THE HEARST CORPORATION

Hearst Forests
P.O. Drawer 670
McCloud, California 96057
Telephone; (530) 964-2425 Fax: (530) 964-2407
Email: lbradshaw@nctv.com

March 19, 2013

Mr. Mike Bacca
Cal Fire
6105 Airport Road
Redding, California 96002

Re: 2012 MSP Report.

Dear Mike:

Attached for your use is the final 2012 Demonstration of Maximum Sustained Production Update report (dated January, 2013 revised 2/18/2013). We believe all additional information and justification requested by Cal Fire has been included in this report and reviewed and accepted by your staff. Please distribute this internally to other Cal Fire personnel as appropriate – **note: we feel certain highlighted pages are confidential "trade secret" information not made available for public review/information.**

Regards,

Lloyd T. Bradshaw
Manager, Hearst Forests & Wyntoon Timberlands

April 26, 2013 Addendum to Hearst Forests' PTEIR – 2012 Demonstration of Maximum Sustained Production Update

HEARST FORESTS

Report on

Demonstration of MAXIMUM SUSTAINED PRODUCTION 2012 Update

Report Date: January, 2013
(revised 2/18/2013)

1.0 INTRODUCTION

1.1 Background

In 1996-97, Hearst Forests (Hearst), in conjunction with VESTRA Resources, Inc. (VESTRA) developed and selected a management plan which was the basis for the timber management plan portion of Hearst's Programmatic Timber Environmental Impact Report (PTEIR). The resource monitoring plan contained in the PTEIR specifies that the Hearst timber inventory system will be maintained by remeasurement and analysis of timber inventory data five years following the 1996-97 inventory and every 10 years thereafter. The 1996-97 inventory work was summarized in the document *Hearst Forests Report on Forest Resource Inventory, July 29 1997*. Two systems of inventory plots were installed at that time: (1) temporary field plots and (2) permanent field plots. FREIGHTs was the growth-and-yield component of the planning model used in this work.

In 2001-02 – in keeping with the commitment made in the PTEIR - Hearst and VESTRA updated the vegetation/inventory information and analyzed the new data to update the Hearst Forest management plan. This update included remapping vegetation type boundaries, growing 1996-97 inventory plot data forward to estimate current tree dimensions and volumes, replacing approximately 40 percent of the temporary inventory plots, and re-running the planning model with new data and updated modeling assumptions. This work was summarized in *Hearst Forests Report on Sustained Yield Planning Process 2002 Update, November 2002*. As in 1996/97, FREIGHTs was used to model the inventory, growth and harvest over a 100-year planning horizon.

Additional planning work was conducted and a report submitted in 2005 (*Hearst Forests Report on Sustained Yield Planning Process 2005 Update*). However, Hearst Forests continued to manage its lands and timber using the harvest schedule described in the 2002 Report throughout the 2001-2011 decade, and considered that report to be the guiding document for the decade.

1.2 Summary – 2010-2012 Updates

In conformance with HEARST's PTEIR monitoring plan, Hearst's forest resource inventory was updated in 2010-2011. This update process consisted of the following steps, described in more detail in Section 2 of this document:

1) The timber type map was reviewed and updated,
2) Permanent plots were remeasured, and
3) Additional temporary plots were allocated and established.

Subsequent to updating the inventory, Hearst updated its sustained yield plan model, as described in Section 3 of this Report. Growth rates were calibrated for use in the ForSee growth-and-yield model. Using the updated timber type map, mapped harvest constraints, the 2010/2011 inventory data, and a set of silvicultural regimes developed in ForSee, the sustained yield model for Hearst lands was rerun to project stocking, growth and harvest volume levels over a 100-year planning horizon.

The selected alternative ('Alternative 22') demonstrates non-declining harvest with balanced growth and yield. Harvest levels begin at 25 MMBF/year for the first 5-year period and stays at that level for the next 50 years, increasing slightly after that. Inventory volumes increase 12% over the 100-year horizon.

2.0 FOREST RESOURCE INVENTORY UPDATE – 2010/2011

Hearst Forests' inventory design for the 2010/2011 update is the same design as was employed in 1996-97 and 2001-02. The design is a stratified inventory, with field inventory plots located in the various timber/vegetation type polygons and summarized to develop statistics for each timber type and for the property as a whole.

To accomplish this for the current update, Hearst Forest staff reviewed and updated the property-wide timber type GIS layer in 2010. In the 2010 field season, Hearst's permanent inventory plots were remeasured for the first time since they were installed in 1996. Additional temporary field plots were allocated to timber types, established and measured in 2011.

2.1 Timber Type Stratification

Hearst Forests' 2010 timber type identification and polygon delineation was conducted using 2010 orthophotography, supplemented with aerial photography and field knowledge and visits by Hearst forestry staff.

