Section VII. O.

VERIFYING INTERMITTENT CHANNELS
Wall Creek Watershed Analysis

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Introduction

Accurate stream maps are needed for resource planning and analysis of watershed conditions. The existing Forest GIS stream layer, containing information on location and stream class, was updated in 1992 in part to improve the accuracy of mapped intermittent streams. Stream systems are branching networks and contain proportionally more miles of tributaries than main streams. However, there are no established field inventories for intermittent channels and existing maps may underestimate and/or incorrectly locate intermittent streams. On the Umatilla National Forest, using the current GIS database, class IV intermittent streams account for 61 percent of the total miles of stream on the National Forest.

Intermittent streams are defined as any "non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition". By definition, intermittent streams carry water seasonally and in response to storm events. Intermittent streams are important for routing water, sediment, and organic matter into main stream systems. Major controls on drainage system development include climate, geology, and topography.

Drainage density, or the sum of the channel lengths per unit area, is a useful measure for interpreting watershed hydrology and is directly related to precipitation amount and intensity, infiltration, and runoff. Drainage density is also controlled by geology and topography, and can be influenced by management activities. Average stream density on the Umatilla National Forest (2188 square miles) is 4.5 miles per square mile.

Techniques for mapping stream networks include field checking locations, air and topographic map interpretation, and semi-automated delineation using GIS software. Field checking stream locations is the most accurate method for identifying and mapping intermittent streams.

Objectives

The study objective is to verify and update existing GIS stream class information, with emphasis on class IV streams, in the Wall Creek watershed. This effort is part of the Wall Ecosystem Analysis project underway (FY95). The length, location, and density information is to be used as part of an assessment of watershed condition and response, and for making recommendations for restoration of watershed function. Total stream miles are used to determine approximate acres in Riparian Habitat Conservation Areas (RHCA's).

The existing database for Wall Creek shows the following miles of stream by stream class compared to Umatilla National Forest totals:

TABLE 1. Miles of Stream by Class

	WALL		FOREST	
Class	Miles	Percent	Miles	Percent
Class I	96.3	13.2	1037.3	10.5
Class II	10.5	1.4	405.3	4.1
Class III	76.9	10.5	2382.4	24.2
Class IV	546.4	74.9	6040.0	61.2
Total	730.1	100	9865.0	100

Intermittent streams account for 75 percent of the total stream miles in Wall watershed, higher than the Forest average. Average stream density (miles per square mile) in Wall Creek is 3.6 miles, less than the Forest average. More intermittent streams and lower stream density in Wall Creek are a reflection of the generally low precipitation and temperature extremes of Wall Creek as compared to Forest averages.

Assumptions

Overall, in terms of the accuracy of existing stream maps, it is expected that existing records would be least accurate in the length and location of the intermittent streams, which is the focus of this investigation. In addition, the length and location of intermittent streams are not expected to remain static. Over time, under variable weather conditions (periods of drier-than-average or wetter-than-average conditions) the length and location of intermittent channels are expected to change. Over the long term (1000's to 10,000's of years), stream networks expand as landscapes gradually erode. Over shorter time frames (10's to 100's of years) stream networks expand and contract.

Intermittent channels by definition exibit a defined channel and evidence of annual scour or deposition, so consecutive annual flows must occur to establish such a channel. However, rapid headward migration of channels as a result of high intensity storms, and road ditch-relief drainage channels are examples of short-term processes that can expand channel networks. And, prolonged periods of drought such as the period 1988-1992 can cause contraction of the seasonally-wetted channel network.

Generally it was thought that the field investigation would result in more miles of stream overall, and changes in the location of some of the mapped, GIS intermittent streams. Determining the level of accuracy of existing GIS stream database will help in future Forest-wide updates. Stream maps tend to be more accurate on steeper, well dissected landforms, and less accurate on gently rolling terrain. Geology and groundwater influences are also important factors in stream location.

Verified stream information will be used to estimate total miles of stream in the watershed, and to project acres to be managed in RHCA. Stream density information will be used in the watershed hydrology analysis and linked to aquatic and vegetation issues as part of the Wall Ecosystem Analysis.

Methods

A sampling approach to determining the accuracy of the GIS maps was taken (nonrandom, stratified sample) with field work in 6 subareas (within 6 of 16 subwatersheds) representing basic geologic types and slope classes (Table 2). The total sample was 8.5 percent of the entire Wall watershed. Within subwatersheds, samples averaged 18 percent of individual subwatershed areas. Sample areas ranged from 1.9 to 4.2 square miles.

Field surveys field verified presence/absence of class IV streams (defined as intermittent/ephemeral channels with defined bed and banks and evidence of annual scour or deposition). Field surveyors walked all mapped class IV stream courses within the sample areas, and checked unmapped "valleys", or topographic declivities, evident on 1:24000 USGS topographic maps. Field surveyors also used recent aerial photos to identify possible streamcourses. Streams were verified, added, or deleted based on field observations. Where streams were discontinuous downslope, a Class IV stream was mapped if the defined channel extended the majority of the distance downvalley, and connected with another stream of equal or higher class.

