(3)

Beneficial Efforts for Temperature Effects -

In order to not impact stream temperatures negatively the following standard FPR beneficial actions are included.

1) Conservative interpretation of the rules regarding transition line location has resulted in an expanded Class I watercourse WLPZ. Also, the entire floodplain is now a riparian protected zone.
2) A no-cut zone for the first 30 feet past this transition line will result in an approximately seventy-foot-wide heavily forested zone adjacent to the river channel consisting of the largest trees next to the river all being left. This zone along with the thirteen largest trees per acre and a minimum of 80% canopy left in the Inner Zone A and a minimum of 50% canopy left in inner zone B means that there will be no significant impact on the shade canopy of the river.
3) Stream canopy retention standards on all Class II watercourses (see item 26 above) and the leaving of all hardwoods within the WLPZ should maintain good canopy cover on class II watercourses.

Beneficial Efforts for Organic Debris Recruitment -

1) No removal of Large Woody Debris (LWD) from WLPZs will be allowed in this plan.
2) The landowner has proactively introduced LWD into the watercourses in this watershed. GRT plans to continue this practice.
3) Thirteen largest trees per acre are being left along with most trees that are leaning toward the watercourse.

Beneficial Efforts to Prevent Chemical Contamination -

1) Equipment operators will be required to service their equipment at least 150 feet from a Class I watercourse and 100 feet from a Class II watercourse. Plan maps have been provided in the plan to help the LTO recognize areas that need protecting.
2) All state and federal regulations pertaining to the handling and storage of fuel must be adhered to during logging operations.
3) No herbicide use is proposed.

Findings: Summary of Watershed Analysis Specific to this THP

This THP includes a number of protection measures designed to protect watershed resources. These measures include buffer zones to reduce potential soil disturbance near watercourses and within the flood plains, seasonal restrictions to limit wet weather operations, and specific actions to stabilize roads surfaces. Although timber operations have occurred and are planned to occur within the WAA, those operations have been and are expected to be identified by the RPF preparing the plan and by the responsible agencies reviewing the plan and mitigated to prevent significant adverse impacts. In terms of cumulative impacts, the very limited potential of sediment discharge from operations on this THP and other THPs in the WAA are not expected to combine to create cumulative adverse effects on beneficial uses of water. Additionally, the road stabilization and watercourse restoration efforts that have been performed within the WAA during the past

fifteen years have had a significant positive impact in reducing significant amounts of sediment that would have entered the Gualala River Watershed. More than 295,000 cubic yards of sediment discharge have been avoided. In summary the operations on this THP, on past and future THPs, in regard to road stabilization work and hydrological disconnection of those roads from the watercourses within the WAA by the landowner, and watercourse fish habitat enhancements implemented in concert with the Gualala River Watershed Council within the WAA has led to the conclusion that no cumulative watershed impacts will occur with the implementation of this plan.

B. SOIL PRODUCTIVITY ASSESSMENT

Past Projects- The following Table shows past THPs that have been conducted within the same footprint of the proposed plan going back to 1975 following the passage of the Z'Berg-Nejedly Forest Practice Act of 1973.

THP number	Unit from this plan that overlaps old THP number
75-472son	Portion of Unit 5 and 6
75-473son	Portion of Unit 13 and 14
75-597son	Portion of unit 5
75-623son	Portion of Unit 10
75-800son	Portion of Unit 7, 14,15,17 and 18
75-900son	Portion of unit 5
76-813son	Unit 21 and 22
82-595son/men	Portion of unit 5
85-409son	Unit 15, 16 17, 18, and 19
85-514son	Unit 13 and 14
87-631son	Units 6 and 7
88-122son	Small piece of unit 14
89-647son	Units 8, 9, 10, 11, 12
90-036son	Small piece of unit 5
90-097son	Small piece of unit 5
90-362son	Portion of Unit 1
90-213son	Small piece of unit 5
91-290son	Portion of Unit 5
90-385son	Unit 21 and 22
92-022son	Small piece of unit 5
93-111son	Unit 23
96-156son	Portion of unit 5
99-028son	Unit 21 and 22
99-282son	Small piece of unit 5
99-445son	Portion of unit 5 and most of units 6 through 15

Site factors to be addressed for cumulative soil productivity impacts include:

1. **Organic matter loss**
2. **Surface soil loss**
3. **Soil compaction**
4. **Growing space loss**

Organic Matter Loss: Loss or displacement of organic matter is primarily caused by use of heavy equipment for skidding and site preparation, surface erosion, and high intensity fires. Organic matter loss can cause loss of nutrients contained in the top soil and biomass associated with the harvest area. Most of the biomass nutrients are contained in the top soil and foliage of the existing vegetation. Use of existing skid trails per plan mitigations will limit the amount of organic matter disturbance on the plan. Flagged skid trails will be located to access timber efficiently, with a minimum of ground disturbance.

Specific Mitigation: In order to ensure minimal ground disturbance from ground based yarding, tractors may not drive with their blade lowered, except as needed to move debris. No excavation shall occur on flood prone areas except at watercourse crossings described in Section II of the plan or as needed to improve drainage or resolve access problems resulting from previous logging operations. This mitigation shall reduce the potential for significant impacts in combination with past, present, and reasonably foreseeable probable future projects identified above, from having a reasonable potential to cause or add to significant cumulative impacts to soil resources.
The use of a selection and thinning from below silviculture prescriptions will retain a canopy cover that will continue to contribute organic matter to the heavy duff layer within the flood prone area.

Surface Soil Loss: Loss of top soil can significantly reduce soil productivity as the highest nutrient content is contained in the top layer of the soil. Surface soils can be lost due to erosion and displacement by heavy equipment. While displacement of some top soil and organic matter is unavoidable on haul roads and skid trails, the loss will be minimized by proper installation and maintenance of erosion control structures, and straw mulching and grass seeding where needed as specified in Section II, Item #18, of the THP. With skidding equipment 1) limiting to rolling over existing understory vegetation and the heavy duff layer without any blade use, 2) skid access confined to existing skid trails used by past harvest entries, and 3) with the objective to minimized skid trail use to access marked timber by end-lining where feasible, disturbance to soil within the flood prone area shall be minimal. Observations from the impact of past harvest entries onto these areas or similar areas on the property have showing that no measured soil exposure occurs when harvest operations are conducted under the stated mitigated conditions.

Soil Compaction: Within the plan area soil compaction is associated with the use of heavy equipment, especially during saturated conditions. Soil compaction can affect site productivity through the loss of the ability to transmit air and water and by restricting root penetration. The restrictions of the operations during the winter period as specified in Section II, Item #18 and Item #23 will prohibit tractor operations during periods when soil moisture is high and compaction is most likely to occur. Also, outside of the winter period, the plan has wet weather restrictions for heavy equipment use well. This operation will not result in or create any level of soil compaction.

Growing Space Loss: Loss of growing space to road, landing and permanent skid trail construction is an unavoidable factor in most harvest systems. It will not be necessary to build any new roads for this THP and existing skid trails will be sufficient to access the plan areas. Many old skid trails will not be used and all necessary skid access within the WLPZ has been flagged. No foreseeable net loss of growing space will occur.

Findings: The soil productivity assessment area includes the area within the THP boundary where potential adverse impacts are most direct and is exclusive of the appurtenant road system accessing the plan. As indicated in the soil impacts analysis above any impacts to the soil resources are expected to be very limited with no discernable adverse impacts with the mitigation measures incorporated regarding skidding of logs. An

Erosion Control Plan (ECP) is imbedded as an active operation feature of the THP as well to facilitate enrollment with the State Regional Water Quality Control Board's General Waste Discharge Requirements (GWDRs) program. This ECP reiterates the measures to be taken to control and monitor sediment discharge off the project area. Along with the THP the ECP addresses any necessary mitigations for the protection of the soil resource, the drainage off truck roads, and the installation and monitoring of sediment control structures. Little to no change in soil productivity is expected to occur as the result of this harvest operation.

This project combined with past and expected future projects will not result in significant adverse cumulative impacts to the soil assessment area due to requirements and mitigations included in the THP to protect soil resources.

C. BIOLOGICAL RESOURCES ASSESSMENT:

Biological Resources:

Animals (non-aquatic): The scoping process involved doing a query of the Natural Diversity Database (NDDB) on March 17, 2014 for initial plan preparation, and again on November 29, 2018, for the Gualala, Stewarts Point, McGuire Ridge and the quads surrounding them. Although the biological assessment area is four watersheds (Mouth of the Gualala 1113.850202, Big Pepperwood 1113.850201, Little Creek 1113.830004, Annapolis 1113.840303 (except for spotted owls) this NDDB scoping search gives a wider geographic assessment of possible occurrences in the general vicinity of the THP. The following animal species (goshawk, bald eagle, osprey, marbled murrelet, grasshopper sparrow, rhinoceros auklet, tufted puffin, Point Arena mountain beaver, western pond turtle, Sonoma tree vole, North American porcupine, American badger, Townsend's big-eared bat, California red-legged frog, foothill yellow legged frog, Pacific tailed frog, California giant salamander, southern torrent salamander, red-bellied newt, monarch butterfly, Behrens silverspot butterfly, Sonoma arctic skipper, obscure bumble bee, western bumble bee, pink salmon, coho salmon, steelhead, tidewater goby, and Gualala roach) occurred on the Natural Diversity Database search. The scoping process also involved reviewing the following: adjacent THPs, the Gualala River Watershed Assessment Report (2002) and reviewing Lawrence Kobernus' report titled "Wildlife Species with Special Status that may be present On Gualala Redwoods or other HJW managed properties" (updated May 1999). The stream reports referenced in the sources list commissioned by GRT were also studied.

GRT's GIS database, which is updated continually with new findings, was also consulted for known listed wildlife in the scoping area. Spotted owls are reported within 0.7 miles in a CNDDB query. Coho salmon have been known to occur when there was an active fish planting program, and steelhead trout occur naturally within watercourses in the scoping area of the Gualala River Watershed.

Plants: Near the end of this section is the rare plant scoping summary (the plant survey will be conducted at a later date). Note: plant survey has since been completed and was amended into the approved plan; see THP Amendment #3 dated 07-07-2016.

The following reference sources were used to determine the range and habitat requirements of listed species and to aid in field identification.

CNPS website

California Natural Diversity Data Base, March 1, 2014, November 29, 2018

Raptors of California, Hans and Pam Peeters, 2005 University of California Press

The Audubon Society Field Guide to North American Bird, John Whitaker, Alfred Knopf Inc 1992

The Audubon Society Field Guide to North American Bird, Bebler and King, Alfred Knopf Inc 1992

California Mammals, E.W. Jameson and Hans Peeters, University of California Press, Berkeley, 1988.

California's Wildlife, Vol. I - Amphibians and Reptiles, California Statewide Wildlife Habitat Relationships System, May 2, 1988.

California's Wildlife, Vol. II - Birds, California Statewide Wildlife Habitat Relationships System, November, 1990.

California's Wildlife, Vol. III - Mammals, California Statewide Wildlife Habitat Relationships System, April, 1990.

Field Guide to the Birds of North America, National Geographic Society, 1987.

Scats and Tracks of the Pacific Coast, James Halfpenny, 1999 Falcon Publishing

SENSITIVE AQUATIC SPECIES

Sensitive Fish species

Fisheries Habitat

The following are the Class I watercourses within the Biological assessment area for aquatic life. The South Fork Gualala River, Main Stem, North Fork and Wheatfield Fork of the Gualala River, Groshong Gulch, Buckeye Creek, Rockpile Creek and Big and Little Pepperwood Creeks. Additional information may be included below for upstream and downstream areas even though they are outside the assessment area.

Current Fish Species in the Gualala River Watershed, California

Common Name, Scientific Name

Anadromous

Coho salmon, *Oncorhynchus kisutch*
Steelhead trout, *Oncorhynchus mykiss*
Pacific lamprey, *Lampetra tridentata*

Freshwater

Gualala Roach, *Lavinia symmetricus parvipinnis*
Coast range, sculpin *Cottus aleuticus*
Prickly sculpin, *Cottus asper*
Riffle sculpin, *Cottus gulosus*
Threespine stickleback, *Gasterosteus aculeatus*

Marine or Estuarine

Surf smelt, *Hypomesus pretiosus*
Pacific herring, *Clupea pallasii*
Staghorn sculpin, *Leptocottus armatus*
Starry flounder, *Platicthys stellatus*

Many of the issues that affect fish survival such as large woody debris, sedimentation and temperature are addressed above in the watershed assessment.

The following aquatic species, Southern Torrent Salamander, California Red-legged Frog, Tailed Frog, Foothill Yellow Legged Frog, and the Western Pond Turtle have potential habitat in the watercourses and will be protected by WLPZ protections and other FPA rules as listed elsewhere in the THP.

Coho Salmon (Oncorhynchus kisutch), Steelhead (Oncorhynchus mykiss), and Chinook Salmon (Oncorhynchus tshawytscha)

The life cycles of anadromous fish involve habitation of both inland freshwater streams and the ocean. Adult fish migrate into inland fresh water from the ocean and spawn. The offspring hatch and live a portion of their lives in freshwater and then migrate into the ocean. In the ocean the fish continue to grow and mature. After several years the fish return to the streams (usually of their birth) and spawn.

The decline of anadromous fish populations has been attributed to many factors. Quantitative data, that would reveal which problems are real and which are perceived, is lacking. Possible factors affecting the anadromous fish include stream habitat conditions, water diversion, ocean conditions, global and regional climate changes, introduction of hatchery bred fish, introduction of exotic species, spread of disease by hatchery stock, predation by birds and mammals, commercial, sport and subsistence fishing, and poaching. Most likely, declines in coho populations are caused by the combination of multiple factors with higher temperatures, shallower pools, and limited ocean access to the river being primary causes for decline in populations.

Chinook Salmon (Oncorynchus tshawytscha) Status: Federal- Threatened- Past surveys do not show this species to be present. Anecdotal evidence may indicate that the species was in the Gualala watershed in the past. Small runs of Chinook reportedly were observed in the 1990's (CFL 1997).

Silver Salmon / Coho (Oncorynchus kisutch). Status: Federal – Threatened, California – Endangered. See below for summary for what is known about this species.

Steelhead (Oncorynchus mykiss) Status: Federal-Threatened. See below for summary for what is known about this species.

Summary of Historic (1964-1981) Stream Surveys Conducted in the Gualala Mainstem/South Fork Subbasin (from NCWAP)

Mainstem South Fork Subbasin	Date Surveyed	Habitat Comments	Barrier Comments	Recommendations Management
South Fork	9/23 and 9/24 1964 5/17 and 18/1977	Plentiful spawning areas throughout the stream. Pool: Riffle 95:5. Generally poor shelter consisting of overhanging banks, boulders, logs, aquatic plants and overhanging aquatic plants. Summer flows are limited. Pool: Riffle ratio 7:3. The majority of pools had little to no shelter. Shelter consisted of boulders, aquatic plants, logs, undercut banks, and overhead canopy	Old Log Jams. None Complete. No barriers observed. Each summer a dam is constructed approximately ½ mile below the Wheatfield Fork.	Continue to manage for production of juvenile steelhead trout and coho salmon.
Marshall Creek Marshall Creek Tributary #3 Marshall Creek Tributary #5	9/28/1964	Deposits of good spawning gravel exist throughout the stream from the mouth to the upper fisheries value. Pool: Riffle ratio 50:50. Good shelter provided by logs, boulders, undercut banks, roots, and trees.	No complete barriers.	Should be managed as a steelhead trout and coho salmon spawning and nursery stream.
	9/28/1964	Very limited fisheries value. Watershed severely burned 10 years ago. Lower half mile has spawning gravel available, but summer flow is very low.	Total barrier to fish a half mile above the mouth.	None
	9/29/1964	Summer flows are limited. Some suitable spawning gravel directly above large log jams.	Over 40 log jams in a 1 mile stretch of stream. A number form complete fish passage barriers.	Remove log jams.
McKenzie Creek	9/23 and 24/1964	Spawning areas fair to good in the lower 1/3 of stream, excellent in the middle section of stream, and fair in the upper 1/3 of stream; Pool: Riffle ratio 60:40; Good shelter provided by rocks and undercut banks.	7 partial barriers; Large 7 feet high 40 feet dam present 1/6 mile upstream from mouth; Large bedrock falls 1-1/4 miles upstream	Continue to manage as a coho salmon, steelhead trout spawning and nursery area. After removal of falls, possible planting of coho salmon to re-establish a self-

Coho Salmon and Steelhead Trout Data Summary by Decade, Gualala River Watershed, California		
Decade	**Coho Salmon**	**Steelhead Trout**
1940s	A.C. Taft, chief of the Bureau of Fish Conservation, noted that the fishing pressure on the Gualala River increased 200-300% immediately after World War II ended in 1945	A.C. Taft, chief of the Bureau of Fish Conservation, requested that the entire Gualala River and its tributaries be closed to fishing for small and immature steelhead trout and salmon. Upon his recommendation, the summer closure began in 1945 and remained until 1982.
1950s	In 1952, electrofishing below the confluence of the North Fork revealed that the length frequencies of the fish removed showed a healthy condition (Kimsey 1952). Bruer (1953) wrote that there are millions of young steelhead trout and coho salmon in the Gualala watershed. In 1957, Fisher, cited that the adverse logging conditions and past improper practices had done considerable damage to the headwaters. This was primarily in the form of old logjams, debris and siltation. By 1959, the summer opening was not worth while for a person who must travel any distance (Kastner 1959).	During December 1954 through February of 1955, creel surveys were conducted to determine the quality of the steelhead trout fishery on the Gualala River. Five hundred and seven fish were checked. A total catch estimate of 1,352 fish for the season was extrapolated with data from a use count. In 1956, Fisher, concluded that the Gualala remained one of the better Region III steelhead trout streams. It appeared to sustain a good steelhead trout population despite the poor environmental conditions over a considerable portion of its headwaters. He speculated that unaffected tributary streams must have provided good spawning conditions.
1960s	Stream surveys were conducted in 1964. The species presence and relative abundance of salmonids were estimated from observations recorded while walking upstream along the banks. These surveys had no quantitative basis from which to estimate populations. Where coho salmon were observed during these stream surveys the management recommendations included "possible planting to re-establish a self supporting run" (Table 3-5). Based on CDFG's management prescriptions of the time, this recommendation likely indicated that the native coho salmon populations were not self-sustaining prior to 1964. CDFG reported population estimates of 4000 coho salmon in 1965. This population estimate was made without any supporting data thus is not reliable. The estimate was ranked "C without data" the lowest quality rating designated by the California Fish and Wildlife Plan, Volume III. In 1969, 90,000 coho salmon were planted.	Steelhead trout were present during stream surveys in 1964. Only one creel census survey was conducted on January 24, 1962. The result of the survey showed 11 steelhead trout caught by 18 anglers. Total angler hours were 56.5 resulting in a catch-per-unit-effort of 0.20 fish/hour. CDFG reported steelhead trout population estimates of 16,000 in 1965. This population estimate was made without any supporting data, thus is not reliable. The estimate was ranked "C without data", the lowest quality rating designated by the California Fish and Wildlife Plan, Volume III.
1970s	Hatchery plants of coho salmon; 1970, 30,000; 1971, 30,000; 1972, 15,000; 1973, 20,000; 1975, 10,000. Total number of coho salmon planted in the 70s, 105,000. Some streams were surveyed in 1970 with methods similar to those conducted in 1964 (Table 3-5). It is not known how many of the coho salmon observed during these stream surveys were from the 120,000 planted in 1969-1970. No mention of marked or unmarked hatchery coho salmon were found in the planting records or stream reports In the mid-1970s, the CDFG's Coastal Steelhead Project was conducted, in part, on the Gualala River, California. In 1972-73, the creel censuses began in November and resulted in high counts of coho salmon catches with 831 total coho salmon counted. All other years, the creel censuses began in December after the peak of the coho salmon run had passed. In the 1973-74 survey fifty-two coho salmon were counted, in the 1974-75 survey ten coho salmon were counted, in the 1975-76 survey ten coho salmon were counted and in the 1976-77 survey no coho salmon were counted.	Some streams were surveyed in 1970 with methods similar to those conducted in 1964 (Table 3-5). The steelhead trout observed during these stream surveys were assumed native as planting did not occur until 1972. The steelhead trout planted during the 1970s were 12,750 in 1972; 20,300 in 1973; 15,600 in 1974; 24,600 in 1975; and 10,070 in 1976, a total of 83,320. The Mad River Hatchery yearling steelhead trout were marked by a fin-clip. CDFG reports cite origins of brood stocks as Mad River Hatchery, South Fork Eel River and San Lorenzo River. In 1972-73, L.B. Boydstun, CDFG fish biologist, estimated that the fishing effort on the Gualala River had probably increased over 60% since the early 1950s, when the only other creel censuses were conducted. In spite of the increased pressure during the 1972-73 season, the steelhead trout catch was around 25% of what it was during the 1953-54 and 1954-55 seasons. He attributed the poor catch to smaller populations. During the 1972-73 creel census, 288 steelhead trout were caught. No recognizable hatchery fish from the

	California Drought	spring planting in 1972 were observed. During 1975-76 and 1976-77, steelhead trout population estimates were made as part of a five-year study. This study utilized creel census, use counts, adult tagging, and downstream migrant trapping in conjunction with the planting of steelhead trout. The goal of the project was to estimate winter adult steelhead trout populations, estimate angler harvest rates and evaluate the contribution of hatchery steelhead trout to the fishery. This program focused on enhancing the Gualala River as a sport-fishing stream. The steelhead trout population estimate was 7,608 in 1975-76 and 4,324 in 1976-77, 95% confidence intervals. Two years of data is not sufficient to establish a population trend. Adult steelhead trout population data does not exist after 1977. Harvest estimates were made at the end of the fishing seasons for each of the five years studied. In the 1972-73 season, 288 fish were surveyed. In 1973-74, 1682 steelhead trout were marked for possible recapture. In 1974-75, there were 793 fish counted and in 1975-76, there were 1418 fish counted. Eleven percent of the fish surveyed in 1975-76 were hatchery fish, and a 20.3 % harvest rate was calculated. In the 1976-77 season, there was a 19.8% harvest rate with no hatchery fish recorded. No creel census results were documented from the 76-77 season. The surveys typically began in December. The 1972-73 survey began in November.
1980s	From 1985-1989, 102,000 coho salmon were planted.	From 1983-89, 301,770 steelhead trout were planted in the Gualala River. The year totals of steelhead trout planted were; 12,500 in 1983; 13,400 in 1984; 9,700 in 1985; 57,450 in 1986; 26,250 in 1987; 108,750 in 1988 and; 73,700 in 1989. Bag seines were employed five times during the years of 1984-1986, to sample the game and non game fishes of the Gualala River estuary. The purpose of this survey was to assess the impact of proposed water diversions on aquatic species, in general, and juvenile salmonids, in particular. On Robinson Creek, one station was three-pass electro fished and showed a steelhead trout density of 0.85 per meter. Since electrofishing data were collected only in 1983 on Robinson Creek, insufficient data exists in which to make comparisons. Three pass electrofishing data were collected on a lower and upper site in the Little North Fork in 1988 and 1989. The surveys resulted in an average steelhead trout density of 0.45 on the Little North Fork. In 1989, juvenile steelhead trout population on Fuller Creek (approx. 6 mile long, 3rd order stream) was estimated at 62 with a standard error of 8.599. Four stations were fished with a two or three pass depletion electro-fish method. These stations were located on South Fork and Mainstem of Fuller Creek. The intent of this survey was to assess the impacts from the upstream logging. Station 4 was upstream of the falls on the South Fork, where resident rainbow trout were observed. Young-of-the-year and one year and older steelhead trout, western roach, and three-spined stickleback were found during these surveys.
1990s	Over three years, 45,000 juvenile coho salmon from the 1995-1998 brood years were planted in the Little North Fork. The juveniles were from the Noyo River Egg Collecting Station run by CDFG in Fort Bragg, CA. During snorkel surveys, Gualala Redwoods, Inc. observed	In 1990, a total of 41,300 steelhead trout were planted in the Gualala River. Since1993, the Gualala River Steelhead Project rescued steelhead trout juveniles from streams in danger of drying up during the summer months. Rescued fish are kept in

	coho salmon young-of-the-year on the Little North Fork, Robinson and Dry Creek in 1998 Between July 1, 1999 and June 30, 2000, spawner and electrofishing surveys were conducted on the Little North Fork Gualala River. These surveys were conducted to determine whether the planting of coho salmon during the 1996-98 periods was effective. No coho salmon were found.	two Doughboy pools at the hatchery on Doty Creek, a tributary to the Little North Fork of the Gualala River. The fish are released in the North Fork Subbasin and main stem Gualala River after the first substantial winter rains increase stream flows. From 1993-1997 and 1999-2000, 37,030 steelhead trout have been rescued and 20,328 have been released. During 1990-93, 95, 98, 99 and 2000 three-pass electrofishing data were collected on a lower and upper site in the Little North Fork. No effort was recorded in 1990-1992. Both sites showed small fluctuations in young-of–the year populations. Both sites showed a slight increase in one year old fish from 1995-2000. Two year and older steelhead trout numbers were identical at the lower site and slightly increased at the upper site from 1998-2000. In 1995, one-pass electrofishing surveys were conducted on Fuller Creek and South Fork Fuller Creek. Young of the year, year plus and two year plus steelhead trout were observed. The results were not comparable to the 1989 survey, due to differences in sampling techniques. Gualala Redwoods, Inc. conducted snorkel surveys in 1997, 1998 and 1999. In 1997-98, one year and older steelhead trout were observed in Buckeye Creek and South Fork. In 1998, one year and older steelhead trout were observed in the Wheatfield Fork. In 1999, one year and older steelhead trout were observed in Little North Fork, Robinson Creek, North Fork and Doty Creek.
2000	Between July 1, 1999 and June 30, 2000, spawner and electrofishing surveys were conducted on the Little North Fork, a tributary to the North Fork by CDFG. These surveys were conducted to determine whether the planting of coho salmon during the three-year period of 1995/96-1997/98 were effective. Robinson Creek and Dry Creek were surveyed in 1999, 2000, and 2001, no coho salmon were found (CDFG unpubl. data) Historical coho salmon streams listed by Brown and Moyle (1991) were electro-fished in September, 2001. The method used was the modified ten-pool protocol (Attachment D). The streams electro-fished were North Fork, Doty Creek, South Fork, Franchini Creek, Wheatfield Fork, Haupt Creek, Tombs Creek, House Creek, Pepperwood Creek and Marshall Creek. This survey was specifically aimed at establishing coho salmon presence in the streams sampled. Coho salmon were not found in any of the streams surveyed. Coho Salmon Status Review (2001) stated no known remaining viable coho salmon populations in the Gualala River system. In September 2002, coho salmon young-of-the year were present on Dry Creek, a tributary of the North Fork during a snorkel survey and two sites on the Little North Fork and Doty Creek during electrofishing. Coho young-of-the-year were present on McGann Creek, rescued and released (R. Dingman, pers. comm.)	In 2000-2001, 7,600 and 5,450 steelhead trout were planted on the North Fork between Elk Prairie and Dry Creek. During snorkel surveys, Gualala Redwoods, Inc. observed one year and older steelhead trout on: Little North Fork, Robinson, North Fork, and Dry Creek in 2000 and 2001; on the mainstem of Buckeye Creek in 2000 and 2001; and on the South Fork in 2000 and 2001. February-April 2001, a volunteer effort steelhead trout spawning surveys observed redds on Wheatfield Fork, Tombs Creek, Britain Creek, House Creek, and South Fork. Redds were observed on Rockpile Creek in 2001 (K. Morgan, pers. comm).

2003 to 2014	The last observed Coho were in Dry Creek in 2004.	The survey in 2008 shows steelhead in every creek surveyed which included Dry, Robinson, Big and Little Pepperwood, Buckeye the Little North Fork , the North Fork, the South Fork and Wheatfield forks of the Gualala. Since then surveys have been conducted in 2009, 2011, 2012 and 2013 in Big Pepperwood and the South Fork of the Gualala with steelhead present in all surveys. In 2012 there were 1067 in a 1000 foot reach which was the highest number ever counted for that reach however the following year the number was 10% of that.

Gualala Roach (Lavinia symmetricus parvipinnis) Status California-Special Concern- Eleven specimens of Gualala Roach were collected by Wendy Jones in 1999 on the South Fork of the Gualala River near the Annapolis road at Valley crossing and the confluence of the Wheatfield fork Gualala River. Numerous other records of this fish in the past are noted in the Gualala River Watershed Technical Support Document (GRWTSD).

Although no population estimates have been conducted, the bulk of stream surveys show that roach have increased in abundance while coho have disappeared and steelhead have decreased in most tributaries of the Gualala.

Snorkel surveys conducted in 2013 – Snorkel surveys which covered six of the major creeks in the GRI ownership did not find Coho salmon. Steelhead were found in every creek surveyed. Additionally, Gualala Roach have been observed during surveys as well as Sculpin, three spine stickleback and lamprey eels.

Beneficial actions for Fish Populations-

Almost all of the beneficial actions that are stated above in the watershed section of this report are intended for the benefit of the fish populations in the Class I watercourses. Sediment production and stream temperature effects will be minimized by application of the Forest Practice Rules in addition to the raised standards applicable to this plan. Road storm-proofing has already occurred on much of the area.

Most of the factors that affect anadromous fish are beyond the control of the forest landowner. Factors that the landowner could potentially influence have been addressed in the Forest Practice Rules and the cumulative effects analysis.

The following measures have been incorporated into this THP to provide for the protection of anadromous fish habitat resources:

- Rather than relist them here reference is made to all of the numerous provisions described in Section II under Item 18, Soil Protection and 26, Watercourse Protection. These provisions are there for the protection of anadromous fish habitat and for the other listed and unlisted aquatic species.

- Tree marking the WLPZs within the watershed shall be completed before the preharvest inspection to ensure an adequate opportunity for evaluation by the reviewing agencies.

- No winter period operations are proposed.

- 52 out of the 342 acres of this plan are no-cut zones because of the ASP rules or other biological considerations. Most of the remaining areas have the very high habitat protection standards prescribed by the ASP rules.

- At least 80% overstory canopy shall be retained for water temperature regulation within the Inner Zone A WLPZs of the Class I watercourse. At least 50% overstory canopy shall be retained for water temperature regulation within the Inner zone B WLPZs of the Class I watercourse.

- All hardwoods will be left uncut within the WLPZs except where they are a safety hazard.

- All Class I and Class II watercourse core zones and channel zones are no-cut zones.
- Recruitment of large woody debris for instream habitat and shade canopy will be provided by retaining the 13 largest trees per acre in the class I inner zones and large Class II watercourse WLPZ.
- All road work order points as described in the road work database in Section II have been included in order to minimize sediment production from the existing road system.
- An Erosion Control Plan is included in this THP.

The application of the Forest Practice Rules and specific beneficial actions for soil stabilization, winter operations, and watercourse protection, as described in this timber harvest plan will prevent significant impact to coho salmon and steelhead.

Reptiles

Northwestern Pond Turtle (Clemmys marmorata marmorata). Status: California - Species of special Concern: In California, this species ranges from the Oregon border south to Kern County (Bury 1962). The specific habitat of this species includes areas of permanent water such as ponds, lakes, rivers, marshes, sloughs, and drainage ditches. This species can range up to four hundred meters from their water habitat. It is known that western pond turtles exist and breed within the assessment area. They may be found within the Gualala River and probably in most if not all of its tributaries. There are wet areas that remain wet well into the year during a normal year. These areas where pond turtles may occur are also the areas that are being protected for red-legged frogs (see red-legged frog map). There are Class I watercourses that could support pond turtles either within or near the THP area. No turtles have been observed within the THP area.