In general the minimum size of delineated polygons was 20 acres, although polygons could be significantly smaller if a clear and distinctly different vegetation type existed. There are 986 resulting timber type polygons across the property, for an average size of about 60 acres/polygon. The smallest polygons are about 1 acre in size and the largest is 8,450 acres.

The rules and specifications used to delineate timber type polygons are described in more detail in Appendix A of this document.

The 2010 Hearst timber type stratatification resulted in the timber types and associated acreages listed in Table 1.

Table 1. Strata Types and Acres

Timber Type	Acres
PPN4D	81
PPN4M	3,782
PPN4P	700
SMC4D	4,772
SMC4M	33,985
SMC4P	4,253
SMC4S	1,356
SMC5D	979
SMC5M	1,486

Timber Type	Acres
WFR4D	60
WFR4M	1,880
WFR4P	853
WFR4S	759
Size3M	198
Size3P	474
Size3S	250
Size2	498
NonTimber	4,671
	61,036

2.2 Permanent Plot Re-Measurements

The permanent plots established in 1996 consisted of 51 clusters, each consisting of nine 1/10th-acre fixed area plots. The cluster locations were not located randomly in 1996; rather, they were located to be representative of the timber types that were mapped at that time.

In 2010 Hearst staff located and remeasured the 459 permanent plots for the first time since they were established. The original and remeasured data is of significant value in providing a real-world baseline for timber growth rates on Hearst lands. Twenty-three of the 51 clusters were not harvested between plot establishment in 1996 and remeasurement in 2010.

2.3 Temporary Plot Measurements

In 2011, 876 temporary field inventory plots were allocated among the timber types and randomly located within their timber type polygons. During the 2011 field season Hearst forestry staff established and measured those plots.

Temporary plots were typically 1/10-acre fixed-area plots, although in some dense timber types they could be 1/20th-acre. In general they were measured with the same procedures as were used in 1996-97 and 2002. Some minor procedural changes were necessary to conform to the requirements of the ForSee growth-and-yield program.

Hearsts' field inventory manual is in Appendix B of this document.

2.4 2010/2011 Inventory Statistics

Table 2 displays Hearst 2010 timber types, the number of permanent, temporary and total field plots measured for each type, basal area, net volume and standard error estimates for each timber type as was calculated from the 2010-2011 inventory measurements.

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3.0 SUSTAINED YIELD PLANNING UPDATES – 2012

Section 3 of this report describes the 2012 planning (harvest scheduling) update work. To the extent possible, model components were kept constant between the earlier (1996-97 & 2002) and the 2012 work. The model components are as follows, with more detailed descriptions/discussion in sub-sections 3.1 through 3.5:

- Stratatypes are aggregations of important land conditions that exist across Hearst Forest ownership, in this case an aggregation of timber/vegetation types (as developed in the inventory work described in Section 2 of this report) and site quality. Review of the site quality GIS layer and it's contribution to the modeling work is in Section 3.1.
- Landtypes are the aggregation of Stratatypes and mappable harvest constraints (i.e., those constraints that can be represented in a GIS layer). These constraints for the 2012 Hearst work are discussed in Section 3.2.
- Silvicultural Regimes over a 100-year planning horizon are modeled using the 'batch mode' of the ForSee growth-and-yield model. As noted, modeling work in 1996-97 and 2002 used the FREIGHTs model. Section 3.3 contains descriptions of the modeled regimes in table format, and more detailed descriptions are in Appendix C.
- Access databases and CWHIZ linear programming software were used to store ForSee output, apply additional contraints and calculate optimal harvest levels given the various constraints and silvicultures. The linear programming parameters are listed in Section 3.4.

The model results and associated discussion are in Section 3.5.

3.1 Site Quality Review and Calibration

Site quality and associated growth rates are of course a critical component of long-term growth and yield projections. Because past (1996-97, 2002) projections used the FREIGHTs model and current work utilizes ForSee, it was important to review modeled growth rates and calibrate them appropriately.

This review and calibration process included three steps:

1) Ascertain the growth rates used in 1996-97 and 2002,
2) Modify them, if appropriate, based on any new information on Hearst forestland growth rates (in this case we have good data on actual stand growth from permanent plot remeasurements),
3) Calibrate the ForSee model for 2012 modeling.

In 1996-97 Hearst timberlands were divided into 4 site classes, 1 through 4, based primarily on US Soil Conservation Service and CDF soils mapping. These classes were each assigned a 50-year site index based on site tree measurements for site trees that fell on lands of each site class. An average growth rate was calculated for stands on each site class by growing those stands in FREIGHTs. This data is displayed in Table 3.

