

FINAL

**GEOMORPHIC FIELD EVALUATION
OF SERPENTINITE SOIL BARRENS,
CLEAR CREEK MANAGEMENT AREA (CCMA)**

Prepared For:
U.S. Department of the Interior
Bureau of Land Management
Hollister Resource Area
20 Hamilton Court
Hollister, CA 95023

Prepared By:
Dynamac Corporation
2275 Research Boulevard
Suite 500
Rockville, MD 20850

Submitted September 4, 1998

FINAL

**GEOMORPHIC FIELD EVALUATION
OF SERPENTINITE SOIL BARRENS,
CLEAR CREEK MANAGEMENT AREA (CCMA)**

Prepared For:

U.S. Department of the Interior
Bureau of Land Management
Hollister Resource Area
20 Hamilton Court
Hollister, CA 95023

Prepared By:

Dynamac Corporation
2275 Research Boulevard
Suite 500
Rockville, MD 20850

Submitted September 4, 1998

EXECUTIVE SUMMARY

Introduction

The U.S. Department of the Interior, Bureau of Land Management, Hollister Resource Area authorized Dynamac to conduct a geomorphic field evaluation of the serpentinite soil barren areas (barrens) located within the Clear Creek Management Area (CCMA). The objectives of the geomorphic field evaluation were: to determine the degree of soil erosion and sedimentation taking place within the barrens; to evaluate natural and anthropogenic influences on sedimentation and erosion within the barrens; and, to develop a barren inventory and ranking system.

The field evaluation took place within the eleven primary watersheds located within the CCMA containing barrens: Clear Creek, Larious Canyon/Creek, San Benito River, San Carlos Creek, East Fork San Carlos Creek, Cantua Creek, Sawmill Creek, Picacho Creek, Diaz Canyon, Leona Arroya, and White Creek. These areas represent distinct and separate watersheds, often with extreme geographic, topographic, and mineralogical variability.

The project was divided into three phases: preparation of a work plan identifying the planned approach, staffing requirements, and milestone schedule; performance of the field mapping; development of the barren inventory data base and ranking system; and, preparation of a final report summarizing the field mapping activities, ranking results, and recommendations for Best Management Practices (BMPs) which could be implemented at the CCMA. The project was performed under the Technical Assistance Contract, Work Assignment 94-021, Clear Creek Management Area.

Barren Scoring and Ranking Methodology

Due to the large size of the study area as a whole and the respective watersheds investigated, each watershed was broken down into several subwatersheds. The subwatersheds, delineated by regional drainage patterns within each watershed, formed significantly more manageable units for evaluation. Subwatersheds were often broken down even farther when necessary to maintain the integrity of separate barren units. For example, it was common to find two barren units within a subwatershed; one at the ridge line, the other along the drainage. Each of these barren areas were evaluated separately to accurately represent their often drastically different physical characteristics.

Prior to the field evaluation, a checklist was developed by Dynamac and BLM personnel to aid the field teams in collecting all pertinent information on the barren areas. The checklist included the following physical characteristics that play a part in sedimentation and erosion: drainage area size, relative size of barren within the drainage, soil color, vegetation type and percent of cover, amount of gullying, slope of ground surface, number and order of streams present, off-highway-vehicle (OHV) use density, amount and type of armoring present, mining history, proximity to access routes, and sediment trapping features.

Once the field data were collected, they were entered into a database designed to manage the information and eventually generate a quantitative score describing the sedimentation and erosion potential of each barren area. The overall score of a barren is given by the summation of the

individual scores of each of the characteristics listed above. The maximum contribution of each of the individual barren characteristics scores to the total score for the barren was determined by knowledge of the site conditions, standards for generating empirical models, and professional judgement. The total score of a single barren area may range from zero to 100, with a score of 100 indicating a barren with a maximum sedimentation and erosion potential. A score of zero does not indicate that there is no potential for sedimentation and erosion within the barren area; rather, it indicates the potential is at a minimum when compared with the other barrens. High scores are most often characterized by high OHV use, obvious signs of gullyng, white or grey soils with little armoring, steep slopes, in close proximity to major streams, few or no sediment trapping features, and minimal vegetative cover. Low scores are indicative of lower OHV traffic, undisturbed, heavily armored, brown and red soils, gentle slopes, sediment trapping features, and an absence of major streams in the subwatershed.

