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DOWNSTREAM ANALYSIS

FOREST RIDGE PERFORMANCE BASED CLUSTER PLAT

File No. LP-08-

PRELIMINARY
SUBJECT TO REVISION
DATE 8-5-09

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**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

SITE OVERVIEW

This site consists of 478.45 acres located in Section 24, Township 20 North, Range 15 East, W.M., Kittitas County, WA and lying north of City of Cle Elum and off of the extension of Columbia Street onto a County private road system(Creekside Road). The site is vegetated with evergreen and deciduous trees with underbrush. Site has experienced selective logging within the past 20-years. There are no structures on-site. The western ¼ of the property slopes southwest into Balmer's Canyon and remainder property slopes south and inward into Steiner's Canyon.

On-site slopes vary from 2.0% to +35%. A review of the Department of Natural Resources maps showed several non-classified streams on-site. However, these streams were classified downstream by a wildlife biologist of Sewall Wetland Consulting, Inc. in June and July of 2009(please see attached aerial map). None of the site is within a 100 Year Flood Plain according to the latest F.E.M.A. maps. This project is within the Upper Kittitas County Sub-Basin of the Yakima River Basin.

A preliminary drainage investigation with the City of Cle Elum was conducted in May of 2009 to gather written complaints and history of drainage patterns downstream. No written comments have been recorded, however verbal discussions with City and County officials indicate that yearly flooding occurs downstream of the property along the Balmer's & Steiner's Canyon.

**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
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UPSTREAM BASIN

The upstream basin contributing to this site consists of approximately 300 acres of similar land characteristics immediately north of the property. 50% of this upstream contributory sheet flows onto the property with the other 50% entering defined stream channels.

DOWNSTREAM BASIN

Storm runoff on the site splits into two sub-basins, Balmer's Canyon and Steiner's Canyon. Balmer's Canyon drains south and eventually crosses under Columbia St./Creekside Road and enters the City of Cle Elum limits and private property. It then combines with Steiner's Canyon runoff north of 3rd St. just outside of the City limits and east of Cottage Avenue. Steiner's Canyon drains south and crosses Creekside Road before heading south east toward the Yakima River. See the Off-Site Analysis Drainage System Table.

FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT LEVEL 1 DOWNSTREAM ANALYSIS

CONCLUSION

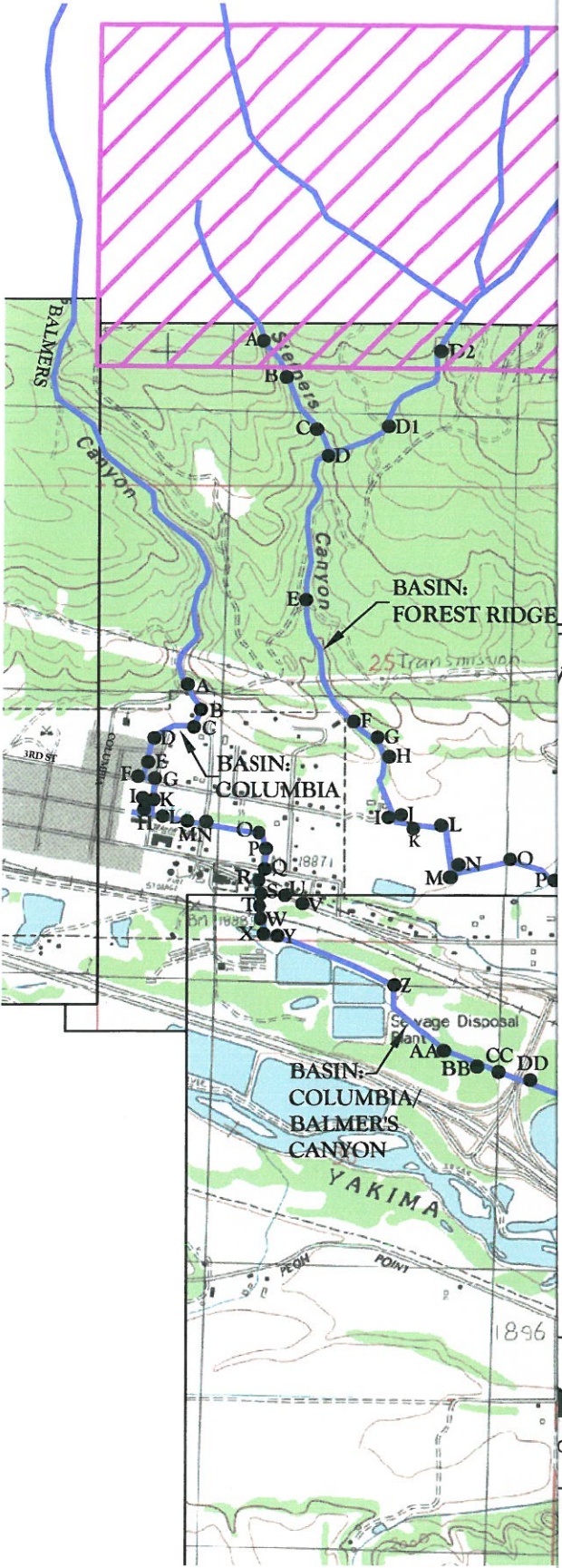
Although there is no written history of drainage complaints within the City of Cle Elum or Kittitas County Public Works records, it is local knowledge that downstream flooding exists during spring runoff and large storm events. This report provides a good summary of the drainage system that exists today and will assist all future developments in designing methods to improve the system in the future. It should be made clear that the project site is located $\frac{3}{4}$ of a mile north of the City limits of Cle Elum. Responsibility of drainage improvements beyond $\frac{1}{4}$ of a mile are not typically done, but may be necessary to address annual problems for this area. Below are suggestions:

- City of Cle Elum & Kittitas County need to create a process to collect written documentation of drainage complaints.
- Forest Ridge PBCP should be proactive in establishing a maintenance strategy of streams, culverts & catch basins that convey stormwater on-site. City of Cle Elum, County and downstream neighbors should do the same for the off-site.
- Forest Ridge PBCP should establish a snow removal strategy of private streets that allow the majority of the stormwater systems to still convey stormwater. City and County should do the same for the off-site.
- Forest Ridge PBCP, at time of civil design, should perform a backwater analysis on portions of the downstream path to determine ditch & pipe velocities and capacities for the 100-yr. storm event. This analysis will determine if upgrades to the existing downstream system are necessary by either City, County or applicant.

**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

- Forest Ridge PBCP, City, County and downstream neighbors need to stabilize channels, outlets and protect drain inlets
- Forest Ridge PBCP shall control on-site flow rates and pollutants per DOE's Stormwater Management Manual for Eastern Washington.
- Forest Ridge PBCP shall maintain BMPs

FIGURE C. _____



GRAPHIC SCALE



(IN FEET)
1 inch = 2000 ft.



108 EAST 2ND ST.
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**DOWNSTREAM DRAINAGE SYSTEM
FOREST RIDGE
PERFORMANCE BASED CLUSTER PLAT**

**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

OFF-SITE ANALYSIS DRAINAGE

SYSTEM TABLE

**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

STEINER'S CANYON

SYSTEM TABLE

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Forest Ridge		Sub: Steiner's Canyon		Sub: Number:		
Symbol	Drainage, Component Type, Name and Size	Drainage Component Description	Slope	Distance from site discharge	Existing Problems/Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: Sheet flow, swale, stream, channel, pipe, pond; Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts
A	Discharge site	Creek	~8%	0		Ravine very choked w/brush+wood + debris
B	Waterfall/grade break		~100%	A-B=~800'		Elevation drops
C	Tributary inflows from NE		2%	B-C=~400'		~20% inc. ~20% horizontal
D	Culvert Crossing	30" cmp~40' long Under gravel road	2%	C-D=~150'		3' wide creek w/3'-4' high vertical banks
E	Culvert crossing	36" cmp~15' long under dirt rd.	2%	D-E=~800'		
F	Culvert crossing	36" cmp~12' long under dirt rd.	2%	E-F=~1000'		
G	3 culverts laid side by side	(2) 24" black corrugated plastic (1) 18" cmp	2%	F-G=~150'		Creek widens to ~25' diameter pool Pool drains through 3 culverts
H	Culvert & crossing	36" cmp	2%	G-H=~200'		
I	(2) culverts laid side by side	(2) 24" cmp~20' long Under paved DW	1%	H-I=~900'		
J	Stream enters culvert	36" cmp heading E.	1%	I-J=~250'		

