Final Economic Assessment and Logging Systems Report
For Moonlight Wheeler Recovery Project

Submission of this report by Elaine Vercruysse, December 15, 2008

Moonlight Wheeler Recovery Project is contained within the burned area of the Moonlight Fire and the Antelope-Wheeler Fire. The project is on the Mt. Hough Ranger District, Plumas National Forest. The legal description is T. 26 N. R. 11 E. Sections 5; T. 27 N., R.10 E., Sections 1, 2, 11-14, 22-25; T. 27 N. R. 11 E. Sections 2-11, 13-15, 17-19, 22-36; T. 27 N., R.12 E., Sections 4, 5, 8, 9, 16-22, 29-32; T. 28 N. R. 10 E. Sections 24, 25, 26, 34, and 35; T. 28 N. R. 11 E. Sections 13, 14, 17, 18, 19, 29-34; T. 28 N. R. 12 E. Sections 18, 19, 20, 21, 28-34. The legal description for the Wheeler fire is T. 26 N. R. 12 E. Sections 2, 3, 10, 11, 14, 15, 16, 21, 22, 23, and 26, 27; T. 27 N., R.12 E., Sections 26, 27, 34, and 35.

Moonlight Units

This Economic Assessment is based on stand exam information retrieved from the harvest units. The average volume per acre for ground based activities is 11.2 mbf and for skyline and helicopter it is 13.8 mbf with a stand composition predominantly of white fir and Ponderosa pine. A deterioration rate factor of 40% was used since the timber is dead. The diameter size ranges from 16 inches to 56 inches with an average DBH of 24 inches. Twenty two percent of the volume on tractor is within 16 to 24" DBH and the skyline volume is 35% in this DBH range. Helipace Version 3.0.1.2 and Log Cost 9.0 were used to calculate the logging costs. Biomass can be removed ranging in DBH depending on the deterioration of the merchantable material. Biomass estimates are based on less than 10" DBH however, the DBH can go up depending on merchantability of the timber. Volume per acre significantly changes as time lapses.

Wheeler Units

The average volume per acre is 9 mbf for ground based and helicopter activities. The stand composition is predominantly ponderosa pine and Douglas fir. A deterioration rate of 40% was used since the timber is dead. The diameter minimum size is 16 inches. Volume per acre significantly changes as time lapses.

Table 1. Initial Acres of Treatment (Before Reconnaisance)

Roadside	Tractor with Biomass Removal	Tractor with Biomass Removal slopes at 25%	Skyline	Downhill Cable Yarding	Helicopter	Total Treated Area	
Acres accounted in Tractor	6339	2197	872	51	5347.41	15771	Alternative A
Under Tractor	6339	2197				7842	Alternative C

Design Criteria Summary

Ground-based logging systems

- Ground-based equipment would be restricted to slopes less than 35 percent except on decomposed granitic soils where equipment would be restricted to slopes less than 25 percent.
- In general, ground based logging would remove trees under 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. Residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
- Large tracked skidders with grapples necessary for removal of trees greater than 24" DBH.
- Some extended end-lining required using 7/8 inch cable to handle weight of logs. Logs weighing more than 21 kips will have to be bucked or ripped.
- Feller-buncher may also be used to remove trees less than 24" DBH.

Skyline logging systems

- Harvest and remove trees greater than 16 inches dbh, up to 872 acres, as sawlog product.
- Limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
- Skyline yarding would require one end suspension with full suspension over streamcourses. Corridors will require multispan skyline configuration.
- Mobile yarder required to handle payload of 10 kips. Tower height up to 52 ft. with two to three drums.
- Tailhold trees at end of corridor will need rigging set a 40'ft. if not available then extend cable to gain lift with topography.

Roadside Hazard Removal

- Ground-based equipment would operate from National Forest System or non-system roads.
- No off road operations of equipment on slopes, road cutbanks, or road fill slopes greater than 25 percent.

- Areas with steeper slope equipment will remain on the road and trees would be removed either by extended end-lining, rigging with block and tackle or with a small yarder. Approximately 1200 acres cross slopes greater than 25%.

- In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. Residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
- Existing landings can be used as well as existing skid trails. No new landings or skid trail for roadside hazard tree removal.
- Extended end-lining will require 7/8 SWL cable to handle greater than 24" dbh trees.
- Extended end-lining will go out a distance 40 ft. uphill and downhill 140 ft.