As detailed in the preceding paragraphs, the study area was broken down into subwatersheds and the barrens were examined on a subwatershed basis. Similarly, the barren scoring model was originally designed to provide scores based on these subwatersheds. However, previous barren studies at CCMA were performed based on "barren polygons" (polygons). These polygons are loosely defined as continuous, uninterrupted barren units. Under this definition, a barren unit may extend past watershed, subwatershed, or other types of boundaries; provided it is a single, uninterrupted unit, it is considered a polygon. In order to provide continuity with previous studies, the scoring model was expanded in such a way as to transform the subwatershed scores into scores for the polygons. Generally speaking, a polygon score can be derived from a weighted average of the scores of the subwatersheds of which it is comprised. The weighted average is calculated based on the areal percent that the polygon crosses a subwatershed. For example, if a barren polygon crosses two subwatersheds equally, its total score is equal to sum of 50% of each of the individual subwatershed scores. The delineation of the subwatersheds and polygons in the study area is shown in Drawing 1.

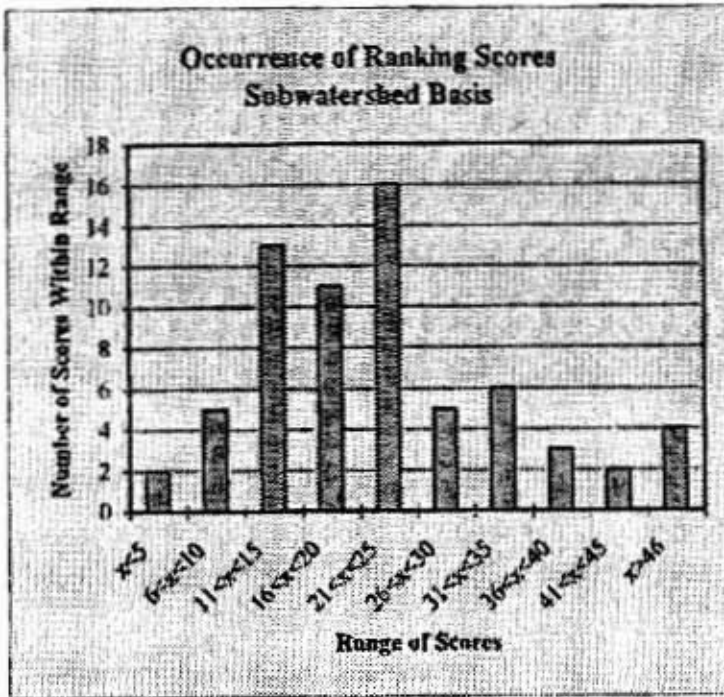
Scores were generated for a total of 67 subwatersheds within the study area, from which scores for 47 polygons were derived. The average score for the subwatersheds was 23, with a maximum score of 50 found in a subwatershed along a ridge line in the southern section of Clear Creek Canyon, and minimum scores of 2 and 3 in each of two relatively small barrens in the central section of the Clear Creek Watershed and San Benito River Watershed, respectively. Distribution of the scores for the subwatershed were approximately Gaussian, with nearly 50 percent of the scores falling between 11 and 20. A summary of the scores generated on a subwatershed basis is presented in Graph ES-1. The polygon scores had an average of 24, with a maximum of 47 for a polygon located along a ridge line between Clear Creek Canyon and the Picacho Creek Watershed. A minimum score of 3 was obtained for a small, relatively inaccessible polygon in the San Benito River Watershed. The distribution of scores for the polygons was slightly less uniform, and this is anticipated because of how these scores were derived. Nevertheless, the vast majority of the polygon scores fell between 11 and 30, with only 25 percent outside of this range. A summary of the scores generated on a polygon basis is presented in Graph ES-2.

The score ranges for each of the three categories into which the barrens were placed have been determined by a statistical analysis performed upon the entire population of polygon scores. The breakdown is as follows:

Ranking Category	Range of Scores	Number of Polygons in Range
Minor Contributor	Less than 15	11
At Risk	$16 < X < 30$	24
Major Contributor	Greater than 31	12

Consistent with the fact that the distribution of the polygon scores are approximately Gaussian, approximately 50 percent of the scores are in the "at risk" category, while the outliers make up the remaining 50 percent.