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Forest Ridge			Sub. Steiner's Canyon			Sub. Number:	
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see map	Type: Sheet flow, swale, stream, channel, pipe, pond. Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 ml = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts	
O	2 culverts laid side by side ~15' long	(1) 18" cnp	2%	N-O=600'			
P	Under field crossing Culvert crossing	(1) 18" concrete 36" cnp under paved rd.	1%	O-P=400'			
Q	Tributary from SW	36" cnp under paved rd.	1%	P-Q=65'			
R	Irrigation takeoff	Gate valve feeding 18" cnp feeding ditch flowing SE	1%-2%	Q-R=1200'			
S	Culvert Crossing	24" cnp ~20' long under farm crossing	1%	R-S=50'			
T	Culvert Crossing	36" cnp ~50' long under paved rd.	1%	S-T=300'			
U	Irrigation take off	Gate valve feeding small ditch to S.	1%	T-U=100'			
V	Begin O ditch liner	Rubber liner in ditch	1%-2%	U-V=200'			
W	End Berm	Berm @ S. Bank Ends	1%	R-W=200'		Creek flows into wooded area	
	End liner	Liner ends					

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Forest Ridge			Sub. Steiner's Canyon		Sub. Number:	
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see map	Type: Sheet flow, swale, stream, channel, pipe, pond: Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 ml = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts
X	Irrigation take off	Notched log set in creek bank to regulate flow to ditch running N.	1%	W-X=50'		
Y	Stream enters wetland/swamp	Multiple channels + pools no main channel	<1%	X-Y=100'		
Z	(3) culverts laid side by side under gravel DW	(2) 24' corrugated black plastic (1) 18" corrugated black plastic	<1%	Y-Z=250'		
AA	Irrigation takeoff	Gate valve feeding 18" cmp heading S. under paved rd.	3%	Z-AA=1000'		
BB	Culvert crossing	30" cmp~30' long under gravel rd	2%	AA-BB=20'		
CC	Culvert crossing	30" concrete ~ 40' long under paved rd.	2%	BB-CC=175'		
DD	Tributary joins	Outflow of pond to W. flows into creek	1%	CC-DD=400'		Crossing under Airport Rd.
EE	Culvert Crossing under gravel rd.	(2) 30" cmp culverts laid side by side 15' long	<1%	DD-EE=1000'		
FF	Stream enters swamp	No discernable channel	1%	EE-FF=400'		
		Sheet flow through lots of skunk cabbage				

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Forest Ridge			Sub.#1		Sub. Number:	
Symbol	Drainage, Component Type, Name and Size	Drainage Component Description	Slope	Distance from site discharge	Existing Problems/Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: Sheet flow, swale, stream, channel, pipe, pond. Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts
GG	Stream leaves swamp		1%	FF-GG ~800'		Ground around stream still swampy, but channel is discernable
HH	Stream enters swamp		<1%	GG-HH ~500'		Channel becomes indiscernable
II	Stream leaves swamp		<1%	HH-II ~1100'		Swamp narrows into 20'-30' wide slow flowing wetland/channel
JJ	Culvert Crossing	72" cmp culvert ~ 45' long under gravel rd.	<1%	II-JJ ~800'		
KK	Stream enters swamp/beaver pond			JJ-KK ~600'		Large areas of open water observed beaver in pond
LL	Beaver Dam stream enters swamp		1%	KK-LL ~150'		~1.5 acre Beaver pond/swamp
MM	Culvert crossing	(2) 60" cmp culverts ~45' long under paved rd.	1%	LL-MM ~1200'		

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Forest Ridge			Sub. Steiner's Canyon		Sub. Number:	
Symbol	Drainage, Component Type, Name and Size	Drainage Component Description	Slope	Distance from site discharge	Existing Problems/Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: Sheet flow, swale, stream, channel, pipe, pond; Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts
NN	Conc. Box culvert	4'x4' crossing SR 970	1%	0'-100'	No obstructions	
OO		Corr. Metal pipe cul. X-ing Driveway			No obstructions	
PP		Natural Veg. Cat-Tails/reeds	2%	125'-225'	Naturally flowing no obstructions	
QQ	Pond 75' long X 30' wide	Cat-tails/reeds 1'-1.5' deep	0%-1%	225'-300'		
RR	30" metal culvert x-ing driveway		1%	300'-325'	No obstructions	
SS	Stream 2:1	Natural Veg.	1%-2%	325'-500'	Some debris in crk. No restrictions of flow	
TT	Channel 20'-30' wide	Heavily veg., shrubs, reeds, cat tails	1%	500'-1200'	Ponding/swampy outside of channel large wetland	
UU	Swamp 100'-400' wide	Trees, reeds & cat tails	0%-1%	1200'-3800'	Large swamp w/no obvious channel or flow	
		3800 Teanaway River				