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3.2 Modeling Constraints

Hearst staff provided a GIS layer representing mappable harvest restrictions, i.e.- 'Special Management Zones', on Hearst lands. This layer is the same as was used in 2002, and includes 1,105 acres of Preserve lands on which no timber harvests will be scheduled, and 3,594 acres of WLPZ, SMC5 and SMC6 lands that are constrained to high basal area retention harvests. These restricted acres fall across Hearst's timberland and non-timberland acres as shown in Table 6 below.

Note that 'SMC5' and 'SMC6' in Table 6 do not refer to current Hearst timber or strata types; rather these refer to lands that are designated for the development of CWHR size 5 and/or size 6 stands. To accomplish this goal, only High Basal Area Retention prescriptions (regimes 221 and 281) may be applied to harvesting in these lands.

Table 6. Acres of Harvest Restrictions by Timberland/Non-Timberland Designations

	Preserve No Harvest	WLPZ/SMC5,6 Hi BA Retention	No Restrictions	Totals
Timberland	1,105	3,432	51,828	56,365
Non-Timberland	0	162	4,509	4,671
				61,036

3.3 Silvicultural Regimes

The 'Batch Mode' of ForSee allows the user to develop a set of silvicultural regimes that may be applied to any or all stratatypes. Hearst's 2012 harvest model utilizes the regimes listed in Table 7.

Table 7. Silvicultural Regime Summary

Regime Number	Silviculture	Cut Cycle/ Rotation (yrs)	Post-Harvest Basal Area Retention	
1	No Harvest	-	-	Preserve
201	Selection	10	100 ft2/acre	Site 1 lands, general
221	Selection	10	120 ft2/acre	Site 1 lands, WLPZ and SMC5/SMC6 areas
241	Selection	15	75 ft2/acre	Site 2/3/4 lands, general
261	Selection	15	88 ft2/acre	Site 2/3/4 lands, general
281	Selection	15	120 ft2/acre	Site 2/3/4 lands, WLPZ and SMC5/SMC6 areas
341	Alt Selectn	15	50 ft2/acre	Understocked lands only
401	Clearcut	80	-	Not generally used; 50 acres/period allowed for appropriate stands

Other modeling parameters applied to all of the selection regimes included a Diminution Quotient of 1.3, a maximum post-harvest tree size of 32" DBH, and a minimum allowable harvest volume of 1000 BF/acre. A 2% waste percent of volume was applied to all harvests to account for breakage and unseen defect.

As described previously, regimes 221 and 281 retain a minimum of 120 ft2/acre of basal area, and are intended to develop and maintain late seral successional stands (i.e., CWHR size 5 and 6) within the WLPZ and SMC5/SMC6 lands.

The minimum 1000 BF/acre harvest volume noted previously refers to the minimum volume that must be harvested in order for a modeled harvest to be considered viable. One MBF/acre is of course a very low level to produce a commercially viable harvest; however, Hearst selection harvest plans typically include areas of heavier and lighter stocking, and it would not be unusual for 1 MBF/acre to be harvested on lightly stocked areas within a larger harvest plan.

Appendix C describes these modeled regimes in more detail.

3.4 Sustained Yield Modeling

The output of the ForSee growth-and-yield model is stored in Access database tables. This data is then prepared via queries as input to CWHIZ linear programming software to calculate optimal timber harvest levels, given the set of constraints and possible silvicultural regimes. The linear program parameters are as follows:

Maximize cumulative discounted (4% rate) harvest over all periods,
Subject to

- *Harvest less than or equal to long-term sustained yield (LTSY),*
- *Non-declining yield (very small declines allowed),*
- *Up to 51 acres of clearcut allowed per period,*
- *High Basal Area Retention prescriptions applied to Special Management Zones exclusively,*
- *No Harvest allowed in McCloud River Preserve.*

The first two constraints above reflect the purpose of this 2012 report document – namely to demonstrate Hearst's commitment to and plan for achieving Maximum Sustained Yield of timber volume.

As suggested in the list of Hearst intended silvicultural prescriptions (Table 7), Hearst Forests is firmly committed to managing their lands via uneven-age/selection management. However as noted in the 3rd constraints above, up to 51 acres of clearcut harvest per 5-year period is included in the harvest model to allow flexibility in dealing with chronically understocked areas or small areas of fire or disease.

The harvest constraints in Special Management Zones (SMZs) and the McCloud River Preserve are consistent with goals of the property owners and also provide habitat diversity on Hearst Forest lands. While described somewhat differently in the various past reports, i.e., 'enhanced retention selection' (2002 report), 'late-successional' (2005 report) and 'high basal area retention' (the current 2012 report) – the SMZ lands have been consistently managed in this manner prior to and throughout the life of the PTEIR.

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Appendix A – Hearst Timber Type Delineation Specifications

This appendix describes the rules and specifications used by Hearst forestry staff to delineate vegetation or timber types, i.e., areas within Hearst Forest lands that are relatively homogenous with regard to tree species, size and density.