Amphibians

Southern Torrent Salamander (Rhyacotriton variagatus) Status: California – Species of Special Concern- The range of this species in California coincides with the extent of humid coastal forests in the northwestern part of the state, up to approximately 3,900' above sea level, south to Mendocino County (Anderson 1968). The specific habitat of southern torrent salamanders includes cold mountain streams, springs, seeps, waterfalls, and moss-covered rock rubble with flowing water in humid coastal coniferous forests (Anderson 1968, CWHR 1979, Bury and Corn 1988, Welsh 1990). These salamanders seem to inhabit the splash zone and are rarely found more than one meter from water (Anderson 1968, and Nussbaum and Tait 1977). Southern torrent salamanders' range includes Del Norte, Humboldt, western Siskiyou, Trinity and Mendocino Counties. Marginal suitable habitat does exist within the watershed and but not within the THP. The THP is south of the recognized range. The RPF has had the training to recognize southern torrent salamander habitat. None of these salamanders have ever been discovered on landowner's property.

Tailed Frog (Ascaphus truei). Status: California - Special of Special Concern. Tailed frogs range from southern Mendocino County north through the coastal ranges into Oregon and Washington. THP area falls south of traditional range. Suitable fast rushing creeks do exist within parts of the watershed but not within the THP boundaries. Limitations on equipment operations and canopy retention standards within the WLPZs will reduce potential impacts on this species if they are present.

California Red-Legged Frog (Rana aurora draytonii). Status: Federal- endangered California - Species of Special Concern. Some of the following habitat description is excerpted from: U.S. Fish and Wildlife Service. 2002. Recovery Plan for the California Red-legged Frog (Rana aurora draytonii). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

General Habitat. The frog uses a variety of areas, including various aquatic, riparian, and upland habitats usually below 3500 feet in elevation.

Breeding Habitat. Breeding sites of the California red-legged frog are in a variety of aquatic habitats; larvae, tadpoles, and metamorphs have been collected from streams, deep pools, backwaters within streams and creeks, ponds, marshes, sag ponds, dune ponds, springs and lagoons. Breeding adults are often associated with deep (greater than 0.7 meter [2 feet]) still or slow moving water and dense, shrubby riparian or emergent vegetation (Hayes and Jennings 1988), Reis (1999) found the greatest number of tadpoles occurring in study plots with water depths of 0.26 to 0.5 meters (10 to 20 inches). California red-legged frogs also frequently breed in artificial impoundments such as stock ponds.

Dispersal and Use of Uplands and Riparian Areas. During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Frogs have been observed to make long-distance movements that are straight-line, point to point migrations rather than using corridors for moving in between habitats. During dry periods, the California red-legged frog is rarely encountered far from water. California red-legged frogs have been known to travel up to 1.4 km straight line from the breeding site however the majority of frogs never travel further than 30 meters from the breeding site.

Summer Habitat. California red-legged frogs often disperse from their breeding habitat to forage and seek summer habitat if water is not available. This summer habitat could include spaces under boulders or rocks and organic debris, such as downed trees or logs, or in mammal burrows and moist leaf litter; industrial debris; and agricultural features, such as drains, watering troughs, abandoned sheds, or hay-ricks. California red-legged frogs use large cracks in the bottom of dried ponds as refugia.

Water Quality: California red-legged frogs are sensitive to high salinity, which often occurs in coastal lagoon habitats. Observations indicate that California red-legged frogs were absent when temperatures exceed 22 degrees Celsius (70 degrees Fahrenheit), particularly when the temperature throughout a pool was this high and there are no cool, deep portions.

Wet Season defined: Wet Season starts with the first frontal rain system depositing a minimum of 0.25 inches of rain after October 15 and ends on April 15.

Dry Season defined: Dry Season starts April 16 and ends with the first frontal rain system depositing a minimum of 0.25 inches of rain after October 15.

Predators and Disturbance:

Raptors, bobcats, racoons, foxes, rough-skinned newts, otters, herons (both great blue and green) and other predators are known to be in or around the project area. The wider assessment area includes developed areas of The Sea Ranch and associated paved roads. Dogs, domestic cats, vehicles, lawn mowers, pesticides and livestock associated with developed areas are a threat to frogs. Residential lighting may affect frogs during migration. Bullfrogs (a predator of red-legged frogs have been heard and seen in ponds in the assessment area. Falling, skidding, log hauling and other vehicle traffic associated with logging could disturb or kill individuals.

Nearest recorded sighting:

The nearest CNDDB confirmed sighting of frogs is over 21 miles (straight line) to the SE in Austin Creek State Recreation Area. However, Sea Ranch residents reported a red-legged frog in Salal Creek in the summer of 2015 approximately one mile southwest of the THP area and egg masses were reported to have been found in a pond near Mill Bend approximately one mile west of the THP area.

Timber Harvest Plan Habitat: The THP area contains Class I, Class II and Class III watercourses and some ephemeral wet areas. The Class III watercourses flow only in response to rain and do not offer potential habitat. Class II watercourses in the plan area may exhibit shallow pools but when flowing the current may be too fast to offer breeding habitat. Class II watercourses may have water present into spring and summer. The flood prone area of the THP may provide habitat in the form of shallow standing water but the canopy is quite dense and the flooded areas dry out early in the year so the habitat does not appear to be optimal. Two areas have been designated in the plan as potential habitat and have been given additional protections. See item 32 in section II for specifics. The Class I and II watercourses have no-cut zones adjacent to them and then have limited selection harvesting outside of that zone. See item 26 for specifics on watercourse protection measures.

Assessment Area Habitat:

Within the assessment area, known ponds include; numerous sag ponds, several unclassified ponds and numerous seasonal wet areas (low spots that collect water). The sag ponds are generally shallow (less than 2 feet) and dry partially or completely during the spring and summer. Some ponds do have emergent vegetation in the form of pond lilies or cattails. The sag ponds in the area all have riparian canopies and do not resemble "open" stock ponds where California red-legged frog are commonly found. The seasonal wet areas may hold water after rainfall. These areas may be up to several feet deep during the winter but tend to be dry by late spring, early summer.

The Class I watercourses within the assessment area include the South Fork Gualala River, Main Stem, North Fork and Wheatfield Fork of the Gualala River, Groshong Gulch, Buckeye Creek, Rockpile Creek, and Big and Little Pepperwood Creeks.

Class II watercourses in the assessment area may exhibit shallow pools but when flowing the current would be too fast to offer breeding habitat. Class II watercourses may have water present into spring and summer and can act as a corridor for migration however telemetry studies indicate that the frogs that do migrate usually do so over land in the direction of their destination.

The Class III watercourses flow only in response to rain and do not offer potential habitat.

Aquatic Biologist Matt Goldsworthy for MRC has been conducting surveys since 2003 in the Annapolis area (east of the THP area) and they have not found any red-legged frogs. Their conclusion "It appears as if the Annapolis area is not occupied by red-legged frogs based on the large amount of survey work completed as well as the lack of observations in the CNDDB from the Annapolis and adjacent quads."

Foothill Yellow-Legged Frog (Rana boylii). Status: California – candidate for listing- Aquatic. Adult foothill yellow-legged frogs are moderately sized (between 1.5 and 3 inches long) with yellow color under their legs. They inhabit partially shaded, rocky perennial streams and their life cycle is synchronized with the seasonal timing of streamflow conditions. Adult frogs move throughout stream networks from winter refugia to mating habitat where eggs are laid in spring and tadpoles rear in summer. These frogs need perennial water where they can forage through the summer and fall months and the primary cause for mortality in eggs is desiccation. This makes drafting from shallow watercourses where the water level is lowered a concern for this species. Eggs and tadpoles prefer stream temperatures higher than those required for salmonids, with tadpoles selecting temperatures between 16.5C and 22.2C. The installation of crossings on watercourses is another area where this frog or its egg masses can be impacted

This species is also occasionally found in other riparian habitats including moderately vegetated backwaters, isolated pools, and slow moving rivers with mud substrates. (Don T. Ashton, Amy J. Lind, and Kary E. Schlick;

1997) Threats include predators such as garter snakes, bullfrogs, herons and raccoons. Other threats include droughts, floods and human disturbance. Populations of R. boylii have declined in southern and central California south of the Salinas River, Monterey County, and also in the west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento and San Joaquin Rivers. In the Coast Ranges north of the Salinas River R. boylii stills occurs in significant numbers in some coastal drainages. (Jennings and Hayes 1994).

These frogs do occur in suitable habitat in the assessment area and may occur in the same habitat that has been identified as potential red-legged frog habitat in the plan area. Any adult frogs that may exist near the THP will be protected by WLPZ requirements. This frog's egg masses will also be protected by the limitations that are part of the 1600 agreement which severely limit the reduction of water levels that are allowed during water drafting. Class I crossings are cleared of fish during installation and frogs will be cleared from the immediate area at the same time. The mitigations contained in the plan for protection of the red-legged frog, as well as fish, will also protect the foothill yellow-legged frog and its habitat. Operations of this THP under stated plan restrictions and mitigations will not likely result in a take, nor have any adverse impact on the species.

Sensitive Bird Species

During layout of this plan the THP area was traversed numerous times. Recordings of sharp-shinned hawks, Coopers hawks and Goshawks (both adult and juvenile) were played repeatedly at numerous locations throughout the THP in April and May of 2014 without eliciting a response. Signs of possible raptor predation have been seen on the appurtenant road system but no raptor nests, plucking posts or concentration of mutes were discovered.

Species that are of special concern-

Bald Eagle (Haliaetus leucocephalus). Status: California - Endangered (1971), Federal - Delisted 2007. In California, bald eagles breed in the northern quarter of the state. The species winters throughout most of their breeding range, with half of the state's population wintering in the Klamath Basin (Zeiner et al. 1990b). Specific winter habitat of this species is generally large trees with open crowns near large creeks, rivers, or lakes that have a fish supply.

In Mendocino and Sonoma County bald eagles are a rare winter migrant; only a few individuals are observed annually. These wintering eagles are opportunistic hunters and scavengers, normally passing through the area during their winter migration. The Gualala River drainage provides foraging habitat. Bald eagles prefer large trees to hunt from. The proposed project will have no effect on bald eagles foraging opportunities.

There are no known nests of bald eagles in the assessment area. Bald eagles are a premier species and are quite visible. If nesting was occurring in the area it is doubtful that it would be missed by local residents or by foresters or biologists working for the company. A mature bald eagle was seen wintering on the estuary of the Gualala River in December 2007 and again in the winter of 2013, and a pair have been seen in the vicinity of the lower estuary of the Gualala on a number of occasions in 2017 and 2018.

Golden Eagle (Aquila chrysaetos). Status: California - Special Concern.
The range of golden eagles in California is throughout the state, scarce in the southeastern desert region, and they are found in rolling country with lightly wooded areas, savannas, grasslands, desert edges, farms, or ranches. The species is a rare to uncommon resident and breeder (Harris 1991). The overall breeding densities of this species are relatively low, due to territorial spacing of nesting and foraging habitats. Overall population densities of this species currently appear stable, but excessive disturbance at nest sites can cause nest failure.

In Mendocino County and Sonoma County the golden eagle is an uncommon permanent resident and local breeder. Locally, golden eagles use a variety of habitats, including conifer and hardwood forests, mixed conifer-hardwood woodlands, coastal oak woodlands, and grasslands. Golden eagle forage and roosting habitat with some nesting habitat can be found in the assessment area and golden eagles have been infrequently observed soaring over landowner's property. Usually golden eagles prefer cliff ledges or large wolfy trees in more upslope and remote areas. Adjacent clearcuts provide foraging habitat. No large nest structures were observed and no golden eagle nests are known to exist in the assessment area.

Northern Goshawk (Accipiter gentilis). Status: California - Species of Special Concern.
In California the northern goshawk is an uncommon resident. Goshawks typically breed on north slopes, near water in the densest parts of mature conifer forests but close to openings. The nest is usually located in fork of large horizontal limbs in large live trees at the bottom of the live canopy. In the north coast redwood belt goshawks are extremely rare nesters and irregular transients. They are not known to breed this far south in the coast range. It is unlikely but possible that goshawks will use the type of second growth redwood forest present on this THP however the RPF has searched for visible evidence of goshawks, such as adults or juveniles, plucking posts, or nest structures and played recordings of goshawks repeatedly. It is unlikely that goshawks are present within the THP area.

Cooper's Hawk, (Accipiter cooperi)-Status: California species of special concern.
In California, this species ranges throughout the state, but is not common in the northwest and southeast. In the north coast region they are an uncommon resident, more regularly seen in winter, and breed sparingly throughout (Harris 1991). Incidental sightings on this ownership corroborate this assessment. Nesting habitat of this species in California is most frequently in dense stands of live oak, deciduous riparian stands, and other forested habitats near water.
The potential nesting habitat for this species within the THP is possibly in the hardwoods or small conifers that exist adjacent to the watercourses. Since all harvest trees within the WLPZs will be premarked destruction of any possible nests will be less likely. Coopers hawks have been observed on the east side of the Gualala River near the THP area.

Sharp-Shinned Hawk (Accipiter striatus)- Status: California species of special concern.
Both the breeding and wintering habitats of this species have been characterized as woodlands of young or open forests with a variety of plant life forms (Johnsgard 1990). Remsen (1978) suggested that timber harvest may be a threat to nesting habitat of this species, but the work of other authors indicates that forest harvest resulting in younger stands benefits the species (Postovit and Postovit 1987, Reynolds et al. 1982).
Sharp-shinned hawks prefer to breed in young stands of conifer and tanoak. Habitat does exist within the THP for this hawk. Sharp-shinned hawks are regularly observed hunting on landowner's property. No sharp-shinned hawks or nests were observed during plan layout. Prey remains of small birds are commonly found on the landowner's property and these are most likely from Sharp shinned hawks.

American Peregrine Falcon (Falco peregrinus anatum). Status: California - Endangered (1971), Federal – Delisted

In California, the species breeds and winters throughout the state, with the exception of desert areas (CDF&G 1990). In the north coast region they are an uncommon migrant and winter visitor; a rare, local breeder, and summer resident (Harris 1991). The specific habitat of this species is tall cliffs for nest and perch sites with protection from mammalian predators and the weather, most often close to water and adequate prey populations. Peregrines are not known to be present in the vicinity of the project and there are no large vertical cliffs within the biological assessment area. It is known that peregrines forage up and down the coast, up some of the major river valleys and over the clearcut blocks, which fall within the biological assessment area. This foraging area will not be affected by operations. Logging activities should not negatively impact the birds' ability to capture prey. The proposed project will have no effect on Peregrine Falcons.

Northern Spotted Owl (Strix occidentalis). Status: Federal - Threatened (1990).

An uncommon, permanent resident in suitable habitat. The Northern Spotted Owl primarily inhabits old growth forests in the northern part of its range (Canada to southern Oregon) and landscapes with a mix of old and younger forest types in the southern part of its range (Klamath region and California) . The species' range is the Pacific coast from extreme southern British Columbia to Marin County in northern California. It nests in cavities or on platforms in large trees and will use abandoned nests of other species. The Northern Spotted Owl is primarily nocturnal. Its diet consists mainly of wood rats (Neotoma sp.) and flying squirrels, although it will also eat other small mammals, reptiles, birds and insects.

One threat to spotted owl populations, at least in the northern part of its range, has been the loss of old-growth and mature late-seral forest, which contains large dead trees for nesting and prey habitat, as well as cool, dark roosts under the dense overstory canopy. Fragmentation of remaining habitat results from logging and roads, and may have increased predation by Great Horned Owls and other species. More recently (since 1960's), a related eastern species, the Barred Owl (Strix varia), has invaded the Pacific Northwest. Barred owls are larger, more aggressive, and compete for both nest-sites and food. It is believed that Barred Owls occasionally attack spotted owls but the evidence for this is sparse. More likely the slightly larger barred owl displaces Spotted Owls from their territory. Barred Owls will also mate and hybridize with spotted owls. Barred Owls in the west occur in both young and old forest and are thought to displace spotted owls from their territories in old growth and mature forests. Additional threats to Spotted Owls include loss of habitat to wildfire and forest diseases, and also the West Nile Virus.

The habitat typing used in this assessment is consistent with the USF&WS Coastal Northern Spotted Owl Habitat Description.

> Nesting-roosting habitat includes: 60% (or greater) canopy cover of trees 11 inches (or larger) diameter at breast height.
>
> Foraging habitat includes: 40% (or greater) canopy cover of trees 11 inches (or larger) diameter at breast height. Basal area of 75 (or greater) sq. ft. of trees 11 inches (or larger) diameter at breast height.

The timberland owner is working with Forest Ecosystem Management (FEM) to develop and refine the Northern Spotted Owl habitat classification in GIS, which will allow for more accurate habitat mapping and analysis. FEM biologists ground truth habitat typing during NSO surveys and Activity Center walk-in visits. FEM's preliminary overview finds that company has correctly mapped the NSO habitat, and in some cases is more conservative than the FEM surveyor's typing.

In addition to FEM habitat analysis, Theodore Wooster, former CDF&G biologist for NSO technical assistance in this region from 1990 - 1999, completed some ground truthing of Gualala Redwoods' property in January 2007.

Priority Ranking of Habitat Retention Areas.

Tree Species Composition.

Mixed conifer stands should be selected over pine-dominated stands.

A. Abiotic Considerations include the following:

i. Distance to Nest.

I. Nesting-roosting and foraging habitat should be located closest to identified nest tree(s), or closest to roosting tree(s), if no nesting trees are identified.

ii. Contiguity.

I. Nesting-roosting habitat within the 0.5-radius circle around an activity center must be as contiguous as possible.

II. Fragmentation of foraging habitat must be minimized as much as possible.

iii. Slope Position.

I. Habitats located on the lower one-third of slopes provide optimal microclimatological conditions and an increased potential for the presence of intermittent or year-round water resources.

iv. Aspect.

I. Habitats located on northern aspects provide optimal vegetation composition and cooler site conditions.

v. Elevation.

I. Habitat should be located at elevations of less than 6000 feet, although the elevation of some activity centers (primarily east of Interstate 5) may necessitate inclusion of habitat at elevations greater than 6000 feet.

Size and Shape of Habitat Patch

a. Narrow strips of habitat (WLPZs, retention areas between clearcuts, etc.) may contain the characteristics of nesting-roosting habitat. However, when these narrow strips of habitat are surrounded by unsuitable or low quality habitats, they function as foraging habitat at best.

b. Narrow strips of habitat (100 meters or less) provide for a lot of edge habitat and little or no interior habitat. Franklin et al (2000) describe interior habitats as the amount of spotted owl habitat ≥100 meters from an edge. They describe edge habitat as edge between spotted owl habitat and all other vegetation types.

c. Because WLPZs, for example, are 100 meters or less in total width, they are considered edge habitats surrounded by unsuitable habitat. Edge habitats do not provide for protection from predators nor do they provide the microclimates of interior habitats.

No take discussion-

The THP as proposed will not 'take' NSOs nor will NSO habitat within the assessment area be reduced below threshold levels established by the Forest Practice Rules or guidelines recommended by USFWS. Approval of this THP will require the Director to determine there will not be a take of Northern Spotted Owl (NSO) as a result of timber operations. This determination will be based on the fact that the plan is in conformance with 14CCR 919.9 (e) and current guidelines developed by USF&WS specifically to avoid take of NSO. The USF&WS guidelines are intentionally ultraconservative to ensure that, if followed, the Director can confidently determine no take will occur. THP Section II, Item 32 contains operational actions to avoid take of NSO. THP

Section V contains non-operational information such as CNDDB reports, activity center walk-in survey results, evening survey results, pre and post harvest habitat maps, a map of survey routes and tables of activity center habitat acreage summaries. This non-operational information provides the Director supporting evidence that the THP conforms to the USF&WS guidelines and 14CCR 919.9 (e). Methods to avoid take of NSO include locating the birds, seasonal restrictions, restrictions based on proximity to NSO activity centers and prohibitions on reducing acres of habitat below thresholds determined by USF&W and the Rules of the Board of Forestry. Because this THP will not result in take and conforms to USF&WS guidelines, cumulative negative impacts are avoided. The effects of the proposed operations cannot accumulate with effects of past or foreseeable future projects to negatively impact NSO. Additional information on the Spotted Owl has been attached in Section II and Section V of the plan.

Marbled Murrelet (Brachyramphus marmoratus). Status: California - Endangered (1992), Federal - Threatened (1992). In California the species ranges from the Oregon border south to Santa Cruz County. Specific nesting habitat of this species is large, older, sometimes decadent trees (Carter and Erickson 1988, and others). Although marbled murrelets have been found nesting in some cases in younger trees, and also on the ground, they have primarily been found nesting in over mature coniferous forest throughout most of their range (Carter and Erickson 1988, Paton and Ralph 1988, Hamer and Cummins 1990, 1991. Throughout most of the year this species is found in small groupings in near shore coastal waters where they feed on small baitfish. Habitat loss, gillnetting, and catastrophic events such as oil spills and wildfire are potential threats to this species.

Department of Fish and Game biologists using radar near where the Annapolis Road crosses the South Fork and Wheatfield Fork also suspect that murrelets fly up the Gualala River although at this time murrelets have not been visually confirmed. Private biologists working for landowner have conducted extensive surveys along the South Fork Gualala River and at the confluence of the North Fork and South Fork. The nearest known Murrelets are approximately 5 miles south of the THP area near Clipper Mill Bridge. CDFW documented these birds in 1999 and recent information indicates they may still be in that area.

Surveys for this species were conducted in 2013 and 2014 along the mainstem South Fork Gualala, and potential habitat structure was surveyed again in 2017 and 2018 at the confluence of the North Fork and South Fork near the Green Bridge. No Murrelets were detected during these surveys and the habitat available within the THP area is not conducive to murrelet nesting.

Osprey (Pandion haliaetus). Status: California - Special Concern. The range of this species in California is the northern portion of the state where their nest sites are associated with large fish-bearing bodies of water. In the north coast region this species is a common summer resident and breeder; but rare in winter (Harris 1991). Typical habitat consists of large elevated trees or artificial structures for nesting within a few kilometers of a fish source (Johnsgard 1990). Although ospreys are most often very tolerant of human activity and often nest adjacent to roads and other conspicuous locations, disturbance of nest sites during the nest season (April-early October) can cause nest abandonment.

Osprey nests have been continually monitored on landowner's property since at least 1975. There are no known nests within the buffer zones given under FPR 919.3b(5) for this species. There are several known osprey nests clustered around the mouth of the Gualala River. There are two nests near Unit #1 but are outside the normal buffers afforded this species. There are also at least five known nests facing the Pacific Ocean either on the German Rancho side of the Gualala or on the north side of the Gualala in China Gulch. None of these nests are close to any units of this plan. There have historically been nests along the South Fork Gualala River and up Buckeye Creek but at this time there are no known occupied nests.

Great Blue Heron (Ardea herodias) Status: California - Special concern- In California this species ranges throughout most of the state up to approximately 4,900' above sea level, with heronries scattered throughout northern California (Zeiner et al. 1990b). Great blue herons inhabit a wide variety of freshwater and salt water habitats. Foraging areas include coastal bays, lagoons, tidal flats, mud flats, and rocks along rivers, creeks, ponds, and lakes (Yocom and Harris 1975) and also agricultural lands and along watercourses in mountainous areas. Their heronries are often found in brush, on rocks and ledges, or on the ground, but they prefer groves of trees near feeding areas (Zeiner et al. 1990). Individual large trees are sometimes used by single pairs of herons as well. Threats to this species include alteration of habitat through development and harvesting or inadvertent destruction of nest trees.
The birds are often seen foraging along the larger forks of the Gualala River. The main concern with this species would be protection of a nesting colony from disturbance although these species are known to nest singly as well. A heronry or individual heron nest should have been visible during the THP layout and none were observed. An individual heron nest is often placed in the largest tree around and since the 13 largest trees per acre in the near stream environment are being protected on this plan any possible nest sites will be protected.

Great Egret (Casmerodius albus). Status: California- Special Concern- In California, the range of great egrets is widespread throughout the state except at high elevations, and in desert areas (Brown et al. 1986). The specific habitat of this species is nearly synonymous with that of the great blue heron, with the two species often foraging and breeding in close proximity. After severe population declines around the turn of the century due to the harvest of their feathers, populations have rebounded. Alteration or draining of wetlands habitat, as well as industrial or residential development are considered threats to the continued well being of this species. As with great blue herons, no great egret rookeries are known in the BAA. No egrets or nests were observed.

Vaux's swift (Chaeturi vauxi)- California species of special concern- The range of this species in California is the length of the state in migration, and breeding in a narrow coastal belt from Del Norte County south to Santa Cruz County. On the north coast the species is considered a common summer resident and breeder; casual in winter (Harris 1991). Specific habitat for this species includes hollow trees, snag-tops with cavities, and also chimneys for nests and roosts. The removal of old, decadent redwoods and Douglas-firs with hollow snag-tops can cause loss of nesting habitat for this species. Vaux's swift have been regularly observed over the Gualala River. Snags and large decadent trees for roosting or nesting will be protected. No large decadent trees or snags will be felled (unless they are a safety hazard) that might provide habitat for this species. Within the boundaries of this THP there are no known Vaux's swift nests.

Purple Martin (Progne subis)- California species of special concern- In California, the range of purple martins is throughout the state west of the desert regions from sea level to approximately 6,000' above sea level. Purple martins are most commonly observed near coastal lowlands near river mouths. Harris (1991) lists this species as an uncommon summer resident and breeder. Specific habitat of this species for breeding is abandoned woodpecker cavities in isolated tall trees or snags, man-made martin houses (Allen and Nice 1952), or on cliffs (Bent 1942). Although apparently once a common breeder in this region, populations have decreased due to competition from introduced starlings, removal of snags, and loss of riparian habitat (Remsen 1978, Zeiner et al. 1990b). No Purple Martins were observed. Their preferred habitat will be protected by not harvesting snags or large decadent trees (live culls).

Sensitive Mammal Species

Gray Wolf (Canis lupus) Status-California- Endangered

Range in California-Although gray wolves formerly inhabited California, their historic abundance and distribution is unclear (Schmidt 1991, Shelton and Weckerly 2007). While there are many anecdotal reports of wolves in California, specimens were rarely preserved. The historic range of the wolf in California has been reported to include the Sierra Nevada, southern Cascades, Modoc Plateau, Klamath Mountains, and perhaps the North Coast Ranges (Stephens 1906; Grinnell et al 1937; Hall 1981; Paquet and Carbyn 2003). However, Schmidt (1991) concluded that wolves also "probably occurred in the Central Valley, the western slope of the Sierra Nevada foothills and mountains, and the Coast Ranges of California until the early 1800s, although their population size is unknown and may have been small."

Habitat- The gray wolf is a habitat generalist, and can occur in deserts, grasslands, forests and arctic tundra. Habitat use by gray wolves is strongly correlated with the abundance of prey, snow conditions, absence or low livestock densities, road densities, human presence and topography. Actual dens are usually constructed for pups during the summer period. When building dens, females make use of natural shelters such as fissures in rocks, cliffs overhanging riverbanks and holes thickly covered by vegetation. Sometimes, the den is the appropriated burrow of smaller animals such as foxes, badgers or marmots. An appropriated den is often widened and partly remade. On rare occasions, female wolves dig burrows themselves, which are usually small and short with 1–3 openings. The den is usually constructed not more than 500 meters away from a water source, and typically faces southwards, thus ensuring enough sunlight exposure, keeping the denning area relatively snow free.

A lone wolf, designated OR7, journeyed into northeastern California from Oregon several times since 2011. Recently a pair of wolves was discovered to be raising a family at an undisclosed location in Northern California.

There are no known wolves near the THP. Habitat is poor in the vicinity of the THP because of the lack of prey species, particularly deer, which would be the main prey species available in California. See Section II for protection measures.

Point Arena Mountain Beaver (Aplodontia rufa nigra)- Federal- Endangered

This species is found along streams in dense, riparian-deciduous forest and open stages of most forest types near water. Needs dense understory vegetation and friable, moist soils for burrowing into. WLPZ measures applied properly should protect their food, i.e. herbaceous and deciduous vegetation and the moist, friable soils important for denning.

According to "California's Wildlife" Volume III mammals, this THP is south of their range. Their burrows are described in the Audubon field Guide as being up to 19" in diameter surrounded by fan shaped earth mounds and in wet areas a tent of sticks erected over entrances. No such burrows or structures were observed in the WLPZs. This species has never been known to occur on landowner's property.

Sonoma Tree Vole (Phenacomys longicaudus). Status: California - Special concern.

The range of this species in California includes coastal forests in the humid fog belt (Jameson and Peters 1988) south to Sonoma County on the coast and to Mendocino County in the coastal mountains, and east to Trinity County (Maser 1966). They have been located at elevations of from 150'-3,100' above sea level (Maser 1966). The habitat of this species predominantly includes the existence of Douglas-fir trees, with grand fir, Sitka spruce, redwood and western hemlock also used (Meiselman 1987, Williams 1986). Some authors have suggested that this species is associated with old growth or fairly dense mature forest with large trees (Carey et al. 1991, Williams 1986). However, habitat records reviewed by Maser (1966) suggested that this species also uses young second growth Douglas-fir trees 7"-15" DBH, and also habitats described as broken, isolated,

and scattered by clearcuts, open grassland, bracken fern and cultivated fields; or 30-50 year old stands with a few interspersed older trees, but little evidence of dense forest. It is known from the experience of foresters working for GRT that Sonoma Tree Voles also nest in redwood trees, Bay Laurel trees and snags and are often found near water on GRT property. There also seems to be an affinity for nesting near waterfalls, perhaps because of the higher humidity in the vicinity of a waterfall since this species gets all of its moisture from the vegetation it consumes. Numerous tree voles have been documented and protected in the last ten years on the landowner's property.
Several wildlife trees were marked for protection that had structures that may have been red tree vole nests although no positive identification was made

Pacific Fisher (Martes pennanti)
The range of the Pacific fisher in California is the Pacific coastal range, Siskiyou range and Sierra Nevada Mountains. Primarily nocturnal, the pacific fisher is a good climber and swimmer. Its home range on the California coast can be up to 3,700 acres for females and 14,000 acres for males. The fisher prefers stands with large trees and high canopy closure. Douglas fir and true fir were the preferred forest types in the Coast Range. Oaks, especially black oaks appear to be important for denning in some areas. Its main quarry is hares, porcupines, squirrels, mice, chipmunks, carrion, fruit and other plants. It dens in hollow trees, logs or rocky crevices. It has natal denning areas and once kits are old enough they are moved to maternal denning areas. The natal period occurs as early as March 1 and extends to May 15th. Maternal denning occurs from May 16th and is usually completed by July 31st.
Resting areas include large limbs, raptor or squirrel nests, and mistletoe brooms. The fur is especially prized which has caused its extirpation in some areas. It requires extensive wilderness, so loss of habitat has also depleted populations. One threat to fishers may be the loss of large decadent trees that contain cavities that are used for natal and maternal denning.
No fishers have ever been detected within the GRT ownership. Within the watershed, loss of large decadent features that would be used by fishers occurred mostly at the turn of the century and again in the 1950s and 1960s.

Pacific Fisher Analysis
1. Regulatory mechanisms that exist to protect habitat and structural elements for existing fisher populations within the planning watershed and the need to provide additional mitigation measures.