Timber Operations

1. Ground-based treatments

There are two types of ground-based treatments. The first are units which equipment may only operate on slopes up to 25% due to the soil type. These

areas were evaluated using mechanical equipment, feller/bunchers. The cost is estimated to be at $75/mbf stump to truck. The average yarding distance is 800 feet. One crew to log the acres is estimated to take 1 seasons. Daily production rate is estimated to be 29mbf. Analysis does not include cost to remove biomass.

The second ground-based treatment can operate up to 35% slope. This was assumed to be accomplished with a large skidder. The average cost is estimated to be $133/mbf stump to truck. The average yarding distance is 800 feet. One crew operating will take 2 seasons to complete the harvesting. Daily production rate is estimated to be 114 mbf. Analysis does not include cost to remove biomass.

In order to yard material to the landing due to the wide range of class size both mechanical equipment and skidders will be used.

2. Helicopter treatments

a. Wheeler Units

A medium capacity helicopter with a 8,000 lb. lift capacity was used for the logging feasibility of this project. The average yarding distance is 1524 feet with the longest yarding distance at 4000 ft. The longest distance to the service landing is 4600 feet. Analysis assumed 56 to 70 logs per acre 16 foot lengths with gross weight at 13 lbs./bf. It is understood that during operations a 32 foot length log will be used. The landing and field crew will be 6 to 9 people and 1 to 2 loaders with operators.

There will be 6 landings available with two as new construction. Two additional sites can be used for cold decking when landings become too full with logs in order to keep production rates at there highest levels. This analysis does not factor these two sites into the equation. There is one service landing location and the longest distance to the service landing is 2.5 miles with the average distance to a unit at 3000 feet. Move in and move out including ground and aircraft is $40/ mbf.

Project is estimated to take 88 work days to complete with a net daily production rate at 172 mbf and the cost for stump to truck to be $240/mbf.

b. Moonlight Units

A large capacity helicopter with a 20,000 lbs. lift capability was used for the logging feasibility for this project. It is estimated that the average production rates will range from 162.3 mbf to 311.6 mbf. The average yarding distance is 3000 feet with the longest yarding distance at 5500 ft. There are 12 landings and 3 service landings planned with a log landing size of 2 acres. 10 of the landings will require new construction. One landing will require reconstruction and 4 landings are constructed from previous helicopter projects. The range in elevation for the units is 3800 ft. to 6600 ft. Move in and move out including ground and aircraft is $13/mbf. The project is estimated to take one season of eight months to complete this project with the average daily production rate of 100 mbf and stump to truck cost at $270/mbf.

3. Skyline Yarding Treatments

a. Wheeler Units

Skyline yarding was not considered because the corridors in order to have the deflection necessary to yard with one end log suspension would require long reaches in much of the project area. In order to have the deflection the cable would be rigged into the tailhold tree between 20 ft. to 40 ft. up into the tree. The project is located in high fire severity burned areas. The tailhold tree would be more than likely a dead tree. There would be very few live trees to use as a tailhold. OSHA requirement is that the tailhold tree containing rigging must be free of defect and structurally capable of withstanding the forces that will be placed on it. Artificial tailhold in many of the corridors would not work because there would be lift necessary for the deflection. The eastern edge of the project would have corridors on an average over 2100 ft. continuous downhill with no terrain lift for another 1000 ft. Corridor downhill length would range from 1600 ft. to 3300 ft.

I spoke to Tom Mahon a cable logger operator who is actively logging in Idaho and he predominantly cable logs. He recommended avoiding the use of dead tailhold trees.

I spoke to the Redding, CA OSHA inspector and he did not state you could not use a dead tree but that you must insure that it can withstand the forces placed on it. He stated that most of the time a dead tree will not be pulled over but buckles from the force of the load. He said that if we were to cable log that he could come out and help in the selection of a dead tail tree.

In order to move swiftly with project development, protect the soils, maintain watershed health, helicopter logging became the attractive option.