Graph ES-1: Summary of Scores, Subwatershed Basis



Graph ES-2: Summary of Scores, Polygon Basis

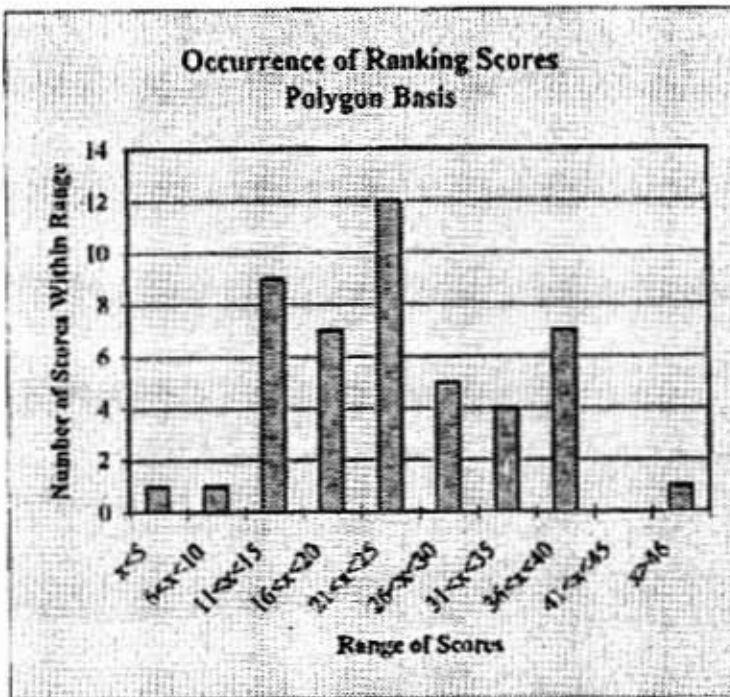


TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Executive Summary	ii
1.0 INTRODUCTION	1
1.1 Authorization and Objective	1
1.2 Field Survey Approach	1
1.2.1 Drainage Area Size	1
1.2.2 Barren Area Percent of Drainage Area	2
1.2.3 Soil Color	2
1.2.4 Vegetative Cover	2
1.2.5 Gullyng	2
1.2.6 Slope	3
1.2.7 Stream Order	3
1.2.8 OHV Use Density	3
1.2.9 Armoring	3
1.2.10 Mining History	3
1.2.11 Proximity to Access Roads	3
1.2.12 Sediment Trapping Capability	4
1.3 Barren Scoring	4
1.3.1 Positive Values	4
1.3.1.1 Drainage Area Size	5
1.3.1.2 Barren Area Percent of Drainage Area	5
1.3.1.3 Gullyng	6
1.3.1.4 Slope	6
1.3.1.5 Stream Order	7
1.3.1.6 OHV Use Density	7
1.3.1.7 Accessibility/Proximity to Access Roads	7
1.3.1.8 Mining History	8
1.3.2 Negative Values	8
1.3.2.1 Vegetative Cover	8
1.3.2.2 Armoring	8
1.3.2.3 Percent of Barren With Vegetative Boundary	9
1.3.2.4 Sediment Trapping Capability	9
1.3.3 Interpretation of Scores	9
2.0 SITE CHARACTERISTICS	11
2.1 Site Location	11
2.2 Site Description	11
2.3 Watersheds Investigated	13
3.0 FIELD DATA ANALYSIS	14
3.1 Polygon Descriptions	14
3.1.1 Polygon 1 (PG-1)	14
3.1.2 Polygon 2 (PG-2)	18