The ASP rules require leaving the 13 largest trees per acre near Class I and large Cass II watercourses. These are the trees that are most likely to have features that are most conducive to fisher denning. These areas are also equipment exclusion zones which reduces the possibility of disturbance. Both Class I and Class IIs have zones adjacent to them that are no-harvest zones and these often have the largest trees in the watershed which are protected from harvest. Also snags are generally left across the entire landscape unless they create a safety concern. GRT will continue a policy of leaving at least two wildlife trees per acre across the property. These trees are evaluated by foresters and chosen based on qualities such as cavities, large size, platforms, busted tops, large branches, which are many of the same qualities that fishers prefer for denning and for resting. GRT will continue to leave hardwoods 24 inches DBH or larger up to four trees per acre and all downed large woody debris within WLPZs are left. Most large woody debris outside of WLPZs is also left unless it is being used for creek restoration work.

Measures that have been incorporated in this THP to avoid take include:
A. leaving of all snags that aren't a safety risk;

B. marking of two wildlife trees per acre which are those trees that have the characteristics that fishers prefer such as forks, cavities, busted tops, nests, mistletoe brooms or decadent trees with large flat branches; and
C. Leaving all large hardwoods (24" or greater) up to 4 per acre.

2. The specific requirements for fisher regarding structural elements for denning and resting sites within the Plan area.
   As mentioned above the fishers need large trees and snags with cavities, large limbs, downed logs, witches' brooms, for both denning and resting. Since this THP is in the redwood belt there exist many hollow old growth redwood stumps in addition to decadent Douglas fir trees and large woody debris scattered across the plan area.

3. Existence of large scale habitat plans on or near the proposed Plan area.
   Across the landscape the existence of numerous alluvial flats adjacent to the Class I watercourses on this property provide linearly connected habitat corridors where all of the best elements needed by fishers are provided for. These elements are contiguous with class II large and standard protection zones which also provide habitat and with areas of no-cut or selectively cut zones that provide additional habitat. Even the evenaged management units on the property provide habitat in the form of down logs and foraging opportunities by supporting a greater number of small mammal prey species.

4. Anticipated change in fisher habitat quantity and quality within the planning watershed and biological assessment area as it relates to possible future projects.
   It is projected that fisher habitat on GRT property will actually improve over time since structural elements that fishers prefer are mostly not harvested. There will be some loss of large snags as these deteriorate over time however the large redwood snags and goosepens are likely to be present and relatively stable for long periods of time into the future. Some snags of existing live trees will develop over time. In addition, the stands that exist on alluvial flats, which are quite extensive on this property, will have only light harvesting of the smaller trees in the future and the largest and oldest trees will continue to age slowly, developing old growth qualities eventually.

Townsend's big-eared bat (Corynorhinus townsendii)

(note: the following was taken from CWHRS Townsends Big Eared Bat by J. Harris, and updated by pers. comm., M. Baker, Nov. 12, 2015)

DISTRIBUTION, ABUNDANCE, AND SEASONALITY

Townsend's big-eared bat is found throughout California, but the details of its distribution are not well known. This species is found in all but subalpine and alpine habitats and may be found at any season throughout its range. Once considered common, Townsend's big-eared bat now is considered uncommon in California.

SPECIFIC HABITAT REQUIREMENTS

Feeding: Small moths are the principal food of this species. Beetles and a variety of soft-bodied insects also are taken. Captures their prey in flight using echolocation, or by gleaning from foliage. Flight is slow and maneuverable. Capable of hovering.

Cover: Requires caves, mines, tunnels, buildings, or other human-made structures for roosting. COTO are also known to roost in basal hollows of large trees (>42" dbh) or perhaps stumps if the stumps are closed at the top. The roost entrance in in buildings, caves, and mines has been reported to be as small as 1 square foot in size (Pierson & Rainey 1998). The roost entrance in basal hollows has been reported ranging from 1 to 5.9 feet wide, and 2.6 to 14 feet high in size (Fellers & Pierson 2002). Basal hollow roost entrances greater

than 2 square feet that extend 1 foot or more upward into the tree above the top of the entrance to buffer changing microclimates and are greater than 3 feet above the ground for protection from predators. The only light penetrating the roost area originates from the roost entrances so that the internal roost area remains semi-dark to dark, however COTO are also known to roost in complete darkness and away from cave and mine entrances to roost also. COTO roost in a range of light conditions in anthropogenic structures and in basal hollows.

COTO may use separate sites for night, day, hibernation, or maternity roosts. Hibernation sites are cold, but not below freezing. Individuals may move within the hibernaculum to find suitable temperatures. Maternity roosts are warm. Roosting sites are the most important limiting resource. Disturbance of roosts is noted as the reason for the species' recorded population declines.

Reproduction: Maternity roosts are found in caves, tunnels, mines, and buildings. Small clusters or groups (usually fewer than 100 individuals) of females and young form the maternity colony. Maternity roosts are in relatively warm sites.

Water: Drinks water. Relatively poor urine-concentrating ability in comparison to other southwestern bats.

Foraging Pattern: Prefers mesic habitats for foraging. Gleans moths from trees, shrubs, or bushes. COTO also feed along habitat edges, including riparian corridors along streams and smaller tributaries, forest edges, and occasionally in more open habitat with large shrubs and scattered trees.

SPECIES LIFE HISTORY

Activity Patterns: Nocturnal. Hibernates. Peak activity is late in the evening preceded by flights close to the roost. Bats at hibernacula from October to April.

Seasonal Movements/Migration: This relatively sedentary species makes short movements to hibernation sites. Of 1500 banded bats, the longest movement was 32.2 km (20 mi) (Pearson et al. 1952).

Home Range: In early studies it was reported that colonies usually are at least 16-19 km (10-12 mi) apart. A density of 1 bat/126 ha (1/310 ac) was reported on Santa Cruz Island (Pearson et al. 1952). The greatest traveled distance recorded for a banded individual is 64 kilometers (Kunz 1999). This species shows high site fidelity if undisturbed. Territory: Not territorial. Males are solitary in spring and summer. Females form maternity colonies. Hibernates singly or in small clusters, usually several dozen or fewer.

Reproduction: Most mating occurs from November-February, but many females are inseminated before hibernation begins. Sperm is stored until ovulation occurs in spring.

Gestation lasts 56-100 days, depending on temperature, size of the hibernating cluster, and time in hibernation. Births occur in May and June, peaking in late May. A single litter of 1 is produced annually but not all females reproduce every year. Young are weaned in 6 wk and fly in 2.5-3 wk after birth. Growth rate depends on temperature. The maternity group begins to break up in late August. Females mate in their first autumn, males in their first or second autumn. About half of young females return to their birth site after their first hibernation. Subsequent return rates are 70-80%. Maximum recorded age is 16 years.

Niche: Forages with many other species. Relatively specialized on moths, and slow, maneuverable flier. Gleans, and captures prey in the air by echolocation. Roosting sites may be shared with other species. Rabies is found in this species, but incidence is usually less than 1%.

Comments: This species is extremely sensitive to disturbance of roosting sites. A single visit may result in abandonment of the roost. All known nursery colonies in limestone caves in California apparently have been abandoned. Numbers reportedly have declined steeply in California. Especially sensitive to injury by wing banding (Humphrey and Kunz 1976).

Specific to this THP-Although this THP is within the historic range of the Townsends big-eared bat (COTO) no bats of this species have ever been known to occur on GRT property and there are no caves, mines, or abandoned buildings within the THP, which are currently considered the preferred habitat based on available literature; however, no targeted COTO surveys have taken place. Within the THP area there are large old

snags and large old growth redwood stumps that could contain hollows sufficient for roosting. During layout of the plan no evidence of COTO was found which, given that COTO are widespread, but low-density in California and bats are nocturnal and cryptic in general, may be expected outside of targeted survey efforts by bat biologists. The entire plan was marked prior to the preharvest inspection and every square foot of the THP has been walked through. No suitable roosting hollows (as defined above) were observed. It should be noted that the RPF was only aware of the possibility of the COTO listing for the last half of the marking process. On 9/2/15 and 9/3/15 the balance of the THP was checked for potential habitat and none was observed. One COTO occurrence was found in the CNDDB database search, but no occurrences reported in the last twenty years. It is important to note that targeted COTO surveys have not been conducted, and negative survey results do not appear in the CNDDB.

Instructions to the LTO were included in Item 3, Section II of the plan. Measures that have been incorporated in this THP to avoid take are:

1. Leaving of all snags and goosepins.
2. Carefully inspecting basal hollows with red-filtered flashlights or placing guano traps in the base of hollows.
3. Leaving thirteen largest trees per acre in all flood prone areas and leaving all large hardwoods.

Biological Concerns and Significant Wildlife Features Assessment-

Hardwood Cover-

Hardwoods are an important component of wildlife habitat, providing suitable opportunities for roosting and nesting substrate and food production. Hardwoods are evident throughout the BAA in low to moderate concentrations. There are some unique and extensive areas of large Bay Laurel trees on this THP. All of these areas will be protected and are usually in no-cut areas of the plan. There are virtually no tanoak on the alluvial flats because of the periodic flooding that occurs but there are some areas of red alder. In the selection units of this plan only marked trees will be harvested so virtually all of the hardwoods that exist at present will remain post harvest since none have been marked for harvest. The only trees that might be affected are ones that constitute a safety risk for fallers or are knocked down by conifers. There is virtually no understory of hardwoods.

Within the Biological Assessment area there are many areas of dense hardwoods. In recent years, forest management activities have become more intensive (planting, pre-commercial thinning and hardwood reduction) and have tended to favor the more valuable coniferous species. This has resulted in a gradual decrease in the relative percentages of hardwood to conifers within the ownership. Hardwoods throughout the ownership may be more prevalent than prior to 1900 when conifers were harvested and hardwoods were left for economic reasons. Hardwoods have been preserved in WLPZs throughout the assessment area and within protection zones for wildlife species.

Hardwood cover is important for many species of wildlife and WLPZ protections and other no-cut areas will preserve a diversity of tree species. In addition to these set aside areas mature hardwoods will continue to exist within uneven aged management areas. Even in the clearcut areas some hardwoods will reproduce during the stand rotation period and although large mature hardwoods provide the most mast and the best nesting sites, some benefits will be provided by these younger hardwoods that reestablish themselves. The landowner makes an effort to leave hardwoods (trees 24" and larger) as wildlife trees, with a minimum retention of at least 4 large hardwoods per acre where they exist so that the young conifers will have adequate light to grow. Wildlife trees are chosen based on the following qualities when available; conky or defective trees that

are likely to become snags; trees with cavities, forked tops, large branches or loose bark; less common species such as chinquapin, madrone, maple, bay laurel, dogwood, nutmeg, alder or any oak besides tanoak; trees with any type of nest; and hardwood trees with a large diameter.

Multi-Story Canopy-

The proposed silvicultural prescription is very light selection with extensive no-cut areas. The stands in the plan area are relative even aged, single-tiered, and have high canopy retention standards as prescribed by the ASP Rules along the streamside no cut Core area and Inner Zone A. This high canopy retention will likely result in little or no redwood sprout reproduction occurring following harvest within Inner Zone A. Thus, within the FPA it may take several decades to a century or two before a multi-story canopy can be developed. At the watershed level there is extensive variability in stand ages, composition, and structure that will provide for multi-story development.

Road Density-

Except for mainline (i.e., designated permanent) roads, the majority roads in use within the BAA are native soil surfaced roads. These roads are maintained on an "as needed" basis. Main haul roads are subject to low to moderate truck traffic during logging season. The landowner is in the process of refining its road system by gradually abandoning a portion of the old roads that parallel near watercourses and on steeper slope areas where cable logging can be conducted. Rerouting the system to facilitate cable yarding systems and road placement above and away from watercourses will ultimately reduce future potential road impacts. Also a large percentage of the road system on GRT's ownership has been made hydrologically invisible over the last fifteen years through use of cost share watershed restoration grants. Information on the road upgrading program can be found elsewhere in this plan. Many other roads within the BAA over any given year are only subject to infrequent use by GRT's forest management staff. During the rainy season much of the assessment area is inaccessible and receives no traffic. The effect is a seasonal intrusion upon wildlife during the logging season and results in little to no potential impacts over the balance of the year.

This project will not interact with past, present or future levels of road density, and its use, to cause or create a significant adverse impact on animal use patterns in the assessment area, nor is anticipated to cause any adverse impacts to wildlife.

Rock Piles or Cliffs-

There were no cliffs or significant rocky areas in the THP area. Because of the geology of the area cliffs are very rare on the landowner's land.

Ponds and Other Wet Areas-

There are extensive seasonal wet areas within the alluvial flat portions of the plan but because of the sandy nature of the soil most of these ponding areas perk and dry up by the spring. Two areas in a normal year probably retain enough water to be considered potential red-legged frog habitat and pond turtle habitat and are being appropriately protected.

Woody Debris-

Large woody debris is important for maintaining moisture for amphibians and for providing shelter for other small animals and insects. Large woody debris also stabilizes sediment and may provide shelter for young trees. The THP does contain large woody debris scattered randomly throughout the units. All large woody debris within the WLPZs shall be left.

Nests-

No nests besides the inevitable squirrel nests were discovered during plan layout. No raptor nests were discovered during plan layout. All fallers shall be informed to leave trees in which nests or nest holes are observed.

Snags and Decadent (live culls) Trees-

Snags have not been numerically tallied and even when pre-harvest numbers are available it is difficult to estimate how many snags will survive falling operations. A few large redwood chimneys (hollow snags) exist on this plan and will be protected as wildlife trees. Mitigation for this plan is to save all snags and large decadent trees (live culls) that don't represent a safety risk.

Late Successional Forest and Large Tree Analysis-

Individual effects on wildlife and cumulative effects of the loss of late successional forests and individual large trees through evenaged management or because of repeated entries from uneven aged management have been recognized by the Board of Forestry and addressed by memorandum to RPF's ("Disclosure, Evaluation and Protection of large old trees" Duane Shintaku 2005).

Some of the issues relating to the reduction of large old trees are,

1) loss of late succession stands and late succession continuity;

2) loss of decadent and deformed trees that are of special value to wildlife by providing nesting platforms, nesting cavities for birds as well as basal cavities for mammals;

3) loss of high quality downed large woody debris recruitment;

4) loss of other special habitat elements such as loose bark that provides for bat roosting sites and nest sites for smaller birds, perching opportunities for aerial hunters, foraging opportunities for woodpeckers and other insect eaters, territorial perches, etc.

The greatest impact to a late successional and larger tree resource occurred nearly 100 years ago with the logging of the old growth in the watersheds associated with this THP. The goal of modern forestry is to maintain the elements of this habitat type that remain and recruit additional elements while still harvesting timber products.

No late successional stands remain on the GRT ownership. What does remains of the late seral forest on this ownership is scattered old growth trees that have been left for the following reasons;

1) They are rotten, hollow or busted and previous entries did not take them because of the lack of economic value.

2) They are sound but hanging over Class I or Class II watercourses where the current rules protect them from harvesting for the sole intention of eventual LWD recruitment into the stream or river.

3) They are sound but are on an unstable area or in an area that is inaccessible

4) They contain a known nest site, have some other significant wildlife value, or are being left as part of a wildlife habitat retention area or grouping.

By far the most common reason for sound late seral trees that are still on the property is that they are hanging over watercourses, especially adjacent to the Gualala River but also many of the main tributaries have scattered residuals. Indeed, many of the Class II watercourses have scattered old growth trees hanging over them. Sound late seral trees that are outside of a WLPZ are very rare. Usually these trees are residual old growth that were suppressed and are no larger than the surrounding second growth and have little unique

wildlife value. No numbers have been collected regarding the number of residual large old trees per acre across the property, but the number is very likely far less than 0.1 per acre (considering conifers only).

Recruitment of Future Late Seral Elements

Wildlife agencies are concerned that some trees be recruited over time so that the special habitat elements that late seral trees provide do not continue to decrease because of the loss of the existing trees through mortality and decay. There are several ways that the rules accomplish this;

1) The 2009 Salmonid (ASP) rules require the thirteen largest trees per acre within the Class I and large Class II watercourse protection zones be left.

2) The ASP rules also require that the first 30 feet adjacent to a Class I and variable widths adjacent to Class II watercourses be no-cut zones.

3) Large trees on landslides and on the edges of landslides are often left.

4) Some of the largest trees on the property are in inaccessible areas and although there is no guarantee that someday these won't be taken by helicopter, GRT has no plans to yard with helicopters at this time.

5) Much of the timber on GRT lands is 65 to 105 plus year old second growth which means on the higher site areas there are already some very large second growth trees. The biggest of these trees are often Douglas-fir and many of these Douglas-fir trees already have conk on them as a result of past logging injury or just as a result of natural mortality. Since Douglas fir trees make better wildlife trees than comparably sized redwood trees, and because they have lower economic value (and conky ones have zero economic value), these are the first trees to get marked as wildlife trees. GRT has an internal policy is to mark a minimum of four trees per acre as wildlife trees where feasible. The largest trees with defects are the first to get marked. These trees often occur in upslope areas therefore spreading out the benefit away from the WLPZs.

6) GRT will continue to leave hardwoods (up to 4 per acre) that are 24" or larger. Many hardwoods in this size class are late seral and most of these have high value as wildlife trees. Additionally all hardwoods in WLPZs are left.

Findings- Although late seral stands as defined by the Forest Practice Rules were eliminated from the GRT property almost a century ago (although some may have existed as long as 50-60 years ago in the easternmost portions of the property) some late seral conifer elements still remain. These large residuals trees are often found adjacent to Class I watercourses or as large decadent residuals scattered widely over the property. Late seral hardwood trees are often found in more upslope areas as well as along the watercourses.

Present timber harvests generally do not threaten these late seral remnants, unless they are deemed a safety or fire hazard issue. Although large second growth trees are harvested, the Forest Practice Rules regarding WLPZ protection and GRT policies regarding wildlife tree retention is ensuring that many large second growth trees are being left on a per acre basis as well. As an example, every residual tree that has been left in a clearcut, along a designated Class I and Class II watercourse WLPZ and Class III watercourse channel zone, on landslides, on or within protected archaeological sites, around rare plants and wet areas, or left for any number of other reasons will most likely remain until the next schedule harvest entry onto the site. Under a selection harvest regime this can be a 15-25 year span, and on areas where even-aged management is occurring this is at least 60 years. In each subsequent harvest entry where such structure is being retained these residual trees and/or retained structure continues to get taller and older. In addition, GRT land has many areas of highly productive timberland that have 80-100-year old trees. The trees growing on these higher sites have attained very large diameters and height, and though they don't have all the characteristics of old growth they may approach that stature someday.

The few late seral type large trees that have been observed in the plan area are adjacent to the Gualala River and being retained as wildlife trees and a source of eventual LWD recruitment to the river and flood prone area. Instructions have been added to Section II to make sure that fallers attempt to protect these trees when falling adjacent timber.

Note- Although wildlife trees are not normally specifically marked in uneven aged units such as this plan, because of a pre-consultation with California Dept. of Fish and Wildlife, the landowner has agreed to mark any especially good wildlife trees in order to make fallers aware of their location. This marking designation will help to protect these retained trees from impacts during falling and harvesting.

The managed second growth stands, combined with retention of residual later serial forest element, existing today within the BAA do provide some functional wildlife habitat for species primarily associated with late seral forest, in spite of the fact that previous management activities were not designed to retain any particular characteristics. The landowner's THP is designed to retain important functional wildlife habitat elements such that they will be present in the future stands. Late seral structural components are expected to increase within the flood prone areas and WLPZs in the BAA. No significant long-term cumulative adverse impacts to the functional wildlife habitat of species primarily associated with late seral forest characteristics is likely to occur as a result of activities on this proposed THP.

Rare Plant Survey and Scoping Process

Summary of Rare Plant Survey-The rare plant scoping process has been completed for this plan. The rare plant survey was completed 06-29-2016 (see Plan Amendment #3 dated 07-07-2016). Any needed follow-up survey will be completed prior to start of operations and will be submitted as a minor amendment ten days before start of operations. If any rare plants are discovered protection measures will be incorporated into the plan.

Scoping Process-
Much of the following information has been copied directly from Clare Golec's 1997 Rare Plant Assessment for Gualala Redwoods Inc.

Clare's original assessment was modified by her in 2001. The RPF has since revised and updated the plant scoping list to include additional plant listed between 2001 and 2018 to the list of rare, threatened or endangered plants using the CNPS database and the California Department of Fish and Game list of protected plants. Clare Golec's assessment gives the best overview of the process that was used to arrive at a list of Focus Plants (those plants that will be searched for during the actual survey).

The purpose of this document is to identify rare plant considerations in relation to timber management activities for the landowner's ownership and specifically for this THP. These considerations include, the determination of pertinent rare plants, occurrence of and potential habitat for rare plants, potential management impacts to rare plants, and recommended inventory, protection, mitigation and monitoring measures for rare plants. Potential habitat for rare plants will be emphasized in this document as a means to assess rare plants within the ownership. Landowner's ownership is located in southwest Mendocino and northwest Sonoma Counties in California, and situated biologically in the following geographic subdivisions (based on topography, climate and plant communities); the floristic province is the California (CA-FP), the region is the Northwestern California (NW), the two subregions are the North Coast (NCo) and North Coast Ranges (NCoR), and the North Coast Ranges district is the Outer North Coast Ranges (NCoRO) (Hichan 1993). The landowner's ownership is predominately a tree dominated vegetation type of coastal redwood and Douglas-fir. The soils are primarily derived from sedimentary rocks of the Coastal Belt Franciscan Formation (sandstone, siltstone and shale), with old marine sandstone terraces along the coast.

Definition of Rare Plant-
The plants designated in this document as "rare" are the vascular plant species currently protected on both the federal and state levels. These plants have been derived from the following lists: Federal listed or proposed threatened or endangered plants in California, State listed or proposed rare, threatened or endangered plants, California Native Plant Society's (CNPS) list 1A (plants presumed extinct in California), CNPS list 1B (plants rare, threatened or endangered in California and elsewhere), and CNPS list 2 (plants rare, threatened or endangered in California but more common elsewhere). The California Native Plant Society's (CNPS) list 1A, 1B and 2 plants are included in the interest of being thorough, as their inclusion reflects the current knowledge and concerns of the professional and amateur botanists throughout California. In addition, these lists meet the criteria for state listing under Sec. 1901, Chapter 10 of the Native Plant Protection Act, or Secs. 2062 and 2067 (California Endangered Species Act) of the California Department of Fish and Game Codes and are probable candidates for state listing. The CNPS list 1A, 1B and 2 plants are to be considered in the preparation of documents relating to the California Environmental Quality Act.

At present the following rare plants have known occurrence within the ownership: swamp harebell (Campanula californica), very common on the German Rancho, fairly rare elsewhere; running pine (Lycopodium clavatum) one occurrence; coast lily (Lilium maritimum), very common on the German Rancho, rare elsewhere; Point Reyes checkerbloom (Sidalcea calycosa ssp. rhizomata), one unconfirmed occurrence; and thin lobed horkelia (Horkelia tenuiloba), at least 4 sites with multiple plants in each site. Maple leaved checkerbloom (one known site with at least two plants), Bolander's reed grass (quite common in many areas of the ownership) and Usnea longisima (fairly common), all are known to occur and are CNPS list 4 species.

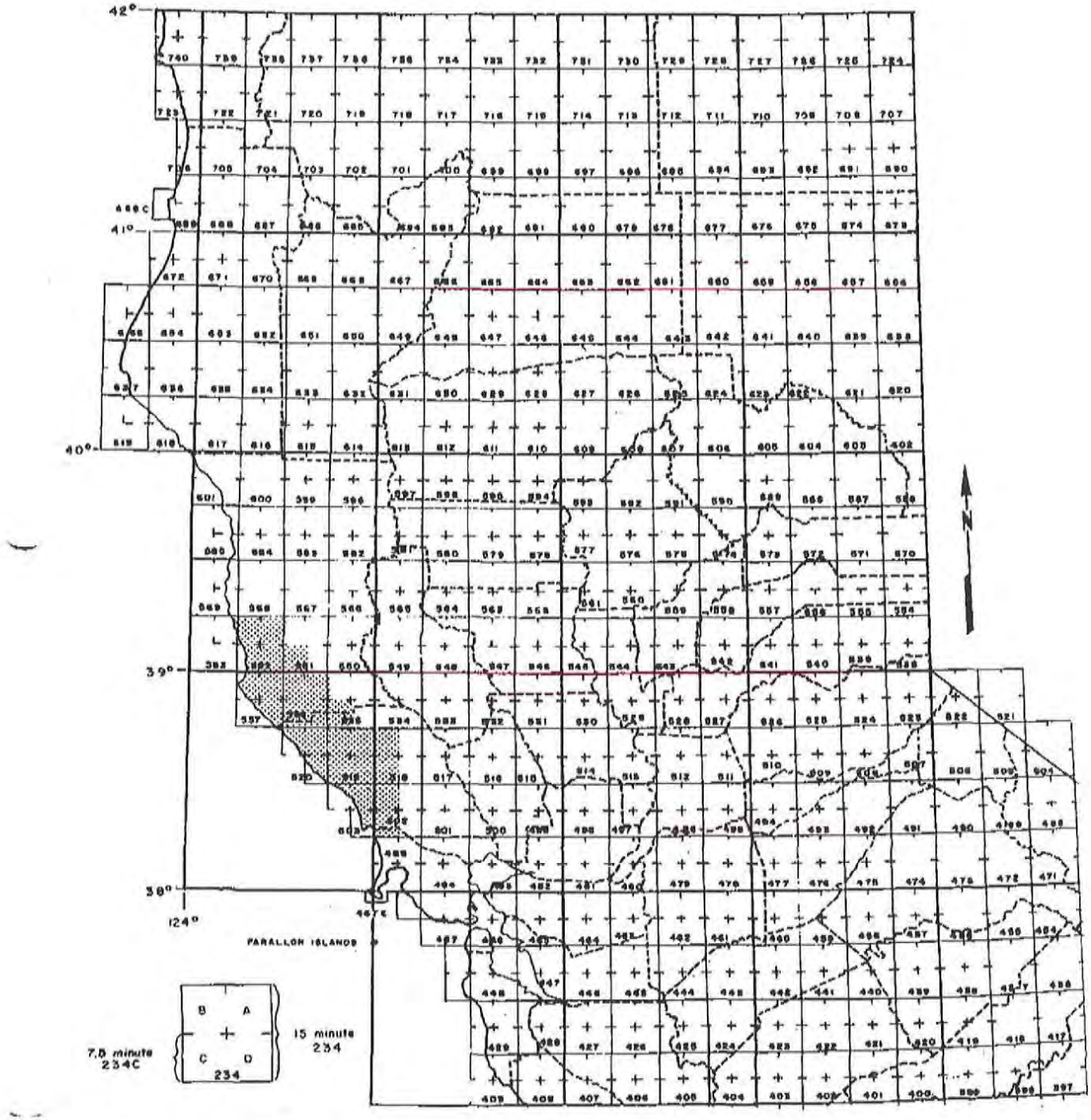
Two categories of rare plants, regional and focus, have been developed based on broad occurrence data and available habitat within the ownership.

Regional Rare Plants-

A regional rare plant is defined as a rare, threatened, or endangered vascular plant (federally listed, state listed, and or CNPS list IA, IB & 2) with known occurrence in southwestern Mendocino and/or northwestern Sonoma Counties in California, the general locale of the ownership. Regional rare plant occurrence was determined by querying the CNPS electronic Inventory of Rare and Endangered Vascular Plants of California (original August, 1997, updated in 2000 and in December 2007) for the ownership and neighboring USGS 7.5' quadrangles. An extensive query area was used to determine regionally appropriate rare plants and to augment floristic survey information. The regional quadrangles queried are listed below by name and number (in accordance with the quadrangle numbering system utilized by California Dept. of Water Resources).

Gualala Redwood Inc. Quadrangles: Stewarts Point (520B), McGuire Ridge (536C), Gualala (537D), Cazadero (519D), Duncans Mills (503A)
Regional Quadrangles: Guerneville (518C), Camp Meeker (502B). Valley Ford (502C), Duncans Mills (503A), Arched Rock (503B), Bodega Head (503D), Warm Springs Dam (519A), Tombs Creek (519B), Fort Ross (519C), Annapolis (520A), Plantation (520D), Big Foot Mtn. (535C), Ornbaun Valley (536A), Zeni Ridge (536C), Gube Mountain (536D), Eureka Hill (537A), Point Arena (537B), Saunders Reef (537C), Philo (55IC), Navarro (552A), Elk (552B), Mallo Pass Creek (552C), Cold Spring (552D), Albion (553A)

Figure 1 **REGIONAL ASSESSMENT AREA**



Regional Rare Plant List - The query of regional quadrangles resulted in 94 regional rare plants, these are listed below by scientific name. Note-This number has risen from 54 plants in the 1997 analysis and 76 in the 2001 analysis. Although these species are the rare plants with known occurrence in the general locale of the ownership, many of these species do not have suitable habitat available within the ownership. The general habitat affiliations of the plants are presented in the regional rare plants table below.

Focus Rare Plant List

Regional rare plants with known occurrence, high potential for occurrence, or moderate potential for occurrence have been designate as "focus rare plants." This designation was determined by the correlation of the ownership habitats with the associated habitats and distribution of regional rare plants. The potential for occurrence of regional rare plants in the ownership are presented below, with the potential for occurrence defined as:

known occurrence, species has known occurrence within the ownership and suitable habitat within the THP
high, suitable habitat within THP and possible occurrence within ownership
moderate, possible habitat within THP and possible occurrence within ownership
low, no habitat available within THP, limited habitat available on ownership or localized occurrence
no potential, no habitat available within ownership

The rare plants associated with serpentine substrates and with a low potential for occurrence were eliminated. The rare plants associated with serpentine substrates are an unlikely concern as habitat (serpentine substrates) was not noted on soil maps or during field review. The rare plants with low potential for occurrence have questionable or limited habitat available, and/or endemic to a specific area outside the ownership. Many of the immediate coastal plants have limited habitat available (coastal dunes, coastal bluff scrub, coastal prairie) and are not associated with forested areas, and are not likely to be impacted with timber management activities. This does not mean that if any of these plants are detected on the ownership that they will not receive consideration, but reflects that they are unlikely to occur within the THP and/or receive adverse impacts from timber management activities.

OWNERSHIP HABITATS

The vegetation present on the ownership have been grouped into general habitat types that reflect environmental conditions (wetland, mesic or xeric), regional areas (coastal or inland), and vegetative components (grass or forest). These habitat types are in large part based on Holland's (1986) vegetation classification system. The habitat types were determined through aerial photograph interpretation and a cursory field review of the ownership. The habitats identified within the ownership are listed and summarized below.

Upland Redwood Forest and Douglas-fir Forest The upland redwood forest and Douglas-fir forest are tree dominated and are associated with the mesic and upland slopes. These are the primary habitats within the ownership and are characterized by coastal redwood, Douglas-fir , grand fir , tanbark oak , evergreen huckleberry, red huckleberry, salal , poison-oak , wood rose , California hazelnut, , redwood sorrel , sword fern , hairy honeysuckle , yerba de selva , Pacific star flower , vanilla grass , Douglas iris , western trillium , evergreen violet , woodland madia , mountain sweet-cicely , wood strawberry , small-flowered alumroot , California toothwort , hillside pea , vanilla leaf , Smith's fairy bells , and bead lily . Recent harvested areas and roadsides have additional species such as blue blossom , coyote brush , French broom , white-stemmed raspberry , toothed coast fireweed , hairy cat's-ear , weedy cudweed , purple cudweed , woolly mullien , Spanish clover , wild carrot , common toad rush , self-heal , English plantain , purple-leaved fireweed , shamrock clover , white clover , Italian thistle , common velvet grass , sweet vernal grass , Orchard grass , creeping bent grass , soft chess , ripgut grass , large rattlesnake grass , small rattlesnake grass , silver European hairgrass , annual bluegrass , and tall flat-sedge.