Moonlight Units

Preliminary analysis from the paper plan indicates three different types of yarders will be required to yard material to the landing. The net payloads were determined by using a standing skyline operation given this is the most restrictive to payload with Logger PC, however the harvest method to be used is live skyline or running skyline. A 8000 lb. or greater payload was used to determine whether the skyline system would succeed and if it failed to meet the payload then a multispan system analysis was used. The size trees to be removed range from 16" DBH to 56" DBH, with the greatest number of trees in the class size at 24" DBH. The analysis of the skyline corridors indicated a need for a 52 foot tower with four drums, a 54 foot tower with three drums, and a 80 foot tower. Skyline diameter for analysis was 1.125 EIPS, mainline .875 EIPS, using an Eaglet motorized carriage with multispan capability. Intermediate supports will be necessary for most of the skyline units and 40 foot lift into the tailhold tree. The yarding of material will require one end suspension with a 1 foot clearance at the uphill side of the log. If one end suspension is not possible then intermediate supports shall be added to the corridor to provide the lift necessary to yard material to the landing with one end suspension. The yarder set up will be

predominantly one corridor per setup with 150 foot spacing to the next corridor. The skyline corridor shall be able to lateral yard 75 feet on either side of the corridor, hence the 150 foot spacing. There are some units with setups with two corridors. Fan configuration opportunities are fewer than the two corridors for one setup. Fan configuration can work given the stand is completely dead and there are no concerns about protection of the residual stand. The criteria for tailhold are live trees that are green with preference for Douglas Fir then Ponderosa Pine 30" DBH or greater with no serious defects, and if unavailable utilize dead Douglas Fir or Ponderosa Pine 36" or greater with no serious defects. The tree size was a recommendation from Pete Hochrein former Forest Engineer given OSHA standard that the tailtree that is used as a lift tree with a 40 ft. height is able to withstand the forces placed on it.

My recommendation is drop skyline in Pierce, Wilcox and Taylor projects and change to helicopter system. The field unit review by resource crew members indicate that most of the units do not have a 36" DBH dead tailhold tree or anything green. Secondly, majority of the units in the three projects do not have elevation gains to assist in deflection needed to improve payloads. The corridors are typically 1200 to 1500 ft. in length on a long continuous slope with minimal to no opportunity to use the topography to gain elevation. This means the corridors will need intermediate supports and 40 foot lift in tail tree in order to obtain a payload and or one end suspension of the log. Additionally, field review by crew members indicate when the criteria met tailholds were available, these trees were going to be removed by the roadside project. Field review was conducted by three individuals from the Feather River Ranger District and some information obtained from resource crew from the Beckwourth Ranger District.

Field Profiles

The field profiles indicate that a yarder can productively yard material with one end log suspension, if a 60 ft yarder, lift trees and some intermediate supports are utilized. Artificial anchors maybe necessary and if a sound tail tree that can have a 20 to 40ft. lift is not available then a larger yarder maybe necessary to yard the material to the landing.

Table 2. Skyline Units

Skyline Units	Average Yarding Distance	Intermediate Support	Lift Tree
15	1500	yes	yes
19	1500	yes	Yes
23	2000	yes	yes
32	1500	yes	yes
32a	900	no	Yes
32b	1000	no	yes
32f	1000	no	yes
32g	1320	no	yes
32sb	1584	yes	no

32sc	300	no	no
104	1600	yes	yes
105	1400	no	yes
113a	1200	no	yes
113d	1100	no	yes
116	1500	yes	yes

Due to safety, the costly temporary road construction, no available roads, due to impacts to resources (such as full bench construction), or engineering designed roads necessary for access or low scattered volume, or numerous settings to obtain volume, no deflection or lack of tailhold to gain lift or a combination of each of these factors the following units have been changed to helicopter.

The following are the list of units which changed from the proposed action:
Pierce Units
73 heavy road construction costs for value.
68 Low volume, and green trees.
118a Scattered low volume
66 Low volume
Taylor Units
54b
56 Green trees not high fire severity
57 Small units with low volume
58 Small units with low volumes
62 No tailholds for 40 ft. lift
100 No tailholds for 40 ft. lift
91c No tailholds for 40 ft. lift
64 Very rocky site for landing and tower setup. Costly road construction full bench. No existing roads, new construction damaging resources and costly construction, rock outcrops obstructing yarding.
65 heavy road construction costs for value.
Wilcox Units
53a
48 Roadside project will remove volume drop from project
101b
45 Small isolated units
46 Small isolated units
Lights Units
103 Engineered system road required
41a Construction of system road necessary
44 Road haul cost very high plus 1.3 mile of temporary road construction necessary.
1c No tailhold or intermediate supports available, partial tractor
41c Split into tractor 25% slope on west side of creek and helicopter on east side of creek.
12 Roadside project will remove potential tailholds
63 No volume 105 snag patch location drop