Hearst Forest timber type names consist of overstory tree species, size and crown cover descriptors. Typing rules and names generally follow the definitions of California WHR types. However, Hearst timber types are based on general photo-interpretation and field review, and may or may not correspond to similarly named CA WHR types as determined using field inventory data. For example, Hearst timber type 'PPN4D' (as delineated and named in the timber typing process) may be determined to be CA WHR type 'PPN4M' as calculated by field data from inventory plots located in the Hearst PPN4D polygons.

That said, Hearst typing rules and naming conventions are as follows:

SPECIES

Species Code	Description
PPN	50+% ponderosa pine by total crown canopy
WFR	50+% white fir and/or red fir by total crown canopy
SMC	Mixed conifer – less than 50% ponderosa pine and less than 50% white fir/red fir

SIZE

Size Code	Description
2	dominant DBH class 1-6"
3	dominant DBH class 6-11"
4	dominant DBH class 11-24"
5	dominant DBH class 24"+

CROWN CANOPY

Canopy Code	Description
S	total crown canopy 10-25%
P	total crown canopy 25-40%
M	total crown canopy 40-60%
D	total crown canopy 60+%

Example: A polygon that is assigned Hearst timber type 'SMC4M' is judged to be a mixed conifer stand (less than 50% ponderosa pine or white fir/red fir), dominated by trees 11-24" DBH with a total crown canopy in the 40-60% range.

Hearst lands that are judged incapable of supporting sustained timber management are given the timber type designation 'NonTimber'.

Appendix B – Hearst Forest Resource Inventory Field Procedure Manual

Contents:

Objectives

Install field plots designed to collect appropriate tree measurements for calculating volume and growth statistics for each merchantable vegetation type on Hearst Forest lands.

Stands that are cruised will have three or more plot clusters in which measurements will be taken. Each cluster consists of three temporary, one-tenth or one-twentieth acre, fixed radius plots oriented in a 'backwards-L' shape, plus a cover transect between the A and B plots. (See Figure 1 – Plot and Cluster Design.)

Four types of measurements will be made:

(1) Merchantable trees and snags (trees greater than or equal to 9.6" DBH),
(2) Regeneration (trees less than or equal to 9.5" DBH),
(3) Cover Transect, and
(4) Fuel Load/Downed Logs.

Plot size for merchantable tree measurements will be 1/20-acre for plots in WFR4M, RFR4M, or any '4D' WHR type. All other plots will be 1/10-acre in size.

Every merchantable tree and snag (trees greater than or equal to 9.6" DBH) within the 1/10-acre or 1/20-acre plots will be measured. Regeneration (trees less than or equal to 9.5" DBH) will be measured within 1/100-acre plots around each plot center. Cover will be measured on a transect between the "A" and "B" plots of each cluster. Fuel Load/Downed Logs will be recorded on the "B" plot of each cluster.

Establishment of Cluster/Plot Locations

Use the following cluster establishment procedure to locate plot centers:

1) Cluster locations are to be established by using bearings and distances from either a point easily identifiable on maps/orthophotography or from a previously established plot. Once a cluster location has been established, this point becomes the center of plot "B". "B" plots should be established on the ground within 100 feet of the mapped location. All ground distances are to be measured horizontally.
2) From plot "B", Plot "A" is to be accurately established at a distance of two chains directly north of plot "B".
3) From plot "B", Plot "C" is to be established at a distance of two chains directly west of plot "B".
4) The "B" plot for an adjacent cluster is located five chains from the current "B" plot in the appropriate cardinal direction. Adjust bearing and distances whenever crossing a feature easily identifiable on the map or ortho.
5) If any "B" plot is established with more than one-half of its area within an adjacent stand, re-establish that plot in its proper location as per the map or ortho. If any "A" or "C" plot is established with more than one-half of its area within an adjacent stand, that plot should be re-established. (See Figure 2 – Method of Plot Re-establishment.) Plots are not to be re-established due to rock outcrops, roads, skid trails, or other features within the stand boundary. However, when plots are established these features or the completed plot card has no trees measured, indicate the feature encountered in the plot card comment spaces.

Monumentation of Plot Centers

1) Yellow plastic flagging will be used to identify plot center locations.

2) The flagging shall be hung as nearly as possible to eye-level at the plot center, and shall be clearly visible.

3) Using a black marker with permanent ink, the following information will be written on the flagging at each plot center:
   - Stand Number
   - Cluster Number
   - Plot Letter
   - Cruise Date

Plot Information and Measurements

The following Plot Header information is recorded for each plot:

- Cluster Number and Plot Letter
- Section, Township and Range.
- Cruise date.
- Cruiser's initials.
- WHR (Stand) Type.
- Plot Type.
- Plot Size.
- Slope percent and Aspect.
- Percent brush cover, average brush height, and predominant brush species.
- Comments, if appropriate. Anything unusual or noteworthy regarding the plot location, surroundings and/or access.