TABLE 2
<u>Generalized Geology and Landforms of Sample Areas</u>

SWS	Name	Dom. Geology	Landform
24A	Little Wilson	Picture Gorge	mod. dissected plateau, steep
24E	Upper Wilson	Picture Gorge	mod. dissected plateau, gentle
25A	Lovlett Creek	Picture Gorge	mod. dissected plateau, mod.
25B	One Trough	Grande Ronde	entrenched plat., gentle/steep
26C	Upper Skookum	John Day form.	mod. disssected, steep
26D	Upper Swale	clastic/andes.	mod. dissected, mod.

The field survey results were compiled in the following manner: within sample areas the GIS mapped stream length and field-verified lengths were determined for Class IV streams. All other class streams within sample areas were assumed to be correct (notes on possible class changes for several class III streams are in the project file). The sample areas were planimetered to calculate stream density within sample areas. GIS stream miles were then compared with field-verified stream miles and expressed as a percent difference (Table 3). Extrapolating field-determined stream densities was done by applying a "correction" factor to the total miles of stream, area-weighted by major geologic unit, within each subwatershed of Wall Creek (Table 5).

Findings

The existing GIS stream class database shows 730 miles of stream (all classes) in Wall watershed (200 square miles) for an average stream density of 3.65 miles per square mile. Within sample areas, GIS-mapped compared to field-verified stream miles varied considerably (Table 3). The average for the sample areas is 7.9 percent more stream length found in the field than in GIS, with a standard deviation of 13.9 percent (75 percent of the sampled areas were plus or minus 13.9 percent).

In general, the field verification shows a relatively modest increase in total Class IV stream miles, averaged over the sample areas, but high variability between sampled areas. In one case (Lovlett Creek) the total stream miles were nearly the same as GIS but the locations were different; GIS-mapped streams were not found in the field, and streams were found in drainages that did not contain a GIS-delineated streamcourse. The greatest decrease (-7.3%) occured in Little Wilson Creek, and the greatest increase (+31.5%) occured in Swale Creek. The accuracy of GIS stream maps is related to geology and landform, with greater accuracy in steeper landforms. Generally, more streams were found in the field on gentler terrain and in the higher elevation (higher precipitation zone), older geologic unit represented by upper Swale Creek.

Management activities that can alter stream length and density occur in 5 of the 6 sampled watersheds, to varying extent. Sampling was not designed to investigate management effects on stream networks, however, comparing the most impacted sample area (One Trough) to the least impacted sample area (Upper Skookum) shows differences in stream length that could be in part attributed to management effects. Comparing GIS to field stream density (Table 3), One Trough, an area with multiple harvest entries and skid trails noted by field surveyors to be intercepting and diverting channel flow, had the second largest increase (19 percent) overall. In contrast, Upper Skookum, a roadless area with minimal logging activity, had a slight decrease in field-verified stream density.

Stream densities in the Wall Creek watershed are lower than average Forest stream densities and low overall compared to stream networks in western Oregon and Washington. Stream densities vary within Wall Creek, with a "corrected" average stream density of 3.8 miles per square mile, slightly more than in the GIS database, but still less than the Forest average. This is again a reflection of climate and physiography. Swale Creek had the highest increase in stream length and density, and is in an area with higher elevations, higher precipitation, and an older geologic unit that has potentially higher groundwater flux.

Recommendations

Intermittent streams, which account for 75 percent of the total stream length in Wall Creek, have important on-site values including riparian vegetation that provides habitat for a variety of mammals and birds, a moderating influence on local climate, and buffering of high flows. Periodic disturbances include fire, windthrow, and flooding. Intermittent channels influence downstream conditions by moderating high flows and controlling the input of sediment and nutrients. Maintaining stable, well vegetated conditions in intermittent channnels will aid in maintenance of on-site values and downstream riparian and aquatic ecosystems.

Total miles of stream and estimated acres in RHCA (excluding non-stream wetland areas such as springs, seeps, and bogs) are reasonable estimates for planning purposes. Assuming average widths for stream classes, approximately 14 percent of the Wall watershed should be managed in RHCA's. However, the variability in accuracy of Forest GIS stream maps is a caution to project teams; time should be allowed to inventory planning areas to determine actual distribution of intermittent streams. Projects in flatter, logged, or higher elevation watersheds should anticipate more streams than current GIS stream maps. Updated stream maps should be input into the Forest GIS database.

Past Forest planning generally did not emphasize maintenance or enhancement of intermittent channels and associated riparian areas (LRMP, 4-59, 163). With the recent PACFISH ammendment, the goals for riparian areas now include intermittent streams, which are to be maintained or restored for water quality, channel integrity, natural timing and variability of water levels and flows, and riparian habitats.