Tan-Oak Forest and Mixed Evergreen Forest

The tan-oak forest and mixed evergreen forest are tree dominated habitats associated with xeric upland slopes. These habitats are often along ridgelines and in the inland areas away from coastal influence and are characterized by species such as, Douglas-fir , sugar pine , tanbark oak , Pacific madrone , giant chinquapin , California-bay , shrub oak , canyon live oak , orange bush monkey flower , spicebush , hoary rnanzanita , hairy manzanita , common manzanita ,buck brush , deer brush , coyote brush , bear grass , California milkwort , yerba de selva , Bolander's phacelia , woolly sunflower , star lily , Indian pink , and western bracken fern .

Bishop Pine Forest/Chaparral

The Bishop pine forest and chaparral are tree and shrub dominated habitats that frequently intergrade, and are found on the sandy and improvised soils associated with maritime ridgelines and terraces. These habitats, along with the associated marshy ponds, are floristically unique and have known occurrence and a high potential for rare plants. The Bishop pine forest and chaparral can be characterized by species such as, Bishop pine , western Labrador tea , wax myrtle , western azalea , hoary manzanita , glossyleaf manzanita , dwarf chinquapin , California rose-bay , evergreen huckleberry , coast silk-tassle , salal , dwarf rock-rose , wavyleaf ceanothus , California false lupine , bear grass , California fescue , coast lily , grape-fern , western bracken fern , goldenback fern , California milkwort , and bird's-foot lotus.

Alluvial Redwood Forest and North Coast Riparian Forest

The alluvial redwood forest and north coast riparian forest are tree dominated habitats associated with the mesic low elevation areas adjacent to Class I and II watercourses. This habitat type is characterized by coastal redwood , western hemlock , red alder , bigleaf maple , California-bay , Pacific yew , Oregon ash , willows , thimbleberry , salmonberry , Pacific bramble , red elderberry , elk clover , cow parsnip , western coltsfoot , toothed monkey flower , hedge-nettle , stinging nettle , coast figwort , small-flowered nemophila, Siberian candyflower , coast boykinia , lace flower , leopard lily , star solomon's seal , trifid bedstraw, wild ginger , slink-pod, fringed false hellebore, smooth violet, Pacific water-parsley, foxglove, common chickweed, small-flowered bulrush, mugwort, poison hemlock, Pacific snakeroot, western buttercup , Kentucky bluegrass, Bolander rush, common rush, sedges (Carex spp.), common horsetail, common scouring rush, lady fern, five-fingered fern, giant chain fern, and deer fern.

Marshes, Swamps, and Ponds-

The marshes, swamps, and ponds are herbaceous and shrub dominated wetland habitats with saturated soils, standing water, and/or slow moving water. These habitats are associated with low spots and backwaters along Class I and II watercourses or depressions in the maritime hardpans of the Bishop pine forest. Marshes, swamps, and ponds are characterized by many herbaceous species of the riparian forests with additional species such as western Labrador tea, western azalea, slough sedge, broom sedge, bluegrass in the marshy areas of the Bishop pine forest and longleaf pondweed in ponds.

Northern Oak Woodland and Grassland

The northern oak woodland and grassland are tree and herbaceous dominated habitats that frequently intergrade and are limited in occurrence. They occur on portions of the inland ridgelines in the Austin Creek tract of the ownership. Isolated grassland habitats, not associated with oak woodlands, also occur sporadically throughout the inland areas of the ownership. These habitats are characterized by species such as California black oak, coast live oak, Douglas-fir, California buckeye, bracken fern, white hyacinth, Ithuriel's spear, blue dicks, popcorn flower, common yarrow, blue-eyed grass, western blue flax, California poppy, common

fiddleneck, stickseed, common catchfly, cinquefoil, sun cup, large-flowered agoseris, spotted clover, bicolor lotus, field bindweed, yellow parentucellia, western buttercup, miniature lupine, sheep sorrel, wild carrot, soap plant, hound's-tongue, cut-leaved geranium, common stork's-bill, rattlesnake weed, scarlet pimpernel, English plantain, baby stars, wild radish, tomcat clover, spring vetch, goose grass, doveweed, wild oats, hedgehog dogtail, large rattlesnake grass, small rattlesnake grass, perennial ryegrass, silver European hairgrass, California oatgrass, fescue grass , and purple needlegrass.

Coastal Prairie

The coastal prairie is a herbaceous dominated habitat associated with openings and terraces along the coast. This habitat has very limited occurrence along western edge of the ownership and was not field reviewed. Coastal prairie is characterized by native bunch grasses mixed with other herbaceous plants. However, many of these areas now support introduced grasses and herbaceous plants.

Coastal Dunes, saltwater Marshes, Bluffs, and Scrub

The coastal dunes, saltwater marshes, bluffs, and scrub habitat types are herbaceous and shrub dominated habitats found along the immediate coastline. These habitats occur only in a very limited area of the ownership, the mouth of the Gualala River, and were not field reviewed.

Potential Rare Plant Impacts

Potential impacts to rare plants within the ownership are addressed in relation to timber management activities. Timber harvesting is the principal activity of landowner and has the greatest potential to impact rare plants associated in or around forested habitats. The potential impacts to rare plants from timber management activities are:

- direct physical impact, resulting from timber felling and removal, road and skid trail construction, or site preparation (such as burning and herbicide spraying)
- indirect impacts, such as expansion, degradation, or loss of habitat, and invasive plant competition
- cumulative impacts, resulting from disturbance regimes that favor temporal and pioneer vegetation types

Rare Plant Assessment:

For an assessment of cumulative impacts on rare plants, a review was made of "Gualala Redwoods Inc. Rare Plants Assessment" prepared by Clare Golec, (former) staff botanist for NRM, originally written October 1997 and updated in 2001 to reflect changes in plant listings. In addition, the CNPS website was accessed, and a 29 quad search which included Gualala, McGuire Ridge and Stewarts Point 7.5 minute maps was made. From this list Table 1 below was created after being modified by using information from Clare Golec's assessment. Table 1 was further modified by accessing the following websites:
http://cnps.site.aplus.net/cgi-bin/inv/inventory.cgi; & http://www.dfg.ca.gov/bdb/pdfs/SPPlants_Changes.pdf; and using information from these sources to include any recently added rare plants that could be in the area of this THP. The plants in Table 1 that had habitat requirements similar to the habitat in the plan area were extracted into Table 2 below which is the focus plants for the survey. In addition, photos of each of the focus plants was obtained and studied to aid in the survey.

Results of rare plant scoping-

Table 1 - **Regional Rare Plants** (Compiled from a 28 quad search with additional inputs)

Scientific Name	Common Name	CNPS_ LIST	Natural communities	Blooming periods	Habitat in the THP
					n=no p=possible y=yes
Abronia umbellata ssp. breviflora	pink sand-verbena	List 1B.1	Coastal dunes	Jun-Oct	n
Agrostis blasdalei	Blasdale's bent grass	List 1B.2	Coastal bluff scrub, Coastal dunes, Coastal prairie	May-Jul	n
Allium peninsulare var. franciscanum	Franciscan onion	List 1B.2	Cismontane woodland, Valley and foothill grassland/clay, volcanic, often serpentinite	May-Jun	n
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	List 1B.1	Marshes and swamps(freshwater), Riparian scrub	May-Jul	Y
Amorpha californica var. napensis	Napa false indigo	List 1B.2	Broadleafed upland forest(openings), Chaparral, Cismontane woodland	Apr-Jul	n
Arctostaphylos bakeri ssp. bakeri	Baker's manzanita	List 1B.1	Broadleafed upland forest, Chaparral/often serpentinite	Feb-Apr	n
Arctostaphylos bakeri ssp. sublaevis	The Cedars manzanita	List 1B.2	Closed-cone coniferous forest, Chaparral/serpentinite seeps	Feb-May	n
Arctostaphylos stanfordiana ssp. decumbens	Rincon manzanita	List 1B.1	Chaparral(rhyolitic), Cismontane woodland	Feb-Apr	n
Astragalus agnicidus	Humboldt milk-vetch	List 1B.1	Broadleafed upland forest, North Coast coniferous forest/openings, disturbed areas	Apr-Aug	Y
Boschniakia hookeri	small groundcone	List 2.3	North Coast coniferous forest	Apr-Aug	Y
Brodiaea californica var. leptandra	narrow-anthered California brodiaea	List 1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley and foothill grassland/volcanic	May-Jul	n
Calochortus raichei	The Cedars fairy-lantern	List 1B.2	Closed-cone coniferous forest, Chaparral/serpentinite	May-Aug	n
Calystegia purpurata ssp. saxicola	coastal bluff morning-glory	List 1B.2	Coastal dunes, Coastal scrub, North Coast coniferous forest	May-Sep	n
Campanula californica	swamp harebell	List 1B.2	Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows and seeps, Marshes and swamps(freshwater), North Coast coniferous forest/mesic	Jun-Oct	y
Carex albida	white sedge	List 1B.1	Bogs and fens, Marshes and swamps(freshwater)	May-Jul	N
Carex californica	California sedge	List 2.3	Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows and seeps, Marshes and swamps(margins)	May-Aug	p

Scientific Name	Common Name	CNPS_ LIST	Natural communities	Blooming periods	Habitat in the THP
Carex comosa	bristly sedge	List 2.1	Coastal prairie, Marshes and swamps(lake margins), Valley and foothill grassland	May-Sep	p
Carex lyngbyei	Lyngbye's sedge	List 2.2	Marshes and swamps(brackish or freshwater)	May-Aug	p
Carex saliniformis	deceiving sedge	List 1B.2	Coastal prairie, Coastal scrub, Meadows and seeps, Marshes and swamps(coastal salt)/mesic	Jun	p
Castilleja ambigua ssp. humboldtiensis	Humboldt Bay owl's-clover	List 1B.2	Marshes and swamps(coastal salt)	Apr-Aug	N
Castilleja mendocinensis	Mendocino coast Indian paintbrush	List 1B.2	Coastal bluff scrub, Closed-cone coniferous forest, Coastal dunes, Coastal prairie, Coastal scrub	Apr-Aug	n
Ceanothus confusus	Rincon Ridge ceanothus	List 1B.1	Closed-cone coniferous forest, Chaparral, Cismontane woodland/volcanic or serpentinite	Feb-Jun	n
Ceanothus purpureus	holly-leaved ceanothus	List 1B.2	Chaparral, Cismontane woodland/volcanic, rocky	Feb-Jun	n
Chlorogalum pomeridianum var. minus	dwarf soaproot	List 1B.2	Chaparral(serpentinite)	May-Aug	n
Chorizanthe cuspidata var. cuspidata	San Francisco Bay spineflower	List 1B.2	Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub/sandy	Apr-Jul(Aug)	n
Chorizanthe cuspidata var. villosa	woolly-headed spineflower	List 1B.2	Coastal dunes, Coastal prairie, Coastal scrub/sandy	May-Jul(Aug)	n
Chorizanthe valida	Sonoma spineflower	List 1B.1	Coastal prairie(sandy)	Jun-Aug	n
Cirsium andrewsii	Franciscan thistle	List 1B.2	Broadleafed upland forest, Coastal bluff scrub, Coastal prairie, Coastal scrub/mesic, sometimes serpentinite	Mar-Jul	n
Coptis laciniata	Oregon goldthread	List 2.2	Meadows and seeps, North Coast coniferous forest streambanks/mesic	Mar-Apr	p
Cordylanthus maritimus ssp. Palustris	Point Reyes bird's-beak	List 1B.2	Marshes and swamps(coastal salt)	Jun-Oct	n
Cordylanthus tenuis ssp. capillaris	Pennell's bird's-beak	List 1B.2	Closed-cone coniferous forest, Chaparral/serpentinite	Jun-Sep	n
Cupressus goveniana ssp. pigmaea	pygmy cypress	List 1B.2	Closed-cone coniferous forest(usually podzol-like soil)		n
Cuscuta pacifica var. papillata	Mendocino dodder	1B.2	• Coastal dunes (interdune depressions)	July - October	n
Delphinium bakeri	Baker's larkspur	List 1B.1	Broadleafed upland forest, Coastal scrub, Valley and foothill grassland/decomposed shale, often mesic	Mar-May	n
Delphinium luteum	yellow larkspur	List 1B.1	Chaparral, Coastal prairie, Coastal scrub/rocky	Mar-May	n

Scientific Name	Common Name	CNPS_ LIST	Natural communities	Blooming periods	Habitat in the THP
Dirca occidentalis	western leatherwood	List 1B.2	Broadleafed upland forest, Closed-cone coniferous forest, Chaparral, Cismontane woodland, North Coast coniferous forest, Riparian forest, Riparian woodland/mesic	Jan-Mar(Apr)	y
Erigeron angustatus	narrow-leaved daisy	List 1B.2	Chaparral(serpentinite or volcanic)	May-Sep	N
Erigeron serpentinus	serpentine daisy	List 1B.3	Chaparral(serpentinite, seeps)	May-Aug	N
Erigeron supplex	supple daisy	List 1B.2	Coastal bluff scrub, Coastal prairie	May-Jul	N
Eriogonum nervulosum	Snow Mountain buckwheat	List 1B.2	Chaparral(serpentinite)	Jun-Sep	N
Erysimum concinnum	bluff wallflower	1B.2	Coastal bluff scrub • Coastal dunes • Coastal prairie	Feb-July	N
Erysimum menziesii ssp. menziesii	Menzies' wallflower	List 1B.1	Coastal dunes	Mar-Jun	N
Erythronium revolutum	coast fawn lily	List 2.2	Bogs and fens, Broadleafed upland forest, North Coast coniferous forest/mesic, streambanks	Mar-Jul(Aug)	Y
Fritillaria liliacea	fragrant fritillary	List 1B.2	Cismontane woodland, Coastal prairie, Coastal scrub, Valley and foothill grassland/often serpentinite	Feb-Apr	n
Fritillaria roderickii	Roderick's fritillary	List 1B.1	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland	Mar-May	n
Gilia capitata ssp. chamissonis	dune gilia	List 1B.1	Coastal dunes, Coastal scrub	Apr-Jul	n
Gilia capitata ssp. pacifica	Pacific gilia	List 1B.2	Coastal bluff scrub, Chaparral(openings), Coastal prairie, Valley and foothill grassland	Apr-Aug	n
Gilia capitata ssp. tomentosa	woolly-headed gilia	List 1B.1	Coastal bluff scrub(rocky, outcrops)	May-Jul	n
Gilia millefoliata	dark-eyed gilia	List 1B.2	Coastal dunes	Apr-Jul	n
Glyceria grandis	American manna grass	List 2.3	Bogs and fens, Meadows and seeps, Marshes and swamps(streambanks and lake margins)	Jun-Aug	y
Hesperevax sparsiflora var. brevifolia	short-leaved evax	List 2.2	Coastal bluff scrub(sandy), Coastal dunes	Mar-Jun	n
Hesperocyparis pygmaea	pygmy cypress	1B.2	• Closed-cone coniferous forest (usually podzol-like soil)		n
Holocarpha macradenia	Santa Cruz tarplant	List 1B.1	Coastal prairie, Coastal scrub, Valley and foothill grassland/often clay, sandy	Jun-Oct	n
Horkelia marinensis	Point Reyes horkelia	List 1B.2	Coastal dunes, Coastal prairie, Coastal scrub/sandy	May-Sep	n
Horkelia tenuiloba	thin-lobed horkelia	List 1B.2	Broadleafed upland forest, Chaparral, Valley and foothill grassland/mesic openings, sandy	May-Jul	n
Lasthenia conjugens	Contra Costa goldfields	List 1B.1	Cismontane woodland, Playas(alkaline), Valley and foothill grassland, Vernal pools/mesic	Mar-Jun	n

Scientific Name	Common Name	CNPS_LIST	Natural communities	Blooming periods	Habitat in the THP
Lasthenia macrantha ssp. bakeri	Baker's goldfields	List 1B.2	Closed-cone coniferous forest(openings), Coastal scrub, Meadows and seeps, Marshes and swamps	Apr-Oct	p
Lasthenia macrantha ssp. macrantha	perennial goldfields	List 1B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub	Jan-Nov	n
Lathyrus palustris	marsh pea	List 2.2	Bogs and fens, Coastal prairie, Coastal scrub, Lower montane coniferous forest, Marshes and swamps, North Coast coniferous forest/mesic	Mar-Aug	p
Leptosiphon jepsonii	Jepson's leptosiphon	List 1B.2	Chaparral, Cismontane woodland/usually volcanic	Apr-May	n
Leptosiphon rosaceus	rose leptosiphon	List 1B.1	Coastal bluff scrub	Apr-Jul	n
Lessingia arachnoidea	Crystal Springs lessingia	List 1B.2	Cismontane woodland, Coastal scrub, Valley and foothill grassland/serpentinite, often roadsides	Jul-Oct	n
Lilium maritimum	coast lily	List 1B.1	Broadleafed upland forest, Closed-cone coniferous forest, Coastal prairie, Coastal scrub, Marshes and swamps(freshwater), North Coast coniferous forest/sometimes roadside	May-Aug	p
Limnanthes vinculans	Sebastopol meadowfoam	List 1B.1	Meadows and seeps, Valley and foothill grassland, Vernal pools/vernally mesic	Apr-May	n
Lupinus sericatus	Cobb Mountain lupine	List 1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest	Mar-Jun	n
Lupinus tidestromii	Tidestrom's lupine	List 1B.1	Coastal dunes	Apr-Jun	n
Lycopodium clavatum	running-pine	List 2.3	Lower montane coniferous forest(mesic), Marshes and swamps, North Coast coniferous forest(mesic)/often edges, openings, and roadsides	Jun-Aug	p
Microseris paludosa	marsh microseris	List 1B.2	Closed-cone coniferous forest, Cismontane woodland, Coastal scrub, Valley and foothill grassland	Apr-Jun(Jul)	n
Monardella villosa ssp. globosa	robust monardella	List 1B.2	Broadleafed upland forest(openings), Chaparral(openings), Cismontane woodland, Coastal scrub, Valley and foothill grassland	Jun-Jul	n
Pinus contorta ssp. bolanderi	Bolander's beach pine	List 1B.2	Closed-cone coniferous forest(podzol-like soil)		n
Piperia Candida	White-flowered rein orchid	List 1B.2	• Broadleafed upland forest • Lower montane coniferous forest • North Coast coniferous forest	Mar-Sept	p
Pleuropogon hooverianus	North Coast semaphore grass	List 1B.1	Broadleafed upland forest, Meadows and seeps, North Coast coniferous forest/open areas, mesic	Apr-Aug	p

Scientific Name	Common Name	CNPS_LIST	Natural communities	Blooming periods	Habitat in the THP
Potamogeton epihydrus	Nuttall's ribbon-leaved pondweed	2.2	Marshes and swamps (assorted shallow freshwater)	June-Sept	p
Rhynchospora alba	white beaked-rush	List 2.2	Bogs and fens, Meadows and seeps, Marshes and swamps(freshwater)	Jul-Aug	p
Sanguisorba officinalis	great burnet	List 2.2	Bogs and fens, Broadleafed upland forest, Meadows and seeps, Marshes and swamps, North Coast coniferous forest, Riparian forest/often serpentinite	Jul-Oct	p
Sidalcea calycosa ssp. rhizomata	Point Reyes checkerbloom	List 1B.2	Marshes and swamps(freshwater, near coast)	Apr-Sep	p
Sidalcea hickmanii ssp. viridis	Marin checkerbloom	List 1B.3	Chaparral(serpentinite)	May-Jun	n
Sidalcea malviflora ssp. patula	Siskiyou checkerbloom	List 1B.2	Coastal bluff scrub, Coastal prairie, North Coast coniferous forest/often roadcuts	May-Aug	n
Sidalcea malviflora ssp. purpurea	purple-stemmed checkerbloom	List 1B.2	Broadleafed upland forest, Coastal prairie	May-Jun	n
Streptanthus glandulosus var. hoffmanii	secund jewel-flower	List 1B.3	Chaparral, Cismontane woodland, Valley and foothill grassland(often serpentinite)/rocky	Mar-Jul	n
Streptanthus morrisonii ssp. elatus	Three Peaks jewel-flower	List 1B.2	Chaparral(serpentinite)	Jun-Sep	n
Streptanthus morrisonii ssp. hirtiflorus	Dorr's Cabin jewel-flower	List 1B.2	Closed-cone coniferous forest, Chaparral/serpentinite	Jun	n
Streptanthus morrisonii ssp. morrisonii	Morrison's jewel-flower	List 1B.2	Chaparral(serpentinite, rocky, talus)	May-Sep	n
Tracyina rostrata	beaked tracyina	List 1B.2	Cismontane woodland, Valley and foothill grassland	May-Jun	n
Trifolium amoenum	showy Indian clover	List 1B.1	Coastal bluff scrub, Valley and foothill grassland(sometimes serpentinite)	Apr-Jun	n
Trifolium buckwestiorum	Santa Cruz clover	List 1B.1	Broadleafed upland forest, Cismontane woodland, Coastal prairie/margins	Apr-Oct	n
Trifolium depauperatum var. hydrophilum	saline clover	List 1B.2	Marshes and swamps, Valley and foothill grassland(mesic, alkaline), Vernal pools	Apr-Jun	n
Triphysaria floribunda	San Francisco owl's-clover	List 1B.2	Coastal prairie, Coastal scrub, Valley and foothill grassland/usually serpentinite	Apr-Jun	n
Triquetrella californica	coastal triquetrella	List 1B.2	Coastal bluff scrub, Coastal scrub/soil		n

Table 1a - Updated additions to the regional rare plants list as of 06/29/17 (made from a 28 quad CNPS search)

Table updated with additional plants on 12/03/18; see asterisks below

Scientific Name	Common Name	CRPR	Blooming Period	Habitat	Micro Habitat	Habitat in the THP
						n=no p=possible y=yes
Bryoria spiralifera	twisted horsehair lichen	1B.1		North Coast coniferous forest (immediate coast)	Usually on conifers	n
Calamagrostis crassiglumis	Thurber's reed grass	2B.1	May-Aug	Coastal scrub (mesic), Marshes and swamps (freshwater)		n
Ceanothus foliosus var. vineatus	Vine Hill ceanothus	1B.1	Mar-May	Chaparral		n
Fissidens pauperculus	minute pocket moss	1B.2		North Coast coniferous forest (damp coastal soil)		p
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	1B.2	Apr-Nov	Valley and foothill grassland	sometimes roadsides	n
Oenothera wolfii	Wolf's evening-primrose	1B.1	May-Oct	Coastal bluff scrub, Coastal dunes, Coastal prairie, Lower montane coniferous forest	sandy, usually mesic	n
Polemonium carneum	Oregon polemonium	2B.2	Apr-Sep	Coastal prairie, Coastal scrub, Lower montane coniferous forest		n
Ramalina thrausta	angel's hair lichen	2B.1		North Coast coniferous forest	On dead twigs and other lichens	Possible on douglas fir (unit one only)
Thamnolia vermicularis	whiteworm lichen	2B.1		Chaparral, Valley and foothill grassland	On rocks derived from sandstone	n
Trifolium trichocalyx	Monterey clover	1B.1	Apr-Jun	Closed-cone coniferous forest (sandy, openings, burned areas)		n
*Amsinckia lunaris	bent-flowered fiddleneck	1B.2	Mar-Jun	Coastal bluff scrub, Cismontane woodland, Valley and foothill grassland		n
*Hypogymnia schizidiata	island rock lichen	1B.3		Closed-cone coniferous forest, Chaparral	On bark and wood of hardwoods and conifers	n
*Silene scouleri ssp. scouleri	Scouler's catchfly	2B.2	(Mar-May) Jun-Aug (Sep)	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland		n

Focus List

Plants with habitat in THP area

Scientific Name	Common Name	Bloom	potential presence
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	May-Jul	moderate
Astragalus agnicidus	Humboldt milk-vetch	Apr-Aug	moderate
Boschniakia hookeri	small groundcone	Apr-Aug	moderate
Campanula californica	swamp harebell	Jun-Oct	high
Carex albida	white sedge	May-Jul	moderate
Carex californica	California sedge	May-Aug	low
Carex comosa	bristly sedge	May-Sep	moderate
Carex lyngbyei	Lyngbye's sedge	May-Aug	moderate
Carex saliniformis	deceiving sedge	Jun	moderate
Coptis laciniata	Oregon goldthread	Mar-Apr	low
Dirca occidentalis	western leatherwood	Jan-Mar(Apr)	moderate
Erythronium revolutum	coast fawn lily	Mar-Jul(Aug)	moderate
Glyceria grandis	American manna grass	Jun-Aug	moderate
Lasthenia macrantha ssp. bakeri	Baker's goldfields	Mar-Aug	moderate
Lathyrus palustris	marsh pea	Mar-Aug	moderate
Lilium maritimum	coast lily	May-Aug	low
Lycopodium clavatum	running-pine	Jun-Aug	low
Piperia Candida	White-flowered rein orchid	Mar-Sept	moderate
Pleuropogon hooverianus	North Coast semaphore grass	Apr-Aug	high
Potamogeton epihydrus	Nuttall's ribbon-leaved pondweed	June-Sept	moderate
Rhynchospora alba	white beaked-rush	Jul-Aug	moderate
Sanguisorba officinalis	great burnet	Jul-Oct	moderate
Sidalcea calycosa ssp. rhizomata	Point Reyes checkerbloom	Apr-Sep	moderate

Common Plant species list (to be used and modified during survey)

THP name-Dogwood	check box if present
Date and time spent-	
alder (red)	
alumroot (small-flowered)	
anise	
Australian fireweed	
Azalea	
baby stars	
Baker's goldfields	
Baker's larkspur	
Bay-Laurel	
beaked tracyina	
bedstraw	
bicolor lotus	
bird's-foot lotus	
Bishop pine	
black oak	
blue blossom	
blue dicks	
blue-eyed grass	
blue flax	
Bolander rush	
Bolander's phacelia	
buck brush	
buckeye	
bulrush (small-flowered)	
buttercup	
calypso orchid	
carrot (wild)	
catchfly	
Cat's ears	
ceanothus (sp.)	
checkerbloom (maple leaved)	
checkerbloom (Point Reyes)	
checkerbloom (purple-stemmed)	
checkerbloom (Siskiyou)	
chickweed	
chinquapin (dwarf)	
chinquapin (giant)	
cinquefoil	
Clintonia (andrews) bead lily	
clover (Santa Cruz)	
clover (showy Indian)	
clover (Spanish)	
clover (spotted)	
clover (white)	
coast boykinia	
fawn lily (coast)	
coast lily	
coastal bluff morning-glory	
coltsfoot	
coralroot	
corn lily	
cow parsnip	
coyote brush	
creeping cudweed	
cut-leaved geranium	
dandelion	
Death camas	
deer brush	
Douglas-fir	
doveweed	

duckweed	
elderberry	
elk clover	
english daisy	
eucalyptus	
English plantain	
fairy bells	
fern (bracken)	
fern (chain)	
fern (deer)	
fern (five-fingered)	
fern (goldenback)	
fern (lady)	
Fern (maiden hair)	
fern (sword)	
fescue	
Fetid adders tongue	
fiddleneck	
field bindweed	
figwort (coast)	
forget me not	
foxglove	
fragrant fritillary	
French broom	
fringecups	
fringed false hellebore	
ginger	
gooseberry	
Grand fir	
grape-fern	
grass (American manna)	
Grass (annual blue)	
Grass (barley)	
grass (bear)	
grass (bolanders reed)	
Grass (cheat)	
grass (creeping bent)	
grass (goose)	
grass (Kentucky blue)	
grass (North Coast semaphore)	
Grass (oat)	
grass (Orchard)	
grass (perennial rye)	
grass (rattlesnake) (large)	
grass (rattlesnake) (small)	
grass (ripgut)	
grass (sweet vernal)	
grass (vanilla)	
grass (velvet)	
great burnet	
groundcone (California)	
groundcone (small)	
hairy honeysuckle	
hazelnut	
hedgehog dogtail	
hedge-nettle	
hemlock	
hill lotus	
Himalayan blackberry	
horsetail	
hound's-tongue	
huckleberry (california blue)	
huckleberry (red)	
Humboldt milk-vetch	
hyacinth (white)	
Indian pink	

inside-out flower (redwood)	
iris (Douglas)	
Ithuriel's spear	
Labrador tea	
lace flower	
large-flowered agoseris	
leopard lily	
little princes pine	
live oak (canyon)	
live oak (coast)	
lupine (false)	
lupine (miniature)	
madrone	
mallow	
manzanita (glossyleaf)	
manzanita (hairy)	
manzanita (hoary)	
manzanita (Rincon)	
maple (bigleaf)	
marsh pea	
milkwort	
miners lettuce	
mountain sweet-cicely	
mugwort	
Napa false indigo	
narrow-anthered California brodiaea	
nemophila (small-flowered)	
nutmeg	
oats (wild)	
orange monkey flower	
Oregon ash	
Oregon goldthread	
Oregon grape	
Pacific bramble	
Pampas grass	
pea (hillside)	
plantain (rattlesnake)	
poison hemlock	
poison-oak	
popcorn flower	
poppy	
purple cudweed	
purple needlegrass	
purple-leaved fireweed	
radish (wild)	
raspberry (white-stemmed)	
rattlesnake weed	
Redwood ivy	
redwood	
redwood sorrel	
rhododendron	
robust monardella	
rock-rose (dwarf)	
running-pine	
Rush (white beaked)	
rush (common)	
rush (scouring)	
rush (spreading)	
rush (toad)	
salal	
salmonberry	
scarlet pimpernel	
sedge (bristly)	
sedge (broom)	
sedge (California)	

sedge (deceiving)	
Sedge (false nutsedge)	
sedge (Lyngbye's)	
sedge (slough)	
sedge (tall flat)	
Sedge (white)	
sedges (Carex spp.)	
self-heal	
shasta daisy	
sheep sorrel	
shrub oak	
Siberian candyflower	
silk-tassle	
silver European hairgrass	
slink pod (fetid adders tongue)	
Smith's fairy bells	
snakeroot (Pacific)	
snowbrush	
soap plant	
soft chess	
solomon's seal	
Sonoma alopecurus	
spicebush	
star flower (Pacific)	
star lily	
stickseed	
stinging nettle	
stork's-bill	
strawberry (wood)	
sugar pine	
sun cup	
swamp harebell	
tanbark oak	
tarweed (slender)	
thimbleberry	
thin-lobed horkelia	
thistle (bull)	
thistle (Italian)	
tomcat clover	
toothed coast fireweed	
toothwort	
trail plant	
trifid bedstraw	
trillium	
Usnea longisima	
vanilla leaf	
vetch (spring)	
violet (redwood)	
water-parsley	
wax myrtle	
weedy cudweed	
western leatherwood	
wild licorice	
willow	
wood rose	
woodland madia	
woolly mullien	
woolly sunflower	
yarrow	
yellow parentucellia	
Yerba buena	
yerba de selva	
Yerba santa	
yew	

Cumulative Impacts Assessment Summary on Rare Plants, Sensitive Natural Plant Communities and Wet Areas
This THP has been thoroughly vetted through the THP Review process with numerous in-field consultations with California Department of Fish and Wildlife (CDFW), the California Geologic Survey, the North Coast Regional Water Quality Control Board and Cal Fire. These Agency reviews focused on reduction of impacts to sensitive areas that could affect salmonids and other sensitive species. Since 2004 some twenty agency site visits (see THP pages 441.14-441-16) have occurred as discussions on how best to protect the resources when harvesting in the Flood Prone Areas (FPA). These on-site discussions aided in the development of the Anadromous Salmonid Protection (ASP) rules by the State agencies and approved by the Board of Forestry in 2010. Three of these on-ground agency site visits were specific to Dogwood post development of the ASP rules. See THP pages 441.8-441.13 for a list of the field meetings that have taken place showing that plan and associated site conditions have been reviewed extensively by the State Agencies.