**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

BALMER’S CANYON

SYSTEM TABLE

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Columbia			Sub. Balmer's Canyon		Sub. Number:	
Symbol	Drainage, Component Type, Name and Size	Drainage Component Description	Slope	Distance from site discharge	Existing Problems/Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: Sheet flow, swale, stream, channel, pipe, pond. Size: diameter, surface area	Drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi = 1,320 ft.	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion	Tributary area, likelihood of problem overflow pathways, potential impacts
A	24" Black Plastic Corrugated Pipe	~ 40' long under gravel rd.	1%	A-B = ~ 140'		Channel splits for ~ 120'
B	18" cmp culvert under gravel DW		4%	B-C = ~ 100'		Channel re-joins
C	30" cmp culvert	Under gravel rd.	3%	C-D = 250'		
D	24" cmp culvert	Under paved st.	3%-4%	D-E = 150'		
E	24" Black corrugated plastic pipe	~ 20' long buried in rip-rap & dirt	3%-4%	E-F = 125'		Pipe laid to protect SSMH @ W. Edge ditch from washout
F	Bend in channel 18" cone culvert	90° turn to E.	1%-2%	F-G = 125'		Channel B joined by small ditch from W.
G	18" cone culvert	~ 55'	1%-2%	G-H = 225'		S. ~ 10' of culvert is 24" cmp sleeved over concrete
H	Homemade ~36" culvert under concrete SW	~ 10' long made of old fuel tank w/ends cut out	2%-3%	H-I = 15'		
I	Drains into 6" diameter cmp under paved st.		2%-3%			

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Basin: Columbia			Sub. Balmer's Canyon		Sub. Number:	
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K	6' diameter cmp under paved st.	~ 60' long	1%	K-L ~ 100'		Ditch w/ ~36" homemade metal culvert enters swale @ W. end 6' culvert
N	6' wide X 4' tall cmp squash pipe	~ 50' long running under paved st.	<1%	N-O ~ 400'		Partially silted @ E. end
O	Wire fence stretched across channel		<1%	O-P ~ 75'	Possible flow restriction	
P	3' tall X 4' wide cmp squash pipe under farm crossing		<1%	P-Q ~ 125'		Pipe beat up & misshapen
Q	Fence stretched across channel		<1%	Q-R ~ 25'		Suspended above H2O no flow restriction
S	6' wide X 4' deep concrete box culvert	~ 55' long under SR970		S-T ~ 70'		
T	7' wide x 4' high concrete box culvert	~ 25' long	1%	T-U ~ 50'		Bottom partially silted

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

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U	36" cmp culvert	~ 30' long under dirt rd.	1%	U-V ~ 70'		
V	36" cmp culvert	~ 20' long	1%	V-W ~ 70'		
W	(2) 48" concrete culverts (side by side)	~ 40' running under RR tracks	2%	W-X ~ 50'		
X	48" cmp culvert	~ 20' long running under gravel rd.	1%	X-Y ~ 250'		
Y	36" diameter DIP suspended over H2O		1%-2%	Y-Z ~ 1300'		Connects flowing ditch south to north. No flow restriction
Z	Wire fence suspended over channel		1%	Z-AA ~ 600'		No flow restrictions
AA	Bend in Stream		1%-2%			
BB	Creek feeds swamp	Swamp filled w/cat tails to N of bend in stream	<1%	BB-CC ~ 1200'		Definite H2O detention area
CC	Bend in creek		1%	CC-DD ~ 550'		
DD	6' diameter concrete culvert	Flowing under overpass for freeway on ramp ~ 150' long culvert	2%	DD-EE ~ 1300'		