The following information is recorded for each standing conifer tree within each plot that is 9.6" DBH and larger.

- Cluster Number and Plot Letter.
- Tree Number.
- Species – tree species codes are in Appendix B.
- DBH to the nearest 1/10-inch.
- Total tree height – height to the nearest foot (used only for trees with unbroken tops).
- Top height – only for broken top trees (live or dead) – height in feet to the physical top of the broken top tree.
- Top diameter – only for broken top trees (live or dead) - estimated bole diameter (to the nearest inch) at the physical top of the broken top tree.
- Height to the Crown Base.
- Defect by Log Position, to the nearest 10%.
- Condition – crown position, hard or soft snag.
- Damage – broken or forked top, visible damage from animals, insects, mechanical or other causes.

For hardwoods, record tree number, species, DBH, height measurements (total or top height & top diameter as appropriate), and snag condition. Height to crown base, defect, crown position, and damage are not recorded for hardwoods.

In addition, measure the Breast Height Age (BH Age) of at least 2, and up to 5, vigorous conifer conifer trees within each cruised stand. This measurement is intended to give an indication of site index on the stand; thus the measured trees should historically and currently be of dominant or codominant crown class, should be more or less defect free, and should be vigorous relative to the other trees in the area. In many stands it may be difficult to find trees meeting these criteria; thus it is important to look for such trees at each plot (until five have been identified and measured within a given stand).

Trees on each plot will be numbered in the following order: Tree #1 is the first tree on the plot in a clockwise direction from a line running north from the plot center. Tree #2 is the next tree clockwise from north, and so on.

In a 1/100-acre fixed area regeneration plot (11.8′ radius around the plot center), tally trees less than 9.5″ DBH by species and size class.

Between the "A" and "B" plots of each cluster, record nine point samples of cover. The nine points consist of the "A" and "B" plot centers and ¼-chain intervals along the cruise line between those points. At each point, fill out the species and size class of the highest canopy or cover layer covering that point. Use a clinometer to determine the vertical point.

In each 1/10-acre or 1/20th-acre "B" plot, record:

Tons/acre of fuel (downed woody material),

Tally of downed logs by size class and decay class.

Section B-1. Data Codes

Sp Code	Tree Species (Conifer)
DF	Douglas Fir
DP	Gray Pine
GS	Giant Sequoia
IC	Incense Cedar
JP	Jeffrey Pine
JU	Junipers (all)
KP	Knobcone Pine
LP	Lodgepole Pine
PY	Pacific Yew
PP	Ponderosa Pine
PC	Port Orford Cedar
RF	Red Fir
SP	Sugar Pine
WP	Western White Pine
WF	White Fir

	Tree Species (Hardwood)
AL	Alder
AS	Ash
BL	Bay Laurel
BO	California Black Oak
LO	Canyon Live Oak
CO	Cottonwood
DW	Dogwood
GC	Golden Chinquapin
IO	Interior Live Oak
MO	Madrone
OW	Oregon White Oak
QA	Quaking Aspen
TO	Tanoak
WL	Willow
HD	Other Hardwood

Df Code	Defect by 16.5' Log
1	Log is 10% cull
2	Log is 20% cull
3	Log is 30% cull
4	Log is 40% cull
....	
9	Log is totally cull

Sp Code	Brush Species
AG	Annual Grass
BB	Bitterbrush
BF	Bracken Fern
BW	Broadleaf Weeds (Forbs)
CQ	Chinquapin
CY	Cherry
DB	Deerbrush
DW	Dogwood
BG	Gooseberry
GM	Greenleaf Manzanita
MU	Mullein
PG	Perennial Grass
RA	Red Alder
RB	Rabbitbrush
SC	Squaw Carpet
VM	Vine Maple
WT	White Thorn
OT	Other
NM	(not measured)

Cnd Code	Condition
P	Pre-Dominant
D	Dominant
C	Codominant
I	Intermediate
S	Suppressed
H	Dead, hard snag
M	Dead, soft snag

Dam Code	Damage
IC	Insect in Crown
IB	Insect in Bole
CO	Conks
MI	Mistletoe
FI	Fire
BS	Bole Scar
BT	Broken Top
MC	Mechanical Crown Dam.
AB	Animal Bole Damage
FO	Fork

Section B-2 - Tree Measurement Procedures

DBH

Measure diameters at a point 4.5 feet above the ground level or root collar on the uphill side of the tree to the nearest 0.1 inch. In the case if irregularities in DBH such as swelling, bumps, depressions, branches, etc., measure the diameter immediately above the irregularity at the place where it ceases to affect the normal stem form.

TOTAL HEIGHT

Total height is recorded for all trees with intact tops. For broken top trees, no total height measurement is recorded.