A rare plant botanical survey has been conducted for the THP during the applicable blooming periods (see THP Amendment #3) for California Natural Diversity Database (CNDDB) and California Native Plant Society (CNPS) List 1 and 2 species and sensitive State and Federal plants that have been determined to have the potential to be present within the operating areas. Surveys found an isolated occurrence of *Campanula californica* (Swamp Harebell) a CNPS List 1B.2 species and it has been provided protection as outlined in the THP. Also, no 'Sensitive Natural Communities' occur as defined by the March 20, 2018 CDFW plant survey protocol. If any additional listed plants are found prior to or during operations, an avoidance and/or mitigation strategy will be developed in consultation with CDFW as stated on page 45 of the THP.

The timber operations on this THP are exempt from Section 404 of the Clean Water Act, which requires permits for the discharge of dredged material into waters of the United States, including wetlands. Article 404(f)(1) of the Clean Water Act is an exemption for established (ongoing) farming, ranching, and silviculture activities such as plowing, seeding, cultivating, minor drainage, harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices. The timber operations are exempt as they will not represent a new use of the water and the activity will not cause a reduction in reach or impairment of flow or circulation of regulated waters, including wetlands (reference: https://www.epa.gov/cwa-404/exemptions-permit-requirements). Furthermore, no dredged or fill material will be placed in any regulated waters or any other areas within the Inner A and B Zones of the Flood Prone Areas. Refer to pages 26 and 27 of the THP which includes the Preferred Management Practices in Inner Zone A and B of flood pone areas. These measures restrict operations and are intended to avoid sensitive areas that could contain rare plants or sensitive plant communities. Also refer to page 47 of the THP which requires a pre-operations meeting with the LTO where the RPF will explain the characteristics of wet areas, the location of mapped wet areas, and the importance of protecting them. Wet areas and wet meadows as defined in the FPRs are being avoided as sensitive areas and no skidding of logs or equipment operations will occur in these areas. Areas that are seasonally wet and which could contain wetland obligate plants or plant communities such as abandoned meanders, swales, oxbow lakes, old channels, and other features that provide off-channel habitat for fish during flood flows are being avoided, with the exception of specific mapped stream crossings which require a CDFW 1600 Agreement consultation that protects or mitigates impacts to rare plants and wildlife.

The amount of flood prone area that is being impacted by heavy equipment is minimal as skid trails are all mapped and pre-flagged by an RPF with timber operators required to stay on those skid trails within the Inner Zone A and B of the FPA. Allowable skid trails are shown on THP pages 77.1 to 77.9. It is estimated that less than 5% of the actual ground is expected to be affected by skidding operations and skidding impacts are reduced by the operators, and only 37.5% of the older existing skid trails will be reused as many of those skid trails are not necessary for timber harvesting which will limit potential impacts. Additionally, significant portions of the Flood Prone Areas between harvest units within the Gualala River corridor owned by GRT are not included in this THP. As evidenced by the numerous gaps between harvest units shown on the Operations Maps pages 52 to 56, these intervening areas are younger planted redwood stands or are areas of sensitive site conditions and/or areas void of commercial timber that that will not be included in future THPs.

For these reasons no cumulative impacts to listed rare plants, special plant communities, or wet areas will occur due to operations from this plan.

Biological Findings: Operations proposed under this THP do not have a reasonable potential to join with the impacts of other projects to cause significant cumulative adverse biological impact. This is due to the limited impacts of light selection harvesting on the FPA stream protection zones, protection measures for plants and listed species built into Section II of the plan, requirements to survey for current and future listed species and protection of any species that occur on or near the plan and within the BAA during timber operations.

D. RECREATION ASSESSMENT -

Past and Future Activities.

The THP area is privately held timber property that is closed to general public access. However, public recreation activities are sometimes allowed that are compatible with the company's management goals. Portions of the landowner's property are utilized occasionally by local residents for hiking, riding, bird watching, picnicking, bicycling, hunting, and other recreational purposes. All of this activity occurs either as a result of trespass or by permit issued by the company. The Gualala River that is accessible by the public is near some of the proposed harvest units is utilized for swimming, fishing, drift boat fishing, canoeing and kayaking. The THP area is behind locked gates and public access is not allowed without a permit. Potential recreational impacts are primarily limited to campground and river users, and those impacts are generally in the form of visuals, noise, and traffic which are addressed below. No other impacts to recreational use are expected to occur.

Unit #1 falls within the Coastal Zone Special Treatment Area for visual impacts and therefore has additional restrictions on silviculture and yarding. It is also near a publicly owned campground and therefore must be considered for impacts relating to recreation. The campground was gifted to the County of Sonoma by the previous landowners of GRT for use as a park. The area immediately adjacent to the campground was originally included in this THP but prior to plan submission that area was removed by the previous landowners. The nearest portion of Unit #1 is 200-300 feet from the actual campground boundary area. There is no permissible recreation in the area between the campground and the proposed harvest.

Wild and Scenic River Special Treatment Area- About ½ acre of Unit #1 is within 200 feet of the mainstem Gualala River which is designated as a Wild and Scenic River specifically for recreation. Silviculture in this area is selection under the same stringent constraints as the flood prone areas in the rest of the plan.

Findings: The assessment area for recreation resources includes the THP area, plus the area within 300 feet of the THP boundaries. The assessment area as described seems appropriate for an assessment of potential significant effects to the recreational resources which may occur in the vicinity of the plan area. This area is private rural forested property. On such a property, there is an expectation that timber operations will occur periodically. This land is not open to the public for recreational use and is behind locked gates. Given the property's locale near public road access, the County Regional Park, and that the Gualala is a navigable river, trespass is difficult to control. Near and on property public use as described above is limited to 'day use' only, and there are no residents or cabins within ¼ mile of the harvest area. Access during falling operations may have to be tightly controlled for safety purposes due to the presence of open gates as logging crews enter and leave the property, but nothing else proposed in this THP will significantly affect recreational opportunities. Conventional logging operations are not known to have caused any significant adverse impacts to recreation resources in the area in the past, therefore, none are anticipated from this THP, either singly or cumulatively.

E. VISUAL ASSESSMENT -

Past and Future Activities -See table at beginning of CWE for past activities.

A small portion of this THP (Unit 1) may be visible from County Road 501 or from the county park road. Also, Unit 22 may be slightly visible from the Annapolis Road. Access on the Gualala River is controlled within the boundaries of the ownership but if someone were to float the river starting from outside the property they would be able to see most of the harvest units. However, since there is a no-cut buffer adjacent to the river the actual logging will be unnoticeable. The density of the leave stand (at least 80% canopy) for the first 150 feet adjacent to the river means that the harvest will be so light as to be invisible from outside the plan boundaries. The RPF has examined the harvest area from the Gualala River in numerous locations and it is impossible to see past the first 50 feet of timber. There will be no visual impact on public using the Gualala River or from public roads or by any adjacent landowners.

Unit #1 is part of the Gualala River Special Treatment Area and was listed specifically as a site of significant scenic value. This scenic value will be protected by the chosen silviculture of single tree selection as well as a significant visual buffer provided by leaving everything in the flood prone area between Unit #1 and the river and everything adjacent to the campground out of the plan. This buffer is 200 to 400 feet wide and is heavily timbered and even if it was included in the THP the restrictions required of flood prone areas would leave such a thick screen of vegetation that no change in scenic value will occur.

The road that leads to the Sonoma County campground was separately evaluated for visual impacts. At its closest point it comes within 200 feet of the harvest area. The entire stretch of this road is heavily screened except for one 50-foot wide section where a portion of the harvest unit could possibly be seen. Even along this section of road only an edge of the unit can be seen, and one will not be able to see any of the actual logging impacts except for possibly that one or two trees will be gone from a number of redwood clumps.

The portion of the THP that falls within the Wild and Scenic River corridor is ½ acre of Unit #1. Heavy timber along the river will screen this area for there is up to 700 square feet of basal area per acre in the zone immediately adjacent to the river. This existing heavy screening will make it so that the logging will not be visible from the river or from County Road 501 or the county park. An area adjacent to Dogwood Unit #5, but across the river, was recently harvested in 2014 as part of the Kestrel THP (1-11-087 SON). Signs of logging and its impact on this area are imperceptible within a few years following harvest. Photographic documentation of this has been added as an addendum in Section V of the THP.

Finding: Given the stated selection silviculture method proposed for the plan there will be no discernable visual change to the timbered hillslopes, river corridor, or timbered skyline. Thus, regardless of viewing distance there will be no immediate significant adverse impact or cumulative effects relating to visual resources with the operation of this harvest plan.

F. TRAFFIC ASSESSMENT -

Past Activities.

The roads listed at the beginning of this Section under Traffic Assessment Areas have a long history of log hauling use going back to the 1940's. Since the advent of the log truck appurtenant public haul roads have seen continuous annual use in the transportation of forest products to the present day.

Vehicular Traffic Impacts:

The assessment area for traffic is the private road system west or east of the THP to the Annapolis Road and from there west to Hwy 1 or east on Annapolis road. Also, the THP will use the same private road system to County Road 501 and from there to Old State Hwy and then to Hwy 1. Lastly logs coming off of Unit #1 will use a private road system until it reaches the Sonoma county park road (Old Hwy 1) and from there to Hwy 1; see appurtenant road map in Section II. These roads have historically been used as haul routes for timber and for other agricultural purposes. Annual harvest of timber from landowner's lands and from other timberland owners in both Mendocino and Sonoma counties has decreased in the last decade and consequently the log truck traffic has also decreased. Tourist traffic and resident traffic has likely increased over the same period.

Use of the Sonoma County Park Road (Old Hwy 1) to Hwy 1 will receive a minimal amount of traffic since the only logs coming off this area is Unit #1, which is just 12 acres. Anticipated use of this road will be less when compared to its use in recent years from adjacent harvest plans by the previous landowner (in 2015 approximately 300 log truck loads used this Old Highway 1 South access to exit the GRT property). It is likely that this will be the only plan being harvested and using this road in the near future. The traffic impact will be perhaps 30 loads of logs; 3 or 5 loads per day over a one to two week period.

Most of the log truck flow off the plan area with enter public roads from one of two location once they leave the River Road (i.e., GRT's mainline haul road that parallels the Gualala River from the south at Valley Crossing to the Green Bridge in the north). Logs leaving the GRT's River Road to the north will inter onto Gualala Road (county paved) at the Green Bridge and will head west to Hwy 1 at the town of Gualala. Trucks leaving GRT's River Road south will enter onto Annapolis Road (county paved) at the Wheatfield bridge near Valley Crossing. All these public roads have received extensive log truck annually over the last six decades. Harvesting of this THP will not alter or measurable change the annual log flow off the property or within the greater Gualala River subbasin.

Finding: This project will not significantly add to the annual truck traffic that leaves the property each harvest season. Local log truck traffic created by this project added to local traffic of other types is not expected to create a significant adverse cumulative impact to traffic on local public roads.

G. NOISE ASSESSMENT-

There is one public campground within a few hundred feet of Unit 1. The north end of Unit 5 is a few hundred feet upstream of a beach that is often used by Gualala residents and tourists. Unit 18 and 19 are across the river from The Sea Ranch "Hot Spot" (a green belt area for Sea Ranch residents). Noise from Unit 1 and the north end of Unit 5 may be noticeable from the river by swimmers, kayakers and canoeists. Occasionally people may float the length of the harvest plan area early in the year when the water is higher. The noise impacts from the logging of each of these units on their respective areas will be of short duration. Each area will be impacted for a couple of weeks during falling and skidding. They will also be impacted from log truck

traffic noise mainly on County Road 501 during operations on the north half of the THP for the length of the harvest. Log truck traffic noise is a common annual occurrence on all roads to be used for this THP and since the annual harvest from this landowner is relatively consistent there is no additive cumulative effect from noise resulting from this harvest plan. The noise impact will actually be less in the area adjacent to the county park than in the past since log trucks using the county park road are expected to decrease in the next few years from what has been occurring annually. This noise impact from falling and skidding in the vicinity of Units 1 thru 5 is not an annual occurrence but is a common occurrence throughout the watershed as other harvest plans within this same vicinity have been logged every few years.

Potential noise impacts that may occur with harvesting and hauling of logs off this THP will be of short duration (6 to 8 weeks) and will not be measurably additive with other ongoing projects that may occurring in the area. Harvesting and truck noise is not anticipated to be any more prevalent than what has occurred in past years.

Finding: No significant and/or cumulative impacts related to noise will occur as a result of this operation.

H. Global Warming- Climate Change and Forestry Practice

1. Climate Change in General.

The magnitude, causes, and effects of global climate variability are the subject of intense scientific inquiry and considerable scientific debate and uncertainty (U.S. Senate 2008). Many scientists and policymakers have concluded that the earth's climate is currently warming at a rate that is unprecedented in human

history. Their conclusions are based on temperature data, samples of carbon dioxide (C02) content in prehistoric ice and sediment, and climate models.

The scientific view that has gained greatest acceptance in current public policy is that extraordinary emissions of greenhouse gases (GHG) from human activities are promoting warming of the earth's atmosphere.

While scientific inquiry continues, public policies favor the view that global warming is occurring and is driven by extraordinary GHG emissions from human activities. In California, this view is adopted as the premise for enactment of California Global Warming Solutions Act of 2006 (Assembly Bill 32, Chapt. 488, Statutes of 2006). This statute addresses many items pertaining to global warming, including establishing goals and measures for reducing GHG emissions to 1990 levels by the year 2020. In 2008 the California Air Resources Board (CARB) released goals for reduced emissions by economic sector. The CARB goals recognized that California's forestlands reduce GHG emissions (specifically C02 emissions) by sequestering atmospheric carbon in trees and plants. It is estimated that California's forestlands currently have a net annual sequestration of 5 million metric tons of C02 equivalent (BOF 2008). The CARB has established this as the goal for forestlands and has requested that the State Board of Forestry and Fire Protection undertake a program that maintains this current level of sequestration, and develop opportunities to increase the level of sequestration. By maintaining and promoting the process of carbon sequestration in California's forests, policy makers hope to reduce or reverse the rate of global warming and prevent or mitigate the effects of global warming on the environment.

2. CEQA Analysis Related to Climate Change

The California Global Warming Solutions Act of 2006 (AB 32) is California's legislative effort aimed at reducing GHG emissions. Pursuant to AB 32, CARB must develop an implementation program and adopt control measures to achieve the maximum technologically feasible and cost-effective GHG reductions. AB 32 requires CARB to prepare a Scoping Plan to achieve reductions in GHG emissions in California. On June 26, 2008 CARB staff presented the initial draft of the AB 32 Scoping Plan for Board review. The AB 32 Scoping Plan contains the key strategies California will use to reduce the GHG emissions that are thought to cause climate change. With respect to forestry practice, the Scoping Plan provides:

The 2020 target for California's forest lands is to achieve a 5MMTC02E reduction through sustainable management practices, including reducing the risk of catastrophic wildfire, and the avoidance or mitigation of land-use changes that reduce carbon storage. California's Board of Forestry and Fire Protection has the regulatory authority to implement the Forest Practice Act to provide for sustainable management practices and, at a minimum, to maintain current carbon sequestration levels. The federal government must do the same for lands under its jurisdiction in California. California forests are now a net carbon sink. The 2020 target would provide a mechanism to help ensure that this carbon stock is not diminished over time. The 5MMTC02E emission reduction target is set equal to the current estimate of the net emission reduction from California forests. As technical data improve, the target can be recalibrated to reflect new

information.

In addition to legislation aimed at sector-wide GHG emissions reduction, California law also requires that an individual project's potential impacts on global climate change from GHG emissions be evaluated pursuant to the California Environmental Quality Act (CEQA). To aid in the evaluation of GHG emissions and potential climate change impacts, the Governor's Office of Planning and Research (OPR) issued an interim technical advisory, which provides that a project's impacts on climate change must be analyzed pursuant to CEQA, and that, as with other potential environmental impacts, the CEQA lead agency is required to make a finding of significance for the project. OPR's CEQA Advisory recognizes the difficulty in establishing a significance threshold and making significance determination for a project's impacts on climate change. Nonetheless, OPR advises that each agency must establish its own significance threshold or undertake project-by-project analysis. Pursuant to CEQA Guidelines § 15064.7(a), a significance threshold should be "an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect will normally be determined to be less than significant."
On January 8, 2009, OPR issued "Draft CEQA Guidelines Amendments for Greenhouse Gas Emissions" ("Draft Guidelines") for public review and comment. Consistent with the Technical Advisory and existing CEQA Guidelines section 15064.7, the Draft Guidelines propose to add section 15064.4, which provides that in making a significance determination related to impacts on climate change, a lead agency may consider the extent to which the project could help or hinder attainment of the state's goals of reducing greenhouse gas emissions to 1990 levels by the year 2020 as stated in the Global Warming Solutions Act of 2006."

Because the Board of Forestry has yet to establish a generally applicable significance threshold for assessing the impacts on climate change from forestry projects, the required analysis and significance determination must be made on a project-by-project basis. For purposes of the Proposed Project, impacts on climate change are analyzed using a qualitative threshold that measures a project's impacts on climate change by determining whether the project complies with state guidelines or with industry or sector reduction targets established by CARB pursuant to AB 32. Several California public agencies, including the CARB, the California Energy Commission, and the South Coast Air Quality Management District, have endorsed, if not yet adopted, such a qualitative threshold as a component of measuring a project's impacts on climate change.

CARB's Scoping Plan provides that forestry projects should avoid land-use changes that reduce carbon storage, or such projects should include mitigation to help to ensure that carbon stocks are not diminished over time. The Scoping Plan also establishes a "sector-wide" reduction target of 5 MMTC02E. Applying the Scoping Plan to this project, the Proposed Project, including incorporated mitigation, could have a significant impact on climate change if it were to significantly reduce carbon storage over time, or it is inconsistent with the "sector-wide" reduction target of 5 MMTC02E. The Proposed Project does not have a significant effect because it does not implement a land use change or activity that decreases carbon storage. Rather, it is part of a forest management plan that increases carbon storage over time, consistent with the sector-wide goal.

3. The Project:

The proposed project will result directly and indirectly in carbon sequestration and temporary, insignificant C02 emissions. Carbon sequestration is achieved through a repeating cycle of harvesting and growing of trees that remove C02 from the atmosphere and store carbon in tree fiber. When a tree is harvested, most of the carbon-filled tree fibers become lumber that is sequestered in buildings while a new rotation of trees is planted and grown. To the extent these wood building products replace the demand for new concrete or steel building components; they reduce substantial C02 emissions that are associated with the manufacture of cement and steel. Some of the tree fibers such as branches and tops are left in the forest where they are sometimes burned to reduce fire hazard. However, the vast majority of this material is left to decay and will emit C02 overtime; but, it also supplements the forest soils and forest duff layer where carbon is stored and serves as a substrate and nutrient for more tree growth.

Applying the draft threshold criteria discussed above, the THP would have a less-than-significant impact on the environment because the forestry practices do not implement a land use change and they increase carbon storage overtime, consistent with GHG mitigation goals for California's forestry sector. Information provided by two of the largest forestland owners in California estimate direct GHG emissions from THP operations to be from 0.1050 to 0.1819 metric tons of C02 for every one thousand board feet of harvested timber (short log Scribner scale) resulting from equipment emissions related to the logging. It is reasonable to expect the proposed project to fall within a similar range. These emissions are insignificant relative to global C02 emissions that are thought to affect climate. There is virtually no opportunity to reduce these emissions in a manner that would meaningfully benefit the climate because they are already miniscule (U.S.E.P.A. 2005). An acre of managed forest is entered with equipment once every 50 years or so with emissions measured in hours of equipment operation over those fifty years. Few if any other land uses can match the low intensity of C02 emissions over space and time that are associated with commercial forestry. In urban areas of California, a typical California household will operate one or more vehicles every day for 50 years, and the demands of that household will induce a variety of additional C02 emissions for other forms of commerce, power production, and consumption. In rural areas, even a typical farm acre in California will be subject to equipment operation for several hours or days every year over 50 years - not once every 50 years.

The insignificant GHG effects of the Proposed Project are further diminished by the mitigating effects of carbon sequestered in the lumber produced from harvest. It is estimated that at the end of 100 years, a weighted average of 47 percent of the solid wood products manufactured from the log are still in use, and if the wood in stable storage in a landfill is included, that weighted average over the 100 year period is 76% percent (US Dept of Energy- I605(b) Tables). It is reasonable to expect similar numbers for the proposed project. The 100-year permanency period is the same as that used by the California Climate Action Registry for its analysis of a permanent carbon offset. Accordingly, for every metric ton of C02 emissions attributed to the operation of timber harvesting and hauling equipment, 13.7 metric tons of C02 will be sequestered in the wood products produced from the harvest.

4. State Setting and Area of Assessment.

The assessment area for climate effects is the California timberland ownership of the Plan Submitter and the public transportation routes for the delivery of the logs to the manufacturing centers. Because the use and disposition of manufactured wood products is not under the control of the Plan Submitter after it is delivered to the primary manufacturing center, the direct GHG emissions of manufacturing activities are not estimated here. However, qualitative consideration of the carbon cycle in wood products is addressed as a cumulative effect.

There are 16.6 million acres of productive public and private timberland (statutorily available for harvest) in California (California Department of Forestry 2003). The Plan Submitter owns 29,000 acres in Sonoma and Mendocino counties. This represents 0.17% of the total timberland, and 0.4% of the 7.3 million acres of the private timberlands in the state. This proposed timber harvesting plan includes 290 acres that are actually being partially harvested which represent only 0.0000397% of the total private timberland in the state.

Since 1990 (the State of California's benchmark for achieving GHG reductions) the forest products industry has implemented a significant reduction in harvest levels and the number of sawmills operating in the state. Since record keeping started in 1978, timber harvest peaked in 1988 at 4,670 million board feet and has continued to decline. In 1997 California harvested 2,400 million board feet and by 2007, the harvest level had dropped to 1,626 million board feet (SBE Harvest Tables). This represents a reduction in harvest levels of 32 percent over the eleven-year period. During the same time frame, timber growth has continued to exceed harvest and tree mortality in California. From 2001 to 2005 (five year period), the annualized net change (gross growth minus harvest and mortality) of softwood growing stock was 189,794 thousand cubic feet (1,115 million board feet) for all timberland in California (public and private). For privately owned redwood timberlands, the annualized net growth (net of harvest and mortality) for the same 2001 to 2005 period was 24,281 thousand cubic feet (142 million board feet) (US Department of Agriculture- 2007). These statistics demonstrate that growth has exceeded the combination of harvest and mortality.

During the last two decades, there has also been a reduction in lumber sawmills. In 1990 there were 117 sawmills in California. As of 2007, there were 39 sawmills (CFA). There has also been a reduction in the number of acres harvested over the last 10 years. In 1997 there were 235,000 acres harvested, and in 2007 there was 120,000 acres harvested, representing a reduction of 49% (CDF).

Since 1990, the reduction of timber harvest in California combined with the reduced number of sawmills indicates that the forestry sector has already experienced declining C02 emissions resulting from the harvest, transportation and processing of timber. At the same time, a net increase of forest growth on a statewide and regional level is indicative that timberlands on a statewide level and a regional level are actively sequestering atmospheric carbon thereby reducing GHG.

5. Carbon Sequestration, Emissions, and Land Use Resulting from Intensive Forest Management

Forestlands are, in general, a carbon sink where C02 is captured and fixed by the process of

photosynthesis, which removes carbon from the atmosphere and sequesters carbon in wood fiber (OFRI 2006, U.S.E.P.A. 2005). In California, forests in the North Coast, Cascade Northeast and North Sierra regions were estimated to produce a net benefit of 7.2 million metric tons of C02 equivalents removed from the atmosphere each year (California Energy Commission 2004). Growing forests sequester and store more carbon over time until growth stagnates as trees reach a mature age. Older trees sequester carbon through new growth at a declining rate, but they remain pools of stored carbon until they decay through decline, death, or consumptive use.

Under a static view of carbon sequestration in forest management, there is a misconception that more carbon is sequestered by growing older trees rather than repeated cycles of tree growth under an intensive forest management regime. Under this static view, a stand of trees will sequester and store more carbon if it is allowed to grow old in comparison to harvest at a younger age. While this is true in a static comparison of a stand at two different ages, it ignores the dynamic of carbon sequestration through a combination of intensive forest growth and wood products made from harvested timber. Carbon sequestration requires a dynamic view that measures carbon sequestration and storage over time. A dynamic view of carbon sequestration demonstrates that intensively managed commercial forests are more effective in sequestering carbon and mitigating GHG.

Managed commercial forests make a significant contribution to the sequestration of carbon and mitigation of GHG (IPCC 2007; Mader 2007; OFRI 2006; U.S.E.P.A. 2005). Several studies have documented a positive net effect of carbon sequestration by commercial timberlands where forests are grown, harvested, and processed into wood products (James et al. 2007; Perez-Garcia et al. 2005; Lippke et al. 2004). Even when C02 emissions from timberland management, timber harvest, and forest products uses are considered, the long-term, sustainable, and intensive management of commercial timberlands to produce wood products generates a net carbon sequestration benefit that mitigates GHG (Id). These studies investigated timber harvest at various rotation ages relative to no harvest and perpetual old growth stands. They found that intensive forest management with a rotation of 50 years or less can produce net positive carbon sequestration benefits because carbon is sequestered through repeated cycles of tree growth while a substantial percentage of harvested and milled wood is sequestered for decades or centuries in buildings. Life cycle assessment studies have shown that wood products have a much smaller carbon footprint compared to other building material. Not only is carbon sequestered by trees, but it may be stored for long periods of time in wood products. It is estimated that at the end of 100 years, a weighted average of 47 percent of the solid wood products manufactured from the log are still in use, and if the wood in stable storage in a landfill is included, that weighted average over the 100 year period is 76% percent (US Dept of Energy- I605(b) Tables).

The net sequestration benefits of an intensively managed forest are further enhanced by the effects of substitution. When wood products are used for building materials in lieu of concrete or steel, C02 emissions are reduced because there is less demand for steel and concrete, which are manufactured with large C02 emissions as a byproduct (IPCC 2007; Mader 2007; OFRI 2006; Perez-Garcia et al. 2005; Lippke et al. 2004). Further, to the extent that harvested wood is not incorporated into fixed building components, wood residues may be used as fuel for energy production in lieu of fossil fuels (Id). When wood residues are used in this way, there is no increase in C02 emissions from their combustion because

the same emissions will result from the oxidation and decay of wood residue. However, more significant C02 emissions from the burning of fossil fuels such as coal or oil can be avoided when wood residue is burned to create heat and generate electricity.

The proposed project is one of numerous past, present, and future timber harvest projects on the Plan Submitter's ownership that combines to produce substantial net carbon sequestration benefits over time. These timberlands are sustainably managed in accordance with California law such that the harvest of timber through past, present, and future projects will not exceed the long term tree growth of the California timberlands. Timber harvests are conducted in small patches across the ownership and promptly replanted to begin a new cycle of tree growth and carbon sequestration. Harvested timber is converted to wood products that sequester carbon as building materials. To some degree, these building products substitute for C02 intensive steel and cement building components.

The cumulative beneficial effects of the proposed project as part of the Plan Submitter's intensive forest management are expected to sustain the current timber production land use and reduce the risk of wildfire, which are, in turn, beneficial impacts on GHG emissions and carbon sequestration. Land use conversion from forestry to other uses has a negative impact on GHG (OFRI 2006). In addition, catastrophic wildfires are enormous emitters of C02 and often reduce or destroy the carrying capacity of forest soils to regenerate growing forests (Id). Both of these adverse impacts to GHG are prevented with successful intensive management of forestland for timber production. The project and similar, past, present, and future projects on the Plan Submitter's timberlands are essential to successful intensive forest management that prevents land use conversion.

6. Effects of Climate Change on Timberlands

Regardless of the benefits that the project and similar past, present, and future projects will have on diminishing GHG emissions and promoting carbon sequestration, climate change is likely to occur. The rate and direction of climate change remains very uncertain (IPCC 2007). It is a certainty that the earth's climate has changed in the past with variable cooling and warming trends, but no models exist to reliably predict the rate and direction of climate change or the regional or localized effects on temperatures, precipitation, growing seasons, drought, vegetation, and wildlife (IPCC 2007).

In the face of uncertainty, the impacts of climate change must be assessed in terms of the resilience of the Plan Submitters timberlands should climate changes occur. There are several indications that these timberlands have been and continue to be resilient. After more than a century of timber harvest, most of which occurred without the benefits of modern forest practices regulations and best management practices, these timberlands remain among the most productive forest lands in the world. A key tree species on these timberlands is the California redwood *(Sequoia sempervirons),* which is the epitome of resilience, having persisted for millennia in the coastal climate of northern California. The redwood tree is not expected to be threatened by pests that might be advantaged by global warming, and it is expected to persist at the southern end of its range even if climate change brings higher temperatures and less precipitation (Battle 2006). The redwood tree also benefits from coppice regeneration, which means that it regenerates from the stump after a tree has been harvested. As such, much of the living root system of

redwood trees persists and the genetic diversity of each individual tree is preserved on the landscape as cut trees are replaced by genetically identical sprouts that grow from the same root system. For the same reason, the regeneration and growth of redwood forests after harvest occurs quickly and with more certainty because young trees have the benefit of mature root systems. The resilience of these lasting forests is also supplemented by required planting of seedlings to promote healthy stocking levels on every harvested area.

In addition to redwood, these timberlands grow hearty and resilient species such as Douglas-fir, a species that thrives in open stands following even age harvest. Douglas-fir grows in a variety of climates throughout western North America and is believed to have rapidly colonized areas that are now vast forestlands following the end of the last Ice Age. Through its substantial and continuous investment in reforestation and productive regeneration of forest stands, the Plan Submitter has a strong incentive to nurture healthy and resilient forest stands on its property.

In summary, both the IPCC and U.S. EPA have recognized the positive effects that forests and forest products have on the world's climate. The above qualitative discussion demonstrates that the proposed project as presented and mitigated, in combination with past, present, and reasonably foreseeable probable future projects will not cause, or add to significant cumulative GHG impacts within the assessment area. Following is a project specific quantitative analysis which further demonstrates the proposed operations will result in a net sequestration of green house gases.

References for GHG and Climate Change Cumulative Impact Analysis

Battles, John J., et al. 2006 Climate Change Impact on Forest Resources:
A Report From: California Climate Change Center

Board of Forestry and Fire Protection (2008); Report (Draft) To ARB On Meeting AB 32 Targets. California Environmental Protection Agency- Air Board, (2008); News Release 08-103, December 12, 2008 "ARB adopts landmark rules to clean up pollution from 'big rigs'." California Department of Forestry and Fire Protection 2003. The Changing California; Forest and Range 2003 Assessment. http://frap.fire.ca.gov/assessment2003/Assessment Summary/assessment summary.html

California Energy Commission. 2004. Baseline Greenhouse Gas Emissions for Forest, Range, and Agricultural Lands in California. http://www.energy.ca.gov/reports/CEC-500-2004-069/CEC-500-2004-069F.PDF

James, c.; B. Krumland, and P. Eckert. 2007. Carbon Sequestration in California Forests; Two Case Studies in Managed Watersheds.
http://www.spi-ind.com/html/pdf_forests/CARBONSEQUESTRATION.pdf

Lippke, B.; J. Perez-Garcia, J. Bowyer, J. Meil. 2004. CORRIM: Life Cycle Environmental Performance of Renewable Building Materials. Forest Products Journal 54(6):8-19.