Acknowledgements

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TABLE 3 WALL CREEK: GIS STREAM LAYER - FIELD VERIFIED SAMPLE WATERSHEDS

Name of Subarea	SWS	Landform	Watershed Area (sq. mi.)	GIS Total Class I-IV (miles)	GIS Density (mi/sq mi)	Field Survey Class I-IV (miles)	Field Density (mi/sq.mi)	% Difference
Little Wilson Creek	24A	Moderate dissected, steep	4.2	17.9	4.3	16.6	4	-7.3
Upper Wilson Creek	24E	Moderate dissected, gentle	2.9	9.5	3.3	10.5	3.6	10.5
Lovlett Creek	25A	Moderate dissected, moderate	2.4	10.5	4.4	10.3	4.3	-1.9
One Trough Canyon	25B	Entrenched plateau, flat-steep	1.9	5.8	3.1	6.9	3.6	19
Upper Skookum	26C	Moderate dissected, steep	2.7	8.5	3.1	8.1	3	-4.7
Swale	26D	Moderate dissected, moderate	2.8	9.2	3.3	12.1	4.3	31.5

TABLE 4 WALL CREEK: BREAKDOWN BY STREAM CLASS

Name of Subarea	SWS	Expected GIS Class I Miles	Expected GIS Class II Miles	Expected GIS Class III Miles	Expected GIS Class IV Miles
Little Wilson Creek	24A	0	0	7.4	10.5
Lovlett Creek	25A	0.3	0	1.1	9.1
One Trough Canyon	25B	0	0	0.9	4.8
Swale	26D	1.2	0	2.5	5.5
Upper Skookum	26C	0	2.4	2.7	3.4
Upper Wilson Creek	24E	0	2.7	2	4.8

Name of Subarea	SWS	Field Survey Class I Miles	Field Survey Class II Miles	Field Survey Class III Miles	Field Survey Class IV Miles
Little Wilson Creek	24A	0	0	7.4	9.2
Lovlett Creek	25A	0.3	0	1.1	8.9
One Trough Canyon	25B	0	0	0.9	6
Swale	26D	1.2	0	2.5	8.4
Upper Skookum	26C	0	2.4	2.7	3.1
Upper Wilson Creek	24E	0	2.7	2	5.8

TABLE 5 WALL CREEK: STREAM MILES (CLASS IV) - CONVERSION BY GEOLOGIC UNIT AND SUBWATERSHED

Subwatershed (subarea)	% Dominant Geology Type	Total GIS Miles Class IV	Correction Factor Class IV	Corrected Stream Miles Class IV	Topography & Notes
23C	Tcp 100%	0	0.93	0	steep
24A (Little Wilson Creek)	Tcp 97.7% Tsfj 2.3%	54.8	0.93	50.96	steep
24B	Tcp 99.9% Tca 0.1%	36.55	0.93	33.99	steep
24C	Tcp 99.9% Tca 0.1%	46.74	0.93	43.46	steep
24D	Tcp 89.1% Tcg 5.9% Tca 3.1% Tsfj 2.0%	30.93	1.11	34.33	geology/topo like 24A
24E (Upper Wilson Creek)	Tcp 52.9% Tsfj 25.1% Tca 22.0%	35.73	1.11	39.66	gentle
24F	Tcp 78.0% Tsfj 13.4% Tca 5.7% Tcg 2.9%	42.34	0.98	41.49	like Lovlett Ck., moderate steep
24G	Tcp 97.7% Tsfj 2.3%	34.98	0.93	32.53	
25A (Lovlett Creek)	Tcp 97.7% Tcg 2.3%	49.44	0.98	48.45	moderate steep

TABLE 5 CONTINUED

Subwatershed (subarea)	% Dominant Geology Type	Total GIS Miles Class IV	Correction Factor Class IV	Corrected Stream Miles Class IV	Topography & Notes
23C	Tcp 100%	0	0.93	0	steep
25B (One Trough Canyon)	Tcg 60.2% Tcp 33.4% Tca 6.4%	36.62	1.19	43.58	variable slope, skidding
25C	Tcp 78.3% Tcg 21.7%	19.17	1.03	19.7	* area weighted
26A	Tcp 68.3% Tcg 31.7%	47.11	1.01	47.7	* area weighted
26B	Tcg 81.1% Tcp 12.2% Tca 6.8%	26.57	1.17	31.01	* area weighted
26C (Upper Skookum)	Tca 51.4% Tsfj 34.9% Tcg 12.9% Tcp 0.8%	30.99	0.95	29.44	steep
26D (Swale)	Tcg 51.5% Tca 27.1% Tcp 21.3%	32.57	1.32	42.99	mod. steep, older geol., springs
26F	Tcg 66.6% Tsfj 24.6% Tca 8.8%	21.85	1.14	24.95	* area weighted