All height measurements will be taken by clinometer or abney level. In no event should the angle from level to the point of measurement exceed 45 degrees (i.e., 100 percent or 66 topo).

TOP HEIGHT

Top height is measured for broken top trees only, both live trees and snags. Top height is the height in feet to the physical top of the tree, i.e.- the broken top.

TOP DIAMETER

Top diameter is also measured for broken top trees only. Top diameter is an estimate of the diameter of the tree at the physical (broken) top of the tree, to the nearest whole inch.

HEIGHT to CROWN BASE

Visually balance or compress the lowest live branches of conifer trees and record this height above ground in feet.

BH AGE

Breast Height Age will be recorded in years, but should not include the present years' growth. Use an increment borer at least sixteen inches long when obtaining BH Age. No hardwood species are to be bored. Cores should be re-inserted into the hole after measurements have been performed.

When a tree has a radius greater than the length of the borer, use the following procedures to estimate BH Age:

1) Bore into the tree at BH as far as possible, then extract the core and count the rings. Measure the bark thickness (BT) at BH. The bark thickness should be measure at a point where it is relatively thick, i.e.- a place which is representative of where the diameter tape will lie when pulled tight against the tree bole.
2) Divide the measured DBH in half, then subtract the BH bark thickness. This difference is the radius of the wood part of the tree. (DBH/2 - BT = R)
3) Measure the length of the core (L). Subtract this length from the radius ® of the wood. This determines how much longer the core would have to be to reach the pith. (R - L = dp)

4) Count the number of rings on the innermost inch (n), extrapolate to the calculated center, and add to the original ring count. Record the sum as BH Age. (n x dp + ring count = BH Age) Do not spend time extrapolating beyond 250 years; rather, record 250 under BH Age and move on.

To be considered eligible for BH Age measurement, a tree must have the following qualities:

1) it must be a conifer,
2) it must be located within the plot,
3) it must be in a dominant or codominant crown position, and
4) it must be more or less defect free so that it can be effectively bored.

Final selection of BH Age trees should be made on the basis of determining which of the eligible trees is the most vigorous. Relative vigor should be assessed by evaluating the crown condition, foliage complement, and bole condition of the trees present on the plot. Trees with full, healthy crowns, good diameter growth and no disease or damage should be considered more vigorous than trees lacking in these qualities.

If there is only one tree on the plot that is eligible, then that tree should be bored. If there are no eligible trees, then the BH Age measurement will be taken at a subsequent plot. In general, no more than one tre per plot should be measured. More than one tree may be measured on a plot if the trees are of different species and it is difficult to find suitable trees in the stand.

An attempt should be made to select BH Age measurement trees from all major conifer species existing within the stand.

Section B-3. Tolerance Standards

Listed below are the tolerance standards that will be used to evaluate the accuracy of field measurements.

Plot Location:	
"B" plot location	+/- 100 feet of location on map/ortho
"A" and "C" plot location	+/- 10 percent of true horizontal distance between plots
Percent slope	+/- 10 percent
Percent brush cover	+/- 10 percent
Species identification	+/- 1 percent of total trees recorded
DBH measurement	+/- .03 inch
Total tree height	+/- 5 feet
Crown height	+/- 10 feet
Defect by 16.5′ logs	+/- 20 percent by log
BH Age	+/- 10 years

Section B-4. Database Fields and Data Types

Field	DataType
CLUSTERNO	integer
PLOTLTR	text, 1
SECTION	integer
TOWNSHIP	text, 3
RANGE	text, 3
WHRTYPE	text, 5
CRUISER	text, 3
INVMO	integer
INVDAY	integer
INVYEAR	integer
PLOTTYPE	text, 2
PLOTSIZE	integer
SLOPE	integer
ASPECT	text, 2
BRUSH_COV	integer
BRUSH_HT	integer
BRUSH_SPP	text, 2
COMMENTS	text, 50

REGEN

Field	DataType
CLUSTERNO	integer
PLOTLTR	text, 1
RPLOTSIZE	integer
SPECIES	text, 2
TALLYA	integer
TALLYB	integer
TALLYC	integer

COVER

Field	DataType
CLUSTERNO	integer
PLOTLTR	text, 1
SPECIES	text, 2
SIZE	integer

TREES

Field	DataType
CLUSTERNO	integer
PLOTLTR	text, 1
SPECIES	text, 2
DBH	double
TOTHT	integer
TOPHT	integer
TOPDIA	integer
HTCB	integer
DEFECT_1	text, 1
DEFECT_2	text, 1
DEFECT_3	text, 1
DEFECT_4	text, 1
DEFECT_5	text, 1
DEFECT_6	text, 1
DEFECT_7	text, 1
DEFECT_8	text, 1
DEFECT_9	text, 1
DEFECT_10	text, 1
DEFECT_11	text, 1
DEFECT_12	text, 1
CONDITION	text, 1
DAMAGE	text, 2
BHAGE	integer