Table 3. Project Area Logging Systems

Unit Number	Tractor	Tractor with Biomass Removal	Tractor 25% w/ Biomass Removal	Tractor 25% w/ Site prep	Skyline	Helicopter
1a						192.7
1c						64.3
100		28.5				
102				10.6		
104					27.9	
105					27	
106						23.1
107						62
108						75
109						294.3
11a		22.9				
11b		7.7				
111		8				
113a					18.2	
113d					16	
113e		66.7				
116					47.8	
118a						41.1
119						72.8
12a						50.6
120						321.3
121a						148.9
121b						3.5
12b						6.9
122			7.3			
129						59.5
13		51.0				
130						331
132			19.3			
132b				5.4		
14c						10.7
14d						17.2
14e						16.3
14f		9.6				
15					75.5	
16		97.7				
16a	68.4					
18						131.4
19					41.8	
2a						7.7
20			11.1			
21						19.6
22		44.2				
23					329.7	
23a						29.5
23b					14.2	
24		36.8				
26		77.9				
26a		154.5				

26b		23.4				
26c		174.1				
26f		42.4				
26ia			9			
26ib			9.3			
26ic			31.7			
26id			8.9			
26ie			9.2			
26if			20.2			
26o						63.9
26q			60.9			
28b		13				
28ba		19.3				
28bb		3.9				
28bc		14				
28ea			18.3			
28eb			20.2			
28i			7.4			
29						560.6
31		13.2				
32					16.4	
32a					47	
32b					17.3	
32f					55.9	
32g					37.6	
32sb					129.5	
32sc					6.9	
34			18.6			
36			3.9			
38a			19.7			
38c						102.4
3a		18.1				
3b		170.8				
3c						200.5
40c						565
41						341
41c			10			
43						459.5
4a						339.3
4c				7.4		
4e						21.8
4f						18.6
4h						10.3
4n						38.1
51			18.2			
54			22.9			
54b						9
55b			4.6			
56						**20.4**
57						13
58						11.7
59			33.6			
5a				39.3		
5b						84.3
5c						117.1
5g		107.8				

5d						56.1
5e						40.6
60a		46				
60b		6.8				
61a			17.2			
61b		30.4				
61c		4.3				
62						41.6
68						7.0
69		15.9				
6a						349.7
6b				85.2		
7a						160.5
71						14.6
72		117.3				
72b		6.2				
72d		2.9				
72e		3				
77			30.2			
78			23.6			
79a			34.6			
79b			2.1			
8			29.3			
80			78.2			
81			70.4			
82		4.4				
82a		75.7				
83		20.5				
84a		41				
86		13.8				
86d		6.1				
87		56.6				
87a			65.3			
87b			46.7			
87c			4.5			
87d			6.8			
8b			87.4			
88			22.4			
89						27
90			213.2			
91a						21.8
91b			66.8			
91c						21.3
91e		21.8				
91f		3.2				
92b			32.4			
93			37.3			
93b			48			
94		36.3				
97		213.5				
98		97.4				
99a		42.7				
99b		3				
99c		9.3				
Total	68.4	2557.4	1462.3	140.5	949.9	4874.2

Table was created with acres from partial data from layout on 8/20/08. Total acres planned for treatment are 10,744 acres.