SWS 24A
LITTLE WILSON CREEK

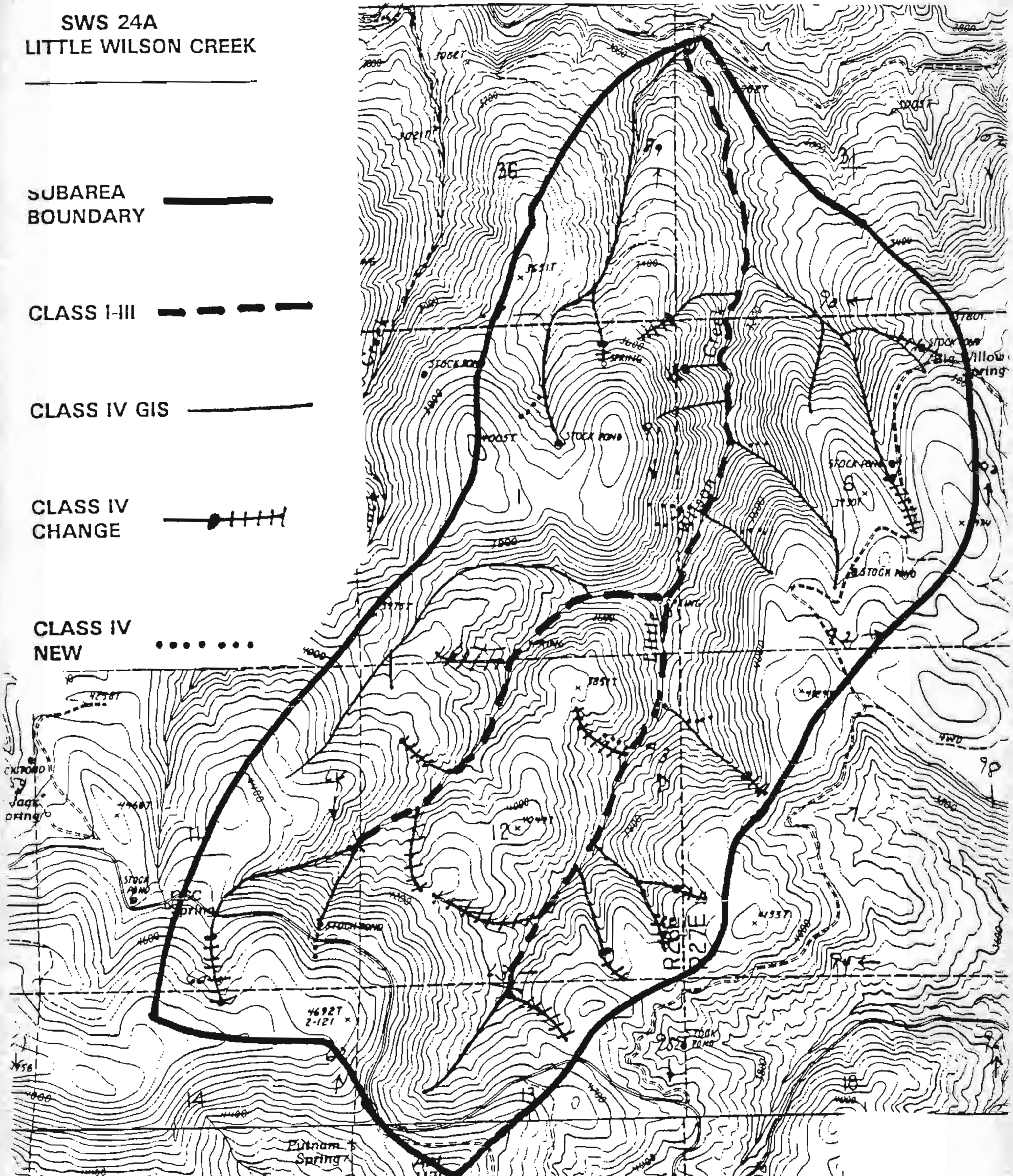
SUBAREA BOUNDARY

CLASS I-III

CLASS IV GIS

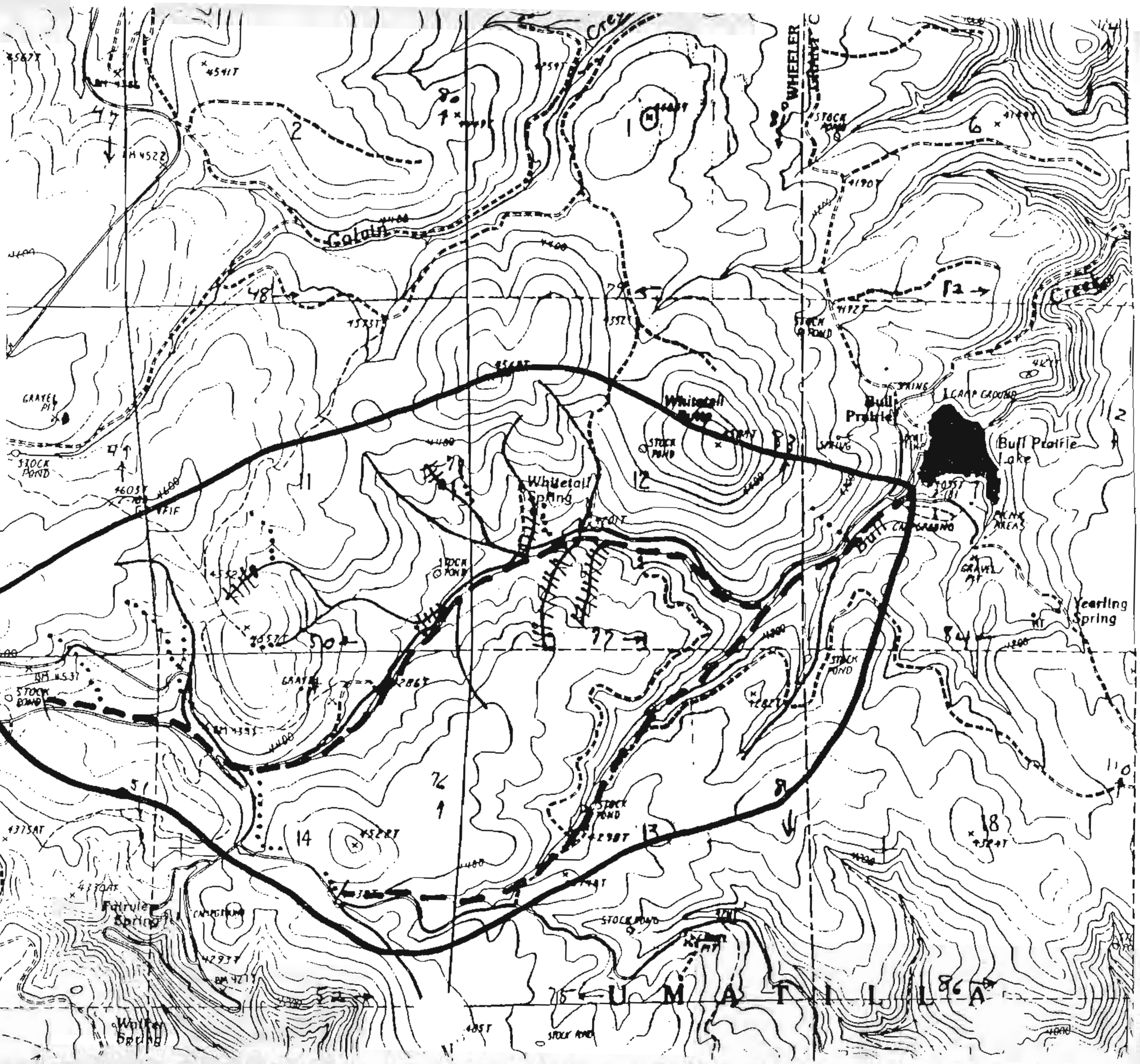
CLASS IV CHANGE

CLASS IV NEW