DOWND

Field	DataType
CLUSTERNO	integer
PLOTLTR	text, 1
TONS_PA	integer
SOFT_1	integer
SOFT_2	integer
SOFT_3	integer
HARD_1	integer
HARD_2	integer
HARD_3	integer

Appendix C – Harvest Prescription Modeling Specifications

This appendix describes the modeling specifications used to generate harvest regime alternatives in ForSee. These specifications are representative of the timber harvest prescriptions and standards implemented on Hearst Forest lands, and are consistent with the direction contained in the Hearst Forests PTEIR. As expected for any model, the specifications described here oversimplify the range of forest conditions and harvest prescriptions typically implemented to achieve desired forest conditions.

Selection Regimes

Selection harvests are executed based on the following rules:

- The specified cutting cycle length (10 or 15 years) for the given prescription must have elapsed, and
- Prior to harvest, there must be at least 15 ft2/acre of basal area more than the target post-harvest basal area, i.e., 115 ft2/acre for Site 1 lands and 90 or 103 ft2/acre for Site 2, 3 and 4 lands.
- The harvest must yield at least 1000 BF/acre.

Residual basal area is allocated to 4" DBH classes using a Diminution Quotient of 1.3 for trees between 8 and 32" DBH. 'Padding' of deficient diameter classes is done uniformly.

A waste percent of 2% of BF volume is applied to each harvest to account for breakage and unseen defect.

Following each harvest, appropriate regeneration is added to the stand to bring the BOF point count up to 300. The species mix of modeled regeneration is as shown in table in table C-1; it differs for site 1 lands (primarily in the NW area of the property and with a predominance of pine) vs site 2/3/4 lands (east and south areas, predominately Douglas and white fir).

Table C-1. Modeled Post-Harvest Regeneration Species Mix

	DF	WF	IC	PP	SP
Site 1 - Pine Lands	15%	20%	10%	50%	5%
Site 2,3,4 - Fir Lands	30%	35%	15%	15%	5%

[Note: "Bring the point count up to 300" as noted in the paragraph above means exactly that. For example if a post-harvest stand consists of 30 trees over 12" DBH (6 points per tree) and 20 trees between 4" and 12" (3 pts per tree) then the stand has ((6 * 30) + (3 * 20)) = 240 points. In this case the model will add 60 in-growth trees (worth 1 pt each) to bring the total point count up to 300.]

High Basal Area Retention Selection Regimes

High Basal Area Retention Selection harvests (regime numbers 221 and 281) rules are similar to general selection with some adjustments for the higher retention levels. Rules are:

- The specified cutting cycle length (10 or 15 years) for the given prescription must have elapsed, and
- Prior to harvest, there must be at least 15 ft2/acre of basal area more than the target post-harvest basal area, i.e., 135 ft2/acre.
- The harvest must yield at least 1000 BF/acre.

Residual basal area is allocated to 4" DBH classes using a Diminution Quotient of 1.3 for trees between 8 and 32" DBH. 'Padding' of deficient diameter classes is done uniformly.

A waste percent of 2% of BF volume is applied to each harvest.

Following each harvest, appropriate regeneration is added to the stand to bring the BOF point count up to 300. The species mix of modeled regeneration is as shown in table in table C-2; it differs for site 1 lands (primarily in the NW area of the property and with a predominance of pine) vs site 2/3/4 lands (east and south areas, predominately Douglas and white fir).

Table C-2. Modeled Post-Harvest Regeneration Species Mix

	DF	WF	IC	PP	SP
Site 1 - Pine Lands	15%	20%	10%	50%	5%
Site 2,3,4 - Fir Lands	30%	35%	15%	15%	5%

Alternative Prescription Selection Regimes

As noted previously, the alternative prescription selection regime (regime number 341) is applied only to understocked lands, with the objective of removing slow-growing trees and setting the stand on a path towards enhanced growth and stocking at levels consistent with the majority of Hearst lands. The initial harvest cuts to 50 ft2/acre, with subsequent harvests ramping up to retention levels of 58, 67, and 75 ft2/acre. Rules are:

- The specified cutting cycle length (15 years) must have elapsed,
- Prior to the initial harvest, there must be between 65 and 90 ft2/acres of basal area. Prior to subsequent harvests there must be at least 15 ft2/acre of basal area more than the target post-harvest basal area, i.e., 73, 82, and 90 ft2/acre.
- The harvest must yield at least 1000 BF/acre.

Residual basal area is allocated to 4" DBH classes using a Diminution Quotient of 1.3 for trees between 8 and 32" DBH. 'Padding' of deficient diameter classes is done uniformly.

A waste percent of 2% of BF volume is applied to each harvest.