Mader, S. 2007. Climate Project: Carbon Sequestration and Storage by California Forests and Forest Products.

http://www.foresthealth.org/pdf/CH2M%20Hi11%20ForesfIIo20Carbon%20Study.pdf

Oregon Forest Resources Institute (OFRI). 2006. Forests, Carbon and Climate Change: A Synthesis of Scientific Findings. http://www.oregonforests.org/media/pdf/CarbonRptFinal.pdf

Perez-Garcia, J.; B. Lippke, J. Comnick, and C. Manriquez. 2005. An Assessment of Carbon Pools, Storage, and Wood Products Market Substitution Using Life-Cycle Analysis Results. Wood Fiber Science 37(5):99-113.

United Nations Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter9.pdf

U.S. Department ofAgriculture, Forest Service. 2007. Forest Inventory and Analysis 2007. http://www.fs.fed.us/pnw/fia/

U. S. Department ofEnergy. 2005. I605(b) Tables. http://www.eia.doe.gov/oiaf/1605/index.html

U.S. Environmental Protection Agency (U.S.E.P.A.). 2005. Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture. http://www.epa.gov/sequestration/pdf/greenhousegas2005.pdf

U.S. Fish &Wildlife Service and National Marine Fisheries Service (FEIS). 2006. Final Environmental Impact Statement for Authorization for Incidental Take and Implementation of a Multiple Species Aquatic Habitat Conservation Plan and Candidate Conservation Agreement with Assurances: Green Diamond Resource Company, Del Norte and Humboldt Counties, California.

U.S. Senate, Environment and Public Works Committee. 2008. Minority Report: More Than 650 International Scientists Dissent Over Man-Made Global Warming Claims. http://epw.senate.gov/public/index.cfm?FuseAction=Minority.Blogs&ContentRecord

Project Specific Greenhouse Gas Analysis

Note: In the following pages the total acres adds up to approx. 369. This is because it does not include 33 acres that are non-timber and on which no harvesting will take place. It does include 39 acres that are various core zones which are timberland but are also no-cut zones and as such have been analyzed.

Dogwood THP (Core Zone) Summary			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		1 Years
Live Trees (Conifers and Hardwoods)	804.75	1481.39	
Wood Products		0.00	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		0.00	
Non-biological emissions associated with milling		0.00	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		676.64	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	33	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		22,329	

Revised 2/23/18

224

Dogwood THP Core zone — Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	Step 1. Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	Step 2. Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	Step 3. Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	Step 4. Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in Step 1.	Step 5. Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	Step 6. Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan, if available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	0%	1.575	14.38							
Redwood	100%	1.575	13.42	0	129	15	1000	0.5	0	0
Pines	0%	2.254	12.14	15	144	22.5	1000	0.5	0	0
True firs	0%	2.254	11.18	30	159	30	1000	0.5	0	0
Hardwoods		2.214	11.76	45	174	37.5	1000	0.5	0	0
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2.204	60	189	45	1000	0.5	0	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.68		75	204	52.5	1000	0.5	0	0
	Hardwoods	1.95		90	219	60	1000	0.5	0	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.00		105	234	67.5	1000	0.5	0	0
	Hardwoods	0.88		0	0	0	0	0	0	0
				0	0	0	0	0	0	0
				0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	Step 8. Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	Computed: MBF * Conifer Multiplier from Step 0.	Computed: BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre) Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre). Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre). None - No site preparation is conducted.	
0	217	2	797	8	None	0
15	242	3	889	12	None	0
30	268	4	982	16	None	0
45	293	5	1075	20	None	0
60	318	7	1167	24	None	0
75	343	8	1260	28	None	0
90	368	9	1353	32	None	0
105	394	10	1445	36	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		648	28.17	Sum of emissions (Metric Tonnes CO2e) per acre	0

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** ((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) ((6 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalent/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalent/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalent/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period.
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00	**Step 13.** Enter Estimated Load Average: MBF/Truck	0.0001	0
15	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
30	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00	**Step 14.** Enter Estimated Round Trip Haul in Hours	0	0
45	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
60	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
75	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
90	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
105	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**0.00**				**0.00**			**0.00**			**0.00**	**0.00**			**0.00**

226 Revised 2/23/18

Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			0.00	Sum of CO2 equivalent in wood products		0.00	0.00

Revised 2/23/18

227

Years	Conifer													Hardwood												Total				
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and In Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	129	797	-	129	797	-	0%	-	0.58	-	0.02	-	-	15	8	-	15	8	-	0%	-	0.57	-	-	-	-	811.70	-	805	805	Pre-harv	1
1			-	130	803	-		-	0.64	-	0.04	-	-			-	16	8	-		-	0.53	-	0.02	-	-	818.38	-	811		1	
2			-	131	809	-		-	0.60	-	0.05	-	-			-	16	9	-		-	0.49	-	0.03	-	-	825.05	-	818		2	
3			-	132	815	-		-	0.57	-	0.07	-	-			-	17	9	-		-	0.46	-	0.05	-	-	831.73	-	824		3	
4			-	133	821	-		-	0.55	-	0.08	-	-			-	17	9	-		-	0.44	-	0.06	-	-	838.41	-	831		4	
5			-	134	828	-		-	0.52	-	0.09	-	-			-	18	9	-		-	0.41	-	0.07	-	-	845.08	-	837		5	
6			-	135	834	-		-	0.50	-	0.11	-	-			-	18	10	-		-	0.39	-	0.08	-	-	851.76	-	843		6	
7			-	136	840	-		-	0.48	-	0.12	-	-			-	19	10	-		-	0.37	-	0.09	-	-	858.43	-	850		7	
8			-	137	846	-		-	0.46	-	0.13	-	-			-	19	10	-		-	0.35	-	0.10	-	-	865.11	-	856		8	
9			-	138	852	-		-	0.44	-	0.14	-	-			-	20	10	-		-	0.33	-	0.11	-	-	871.78	-	863		9	
10			-	139	858	-		-	0.42	-	0.15	-	-			-	20	11	-		-	0.32	-	0.12	-	-	878.46	-	869		10	
11			-	140	865	-		-	0.41	-	0.16	-	-			-	21	11	-		-	0.32	-	0.12	-	-	885.14	-	876		11	
12			-	141	871	-		-	0.40	-	0.17	-	-			-	21	11	-		-	0.32	-	0.12	-	-	891.81	-	882		12	
13			-	142	877	-		-	0.39	-	0.18	-	-			-	22	12	-		-	0.32	-	0.12	-	-	898.49	-	889		13	
14			-	143	883	-		-	0.38	-	0.19	-	-			-	22	12	-		-	0.32	-	0.12	-	-	905.16	-	895		14	
15			-	144	889	-		-	0.36	-	0.19	-	-			-	23	12	-		-	0.26	-	0.14	-	-	911.84	-	901		15	
16			-	145	896	-		-	0.36	-	0.20	-	-			-	23	12	-		-	0.26	-	0.14	-	-	918.52	-	908		16	
17			-	146	902	-		-	0.35	-	0.21	-	-			-	24	13	-		-	0.26	-	0.14	-	-	925.19	-	914		17	
18			-	147	908	-		-	0.34	-	0.22	-	-			-	24	13	-		-	0.26	-	0.14	-	-	931.87	-	921		18	
19			-	148	914	-		-	0.33	-	0.22	-	-			-	25	13	-		-	0.26	-	0.14	-	-	938.54	-	927		19	
20			-	149	920	-		-	0.32	-	0.23	-	-			-	25	13	-		-	0.22	-	0.16	-	-	945.22	-	934		20	
21			-	150	926	-		-	0.32	-	0.23	-	-			-	26	14	-		-	0.22	-	0.16	-	-	951.90	-	940		21	
22			-	151	933	-		-	0.31	-	0.24	-	-			-	26	14	-		-	0.22	-	0.16	-	-	958.57	-	947		22	
23			-	152	939	-		-	0.30	-	0.25	-	-			-	27	14	-		-	0.22	-	0.16	-	-	965.25	-	953		23	
24			-	153	945	-		-	0.30	-	0.25	-	-			-	27	14	-		-	0.22	-	0.16	-	-	971.92	-	959		24	
25			-	154	951	-		-	0.29	-	0.26	-	-			-	28	15	-		-	0.19	-	0.17	-	-	978.60	-	966		25	
26			-	155	957	-		-	0.29	-	0.26	-	-			-	28	15	-		-	0.19	-	0.17	-	-	985.28	-	972		26	
27			-	156	963	-		-	0.28	-	0.26	-	-			-	29	15	-		-	0.19	-	0.17	-	-	991.95	-	979		27	
28			-	157	970	-		-	0.28	-	0.27	-	-			-	29	16	-		-	0.19	-	0.17	-	-	998.63	-	985		28	
29			-	158	976	-		-	0.27	-	0.27	-	-			-	30	16	-		-	0.19	-	0.17	-	-	1,005.30	-	992		29	
30			-	159	982	-		-	0.27	-	0.28	-	-			-	30	16	-		-	0.17	-	0.18	-	-	1,011.98	-	998		30	
31			-	160	988	-		-	0.26	-	0.28	-	-			-	31	16	-		-	0.17	-	0.18	-	-	1,018.66	-	1,005		31	
32			-	161	994	-		-	0.26	-	0.28	-	-			-	31	17	-		-	0.17	-	0.18	-	-	1,025.33	-	1,011		32	
33			-	162	1,001	-		-	0.25	-	0.29	-	-			-	32	17	-		-	0.17	-	0.18	-	-	1,032.01	-	1,017		33	
34			-	163	1,007	-		-	0.25	-	0.29	-	-			-	32	17	-		-	0.17	-	0.18	-	-	1,038.68	-	1,024		34	
35			-	164	1,013	-		-	0.25	-	0.29	-	-			-	33	17	-		-	0.15	-	0.19	-	-	1,045.36	-	1,030		35	
36			-	165	1,019	-		-	0.24	-	0.30	-	-			-	33	18	-		-	0.15	-	0.19	-	-	1,052.04	-	1,037		36	
37			-	166	1,025	-		-	0.24	-	0.30	-	-			-	34	18	-		-	0.15	-	0.19	-	-	1,058.71	-	1,043		37	
38			-	167	1,031	-		-	0.23	-	0.30	-	-			-	34	18	-		-	0.15	-	0.19	-	-	1,065.39	-	1,050		38	
39			-	168	1,038	-		-	0.23	-	0.31	-	-			-	35	19	-		-	0.15	-	0.19	-	-	1,072.06	-	1,056		39	
40			-	169	1,044	-		-	0.23	-	0.31	-	-			-	35	19	-		-	0.13	-	0.19	-	-	1,078.74	-	1,063		40	
41			-	170	1,050	-		-	0.22	-	0.31	-	-			-	36	19	-		-	0.13	-	0.19	-	-	1,085.42	-	1,069		41	
42			-	171	1,056	-		-	0.22	-	0.32	-	-			-	36	19	-		-	0.13	-	0.19	-	-	1,092.09	-	1,075		42	
43			-	172	1,062	-		-	0.22	-	0.32	-	-			-	37	20	-		-	0.13	-	0.19	-	-	1,098.77	-	1,082		43	
44			-	173	1,068	-		-	0.21	-	0.32	-	-			-	37	20	-		-	0.13	-	0.19	-	-	1,105.44	-	1,088		44	
45			-	174	1,075	-		-	0.21	-	0.32	-	-			-	38	20	-		-	0.12	-	0.20	-	-	1,112.12	-	1,095		45	
46			-	175	1,081	-		-	0.21	-	0.33	-	-			-	38	20	-		-	0.12	-	0.20	-	-	1,118.80	-	1,101		46	
47			-	176	1,087	-		-	0.20	-	0.33	-	-			-	39	21	-		-	0.12	-	0.20	-	-	1,125.47	-	1,108		47	
48			-	177	1,093	-		-	0.20	-	0.33	-	-			-	39	21	-		-	0.12	-	0.20	-	-	1,132.15	-	1,114		48	
49			-	178	1,099	-		-	0.20	-	0.33	-	-			-	40	21	-		-	0.12	-	0.20	-	-	1,138.82	-	1,121		49	
50			-	179	1,106	-		-	0.20	-	0.33	-	-			-	40	21	-		-	0.11	-	0.20	-	-	1,145.50	-	1,127		50	
51			-	180	1,112	-		-	0.19	-	0.33	-	-			-	41	22	-		-	0.11	-	0.20	-	-	1,152.18	-	1,133		51	
52			-	181	1,118	-		-	0.19	-	0.33	-	-			-	41	22	-		-	0.11	-	0.20	-	-	1,158.85	-	1,140		52	
53			-	182	1,124	-		-	0.19	-	0.33	-	-			-	42	22	-		-	0.11	-	0.20	-	-	1,165.53	-	1,146		53	
54			-	183	1,130	-		-	0.19	-	0.34	-	-			-	42	23	-		-	0.11	-	0.20	-	-	1,172.20	-	1,153		54	
55			-	184	1,135	-		-	0.18	-	0.34	-	-			-	43	23	-		-	0.10	-	0.20	-	-	1,178.88	-	1,159		55	
56			-	185	1,143	-		-	0.18	-	0.34	-	-			-	43	23	-		-	0.10	-	0.20	-	-	1,185.56	-	1,166		56	
57			-	186	1,149	-		-	0.18	-	0.34	-	-			-	44	23	-		-	0.10	-	0.20	-	-	1,192.23	-	1,172		57	
58			-	187	1,155	-		-	0.18	-	0.34	-	-			-	44	24	-		-	0.10	-	0.20	-	-	1,198.91	-	1,179		58	
59			-	188	1,161	-		-	0.18	-	0.35	-	-			-	45	24	-		-	0.10	-	0.20	-	-	1,205.58	-	1,185		59	
60			-	189	1,167	-		-	0.17	-	0.35	-	-			-	45	24	-		-	0.09	-	0.21	-	-	1,212.26	-	1,191		60	
61			-	190	1,173	-		-	0.17	-	0.35	-	-			-	46	24	-		-	0.09	-	0.21	-	-	1,218.94	-	1,198		61	
62			-	191	1,180	-		-	0.17	-	0.35	-	-			-	46	25	-		-	0.09	-	0.21	-	-	1,225.61	-	1,204		62	
63			-	192	1,186	-		-	0.17	-	0.35	-	-			-	47	25	-		-	0.09	-	0.21	-	-	1,232.29	-	1,211		63	
64			-	193	1,192	-		-	0.16	-	0.36	-	-			-	47	25	-		-	0.09	-	0.21	-	-	1,238.96	-	1,217		64	
65			-	194	1,198	-		-	0.16	-	0.36	-	-			-	48	25	-		-	0.08	-	0.21	-	-	1,245.64	-	1,224		65	
66			-	195	1,204	-		-	0.16	-	0.36	-	-			-	48	26	-		-	0.08	-	0.21	-	-	1,252.32	-	1,230		66	
67			-	196	1,210	-		-	0.16	-	0.36	-	-			-	49	26	-		-	0.08	-	0.21	-	-	1,258.99	-	1,237		67	
68			-	197	1,217	-		-	0.16	-	0.36	-	-			-	49	26	-		-	0.08	-	0.21	-	-	1,265.67	-	1,243		68	
69			-	198	1,223	-		-	0.15	-	0.37	-	-			-	50	27	-		-	0.08	-	0.21	-	-	1,272.34	-	1,249		69	
70			-	199	1,229	-		-	0.15	-	0.37	-	-			-	50	27	-		-	0.07	-	0.21	-	-	1,278.02	-	1,256		70	
71			-	200	1,235	-		-	0.15	-	0.37	-	-			-	51	27	-		-	0.07	-	0.21	-	-	1,285.70	-	1,262		71	
72			-	201	1,241	-		-	0.15	-	0.37	-	-			-	51	27	-		-	0.07	-	0.21	-	-	1,292.37	-	1,269		72	
73			-	202	1,248	-		-	0.15	-	0.37	-	-			-	52	28	-		-	0.07	-	0.21	-	-	1,299.05	-	1,275		73	

Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
74			-	203	1,294	-		-	0.15	-	0.38	-	-			-	52	28	-		-	0.07	-	0.21	-	-	1,305.72	-	1,282		74	
75			-	204	1,290	-		-	0.15	-	0.38	-	-			-	53	28	-		-	0.07	-	0.21	-	-	1,312.40	-	1,288		75	
76			-	205	1,286	-		-	0.14	-	0.38	-	-			-	53	28	-		-	0.07	-	0.21	-	-	1,319.08	-	1,295		76	
77			-	206	1,272	-		-	0.14	-	0.38	-	-			-	54	29	-		-	0.07	-	0.21	-	-	1,325.75	-	1,301		77	
78			-	207	1,278	-		-	0.14	-	0.38	-	-			-	54	29	-		-	0.07	-	0.21	-	-	1,332.43	-	1,307		78	
79			-	208	1,285	-		-	0.14	-	0.38	-	-			-	55	29	-		-	0.07	-	0.21	-	-	1,339.10	-	1,314		79	
80			-	209	1,291	-		-	0.14	-	0.38	-	-			-	55	30	-		-	0.06	-	0.21	-	-	1,345.78	-	1,320		80	
81			-	210	1,297	-		-	0.14	-	0.38	-	-			-	56	30	-		-	0.06	-	0.21	-	-	1,352.46	-	1,327		81	
82			-	211	1,303	-		-	0.13	-	0.38	-	-			-	56	30	-		-	0.06	-	0.21	-	-	1,359.13	-	1,333		82	
83			-	212	1,309	-		-	0.13	-	0.38	-	-			-	57	30	-		-	0.06	-	0.21	-	-	1,365.81	-	1,340		83	
84			-	213	1,315	-		-	0.13	-	0.39	-	-			-	57	31	-		-	0.06	-	0.21	-	-	1,372.48	-	1,346		84	
85			-	214	1,322	-		-	0.13	-	0.39	-	-			-	58	31	-		-	0.06	-	0.22	-	-	1,379.16	-	1,353		85	
86			-	215	1,328	-		-	0.13	-	0.39	-	-			-	58	31	-		-	0.06	-	0.22	-	-	1,385.84	-	1,359		86	
87			-	216	1,334	-		-	0.13	-	0.39	-	-			-	59	31	-		-	0.06	-	0.22	-	-	1,392.51	-	1,365		87	
88			-	217	1,340	-		-	0.13	-	0.39	-	-			-	59	32	-		-	0.06	-	0.22	-	-	1,399.19	-	1,372		88	
89			-	218	1,346	-		-	0.13	-	0.40	-	-			-	60	32	-		-	0.06	-	0.22	-	-	1,405.86	-	1,378		89	
90			-	219	1,353	-		-	0.12	-	0.40	-	-			-	60	32	-		-	0.05	-	0.22	-	-	1,412.54	-	1,385		90	
91			-	220	1,359	-		-	0.12	-	0.40	-	-			-	61	32	-		-	0.05	-	0.22	-	-	1,419.22	-	1,391		91	
92			-	221	1,365	-		-	0.12	-	0.40	-	-			-	61	33	-		-	0.05	-	0.22	-	-	1,425.89	-	1,398		92	
93			-	222	1,371	-		-	0.12	-	0.40	-	-			-	62	33	-		-	0.05	-	0.22	-	-	1,432.57	-	1,404		93	
94			-	223	1,377	-		-	0.12	-	0.40	-	-			-	62	33	-		-	0.05	-	0.22	-	-	1,439.24	-	1,411		94	
95			-	224	1,383	-		-	0.12	-	0.40	-	-			-	63	34	-		-	0.05	-	0.22	-	-	1,445.92	-	1,417		95	
96			-	225	1,390	-		-	0.12	-	0.40	-	-			-	63	34	-		-	0.05	-	0.22	-	-	1,452.60	-	1,423		96	
97			-	226	1,396	-		-	0.12	-	0.40	-	-			-	64	34	-		-	0.05	-	0.22	-	-	1,459.27	-	1,430		97	
98			-	227	1,402	-		-	0.11	-	0.40	-	-			-	64	34	-		-	0.05	-	0.22	-	-	1,465.95	-	1,436		98	
99			-	228	1,408	-		-	0.11	-	0.41	-	-			-	65	35	-		-	0.05	-	0.22	-	-	1,472.62	-	1,443		99	
100			-	229	1,414	-		-	0.11	-	0.41	-	-			-	65	35	-		-	0.05	-	0.22	-	-	1,479.30	-	1,449		100	
																										-	-				

Revised 2/23/18

229

Dogwood THP (Inner Zone A) Summary (single tree selection/tractor)			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		7 Years
Live Trees (Conifers and Hardwoods)	675.05	839.71	
Wood Products		131.97	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		-6.82	
Non-biological emissions associated with milling		-2.40	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		287.41	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	81	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		23,280	

Revised 2/23/18

230

Dogwood THP (Inner Zone A) Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	Step 1. Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	Step 2. Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	Step 3. Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	Step 4. Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in Step 1.	Step 5. Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	Step 6. Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan, if available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	0%	1.675	14.38							
Redwood	100%	1.675	13.42	0	108	15	1000	0.5	10.8	0
Pines	0%	2.254	12.14	15	112.2	22.5	1000	0.5	11.2	0
True firs	0%	2.254	11.16	30	116	30	1000	0.5	11.6	0
Hardwoods		2.214	11.79	45	119.4	37.5	1000	0.5	11.9	0
		Pounds per Metric Tonne		60	122.5	45	1000	0.5	12.2	0
Conversion of Board Feet to Cubic Feet	0.165		2.204	75	125.3	52.5	1000	0.5	12.5	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.68		90	127.8	60	1000	0.5	12.7	0
	Hardwoods	1.95		105	130.1	67.5	1000	0.5	13	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.00		0	0	0	0	0	0	0
	Hardwoods	0.88		0	0	0	0	0	0	0
				0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	Step 8. Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	Computed: MBF * Conifer Multiplier from Step 0.	Computed: BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre) Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre). Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre). None - No site preparation is conducted.	
0	182	2	667	8	None	0
15	189	3	693	12	None	0
30	195	4	716	16	None	0
45	201	5	737	20	None	0
60	206	7	757	24	none	0
75	211	8	774	28	None	0
90	215	9	789	32	None	0
105	219	10	803	36	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		136	28.17	Sum of emissions (Metric Tonnes CO2e) per acre	0

Revised 2/23/18

231

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** (((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) /((6 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalent/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalent/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalent/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period
0	(0.02)	45	1	-0.01	-0.09	3	-0.04	-0.40	0	0.00	0.00	-0.02	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.239804082
15	(0.02)	45	1	-0.01	-0.09	3	-0.04	-0.42	0	0.00	0.00	-0.02			-0.248685714
30	(0.03)	45	1	-0.01	-0.09	3	-0.04	-0.43	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.257567347
45	(0.03)	45	1	-0.01	-0.09	3	-0.04	-0.44	0	0.00	0.00	-0.02			-0.264228571
60	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.46	0	0.00	0.00	-0.02			-0.270889796
75	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.47	0	0.00	0.00	-0.02			-0.27755102
90	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.47	0	0.00	0.00	-0.02			-0.281991837
105	(0.03)	45	1	-0.01	-0.10	3	-0.04	-0.49	0	0.00	0.00	-0.02			-0.286653061
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**-0.21**				**-0.76**			**-3.58**			**0.00**	**-0.14**			**-2.13**

Revised 2/23/18

232

Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	39.82	0.00	-0.27	26.68	0.00	20.30	0.00
15	100%	0%	41.30	0.00	-0.28	27.67	0.00	21.06	0.00
30	100%	0%	42.77	0.00	-0.29	28.66	0.00	21.81	0.00
45	100%	0%	43.88	0.00	-0.30	29.40	0.00	22.37	0.00
60	100%	0%	44.98	0.00	-0.31	30.14	0.00	22.94	0.00
75	100%	0%	46.09	0.00	-0.31	30.88	0.00	23.50	0.00
90	100%	0%	46.83	0.00	-0.32	31.37	0.00	23.88	0.00
105	100%	0%	47.93	0.00	-0.33	32.12	0.00	24.44	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	100%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-2.40	Sum of CO2 equivalent in wood products		131.97	0.00

Revised 2/23/18

233

Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	108	667	11	97	600	67	100%	40	0.68	27	0.02	0.72	27.60	15	8	-	15	8	-	0%	-	0.57	-	-	-	-	815.31	27.60	696	675	101	7
1			-	98	606	-		-	0.64	25	0.04	1.39	26.76			-	16	8	-		-	0.53	-	0.02	-	-	621.98	26.76	642		101	
2			-	99	613	-		-	0.60	24	0.05	2.03	26.00			-	16	9	-		-	0.49	-	0.03	-	-	628.69	26.00	647		101	
3			-	100	619	-		-	0.57	23	0.07	2.67	25.45			-	17	9	-		-	0.46	-	0.05	-	-	635.33	25.45	653		101	
4			-	101	625	-		-	0.55	22	0.08	3.23	24.93			-	17	9	-		-	0.44	-	0.06	-	-	642.01	24.93	659		101	
5			-	102	631	-		-	0.52	21	0.09	3.74	24.49			-	18	9	-		-	0.41	-	0.07	-	-	648.58	24.49	665		101	
6			-	103	637	-		-	0.50	20	0.11	4.26	24.09			-	18	10	-		-	0.39	-	0.08	-	-	655.36	24.09	671		101	
7			-	104	644	-		-	0.48	19	0.12	4.74	23.77			-	19	10	-		-	0.37	-	0.09	-	-	662.04	23.77	677		7	
8			-	105	650	-		-	0.46	18	0.13	5.18	23.41			-	19	10	-		-	0.35	-	0.10	-	-	668.71	23.41	683		8	
9			-	106	656	-		-	0.44	18	0.14	5.61	23.14			-	20	10	-		-	0.33	-	0.11	-	-	675.39	23.14	689		9	
10			-	107	662	-		-	0.42	17	0.15	6.01	22.90			-	20	11	-		-	0.32	-	0.12	-	-	682.06	22.90	696		10	
11			-	108	668	-		-	0.41	16	0.16	6.41	22.81			-	21	11	-		-	0.32	-	0.12	-	-	688.74	22.81	702		11	
12			-	109	674	-		-	0.40	16	0.17	6.77	22.66			-	21	11	-		-	0.32	-	0.12	-	-	695.42	22.66	708		12	
13			-	110	681	-		-	0.39	15	0.18	7.09	22.51			-	22	12	-		-	0.32	-	0.12	-	-	702.09	22.51	715		13	
14			-	111	687	-		-	0.38	15	0.19	7.45	22.39			-	22	12	-		-	0.32	-	0.12	-	-	708.77	22.39	721		14	
15			11	101	624	69		41	0.36	42	0.19	8.47	50.80			-	23	12	-		-	0.26	-	0.14	-	-	646.27	50.80	687		15	
16			-	102	630	-		-	0.36	40	0.20	9.49	49.93			-	23	12	-		-	0.26	-	0.14	-	-	652.95	49.93	692		16	
17			-	103	636	-		-	0.35	39	0.21	10.43	49.11			-	24	13	-		-	0.26	-	0.14	-	-	659.63	49.11	698		17	
18			-	104	642	-		-	0.34	37	0.22	11.33	48.45			-	24	13	-		-	0.26	-	0.14	-	-	666.30	48.45	704		18	
19			-	105	648	-		-	0.33	36	0.22	12.19	47.87			-	25	13	-		-	0.26	-	0.14	-	-	672.98	47.87	709		19	
20			-	106	655	-		-	0.32	34	0.23	12.96	47.34			-	25	13	-		-	0.22	-	0.16	-	-	679.65	47.34	715		20	
21			-	107	661	-		-	0.32	33	0.23	13.74	46.92			-	26	14	-		-	0.22	-	0.16	-	-	686.33	46.92	721		21	
22			-	108	667	-		-	0.31	32	0.24	14.43	46.54			-	26	14	-		-	0.22	-	0.16	-	-	693.01	46.54	727		22	
23			-	109	673	-		-	0.30	31	0.25	15.12	46.16			-	27	14	-		-	0.22	-	0.16	-	-	699.68	46.16	734		23	
24			-	110	679	-		-	0.30	30	0.25	15.78	45.82			-	27	14	-		-	0.22	-	0.16	-	-	706.36	45.82	740		24	
25			-	111	686	-		-	0.29	29	0.26	16.39	45.53			-	28	15	-		-	0.19	-	0.17	-	-	713.03	45.53	746		25	
26			-	112	692	-		-	0.29	28	0.26	16.96	45.39			-	28	15	-		-	0.19	-	0.17	-	-	719.71	45.39	752		26	
27			-	113	698	-		-	0.28	28	0.26	17.53	45.25			-	29	15	-		-	0.19	-	0.17	-	-	726.39	45.25	758		27	
28			-	114	704	-		-	0.28	27	0.27	18.02	45.03			-	29	16	-		-	0.19	-	0.17	-	-	733.06	45.03	765		28	
29			-	115	710	-		-	0.27	26	0.27	18.55	44.85			-	30	16	-		-	0.19	-	0.17	-	-	739.74	44.85	771		29	
30			12	104	645	72		43	0.27	54	0.28	19.77	74.23			-	30	16	-		-	0.17	-	0.18	-	-	674.77	74.23	735		30	
31			-	105	651	-		-	0.26	52	0.28	20.99	73.32			-	31	16	-		-	0.17	-	0.18	-	-	681.45	73.32	741		31	
32			-	106	657	-		-	0.26	50	0.28	22.12	72.46			-	31	17	-		-	0.17	-	0.18	-	-	688.12	72.46	746		32	
33			-	107	663	-		-	0.25	49	0.29	23.17	71.73			-	32	17	-		-	0.17	-	0.18	-	-	694.80	71.73	752		33	
34			-	108	669	-		-	0.25	47	0.29	24.22	71.12			-	32	17	-		-	0.17	-	0.18	-	-	701.48	71.12	758		34	
35			-	109	676	-		-	0.25	45	0.29	25.14	70.52			-	33	17	-		-	0.15	-	0.19	-	-	708.15	70.52	764		35	
36			-	110	682	-		-	0.24	44	0.30	26.11	70.09			-	33	18	-		-	0.15	-	0.19	-	-	714.83	70.09	770		36	
37			-	111	688	-		-	0.24	43	0.30	26.95	69.67			-	34	18	-		-	0.15	-	0.19	-	-	721.50	69.67	776		37	
38			-	112	694	-		-	0.23	41	0.30	27.78	69.25			-	34	18	-		-	0.15	-	0.19	-	-	728.18	69.25	782		38	
39			-	113	700	-		-	0.23	40	0.31	28.58	68.86			-	35	19	-		-	0.15	-	0.19	-	-	734.86	68.86	788		39	
40			-	114	707	-		-	0.23	39	0.31	29.33	68.53			-	35	19	-		-	0.13	-	0.19	-	-	741.53	68.53	794		40	
41			-	115	713	-		-	0.22	38	0.31	30.01	68.34			-	36	19	-		-	0.13	-	0.19	-	-	748.21	68.34	800		41	
42			-	116	719	-		-	0.22	37	0.32	30.72	68.18			-	36	19	-		-	0.13	-	0.19	-	-	754.88	68.18	806		42	
43			-	117	725	-		-	0.22	37	0.32	31.34	67.94			-	37	20	-		-	0.13	-	0.19	-	-	761.56	67.94	813		43	
44			-	118	731	-		-	0.21	36	0.32	31.97	67.71			-	37	20	-		-	0.13	-	0.19	-	-	768.24	67.71	819		44	
45			12	108	664	73		44	0.21	84	0.32	33.35	97.84			-	38	20	-		-	0.12	-	0.20	-	-	701.42	97.84	782		45	
46			-	109	670	-		-	0.21	82	0.33	34.68	96.88			-	38	20	-		-	0.12	-	0.20	-	-	708.09	96.88	787		46	
47			-	110	676	-		-	0.20	80	0.33	35.97	96.00			-	39	21	-		-	0.12	-	0.20	-	-	714.77	96.00	793		47	
48			-	111	682	-		-	0.20	58	0.33	37.13	95.22			-	39	21	-		-	0.12	-	0.20	-	-	721.45	95.22	799		48	
49			-	112	689	-		-	0.20	56	0.33	38.29	94.56			-	40	21	-		-	0.12	-	0.20	-	-	728.12	94.56	804		49	
50			-	113	695	-		-	0.20	55	0.33	39.24	93.84			-	40	21	-		-	0.11	-	0.20	-	-	734.80	93.84	810		50	
51			-	114	701	-		-	0.19	53	0.33	40.23	93.30			-	41	22	-		-	0.11	-	0.20	-	-	741.47	93.30	816		51	
52			-	115	707	-		-	0.19	52	0.33	41.09	92.77			-	41	22	-		-	0.11	-	0.20	-	-	748.15	92.77	822		52	
53			-	116	713	-		-	0.19	50	0.33	41.96	92.24			-	42	22	-		-	0.11	-	0.20	-	-	754.83	92.24	828		53	
54			-	117	720	-		-	0.19	49	0.34	43.22	92.19			-	42	23	-		-	0.11	-	0.20	-	-	761.50	92.19	834		54	
55			-	118	726	-		-	0.18	48	0.34	43.99	91.75			-	43	23	-		-	0.10	-	0.20	-	-	768.18	91.75	840		55	
56			-	119	732	-		-	0.18	47	0.34	44.68	91.46			-	43	23	-		-	0.10	-	0.20	-	-	774.85	91.46	846		56	
57			-	120	738	-		-	0.18	46	0.34	45.42	91.22			-	44	23	-		-	0.10	-	0.20	-	-	781.53	91.22	853		57	
58			-	121	744	-		-	0.18	45	0.34	46.06	90.88			-	44	24	-		-	0.10	-	0.20	-	-	788.21	90.88	859		58	
59			-	122	750	-		-	0.18	44	0.35	47.11	90.95			-	45	24	-		-	0.10	-	0.20	-	-	794.88	90.95	865		59	
60			12	110	681	75		45	0.17	73	0.35	48.52	121.75			-	45	24	-		-	0.09	-	0.21	-	-	726.21	121.75	827		60	
61			-	111	687	-		-	0.17	71	0.35	49.89	120.68			-	46	24	-		-	0.09	-	0.21	-	-	732.89	120.68	832		61	
62			-	112	694	-		-	0.17	68	0.35	51.21	119.69			-	46	25	-		-	0.09	-	0.21	-	-	739.56	119.69	836		62	
63			-	113	700	-		-	0.17	66	0.35	52.41	118.80			-	47	25	-		-	0.09	-	0.21	-	-	746.24	118.80	843		63	
64			-	114	706	-		-	0.16	64	0.36	53.92	118.36			-	47	25	-		-	0.09	-	0.21	-	-	752.91	118.36	849		64	
65			-	115	712	-		-	0.16	63	0.36	54.89	117.53			-	48	25	-		-	0.08	-	0.21	-	-	759.59	117.53	855		65	
66			-	116	718	-		-	0.16	61	0.36	55.91	116.90			-	48	26	-		-	0.08	-	0.21	-	-	766.27	116.90	861		66	
67			-	117	724	-		-	0.16	59	0.36	56.80	116.29			-	49	26	-		-	0.08	-	0.21	-	-	772.94	116.29	867		67	
68			-	118	731	-		-	0.16	58	0.36	57.69	115.67			-	49	26	-		-	0.08	-	0.21	-	-	779.62	115.67	873		68	
69			-	119	737	-		-	0.15	57	0.37	59.30	115.87			-	50	27	-		-	0.08	-	0.21	-	-	786.29	115.87	879		69	
70			-	120	743	-		-	0.15	55	0.37	60.10	115.34			-	50	27	-		-	0.07	-	0.21	-	-	792.97	115.34	885		70	
71			-	121	749	-		-	0.15	54	0.37	60.81	114.98			-	51	27	-		-	0.07	-	0.21	-	-	799.65	114.98	891		71	
72			-	122	755	-		-	0.15	53	0.37	61.56	114.67			-	51	27	-		-	0.07	-	0.21	-	-	806.32	114.67	897		72	
73			-	123	761	-		-	0.15	52	0.37	62.23	114.26			-	52	28	-		-	0.07	-	0.21	-	-	813.00	114.26	903		73	
74			-	124	768	-		-	0.15	51	0.38	63.58	114.55			-	52	28	-		-	0.07	-	0.21	-	-	819.67	114.55	910		74	
75			13	113	697	77		46	0.15	81	0.38	65.03	146.04			-	53	28	-		-	0.07	-	0.21	-	-	749.15	146.04	871		75	

Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
76			-	114	703	-		-	0.14	78	0.38	66.44	144.88			-	53	28	-		-	0.07	-	0.21	-	-	755.83	144.88	878		76	
77			-	115	709	-		-	0.14	76	0.38	67.79	143.80			-	54	29	-		-	0.07	-	0.21	-	-	762.50	143.80	882		77	
78			-	116	715	-		-	0.14	74	0.38	69.02	142.83			-	54	29	-		-	0.07	-	0.21	-	-	769.18	142.83	887		78	
79			-	117	721	-		-	0.14	72	0.38	70.61	142.56			-	55	28	-		-	0.07	-	0.21	-	-	775.85	142.56	893		79	
80			-	118	728	-		-	0.14	70	0.38	71.81	141.63			-	55	30	-		-	0.06	-	0.21	-	-	782.53	141.63	899		80	
81			-	119	734	-		-	0.14	68	0.38	72.85	140.93			-	56	30	-		-	0.06	-	0.21	-	-	789.21	140.93	904		81	
82			-	120	740	-		-	0.13	66	0.38	73.76	140.24			-	56	30	-		-	0.06	-	0.21	-	-	795.88	140.24	910		82	
83			-	121	746	-		-	0.13	65	0.38	74.67	139.55			-	57	30	-		-	0.06	-	0.21	-	-	802.56	139.55	916		83	
84			-	122	752	-		-	0.13	63	0.39	76.61	139.99			-	57	31	-		-	0.06	-	0.21	-	-	809.23	139.99	923		84	
85			-	123	758	-		-	0.13	62	0.39	77.43	139.39			-	58	31	-		-	0.06	-	0.22	-	-	815.91	139.39	929		85	
86			-	124	765	-		-	0.13	61	0.39	78.16	138.97			-	58	31	-		-	0.06	-	0.22	-	-	822.59	138.97	935		86	
87			-	125	771	-		-	0.13	60	0.39	78.93	138.60			-	59	31	-		-	0.06	-	0.22	-	-	829.26	138.60	941		87	
88			-	126	777	-		-	0.13	59	0.39	79.61	136.14			-	59	32	-		-	0.06	-	0.22	-	-	835.94	136.14	947		88	
89			-	127	783	-		-	0.13	57	0.40	81.25	138.63			-	60	32	-		-	0.06	-	0.22	-	-	842.61	138.63	954		89	
90			13	115	711	78		47	0.12	88	0.40	82.73	170.57			-	60	32	-		-	0.05	-	0.22	-	-	770.86	170.57	914		90	
91			-	116	717	-		-	0.12	85	0.40	84.16	169.33			-	61	32	-		-	0.05	-	0.22	-	-	777.53	169.33	919		91	
92			-	117	723	-		-	0.12	83	0.40	85.54	168.18			-	61	33	-		-	0.05	-	0.22	-	-	784.21	168.18	924		92	
93			-	118	729	-		-	0.12	80	0.40	86.79	167.13			-	62	33	-		-	0.05	-	0.22	-	-	790.88	167.13	930		93	
94			-	119	736	-		-	0.12	78	0.40	88.83	167.00			-	62	33	-		-	0.05	-	0.22	-	-	797.56	167.00	936		94	
95			-	120	742	-		-	0.12	76	0.40	89.85	165.00			-	63	34	-		-	0.05	-	0.22	-	-	804.23	165.00	941		95	
96			-	121	748	-		-	0.12	74	0.40	90.91	165.25			-	63	34	-		-	0.05	-	0.22	-	-	810.91	165.25	947		96	
97			-	122	754	-		-	0.12	73	0.40	91.84	164.50			-	64	34	-		-	0.05	-	0.22	-	-	817.59	164.50	953		97	
98			-	123	760	-		-	0.11	71	0.40	92.77	163.76			-	64	34	-		-	0.05	-	0.22	-	-	824.26	163.76	958		98	
99			-	124	766	-		-	0.11	69	0.41	94.96	164.37			-	65	35	-		-	0.05	-	0.22	-	-	830.94	164.37	965		99	
100			-	125	773	-		-	0.11	68	0.41	95.79	163.72			-	65	35	-		-	0.05	-	0.22	-	-	837.61	163.72	971		100	
																										-	-				

Revised 2/23/18

235

Dogwood THP (Inner Zone B) Summary (single tree selection/tractor)			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
d THP (Inner Zone B) Summary (single tree selection	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		14 Years
Live Trees (Conifers and Hardwoods)	533.01	524.12	
Wood Products		180.48	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		-8.96	
Non-biological emissions associated with milling		-3.15	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		159.48	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	171	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		27,271	

revised 2/23/18

236

Dogwood THP (Inner Zone B) Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	**Step 0.** Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	**Step 1.** Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	**Step 2.** Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	**Step 3.** Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	**Step 4.** Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in Step 1.	**Step 5.** Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	**Step 6.** Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan, if available.	**Step 7.** Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	0%	1.675	14.38							
Redwood	100%	1.675	13.42	0	85	15	1000	0.5	21	0
Pines	0%	2.254	12.14	15	79	22.5	1000	0.5	15	0
True firs	0%	2.254	11.18	30	79	30	1000	0.5	15	0
Hardwoods		2.214	11.76	45	79	37.5	1000	0.5	15	0
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2.204	60	79	45	1000	0.5	15	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.68		75	79	52.5	1000	0.5	15	0
	Hardwoods	1.95		90	79	60	1000	0.5	15	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.00		105	79	67.5	1000	0.5	15	0
	Hardwoods	0.88		0	0	0	0	0	0	0
				0	0	0	0	0	0	0
				0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	**Step 8.** Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	**Computed:** MBF * Conifer Multiplier from Step 0.	**Computed:** BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	**Computed:** Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre) Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre). Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre). None - No site preparation is conducted.	
0	143	2	525	8	None	0
15	133	3	488	12	None	0
30	133	4	488	16	None	0
45	133	5	488	20	None	0
60	133	7	488	24	none	0
75	133	8	488	28	None	0
90	133	9	488	32	None	0
105	133	10	488	36	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		-37	29.17	Sum of emissions (Metric Tonnes CO2e) per acre	0

237 revised 2/23/18

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** ((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) (((6 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Entnr number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalent/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalent/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalent/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period.
0	(0.05)	45	1	-0.01	-0.17	3	-0.04	-0.78	0	0.00	0.00	-0.03	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.466285714
15	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
30	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul in Hours	6	-0.333061224
45	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
60	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
75	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
90	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
105	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**-0.28**				**-1.00**			**-4.71**			**0.00**	**-0.18**			**-2.80**

revised 2/23/18

238

Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	77.43	0.00	-0.53	51.88	0.00	39.48	0.00
15	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
30	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
45	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
60	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
75	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
90	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
105	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-3.15	Sum of CO2 equivalent in wood products		180.48	0.00

2391 revised 2/23/18

Years	Conifer													Hardwood											Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre) -	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	85	525	21	64	395	130	100%	77	0.68	52	0.02	1.39	53.68	15	8	-	15	8	-	0%	-	0.57	-	-	-	-	410.28	53.68	457	533	101	14
1			-	65	401	-		-	0.64	49	0.04	2.71	52.03			-	16	8	-		-	0.53	-	0.02	-	-	416.94	52.03	462		101	
2			-	66	408	-		-	0.60	47	0.05	3.95	50.56			-	16	9	-		-	0.49	-	0.03	-	-	423.61	50.56	467		101	
3			-	67	414	-		-	0.57	44	0.07	5.19	49.48			-	17	9	-		-	0.46	-	0.05	-	-	430.29	49.48	472		101	
4			-	68	420	-		-	0.55	42	0.08	6.27	48.47			-	17	9	-		-	0.44	-	0.06	-	-	436.97	48.47	478		101	
5			-	69	426	-		-	0.52	40	0.09	7.28	47.62			-	18	9	-		-	0.41	-	0.07	-	-	443.64	47.62	483		101	
6			-	70	432	-		-	0.50	39	0.11	8.29	46.85			-	18	10	-		-	0.39	-	0.08	-	-	450.32	46.85	489		101	
7			-	71	438	-		-	0.48	37	0.12	9.21	46.23			-	19	10	-		-	0.37	-	0.09	-	-	456.99	46.23	495		101	
8			-	72	445	-		-	0.46	35	0.13	10.07	45.53			-	19	10	-		-	0.35	-	0.10	-	-	463.67	45.53	500		101	
9			-	73	451	-		-	0.44	34	0.14	10.92	44.99			-	20	10	-		-	0.33	-	0.11	-	-	470.35	44.99	506		101	
10			-	74	457	-		-	0.42	33	0.15	11.69	44.52			-	20	11	-		-	0.32	-	0.12	-	-	477.02	44.52	512		101	
11			-	75	463	-		-	0.41	32	0.16	12.47	44.35			-	21	11	-		-	0.32	-	0.12	-	-	483.70	44.35	519		101	
12			-	76	469	-		-	0.40	31	0.17	13.16	44.10			-	21	11	-		-	0.32	-	0.12	-	-	490.37	44.10	525		101	
13			-	77	476	-		-	0.39	30	0.18	13.78	43.78			-	22	12	-		-	0.32	-	0.12	-	-	497.05	43.78	531		101	
14			-	78	482	-		-	0.38	29	0.19	14.48	43.53			-	22	12	-		-	0.32	-	0.12	-	-	503.73	43.53	537		14	
15			15	64	395	93		55	0.36	65	0.19	16.02	81.46			-	23	12	-		-	0.26	-	0.14	-	-	417.76	81.46	499		101	
16			-	65	401	-		-	0.36	63	0.20	17.58	80.30			-	23	12	-		-	0.26	-	0.14	-	-	424.44	80.30	494		101	
17			-	66	408	-		-	0.35	60	0.21	19.00	79.17			-	24	13	-		-	0.26	-	0.14	-	-	431.11	79.17	499		101	
18			-	67	414	-		-	0.34	58	0.22	20.35	78.24			-	24	13	-		-	0.26	-	0.14	-	-	437.79	78.24	505		101	
19			-	68	420	-		-	0.33	56	0.22	21.67	77.44			-	25	13	-		-	0.26	-	0.14	-	-	444.47	77.44	511		101	
20			-	69	426	-		-	0.32	54	0.23	22.85	76.68			-	25	13	-		-	0.22	-	0.16	-	-	451.14	76.68	516		101	
21			-	70	432	-		-	0.32	52	0.23	24.04	76.11			-	26	14	-		-	0.22	-	0.16	-	-	457.82	76.11	522		101	
22			-	71	438	-		-	0.31	50	0.24	25.09	75.57			-	26	14	-		-	0.22	-	0.16	-	-	464.49	75.57	528		101	
23			-	72	445	-		-	0.30	49	0.25	26.16	75.06			-	27	14	-		-	0.22	-	0.16	-	-	471.17	75.06	534		23	
24			-	73	451	-		-	0.30	47	0.25	27.16	74.58			-	27	14	-		-	0.22	-	0.16	-	-	477.85	74.58	540		24	
25			-	74	457	-		-	0.29	46	0.26	28.10	74.16			-	28	15	-		-	0.19	-	0.17	-	-	484.52	74.16	546		25	
26			-	75	463	-		-	0.29	45	0.26	28.96	73.94			-	28	15	-		-	0.19	-	0.17	-	-	491.20	73.94	552		26	
27			-	76	469	-		-	0.28	44	0.26	29.84	73.75			-	29	15	-		-	0.19	-	0.17	-	-	497.87	73.75	558		27	
28			-	77	476	-		-	0.28	43	0.27	30.60	73.42			-	29	16	-		-	0.19	-	0.17	-	-	504.55	73.42	565		28	
29			-	78	482	-		-	0.27	42	0.27	31.40	73.15			-	30	16	-		-	0.19	-	0.17	-	-	511.23	73.15	571		29	
30			15	64	395	93		55	0.27	78	0.28	33.10	111.10			-	30	16	-		-	0.17	-	0.18	-	-	425.28	111.10	522		101	
31			-	65	401	-		-	0.26	75	0.28	34.79	109.92			-	31	16	-		-	0.17	-	0.18	-	-	431.94	109.92	528		101	
32			-	66	408	-		-	0.26	72	0.28	36.37	108.80			-	31	17	-		-	0.17	-	0.18	-	-	438.61	108.80	533		32	
33			-	67	414	-		-	0.25	70	0.29	37.82	107.82			-	32	17	-		-	0.17	-	0.18	-	-	445.29	107.82	539		33	
34			-	68	420	-		-	0.25	68	0.29	39.29	107.04			-	32	17	-		-	0.17	-	0.18	-	-	451.97	107.04	544		34	
35			-	69	426	-		-	0.25	66	0.29	40.57	106.22			-	33	17	-		-	0.15	-	0.19	-	-	458.64	106.22	550		35	
36			-	70	432	-		-	0.24	64	0.30	41.93	105.67			-	33	18	-		-	0.15	-	0.19	-	-	465.32	105.67	556		36	
37			-	71	438	-		-	0.24	62	0.30	43.11	105.10			-	34	18	-		-	0.15	-	0.19	-	-	471.99	105.10	562		37	
38			-	72	445	-		-	0.23	60	0.30	44.28	104.53			-	34	18	-		-	0.15	-	0.19	-	-	478.67	104.53	567		38	
39			-	73	451	-		-	0.23	59	0.31	45.40	104.02			-	35	19	-		-	0.15	-	0.19	-	-	485.35	104.02	573		39	
40			-	74	457	-		-	0.23	57	0.31	46.46	103.56			-	35	19	-		-	0.13	-	0.19	-	-	492.02	103.56	579		40	
41			-	75	463	-		-	0.22	56	0.31	47.39	103.28			-	36	19	-		-	0.13	-	0.19	-	-	498.70	103.28	586		41	
42			-	76	469	-		-	0.22	55	0.32	48.39	103.07			-	36	19	-		-	0.13	-	0.19	-	-	505.37	103.07	592		42	
43			-	77	476	-		-	0.22	53	0.32	49.29	102.76			-	37	20	-		-	0.13	-	0.19	-	-	512.05	102.76	598		43	
44			-	78	482	-		-	0.21	52	0.32	50.16	102.42			-	37	20	-		-	0.13	-	0.19	-	-	518.73	102.42	604		44	
45			15	64	395	93		55	0.21	88	0.32	52.00	140.38			-	38	20	-		-	0.12	-	0.20	-	-	432.76	140.38	556		45	
46			-	65	401	-		-	0.21	85	0.33	53.78	139.15			-	38	20	-		-	0.12	-	0.20	-	-	439.44	139.15	581		46	
47			-	66	408	-		-	0.20	83	0.33	55.48	138.04			-	39	21	-		-	0.12	-	0.20	-	-	446.11	138.04	566		47	
48			-	67	414	-		-	0.20	80	0.33	57.02	137.03			-	39	21	-		-	0.12	-	0.20	-	-	452.79	137.03	572		48	
49			-	68	420	-		-	0.20	78	0.33	58.56	136.18			-	40	21	-		-	0.12	-	0.20	-	-	459.47	136.18	577		49	
50			-	69	426	-		-	0.20	75	0.33	59.78	135.18			-	40	21	-		-	0.11	-	0.20	-	-	466.14	135.18	583		50	
51			-	70	432	-		-	0.19	73	0.33	61.05	134.44			-	41	22	-		-	0.11	-	0.20	-	-	472.82	134.44	588		51	
52			-	71	438	-		-	0.19	72	0.33	62.15	133.70			-	41	22	-		-	0.11	-	0.20	-	-	479.49	133.70	594		52	
53			-	72	445	-		-	0.19	70	0.33	63.26	132.97			-	42	22	-		-	0.11	-	0.20	-	-	486.17	132.97	600		53	
54			-	73	451	-		-	0.19	68	0.34	65.16	133.13			-	42	23	-		-	0.11	-	0.20	-	-	492.85	133.13	607		54	
55			-	74	457	-		-	0.18	66	0.34	66.16	132.51			-	43	23	-		-	0.10	-	0.20	-	-	499.52	132.51	612		55	
56			-	75	463	-		-	0.18	65	0.34	67.04	132.08			-	43	23	-		-	0.10	-	0.20	-	-	506.20	132.08	618		56	
57			-	76	469	-		-	0.18	64	0.34	67.98	131.71			-	44	23	-		-	0.10	-	0.20	-	-	512.87	131.71	624		57	
58			-	77	476	-		-	0.18	62	0.34	68.81	131.23			-	44	24	-		-	0.10	-	0.20	-	-	519.55	131.23	630		58	
59			-	78	482	-		-	0.18	61	0.35	70.42	131.53			-	45	24	-		-	0.10	-	0.20	-	-	526.23	131.53	637		59	
60			15	64	395	93		55	0.17	97	0.35	72.19	169.32			-	45	24	-		-	0.09	-	0.21	-	-	440.28	169.32	589		60	
61			-	65	401	-		-	0.17	94	0.35	73.90	167.93			-	46	24	-		-	0.09	-	0.21	-	-	446.94	167.93	594		61	
62			-	66	408	-		-	0.17	91	0.35	75.56	166.65			-	46	25	-		-	0.09	-	0.21	-	-	453.61	166.65	599		62	
63			-	67	414	-		-	0.17	88	0.35	77.05	165.49			-	47	25	-		-	0.09	-	0.21	-	-	460.29	165.49	604		63	
64			-	68	420	-		-	0.16	86	0.36	79.17	165.11			-	47	25	-		-	0.09	-	0.21	-	-	466.97	165.11	610		64	
65			-	69	426	-		-	0.16	84	0.36	80.36	164.00			-	48	25	-		-	0.08	-	0.21	-	-	473.64	164.00	616		65	
66			-	70	432	-		-	0.16	82	0.36	81.66	163.17			-	48	26	-		-	0.08	-	0.21	-	-	480.32	163.17	621		66	
67			-	71	438	-		-	0.16	80	0.36	82.76	162.35			-	49	26	-		-	0.08	-	0.21	-	-	486.99	162.35	627		67	
68			-	72	445	-		-	0.15	78	0.36	83.87	161.52			-	49	26	-		-	0.08	-	0.21	-	-	493.67	161.52	632		68	
69			-	73	451	-		-	0.15	76	0.37	85.15	161.98			-	50	27	-		-	0.08	-	0.21	-	-	500.35	161.98	639		69	
70			-	74	457	-		-	0.15	74	0.37	87.14	161.26			-	50	27	-		-	0.07	-	0.21	-	-	507.02	161.26	645		70	
71			-	75	463	-		-	0.15	73	0.37	88.03	160.76			-	51	27	-		-	0.07	-	0.21	-	-	513.70	160.76	651		71	
72			-	76	469	-		-	0.15	71	0.37	88.97	160.32			-	51	27	-		-	0.07	-	0.21	-	-	520.37	160.32	657		72	
73			-	77	476	-		-	0.15	70	0.37	89.80	159.76			-	52	28	-		-	0.07	-	0.21	-	-	527.05	159.76	663		73	

revised 2/23/18

240

Years	Conifer												Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/A	Estimated CO2 equivsleint harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/A	CO2 -e in in-use harvested wood products (Metric Tonnes/Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
74			-	78	482	-		-	0.15	69	0.38	91.72	160.30			-	52	28	-		-	0.07	-	0.21	-	-	533.73	160.30	670		74	
75			15	64	395	93		55	0.15	105	0.38	93.49	198.02			-	53	28	-		-	0.07	-	0.21	-	-	447.76	198.02	621		75	
76			-	65	401	-		-	0.14	101	0.38	95.21	196.56			-	53	28	-		-	0.07	-	0.21	-	-	454.44	196.56	626		76	
77			-	66	408	-		-	0.14	98	0.38	96.87	195.21			-	54	29	-		-	0.07	-	0.21	-	-	461.11	195.21	632		77	
78			-	67	414	-		-	0.14	96	0.38	98.36	193.98			-	54	29	-		-	0.07	-	0.21	-	-	467.79	193.98	637		78	
79			-	68	420	-		-	0.14	93	0.38	100.76	193.82			-	55	29	-		-	0.07	-	0.21	-	-	474.47	193.82	643		79	
80			-	69	426	-		-	0.14	91	0.38	101.98	192.61			-	55	30	-		-	0.06	-	0.21	-	-	481.14	192.61	648		80	
81			-	70	432	-		-	0.14	88	0.38	103.25	191.72			-	56	30	-		-	0.06	-	0.21	-	-	487.82	191.72	654		81	
82			-	71	438	-		-	0.13	86	0.38	104.35	190.83			-	56	30	-		-	0.06	-	0.21	-	-	494.49	190.83	659		82	
83			-	72	445	-		-	0.13	84	0.38	105.46	189.93			-	57	30	-		-	0.06	-	0.21	-	-	501.17	189.93	665		83	
84			-	73	451	-		-	0.13	83	0.39	108.10	190.69			-	57	31	-		-	0.06	-	0.21	-	-	507.85	190.69	672		84	
85			-	74	457	-		-	0.13	81	0.39	109.10	189.90			-	58	31	-		-	0.06	-	0.22	-	-	514.52	189.90	678		85	
86			-	75	463	-		-	0.13	79	0.39	109.98	189.35			-	58	31	-		-	0.06	-	0.22	-	-	521.20	189.35	684		86	
87			-	76	469	-		-	0.13	78	0.39	110.92	188.84			-	59	31	-		-	0.06	-	0.22	-	-	527.87	188.84	690		87	
88			-	77	476	-		-	0.13	76	0.39	111.75	188.23			-	59	32	-		-	0.06	-	0.22	-	-	534.55	188.23	695		88	
89			-	78	482	-		-	0.13	75	0.40	113.99	189.02			-	60	32	-		-	0.06	-	0.22	-	-	541.23	189.02	703		89	
90			15	64	395	93		55	0.12	111	0.40	115.76	226.68			-	60	32	-		-	0.05	-	0.22	-	-	455.26	226.68	654		90	
91			-	65	401	-		-	0.12	108	0.40	117.47	225.15			-	61	32	-		-	0.05	-	0.22	-	-	461.94	225.15	659		91	
92			-	66	408	-		-	0.12	105	0.40	119.13	223.72			-	61	33	-		-	0.05	-	0.22	-	-	468.61	223.72	664		92	
93			-	67	414	-		-	0.12	102	0.40	120.63	222.41			-	62	33	-		-	0.05	-	0.22	-	-	475.29	222.41	669		93	
94			-	68	420	-		-	0.12	99	0.40	123.28	222.43			-	62	33	-		-	0.05	-	0.22	-	-	481.97	222.43	676		94	
95			-	69	426	-		-	0.12	97	0.40	124.50	221.16			-	63	34	-		-	0.05	-	0.22	-	-	488.64	221.16	681		95	
96			-	70	432	-		-	0.12	94	0.40	125.77	220.22			-	63	34	-		-	0.05	-	0.22	-	-	495.32	220.22	686		96	
97			-	71	438	-		-	0.12	92	0.40	126.87	219.28			-	64	34	-		-	0.05	-	0.22	-	-	501.99	219.28	692		97	
98			-	72	445	-		-	0.11	90	0.40	127.98	218.34			-	64	34	-		-	0.05	-	0.22	-	-	508.67	218.34	697		98	
99			-	73	451	-		-	0.11	88	0.41	130.86	219.28			-	65	35	-		-	0.05	-	0.22	-	-	515.35	219.28	705		99	
100			-	74	457	-		-	0.11	87	0.41	131.85	218.45			-	65	35	-		-	0.05	-	0.22	-	-	522.02	218.45	710		100	
																										-	-				

revised 2/23/18

241

Dogwood THP (Outer Area and regular selection) Summary (single tree selection/tractor)			Years until Carbon Stocks are Recouped from Initial Harvest (Includes Carbon in Live Trees, Harvested Wood Products, and Landfill)
	Beginning Stocks	Ending Stocks	
Emissions Source/Sink/Reservoir	Metric Tonnes CO2 Equivalent Per Acre Basis		10 Years
Live Trees (Conifers and Hardwoods)	533.01	561.17	
Wood Products		169.20	
Site Preparation Emissions		0.00	
Non-biological emissions associated with harvesting		-8.53	
Non-biological emissions associated with milling		-3.00	
Sum of Net Emissions/Sequestration over Identified Harvest Cycles (CO2 metric tonnes)		185.83	
Project Summary			
Project Acres	Step 17- Insert the acres that are part of the harvest area.	38	
Total Project Sequestration over defined Harvesting Periods (CO2 metric tonnes)		7,062	

revised 2/23/18

242

Dogwood THP (Outer Area) Project Carbon Accounting: Inventory, Growth, and Harvest

This worksheet addresses the sequestation and emissions associated with the project area's balance of harvest, inventory, and growth plus any emissions associated with site preparation. Complete the input for Steps 0- 8 on this worksheet.

Forest Type				Harvest Periods	Inventory		Growth Rates		Harvest Volume	
Multipliers to Estimate Carbon Tonnes per MBF (Sampson, 2002)				Time of Harvest (years from project approval)	Conifer Live Tree Volume (MBF/Acre) - Prior to Harvest	Hardwood Live Tree Volume (BA square feet/Acre) - Prior to Harvest	Conifer Growth Rate BF/Acre/Year	Hardwood Growth Rate BA/Acre/Year	Conifer Harvest Volume (MBF/acre)	Hardwood Harvested / Treated Basal Area (BA/Acre)
Forest Type	Step 0. Identify the approximate percentage of conifers by volume within the harvest plan. Must sum to 100%	Multiplier from Cubic Feet (merchantable) to Total Biomass	Pounds Carbon per Cubic Foot	Step 1. Enter the anticipated future harvest entries. The re-entry cycles should be supported by management plan, if available.	Step 2. Enter the estimated conifer inventory (mbf/acre) present in project area prior to harvest.	Step 3. Enter the estimated hardwood inventory (basal area per acre) present in project area prior to harvest.	Step 4. Enter the average annual periodic growth of conifers between harvests based on estimated growth in management plan, if available. Must be entered for each harvest cycle identified in Step 1.	Step 5. Insert average annual periodic growth of hardwoods between harvests based on estimated growth in management plan, if available.	Step 6. Enter the estimated conifer harvested per acre at current and future entries. The estimate should be based on projections from the management plan, if available.	Step 7. Enter estimated hardwood basal area harvested/treated per acre
Douglas-fir	0%	1.675	14.38							
Redwood	100%	1.675	13.42	0	85	15	1000	0.5	15	0
Pines	0%	2.254	12.14	15	85	22.5	1000	0.5	15	0
True firs	0%	2.254	11.18	30	85	30	1000	0.5	15	0
Hardwoods		2.214	11.78	45	85	37.5	1000	0.5	15	0
Conversion of Board Feet to Cubic Feet	0.165	Pounds per Metric Tonne	2.204	60	85	45	1000	0.5	15	0
Multipliers to Estimate Total Carbon Tonnes per MBF	Conifer	1.68		75	85	52.5	1000	0.5	15	0
	Hardwoods	1.95		90	85	60	1000	0.5	15	0
Multipliers to Estimate Merchantable Carbon Tonnes per MBF	Conifer	1.00		105	85	67.5	1000	0.5	15	0
	Hardwoods	0.88		0	0	0	0	0	0	0
				0	0	0	0	0	0	0
				0	0	0	0	0	0	0

User must enter harvest cycles to 100 years and/or at least three entry cycles.