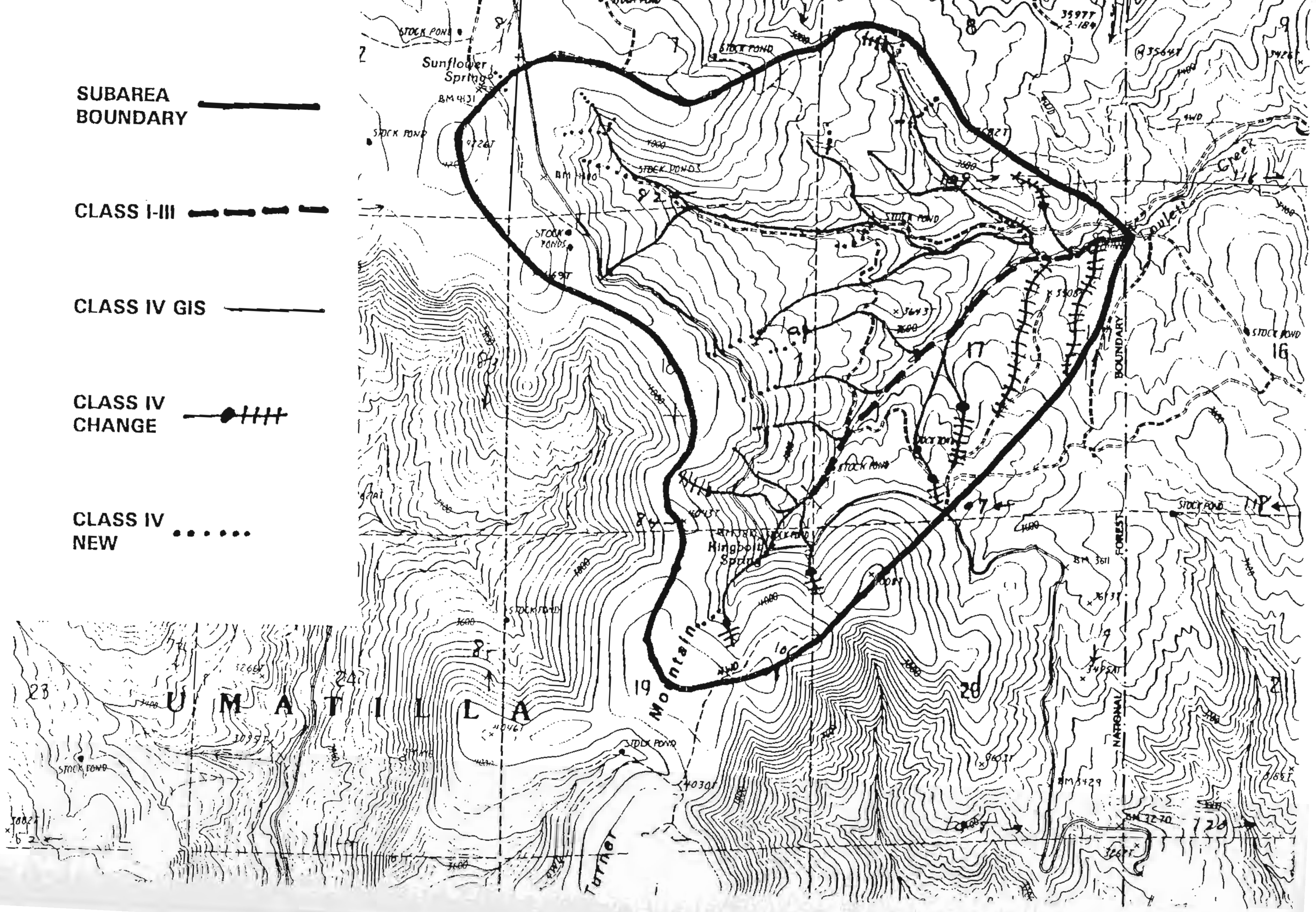


SWS 24E
UPPER WILSON CREEK

- SUBAREA BOUNDARY
- CLASS I-III
- CLASS IV GIS
- CLASS IV CHANGE
- CLASS IV NEW



SWS 25A
LOVLETT CREEK



SWS 25B