Following each harvest, appropriate regeneration is added to the stand to bring the BOF point count up to 300. The species mix of modeled regeneration is as shown in table C-3 for all lands:

Table C-3. Modeled Post-Harvest Regeneration Species Mix

	DF	WF	IC	PP	SP
All lands for Alt Prescription	30%	35%	15%	15%	5%

Even-Aged Regimes

As noted previously regime number 401 is a clearcut, intended to be applied to the rare lands for which this is the most appropriate silvicultural option. The model limits even-aged regime harvests to 50 acres each 5-year period.

To apply this prescription there must be at least 8000 BF/acre present prior to harvest. After harvest, 300 trees/acre are 'planted' to the species mix shown in table C-4.

Table C-4. Modeled Post-Harvest Regeneration Species Mix

	DF	WF	IC	PP	SP
All lands for Clearcut Prescrp.	20%	10%	5%	60%	5%

A modeled pre-commercial thin takes place when the regenerated stand is 10 years old, cutting down to 175 trees/acre. When the stand is 50 years old, a commercial thin removes one-third of the basal area.

Appendix D – Additional Information

In November 2012 CalFire staff submitted a list of questions regarding this Demonstration of Maximum Sustained Yield document and the modeling work that supported it. Responses to those questions were largely incorporated in the text of this January 2013 version of the Report. However, some requested information did not fit neatly into the topics and discussion in the Report; the requested information is thus included here in Appendix D.

[Question #8 from the review questions dated 11-8-2012]
Provide a table that displays the number of acres by corresponding period in which the respective acres were simulated for harvest for the very first time.

[Response]

Period	1	2	3	4	5	6	7	8	9	10	11	12
Acres	14,441	14,773	9,779	493	4,079	3,128	2,249	4,360	475	490	254	63

[Question #9 from the review questions]
Provide periodic periodic silvicultural-regime-by-acre projections.

[Response]

Acres Harvested by Period & Regime

	Regime >>>>							
Period	201	221	241	261	281	341	401	Totals
1	2,140	46	12,114		91		51	14,442
2	5,271	20	9,009		423		51	14,774
3	2,140	46	7,327		2,339	62	51	11,965
4	5,352	20	12,114		91	361	51	17,989
5	3,484	2,535	9,177		448		51	15,695
6	5,831	109	7,327	1,655	3,244	62	51	18,279
7	3,651	2,535	12,612	1,185	110	688	51	20,832
8	5,831	109	9,177	1,708	3,100			19,925
9	3,727	2,535	7,640	1,690	3,244	62	51	18,949
10	5,831	599	12,613	1,185	110	688		21,026
11	3,727	2,535	9,177	1,708	3,100	254		20,501
12	5,835	658	7,640	1,690	3,244	62		19,129
13	3,727	2,535	12,613	1,185	110	688		20,858
14	5,835	658	9,177	1,708	3,100	254		20,732
15	3,727	2,535	7,640	1,690	3,244	62		18,898
16	5,835	658	12,714	1,549	280	688		21,724
17	3,727	2,535	9,177	1,708	3,100	254	51	20,552
18	5,835	658	7,640	1,690	3,244	62	51	19,180
19	3,727	2,535	12,714	1,549	280	688	51	21,544
20	5,835	658	9,177	1,708	3,100	254	51	20,783

[Question #17 from the review questions]
Provide average tree height computations by species and 2-inch diameter class, which reflects the average baseline inventory and at year 100.

Average Tree Heights by Species and 2" DBH Class
All Measured Trees, Baseline Inventory
(height measurements not taken for trees < 9.6")

DBHClass	DF	IC	PP	SP	WF	BO
4						
6						
8						
10	56	40	51	53	53	52
12	64	45	57	57	61	56
14	73	51	65	67	69	57
16	79	56	76	76	76	59
18	85	61	85	78	86	63
20	91	70	93	92	92	60
22	97	72	102	91	99	72
24	103	77	110	94	104	66
26	107	79	113	106	110	62
28	116	85	121	112	112	
30	113	88	125	119	117	87
32	116	96	135	121	119	
34	120	94	140	137	128	

Average Tree Heights by Species and 2" DBH Class
SMC4M, Site 2, Rx 241 at 100 years

DBHclass	DF	IC	PP	SP	WF	BO
2	13	11	13	15	12	10
4	25	25	43	37	30	
6	44	41	64	44	38	20
8	61	38	69	54	45	20
10	71	53	61	64	63	23
12	82	56	65	87	67	35
14	81	60	81	75	63	48
16	86	63	81	72	80	48
18	89	66	85	93	83	58
20	95	65	77	77	91	60
22	95	66	78	101	96	60
24	102	86	102	94	96	71
26	102	89	103	90	97	82
28	108	90	112	120	94	86
30	118	102	121	120	118	105
32	127	106	131	121	119	111
34	129	110	130		126	116