Table 4. Temporary Road Construction Needs

Lights

Road_name	existing	new
TR11a		0.1
TR26q		0.2
TR32f		0.5
TR32g		0.4
TR32sb		0.1
TR34		0.2
TR5g		0.3
TR60a	0.2	
TR82	0.1	
Total	0.4	1.7

Cairn

Road_name	existing	new	pvt
T26f	1.0		
TR113d		1.0	
TR113e		0.3	
TR13		0.4	
TR16b		0.2	
TR23		1.5	
TR26	0.5	0.5	
TR26a	0.6	0.3	
TRpvt			0.3*
Total	2.1	4.2	0.3

Pierce

Road_name	existing	new
TR97b	0.5	
TR69		0.5
TR72		0.5
TR77		0.2
TR79		0.2
TR8		0.4
TR87	0.5	
TR87D		0.1
TR92b		0.2
TR94c		0.1
TR97a	0.4	
Total	1.4	2.3

Taylor

Road_name	new
TR102	0.3
TR98	0.3

TR98B	0.1
Total	0.7

Wheeler

Road_name	existing	new
TR5c1	0.4	
TR3	0.2	
TR3b		0.2
TR4c	0.2	
TR5c		0.4
Total	0.8	0.7

Wilcox

Road_name	new
TR76a	0.4
TR76a2	0.4
TR76a3	0.5
TR76c	0.4
TR76c1	1.1
TR90	0.3
TR90E1	0.2
Total	3.3

*Road on private will not occur due to no right away agreement.

New Temporary Roads for the project area is 12.9 miles. See Map Attachment 1.

Cost and Production

Mechanical harvesting will cost approximately $155.70/ mbf this includes temporary road construction cost, obliteration costs and some mitigation cost which impact productivity.
Tractor harvesting will cost approximately $171.57/mbf this includes same types of expenses as mechanical.
Skyline harvesting will cost approximately $207/mbf this includes other expenses.
Helicopter harvesting will cost approximately $356/mbf. Expenses to logging can be seen on Attachment 2. Attachment 3. is a market analysis. The market analysis indicates that the ground base and cable will offset the expense of the helicopter.

These log cost are figured given the following production rates:

Mechanical = 49.62 mbf/day
Tractor = 43 mbf/day
Skyline = 28 mbf/day
Helicopter = 330 mbf/day

Anticipating logging will end within two years from start.

Landings

Three types of helicopter landings have been planned for use; service landing, log landings and cold deck locations. 25 helicopter landings have been identified, 2 cold deck locations and 3 service landings. Sixteen of these landings will be new construction.

Ground based logging will require .5 acre landings to accommodate the biomass. An estimate of fifty three landings will be used, existing landings will be utilized when available. Skyline units will have very small landings utilizing the road itself every 150 ft. There are two fan configurations planned each requiring a landing. See Map Attachment 1.

Roadside Hazard

Design Criteria

The project area was analyzed for the maximum potential area of impacts for 124 miles of roads or 4389 acres. However the project width varies depending on the height of the hazard tree and whether the hazard tree will fall onto the roadway. The assumption is that most of the hazard tree heights will be less than 150 ft.

This project is planned as four hazard tree removal timber sale projects.
Road packaging is based on grouping the roads into a package for ease of layout, maintaining contiguous and connective road systems and for the administration of the project.

Road maintenance of hazard trees will occur by moving logs to the side of the road by means of a tractor. Equipment can operate on slopes of 35% when soil types allow as determined by the soils scientist. Equipment will remain on the road when granitic soils are present, for slopes greater than 25%. Slopes greater than 35% mechanical equipment will not be allowed to operate off the road regardless of soil type. Equipment will not operate on any cutbank or fill slope of the road prism when greater than 25% slope. The logging operations will require that the operator end-line logs, rig withblocks, use of a winch or any other means as long as one end suspension is maintained. Logs will be brought to the side of the road where a loader will load them onto the truck. No skidding logs down the road. The road will be temporarily closed for stretches and one lane will be open as the material is cleared. Two traffic control individuals will be needed to stop and direct traffic. In areas that are 25% or less slope the tractor may drive up to logs which they are unable to reach from the road. Harvester will be limited on where it can be used given much of the area is greater than 25%. A self loading log truck will be the most efficient. District Leadership decided small unmerchantable material that pose as hazards along the road will not be felled with this project. No new construction of skid trails only existing skid trails and landings maybe used.

Logs will be staged along the road for immediate loading.

If a logger has a small yarder the material may be yarded on steeper slopes down to the road. No new landings. Turn outs and wide spots will be used to stage logs along the road.

Alternatives

The alternatives do not vary in type of logging systems just the amount of logging systems. Alternative A is the full range of logging systems. Alternative C and D are tractor/mechanical only and Alternative E is only roadside.