ONE TROUGH CANYON

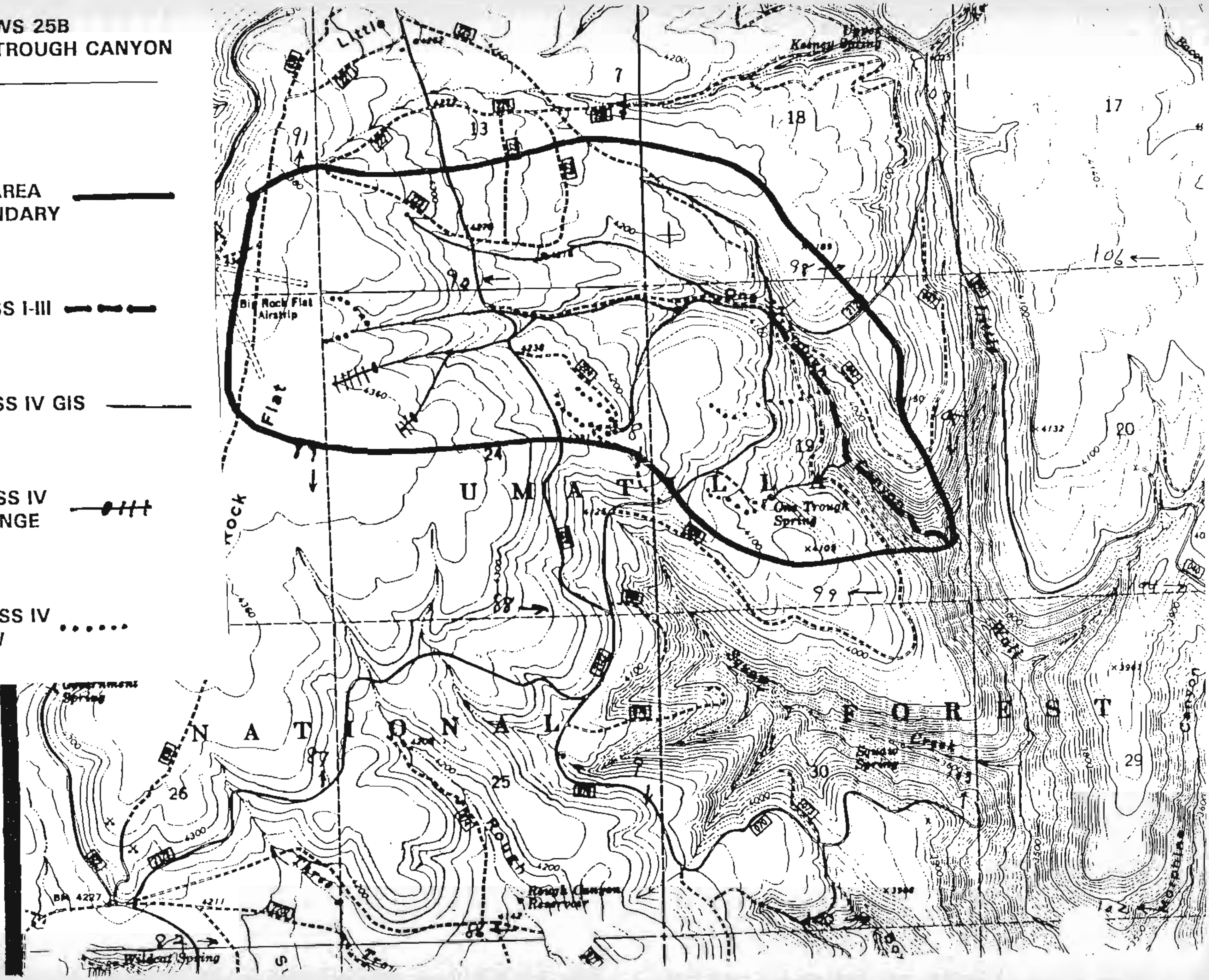
SUBAREA BOUNDARY

CLASS I-III

CLASS IV GIS

CLASS IV CHANGE

CLASS IV NEW



SWS 26C
PPER SKOOKUM

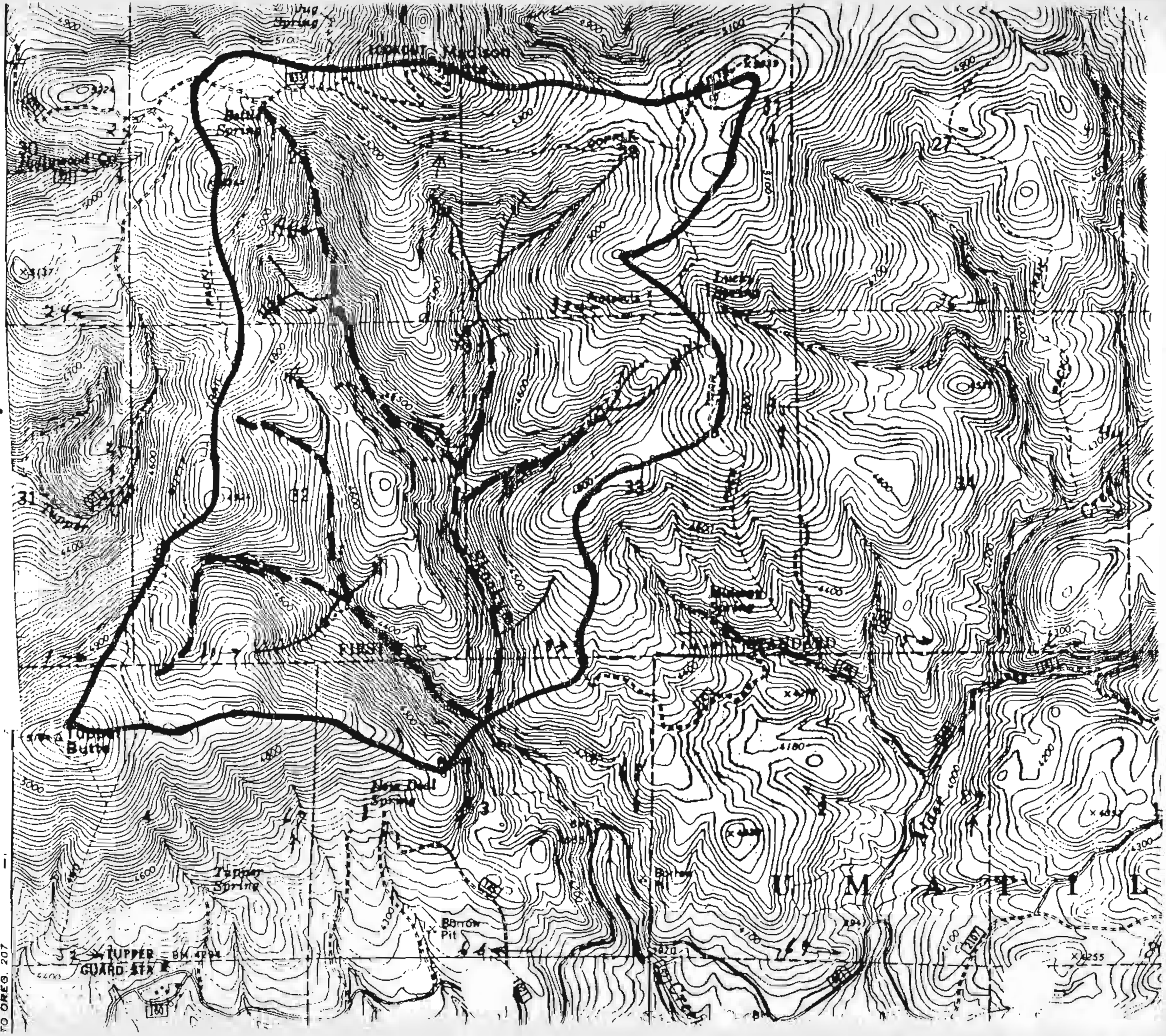