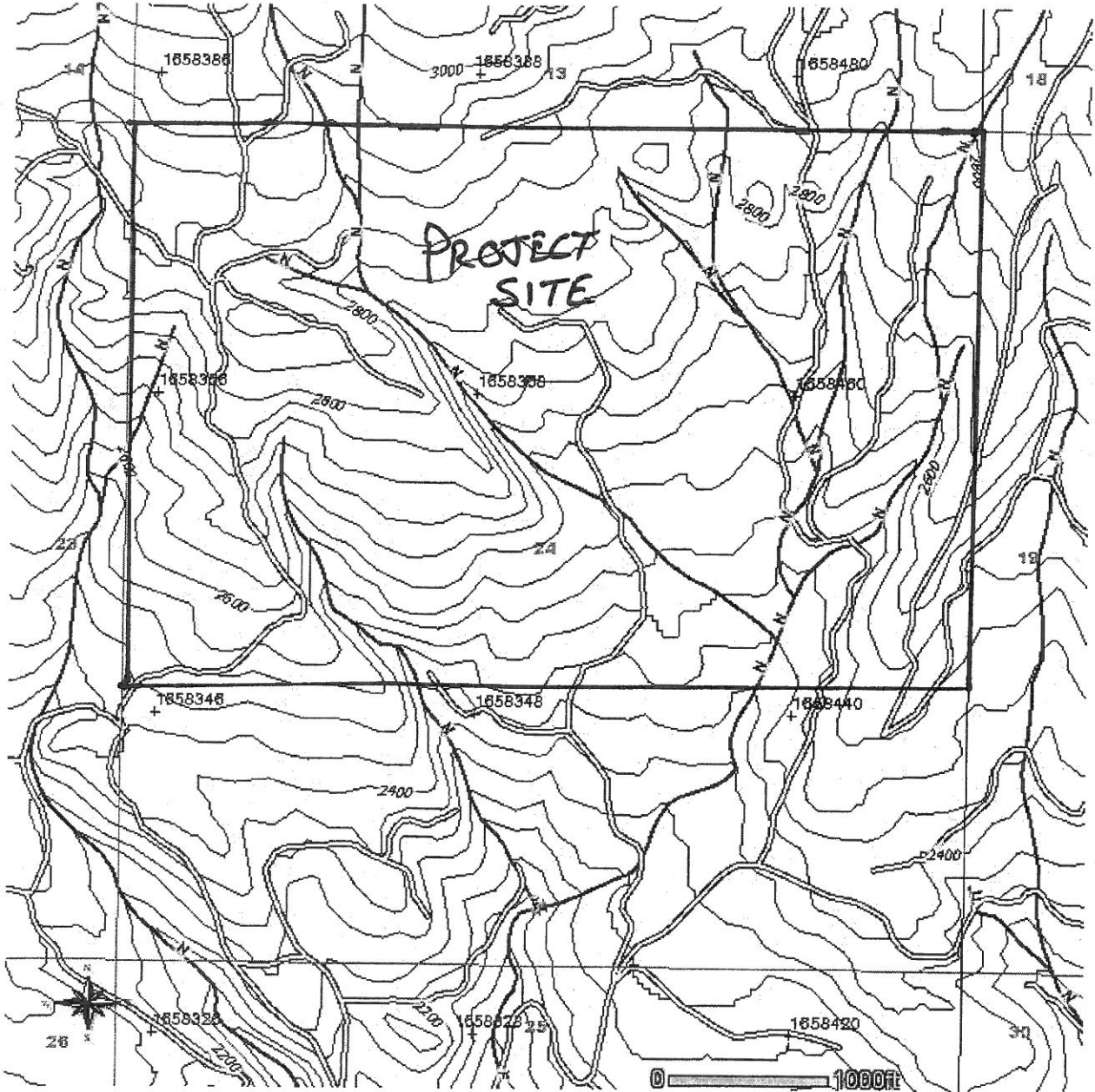
**FOREST RIDGE – PERFORMANCE BASED CLUSTER PLAT
LEVEL 1 DOWNSTREAM ANALYSIS**

**DRAINAGE BASINS, SUBBASINS
AND SITE CHARACTERISTICS**

FOREST PRACTICE ACTIVITY MAP

TOWNSHIP 20 NORTH HALF 0, RANGE 15 EAST (W.M.) HALF 0, SECTION 24

Application #: _____

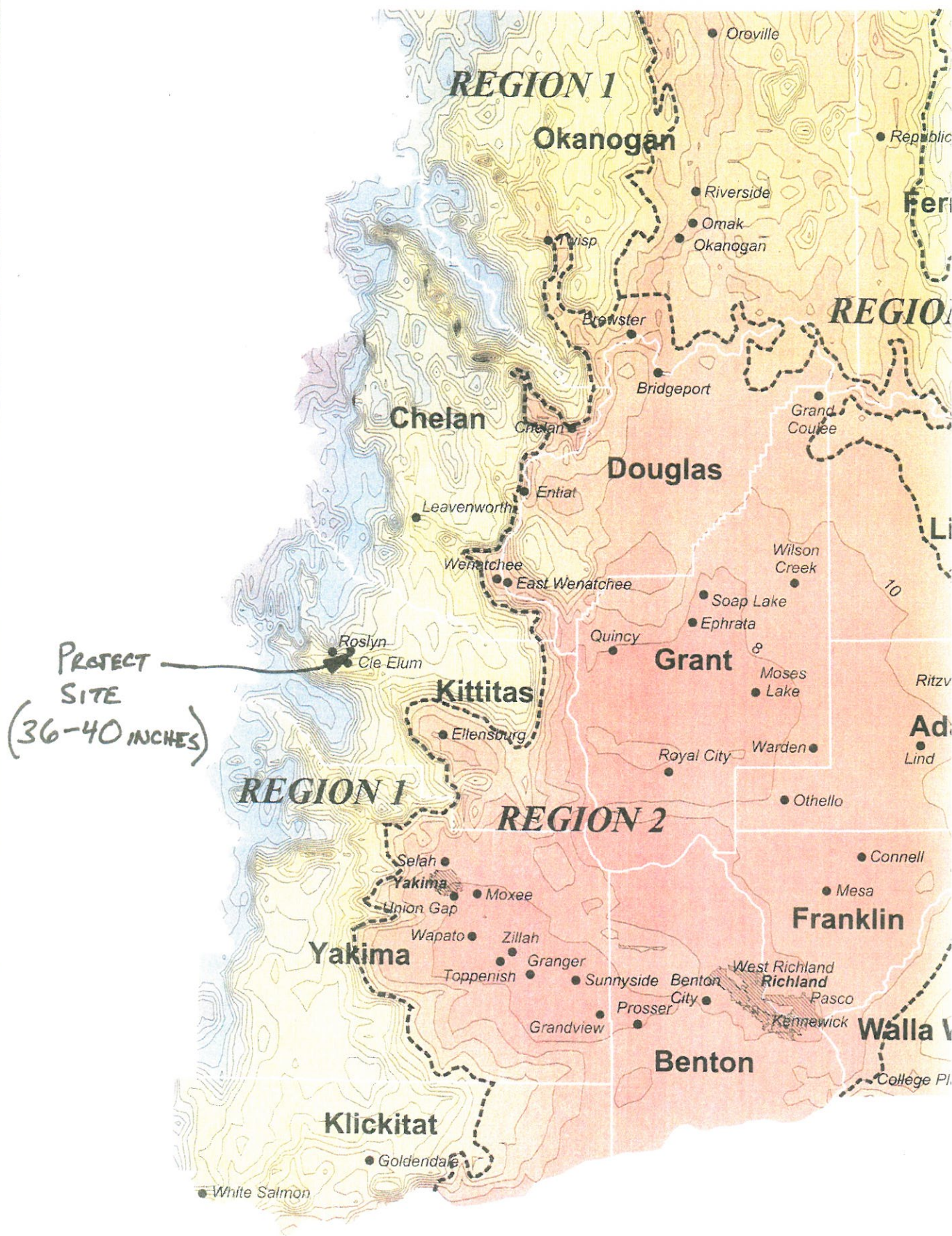


Please use the legend from the FPA Instruction or provide a list of symbols used.

Monday, July 27, 2009 11:21:06 AM
NAD 83
Contour Interval: 40 Feet

DNR MAP

AVG. ANNUAL PRECIP. 1961-1990

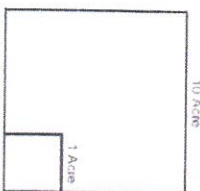


PROJECT SITE
(36-40 INCHES)



Legend

- Property Line
- 0-6% Slopes
- 8-15% Slopes
- 15-25% Slopes
- 25-35% Slopes
- 35% + Slopes



Slope Analysis
Forest Ridge Community

Mar. 2008



2-YEAR 24-HR ISOPHYETAL