Harvest Periods	Inventory Conversion to Carbon (prior to harvest)		Inventory Conversion to Carbon Dioxide Equivalent (prior to harvest)		Site Preparation	
	Conifer Live Tree Tonnes (C/acre)	Hardwood Live Trees Tonnes (C/acre)	Conifer Live Tree Tonnes (CO_2 equivalent/acre)	Hardwood Live Tree Tonnes (CO_2 equivalent/acre)	Step 8. Enter the value (in bold) for each harvest cycel that best reflects the site preparation activities, as averaged across the project area:	
from above (Time of Harvest as years from project approval)	Computed: MBF * Conifer Multiplier from Step 0.	Computed: BA*Volume/Basal Area Ration (to convert to MBF) * Hardwood Multiplier from Step 0.	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Computed: Conversion of carbon to CO_2 (3.67 tonnes CO2 per 1 tonne Carbon)	Heavy- 50% or more of the project area is covered with brush and removed as part of site preparation or stumps are removed (mobile emissions estimated at .429 metric tonnes CO2e per acre, biological emissions estimated at 2 metric tonnes CO2e per acre) Medium - >25% <50% of the project area is covered with brush and removed as part of site preparation (mobile emissions estimated at .202 metric tonnes CO2e per acre, biological emissions estimated at 1 metric tonne per acre). Light - 25% or less of the project area is covered with brush and is removed as part of site preparation (mobile emissions estimated at .09 metric tonnes CO2e per acre, biological emissions estimated at .5 metric tonnes per acre). None - No site preparation is conducted.	
0	143	2	525	8	None	0
15	143	3	525	12	None	0
30	143	4	525	16	None	0
45	143	5	525	20	None	0
60	143	7	525	24	None	0
75	143	8	525	28	None	0
90	143	9	525	32	None	0
105	143	10	525	36	None	0
0	0	0	0	0	None	0
	Difference between ending stocks and beginning stocks		0	28.17	Sum of emissions (Metric Tonnes CO2e) per acre	0

revised 2/23/18

243

Project Carbon Accounting: Harvesting Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 9- 14 on this worksheet.

Harvest Periods	Falling Operations	Production per Day	Emissions Associated with Yarders and Loaders			Emissions Associated with Tractors and Skidders			Emissions Associated with Helicopters			Landing Saws	Trucking Emissions		
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Assumption:** ((.25 gallons gasoline per MBF harvested * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* mbf per acre harvested	MBF (all species) Yarded Delivered to Landing	**Assumption:**(((35 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((55 gallons diesel per day per piece of equipment * 6.12 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((200 gallons jet fuel per day per piece of equipment * 5 pounds carbon / gallon)/2205 to convert to metric tonnes carbon)* 3.67 to convert to metric tonnes CO2 equivalent)/Production per Day			**Assumption:** (((.16 gallons gasoline per MBF * 5.33 (pounds carbon per gallon))/2205(conversion to metric tonnes)* 3.67 to convert to metric tonnes CO2 equivalent)/mbf per acre harvested. Applies to all species whether harvested or not.	**Assumption:** Round Trip Hours/Load average (from below, to compute the mbf/hour) /((5 gallons diesel/hour * 6.12 pounds carbon/gallon)/2205 (conversion to metric tonnes carbon))*3.67 (conversion to metric tonnes carbon dioxide equivalent)		
	Computed. Metric Tonnes CO2 equivalent per mbf harvested Applies to all species whether harvested or treated	**Step 9.** Enter the estimated volume delivered to the landing in a day.	**Step 10.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Yarders and Loaders CO2 equivalent/mbf (metric tonnes)	**Computed.** Yarders and Loaders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 11.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Tractor and skidder CO2 equivalent/mbf (metric tonnes)	**Computed.** Tractors and Skidders CO2 equivalent per Acre Harvested (metric tonnes)	**Step 12.** Enter number of pieces of equipment in use per day for each harvest entry	**Computed.** Helicopter CO2 equivalent/mbf (metric tonnes)	**Computed.** Helicopters CO2 equivalent per Acre Harvested (metric tonnes)	**Computed.** Landing Saws CO2 equivalent per Acre Harvested (metric tonnes)	**Steps 13 and 14 below**		**Computed.** Estimated Metric Tonnes CO2e per harvested acre for each harvesting period
0	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02	**Step 13.** Enter Estimated Load Average: MBF/Truck	4.5	-0.333061224
15	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
30	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02	**Step 14.** Enter Estimated Round Trip Haul In Hours	6	-0.333061224
45	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
60	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
75	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
90	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
105	(0.03)	45	1	-0.01	-0.12	3	-0.04	-0.56	0	0.00	0.00	-0.02			-0.333061224
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
0	-	0	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00			0
Sum Emissions	**-0.27**				**-0.95**			**-4.48**			**0.00**	**-0.17**			**-2.66**

rev 1 sec 2/23/18

244

Project Carbon Accounting: Harvested Wood Products and Processing Emissions

This worksheet addresses the non-biological emissions associated with the project area's harvesting activities. Complete the input for Steps 15- 16 on this worksheet.

Harvest Periods	Quantity of Forest Carbon Delivered to Mills				Non-Biological Emissions Associated with Mills	Quantity of Forest Carbon Remaining Immediately After Milling (Mill Efficiency)		Long-Term Sequestration in Wood Products	
	Conifer Percentage Delivered to Mills	Hardwood Percentage Delivered to Mills	Conifer CO2e Delivered to Mills / Acre	Hardwood CO2 equivalent Delivered to Mills / Acre	**Assumption.** 20 kw/hour (mill energy use) /(40mbf lumber processed/hour) *(.05 metric tonnes/kw hour) * mbf processed	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Conifers	**Computed.** Remaining CO2 equivalent after Milling Efficiency for Hardwoods	**Computed.** CO2 Equivalent Tonnes in Conifer Wood Products in Use-100 Year Weighted Average / Acre and Landfill	**Computed.** CO2 Equivalent Tonnes in Hardwood Wood Products in Use-100 Year Weighted Average / Acre
from Inventory, Growth, and Harvest Page (Time of Harvest as years from project approval)	**Step 15.** Insert the percentage of conifer trees harvested that are subsequently delivered to sawmills	**Step 16.** Insert the percentage of hardwoods harvested or treated that are subsequently delivered to sawmills	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Computed:** The merchantable portion determined by the conversion factors (Sampson, 2002) on the Inventory, Growth, and Harvest worksheet. This is multiplied by the percent delivered to mills to reflect the carbon delivered to mills.	**Calculated.** **The CO2e associated with processing the logs at the mill**	The difference between carbon delivered to mills and carbon remaining after milling is assumed to be emitted immediately		**Estimate.** The weighted average carbon remaining in use at year 100 is 46.3%	**Estimate.** The weighted average carbon remaining in use at year 100 is 23.0%
						The efficiency rating from mills in California is 0.67 (DOE 1605b) for conifers	The efficiency rating from mills in California is .5 (DOE 1605b) for hardwoods	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.	**Estimate.** The carbon in landfills at year 100 is 29.8% of the initial carbon produced in wood products.
0	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
15	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
30	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
45	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
60	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
75	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
90	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
105	100%	0%	55.31	0.00	-0.38	37.06	0.00	28.20	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sum of emissions associate with processing of lumber			-3.00	Sum of CO2 equivalent in wood products		169.20	0.00

revised 2/23/18

245

Years	Conifer													Hardwood												Total					
	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/ Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2 -e in in-use harvested wood products (Metric Tonnes/ Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/ Acre)	Combined CO2-e in Landfills and In-use (Metric	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/ Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/	CO2 -e in in-use harvested wood products (Metric Tonnes/ Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2 -e in Landfills (Metric Tonnes/ Acre)	Combined CO2-e in Landfills and In-use (Metric	CO2-e in Standing Inventories (Metric Tonnes/ Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/ Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
Pre-harvest	85	525	15	70	432	93	100%	55	0.68	37	0.02	1.00	38.33	15	8	-	15	8	-	0%	-	0.57	-	-	-	-	447.32	38.33	479	533	101	10
1			-	71	438	-		-	0.64	35	0.04	1.94	37.17			-	16	8	-		-	0.53	-	0.02	-	-	453.99	37.17	484		101	
2			-	72	445	-		-	0.60	33	0.05	2.82	36.12			-	16	9	-		-	0.49	-	0.03	-	-	460.67	36.12	489		101	
3			-	73	451	-		-	0.57	32	0.07	3.71	35.34			-	17	9	-		-	0.46	-	0.05	-	-	467.35	35.34	495		101	
4			-	74	457	-		-	0.55	30	0.08	4.48	34.62			-	17	9	-		-	0.44	-	0.06	-	-	474.02	34.62	501		101	
5			-	75	463	-		-	0.52	29	0.09	5.20	34.01			-	18	9	-		-	0.41	-	0.07	-	-	480.70	34.01	507		101	
6			-	76	469	-		-	0.50	28	0.11	5.92	33.46			-	18	10	-		-	0.39	-	0.08	-	-	487.37	33.46	512		101	
7			-	77	476	-		-	0.48	26	0.12	6.58	33.02			-	19	10	-		-	0.37	-	0.09	-	-	494.05	33.02	518		101	
8			-	78	482	-		-	0.46	25	0.13	7.19	32.52			-	19	10	-		-	0.35	-	0.10	-	-	500.73	32.52	524		101	
9			-	79	488	-		-	0.44	24	0.14	7.80	32.13			-	20	10	-		-	0.33	-	0.11	-	-	507.40	32.13	530		101	
10			-	80	494	-		-	0.42	23	0.15	8.35	31.80			-	20	11	-		-	0.32	-	0.12	-	-	514.08	31.80	537		10	
11			-	81	500	-		-	0.41	23	0.16	8.90	31.68			-	21	11	-		-	0.32	-	0.12	-	-	520.75	31.68	543		11	
12			-	82	506	-		-	0.40	22	0.17	9.40	31.50			-	21	11	-		-	0.32	-	0.12	-	-	527.43	31.50	549		12	
13			-	83	513	-		-	0.39	21	0.18	9.84	31.27			-	22	12	-		-	0.32	-	0.12	-	-	534.11	31.27	555		13	
14			-	84	519	-		-	0.38	21	0.19	10.34	31.09			-	22	12	-		-	0.32	-	0.12	-	-	540.78	31.09	562		14	
15			15	70	432	93		55	0.36	57	0.19	11.73	69.13			-	23	12	-		-	0.26	-	0.14	-	-	454.82	69.13	514		101	
16			-	71	438	-		-	0.36	55	0.20	13.11	67.97			-	23	12	-		-	0.26	-	0.14	-	-	461.49	67.97	519		101	
17			-	72	445	-		-	0.35	52	0.21	14.38	66.87			-	24	13	-		-	0.26	-	0.14	-	-	468.17	66.87	524		101	
18			-	73	451	-		-	0.34	50	0.22	15.60	65.98			-	24	13	-		-	0.26	-	0.14	-	-	474.85	65.98	530		101	
19			-	74	457	-		-	0.33	48	0.22	16.76	65.21			-	25	13	-		-	0.26	-	0.14	-	-	481.52	65.21	536		19	
20			-	75	463	-		-	0.32	47	0.23	17.81	64.49			-	25	13	-		-	0.22	-	0.16	-	-	488.20	64.49	541		20	
21			-	76	469	-		-	0.32	45	0.23	18.86	63.92			-	26	14	-		-	0.22	-	0.16	-	-	494.87	63.92	547		21	
22			-	77	476	-		-	0.31	44	0.24	19.80	63.42			-	26	14	-		-	0.22	-	0.16	-	-	501.55	63.42	553		22	
23			-	78	482	-		-	0.30	42	0.25	20.74	62.91			-	27	14	-		-	0.22	-	0.16	-	-	508.23	62.91	559		23	
24			-	79	488	-		-	0.30	41	0.25	21.63	62.45			-	27	14	-		-	0.22	-	0.16	-	-	514.90	62.45	565		24	
25			-	80	494	-		-	0.29	40	0.26	22.45	62.05			-	28	15	-		-	0.19	-	0.17	-	-	521.58	62.05	571		25	
26			-	81	500	-		-	0.29	39	0.26	23.23	61.87			-	28	15	-		-	0.19	-	0.17	-	-	528.25	61.87	577		26	
27			-	82	506	-		-	0.28	38	0.26	24.00	61.68			-	29	15	-		-	0.19	-	0.17	-	-	534.93	61.68	583		27	
28			-	83	513	-		-	0.28	37	0.27	24.67	61.38			-	29	16	-		-	0.19	-	0.17	-	-	541.61	61.38	590		28	
29			-	84	519	-		-	0.27	36	0.27	25.39	61.14			-	30	16	-		-	0.19	-	0.17	-	-	548.28	61.14	596		29	
30			15	70	432	93		55	0.27	72	0.28	26.99	99.11			-	30	16	-		-	0.17	-	0.18	-	-	462.32	99.11	548		30	
31			-	71	438	-		-	0.26	69	0.28	28.59	97.94			-	31	16	-		-	0.17	-	0.18	-	-	468.99	97.94	553		31	
32			-	72	445	-		-	0.26	67	0.28	30.09	96.82			-	31	17	-		-	0.17	-	0.18	-	-	475.67	96.82	558		32	
33			-	73	451	-		-	0.25	64	0.29	31.47	95.87			-	32	17	-		-	0.17	-	0.18	-	-	482.35	95.87	564		33	
34			-	74	457	-		-	0.25	62	0.29	32.85	95.08			-	32	17	-		-	0.17	-	0.18	-	-	489.02	95.08	569		34	
35			-	75	463	-		-	0.25	60	0.29	34.07	94.30			-	33	17	-		-	0.15	-	0.19	-	-	495.70	94.30	575		35	
36			-	76	469	-		-	0.24	58	0.30	35.34	93.75			-	33	18	-		-	0.15	-	0.19	-	-	502.37	93.75	581		36	
37			-	77	476	-		-	0.24	57	0.30	36.45	93.19			-	34	18	-		-	0.15	-	0.19	-	-	509.05	93.19	587		37	
38			-	78	482	-		-	0.23	55	0.30	37.55	92.64			-	34	18	-		-	0.15	-	0.19	-	-	515.73	92.64	593		38	
39			-	79	488	-		-	0.23	54	0.31	38.60	92.14			-	35	19	-		-	0.15	-	0.19	-	-	522.40	92.14	599		39	
40			-	80	494	-		-	0.23	52	0.31	39.60	91.70			-	35	19	-		-	0.13	-	0.19	-	-	529.08	91.70	605		40	
41			-	81	500	-		-	0.22	51	0.31	40.48	91.45			-	36	19	-		-	0.13	-	0.19	-	-	535.75	91.45	611		41	
42			-	82	506	-		-	0.22	50	0.32	41.43	91.25			-	36	19	-		-	0.13	-	0.19	-	-	542.43	91.25	617		42	
43			-	83	513	-		-	0.22	49	0.32	42.25	90.94			-	37	20	-		-	0.13	-	0.19	-	-	549.11	90.94	623		43	
44			-	84	519	-		-	0.21	48	0.32	43.08	90.63			-	37	20	-		-	0.13	-	0.19	-	-	555.78	90.63	629		44	
45			15	70	432	93		55	0.21	84	0.32	44.65	128.59			-	38	20	-		-	0.12	-	0.20	-	-	469.82	128.59	581		45	
46			-	71	438	-		-	0.21	81	0.33	46.57	127.37			-	38	20	-		-	0.12	-	0.20	-	-	476.49	127.37	586		46	
47			-	72	445	-		-	0.20	78	0.33	48.23	126.27			-	39	21	-		-	0.12	-	0.20	-	-	483.17	126.27	592		47	
48			-	73	451	-		-	0.20	76	0.33	49.72	125.27			-	39	21	-		-	0.12	-	0.20	-	-	489.85	125.27	597		48	
49			-	74	457	-		-	0.20	73	0.33	51.21	124.44			-	40	21	-		-	0.12	-	0.20	-	-	496.52	124.44	603		49	
50			-	75	463	-		-	0.20	71	0.33	52.43	123.50			-	40	21	-		-	0.11	-	0.20	-	-	503.20	123.50	608		50	
51			-	76	469	-		-	0.19	69	0.33	53.70	122.82			-	41	22	-		-	0.11	-	0.20	-	-	509.87	122.82	614		51	
52			-	77	476	-		-	0.19	67	0.33	54.81	122.13			-	41	22	-		-	0.11	-	0.20	-	-	516.55	122.13	620		52	
53			-	78	482	-		-	0.19	66	0.33	55.92	121.44			-	42	22	-		-	0.11	-	0.20	-	-	523.23	121.44	625		53	
54			-	79	488	-		-	0.19	64	0.34	57.57	121.42			-	42	23	-		-	0.11	-	0.20	-	-	529.90	121.42	632		54	
55			-	80	494	-		-	0.18	62	0.34	58.57	120.85			-	43	23	-		-	0.10	-	0.20	-	-	536.58	120.85	638		55	
56			-	81	500	-		-	0.18	61	0.34	59.46	120.47			-	43	23	-		-	0.10	-	0.20	-	-	543.25	120.47	644		56	
57			-	82	506	-		-	0.18	60	0.34	60.40	120.15			-	44	23	-		-	0.10	-	0.20	-	-	549.93	120.15	650		57	
58			-	83	513	-		-	0.18	58	0.34	61.23	119.72			-	44	24	-		-	0.10	-	0.20	-	-	556.61	119.72	656		58	
59			-	84	519	-		-	0.18	57	0.35	62.51	119.84			-	45	24	-		-	0.10	-	0.20	-	-	563.28	119.84	662		59	
60			15	70	432	93		55	0.17	93	0.35	64.38	157.68			-	45	24	-		-	0.09	-	0.21	-	-	477.32	157.68	614		60	
61			-	71	438	-		-	0.17	90	0.35	66.09	156.34			-	46	24	-		-	0.09	-	0.21	-	-	483.99	156.34	619		61	
62			-	72	445	-		-	0.17	87	0.35	67.75	155.11			-	46	25	-		-	0.09	-	0.21	-	-	490.67	155.11	624		62	
63			-	73	451	-		-	0.17	85	0.35	69.24	154.00			-	47	25	-		-	0.09	-	0.21	-	-	497.35	154.00	630		63	
64			-	74	457	-		-	0.16	82	0.36	71.18	153.49			-	47	25	-		-	0.09	-	0.21	-	-	504.02	153.49	636		64	
65			-	75	463	-		-	0.16	80	0.36	72.40	152.43			-	48	25	-		-	0.08	-	0.21	-	-	510.70	152.43	641		65	
66			-	76	469	-		-	0.16	78	0.36	73.67	151.84			-	48	26	-		-	0.08	-	0.21	-	-	517.37	151.84	647		66	
67			-	77	476	-		-	0.16	76	0.36	74.78	150.86			-	49	26	-		-	0.08	-	0.21	-	-	524.05	150.86	652		67	
68			-	78	482	-		-	0.16	74	0.36	75.88	150.07			-	49	26	-		-	0.08	-	0.21	-	-	530.73	150.07	658		68	
69			-	79	488	-		-	0.15	72	0.37	77.98	150.39			-	50	27	-		-	0.08	-	0.21	-	-	537.40	150.39	665		69	
70			-	80	494	-		-	0.15	71	0.37	78.98	149.72			-	50	27	-		-	0.07	-	0.21	-	-	544.08	149.72	671		70	
71			-	81	500	-		-	0.15	69	0.37	79.86	149.25			-	51	27	-		-	0.07	-	0.21	-	-	550.75	149.25	677		71	
72			-	82	506	-		-	0.15	68	0.37	80.80	148.84			-	51	27	-		-	0.07	-	0.21	-	-	557.43	148.84	683		72	
73			-	83	513	-		-	0.15	67	0.37	81.53	148.32			-	52	28	-		-	0.07	-	0.21	-	-	564.11	148.32	689		73	

revised 2/23/18

246

Conifer

Years	Starting Inventory (MBF/Acre)	Starting Inventory (CO2-e Tonnes/ Acre)	Harvest (MBF/Acre)	Annual Inventory Estimate (MBF/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (%)	CO2-e in in-use harvested wood products (Metric Tonnes/ Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2-e in Landfills (Metric Tonnes/ Acre)	Combined CO2-e in Landfills and in-use (Metric
74			-	84	519	-		-	0.15	65	0.38	83.40	148.74
75			15	70	432	93		55	0.15	101	0.38	85.17	186.50
76			-	71	438	-		-	0.14	98	0.38	86.89	185.07
77			-	72	445	-		-	0.14	95	0.38	88.55	183.76
78			-	73	451	-		-	0.14	93	0.38	90.04	182.55
79			-	74	457	-		-	0.14	90	0.38	92.31	182.29
80			-	75	463	-		-	0.14	88	0.38	93.52	181.13
81			-	76	469	-		-	0.14	85	0.38	94.80	180.27
82			-	77	476	-		-	0.13	84	0.38	95.90	179.41
83			-	78	482	-		-	0.13	82	0.38	97.01	178.54
84			-	79	488	-		-	0.13	80	0.39	99.50	179.17
85			-	80	494	-		-	0.13	78	0.39	100.49	178.42
86			-	81	500	-		-	0.13	77	0.39	101.38	177.89
87			-	82	506	-		-	0.13	75	0.39	102.32	177.41
88			-	83	513	-		-	0.13	74	0.39	103.15	176.83
89			-	84	519	-		-	0.13	72	0.40	105.25	177.51
90			15	70	432	93		55	0.12	108	0.40	107.02	215.20
91			-	71	438	-		-	0.12	105	0.40	108.73	213.70
92			-	72	445	-		-	0.12	102	0.40	110.39	212.30
93			-	73	451	-		-	0.12	99	0.40	111.89	211.03
94			-	74	457	-		-	0.12	97	0.40	114.43	210.96
95			-	75	463	-		-	0.12	94	0.40	115.65	209.73
96			-	76	469	-		-	0.12	92	0.40	116.92	208.81
97			-	77	476	-		-	0.12	90	0.40	118.03	207.89
98			-	78	482	-		-	0.11	88	0.40	119.13	206.97
99			-	79	488	-		-	0.11	86	0.41	121.90	207.82
100			-	80	494	-		-	0.11	84	0.41	122.89	207.02

Hardwood

Years	Starting Inventory (BA/Acre)	Starting Inventory CO2-e (Metric Tonnes/ Acre)	Harvest (BA/Acre)	Annual Inventory (BA/acre)	Estimated CO2 equivalent in Inventory (Metric Tonnes/	Estimated CO2 equivalent harvested in total tree	Portion of Harvest Delivered to Mill (%)	Amount CO2 equivalent transferred to the mill (bole portion	In Use Decay Curve of Wood Products (Conifer) (Metric Tonnes/	CO2-e in in-use harvested wood products (Metric Tonnes/ Acre)	Fraction of CO2 equivalent remaining in landfills (%)	CO2-e in Landfills (Metric Tonnes/ Acre)	Combined CO2-e in Landfills and in-use (Metric
74			-	52	28	-		-	0.07	-	0.21	-	-
75			-	53	28	-		-	0.07	-	0.21	-	-
76			-	53	28	-		-	0.07	-	0.21	-	-
77			-	54	29	-		-	0.07	-	0.21	-	-
78			-	54	29	-		-	0.07	-	0.21	-	-
79			-	55	29	-		-	0.07	-	0.21	-	-
80			-	55	30	-		-	0.06	-	0.21	-	-
81			-	56	30	-		-	0.06	-	0.21	-	-
82			-	56	30	-		-	0.06	-	0.21	-	-
83			-	57	30	-		-	0.06	-	0.21	-	-
84			-	57	31	-		-	0.06	-	0.21	-	-
85			-	58	31	-		-	0.06	-	0.22	-	-
86			-	58	31	-		-	0.06	-	0.22	-	-
87			-	59	31	-		-	0.06	-	0.22	-	-
88			-	59	32	-		-	0.06	-	0.22	-	-
89			-	60	32	-		-	0.06	-	0.22	-	-
90			-	60	32	-		-	0.05	-	0.22	-	-
91			-	61	32	-		-	0.05	-	0.22	-	-
92			-	61	33	-		-	0.05	-	0.22	-	-
93			-	62	33	-		-	0.05	-	0.22	-	-
94			-	62	33	-		-	0.05	-	0.22	-	-
95			-	63	34	-		-	0.05	-	0.22	-	-
96			-	63	34	-		-	0.05	-	0.22	-	-
97			-	64	34	-		-	0.05	-	0.22	-	-
98			-	64	34	-		-	0.05	-	0.22	-	-
99			-	65	35	-		-	0.05	-	0.22	-	-
100			-	65	35	-		-	0.05	-	0.22	-	-

Total

Years	CO2-e in Standing Inventories (Metric Tonnes/ Acre)	CO2-e in Harvested Wood Products (Metric Tonnes/ Acre)	CO2-e in Inventories and in Harvested Wood Products (Metric	Initial CO2-e in Forest	Years in Which Project Sequestration Exceed Initial CO2-e	Number of Years for Growth and Harvested Wood Products
74	570.78	148.74	695		74	
75	484.82	186.50	647		75	
76	491.49	185.07	652		76	
77	498.17	183.76	657		77	
78	504.85	182.55	662		78	
79	511.52	182.29	669		79	
80	518.20	181.13	674		80	
81	524.87	180.27	679		81	
82	531.55	179.41	685		82	
83	538.23	178.54	691		83	
84	544.90	179.17	698		84	
85	551.58	178.42	703		85	
86	558.25	177.89	709		86	
87	564.93	177.41	715		87	
88	571.61	176.83	721		88	
89	578.28	177.51	728		89	
90	492.32	215.20	680		90	
91	498.99	213.70	685		91	
92	505.67	212.30	690		92	
93	512.35	211.03	695		93	
94	519.02	210.96	701		94	
95	525.70	209.73	706		95	
96	532.37	208.81	712		96	
97	539.05	207.89	718		97	
98	545.73	206.97	723		98	
99	552.40	207.82	730		99	
100	559.08	207.02	736		100	
	-	-				

revised 2/23/18

247

RECEIVED
MAR - 8 2018
COAST AREA OFFICE
RESOURCE MANAGEMENT

PART OF PLAN

Sources Of Information:

The following sources of information or persons were consulted for preparation of the Cumulative Impact Assessment.

A. **Watershed Resources:**

Thalweg profile analysis, Gualala river watershed assessment & cooperative monitoring program (O'Connor and Rosser 2006)

GRWC Monitoring Plan Report 2000-2005, Kathleen Morgan , 2006

Gualala River Watershed Technical Support Document by North Coast Regional Water Quality Control Board, 2001

Gualala River Watershed Assessment Report. North Coast Watershed Assessment Program, Klamt, Robert R.C. LeDoux-Bloom, J. Clements, M. Fuller, D. Morse, and M. Scruggs (multidisciplinary team leads). 2002. Appendices. California Resources Agency, and California Environmental Protection Agency, Sacramento, California.

A Study Evaluating the Effectiveness of Riparian Buffers in Minimizing Impacts of Clearcut Timber Harvest Operations on Shade-Producing Canopy Cover, Microclimate, and Water Temperature along a Headwater Stream in Northern California, Cajun Elaine James 2003

Regional Assessment of Stream Temperatures Across Northern California and their Relationship to Various Landscape-Level and Site Specific Attributes, Lewis et al. 2000, Forest Science Project, HSUF Arcata, CA

Dawson, T. E. 1996. The use of fog precipitation by plants in coastal redwood forests. Pages 90-93 in J. LeBlanc, editor. Proceedings of the conference on coast redwood forest ecology and management. University of California, Cooperative Extension, Forestry.

Lewis, J., S. Mori, E. Keppeler, and R. Ziemer. 2001. Impacts of logging on storm peak flows, flow volumes and suspended sediment loads in Caspar Creek, California. Pages 85-125 in: M. S. Wigmosta and Steven J. Burges editors. Land Use and Watersheds: Human Influence on Hydrology and Geomorphology in Urban and Forest Areas. Water Science and Application Volume 2, American Geophysical Union, Washington, D.C.

Gualala River Watershed Literature Search And Assimilation By Patrick Higgins 791 Eighth Street, Suite N, Arcata, CA 95521 707-822-9428

California Dept. Of Fish And Game, Stream Report Archives, Yountville, CA

Gualala Redwoods Inc. Stream Reports For The Years 1995 To 2013

Geo Hazard Maps Created By Tim Best, C.E.G.

revised 9/10/15

USGS 7.5 min map Stewarts Point and McGuire Ridge

Aerial Photographs- 2004 color photos and NAIP imagery

Lidar imagery of the Gualala River

Google Earth

Appeo 9/10/15

B. **Soil Productivity:**

GRI's geographic information system maps

Soil Veg Maps- Dave Devries at Mesa Technical 2630 Hilgard Berkeley, CA 94709

Soil descriptions from the Soil Conservation Service

Aerial Photographs- 2004 color photos

C. **Biological Resources:**

Sources Of Information:

U.S. Fish and Wildlife Service. 2002. Recovery Plan for the California Red-legged Frog (Rana aurora draytonii). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

California Red Legged Frog Movement and Habitat Use , Dr. Gary Fellers, Western Ecology Research Center, July 2007

CNPS web site 2013

California Natural Diversity Data Base, March 1, 2014.

Raptors of California, Hans and Pam Peeters, 2005 University of California Press

The Audubon Society Field Guide to North American Bird, John Whitaker, Alfred Knopf Inc 1992

The Audubon Society Field Guide to North American Bird, Bebler and King, Alfred Knopf Inc 1992

California Mammals, E.W. Jameson and Hans Peeters, University of California Press, Berkeley, 1988.

California's Wildlife, Vol. I - Amphibians and Reptiles, California Statewide Wildlife Habitat Relationships System, May 2, 1988.

California's Wildlife, Vol. II - Birds, California Statewide Wildlife Habitat Relationships System, November, 1990.

California's Wildlife, Vol. III - Mammals, California Statewide Wildlife Habitat Relationships System, April, 1990.

Field Guide to the Birds of North America, National Geographic Society, 1987.

Scats and Tracks of the Pacific Coast, James Halfpenny, 1999 Falcon Publish

The Jepson Manual: Higher Plants of California, James C. Hickman, editor. University of California Press, Berkeley, 1993.

FRAP Multi-source Land Cover Data v02_2 (FVEG02_2, 2002)

CA Resources Agency Ownership Data (GOVLANDS, July 2002)

NCWAP North Coast Watershed Assessment Program, March 2003

Gualala Redwoods Inc. Stream Reports For The Years 1995 To 2013

Gualala River Watershed Technical Support Document by North Coast Regional Water Quality Control Board 2001

TMDL by the EPA 2002

GRI Westside THP Fisheries Report by Dennis Halligan NRM 1434 Third St. Eureka, CA 95501

Gualala River Watershed Literature Search And Assimilation By Patrick Higgins 791 Eighth Street, Suite N, Arcata, CA 95521 707-822-9428

Pam Town, Biologist, Billings Montana

California's Wildlife Volume I, II and III, Published by CDFG, April 1990

Gualala Redwoods Database On Fish Habitat-GRI Gualala CA

GRI property wide Rare Plant Assessment by Clare Golec, updated 2001

Nest Site Selection And Breeding Status Of Ospreys In The Gualala Redwoods, HJW

Wildlife Species With Special Status That May Be Present On Gualala Redwoods Or Other HJW Managed Properties By Lawrence Kobernus 1995 Updated By Troy Leopardo 1999

CDF Guidelines For Species Surveys. RPF Mass Mailing July 1999

Northwest Weeds, Ronald Taylor, Mountain Press Publishing 1990

Pacific Coast Berry Finder , Gleen Keator, Natural Study Guild 1978

Additional Persons contacted for information on cumulative impacts analysis-

John Bennett- forester for GRT

Phil Chidlaw-ex-GIS specialist for GRI

Henry Alden- forester for GRT

Konrad Pehl- ex-forester for GRI