UBAREA
OUNDARY

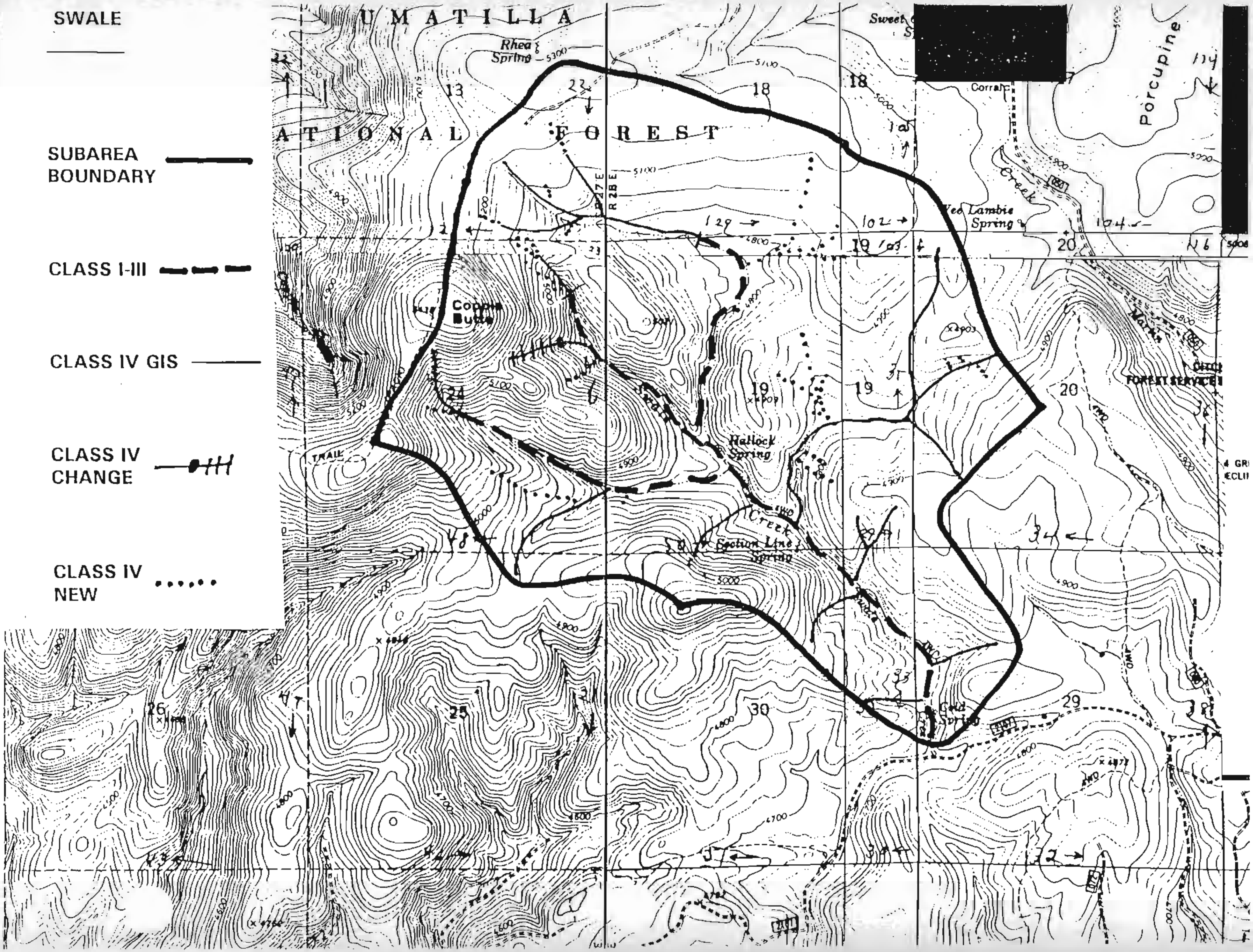
:LASS I-III

:LASS IV GIS

:LASS IV
:HANGE

:LASS IV
NEW




SWALE
SUBAREA BOUNDARY
CLASS I-III
CLASS IV GIS
CLASS IV CHANGE
CLASS IV NEW
UMATILLA
NATIONAL FOREST
Rhea Spring
Ted Lambie Spring
Hallock Spring
Section Line Spring
Coppei Butte
Creek
Porcupine
Corral
TRAIL
FOREST SERVICE
R 27 E
R 28 E