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
3.1.3 Polygon 3 (PG-3)	23
3.1.4 Polygon 4 (PG-4)	27
3.1.5 Polygon 5 (PG-5)	30
3.1.6 Polygon 6 (PG-6)	33
3.1.7 Polygon 7 (PG-7)	42
3.1.8 Polygon 8 (PG-8)	46
3.1.9 Polygon 9 (PG-9)	52
3.1.10 Polygon 10 (PG-10)	57
3.1.11 Polygon 11 (PG-11)	61
3.1.12 Polygon 12 (PG-12)	64
3.1.13 Polygon 13 (PG-13)	67
3.1.14 Polygon 14 (PG-14)	70
3.1.15 Polygon 15 (PG-15)	74
3.1.16 Polygon 16 (PG-16)	78
3.1.17 Polygon 17 (PG-17)	81
3.1.18 Polygons 18, 19, 20, 21 (PG-18, PG-19, PG-20, PG-21)	84
3.1.19 Polygon 22 (PG-22)	89
3.1.20 Polygon 23 (PG-23)	93
3.1.21 Polygon 24 (PG-24)	97
3.1.22 Polygon 25 (PG-25)	100
3.1.23 Polygon 26 (PG-26)	103
3.1.24 Polygon 27 (PG-27)	106
3.1.25 Polygons 28, 29, 30 (PG-28, PG-29, PG-30)	109
3.1.26 Polygon 31 (PG-31)	113
3.1.27 Polygons 32, 33 (PG-32, PG-33)	116
3.1.28 Polygons 34, 35 (PG-34, PG-35)	119
3.1.29 Polygon 36 (PG-36)	125
3.1.30 Polygon 37 (PG-37)	128
3.1.31 Polygons 38 and 39 (PG-38, PG-39)	130
3.1.32 Polygon 40 (PG-40)	134
3.1.33 Polygons 41, 42 (PG-41, PG-42)	138
3.1.34 Polygons 43, 44 (PG-43, PG-44)	142
3.1.35 Polygon 45 (PG-45)	146
3.1.36 Polygons 46, 47 (PG-46, PG-47)	148
3.2 Study Area Summary of Results	151
4.0 BEST MANAGEMENT PRACTICES	158
4.1 Introduction	158
4.1.1 Silt Fences	158
4.1.2 Erosion Control Blankets	159
4.1.3 Rock Backfilling of Gullies	160
4.1.4 Check Dams	161
4.1.5 Interceptor Dyke and Swale	162

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
4.1.6 Sediment Basin	164
4.1.7 Rock Filter	165
4.1.8 Gabion Mattresses	166

LIST OF DRAWINGS

Drawing

1. Clear Creek Management Area Geomorphic Field Evaluation Study Area Map

LIST OF FIGURES

Figures

Page

1.	Location of the Clear Creek Management Area	12
2.	Polygon 1 (PG-1) Detail Map	16
3.	Polygon 2 (PG-2) Detail Map	20
4.	Polygon 3 (PG-3) Detail Map	25
5.	Polygon 4 (PG-4) Detail Map	28
6.	Polygon 5 (PG-5) Detail Map	31
7.	Polygon 6 (PG-6) Detail Map	38
8.	Polygon 7 (PG-7) Detail Map	44
9.	Polygon 8 (PG-8) Detail Map	49
10.	Polygon 9 (PG-9) Detail Map	55
11.	Polygon 10 (PG-10) Detail Map	59
12.	Polygon 11 (PG-11) Detail Map	62
13.	Polygon 12 (PG-12) Detail Map	65
14.	Polygon 13 (PG-13) Detail Map	68
15.	Polygon 14 (PG-14) Detail Map	72
16.	Polygon 15 (PG-15) Detail Map	76
17.	Polygon 16 (PG-16) Detail Map	79
18.	Polygon 17 (PG-17) Detail Map	82
19.	Polygons 18, 19, 20, 21 (PG-18, PG-19, PG-20, PG-21) Detail Map	86
20.	Polygon 22 (PG-22) Detail Map	91
21.	Polygon 23 (PG-23) Detail Map	95
22.	Polygon 24 (PG-24) Detail Map	98
23.	Polygon 25 (PG-25) Detail Map	101
24.	Polygon 26 (PG-26) Detail Map	104
25.	Polygon 27 (PG-27) Detail Map	107
26.	Polygons 28, 29, 30 (PG-28, PG-29, PG-30) Detail Map	111
27.	Polygon 31 (PG-31) Detail Map	114
28.	Polygons 32, 33 (PG-32, PG-33) Detail Map	118
29.	Polygons 34, 35 (PG-34, PG-35) Detail Map	121
30.	Polygon 36 (PG-36) Detail Map	126
31.	Polygon 37 (PG-37) Detail Map	129
32.	Polygons 38, 39 (PG-38, PG-39) Detail Map	132
33.	Polygon 40 (PG-40) Detail Map	135
34.	Polygons 41, 42 (PG-41, PG-42) Detail Map	140
35.	Polygons 43, 44 (PG-43, PG-44) Detail Map	144
36.	Polygon 45 (PG-45) Detail Map	147
37.	Polygons 46, 47 (PG-46, PG-47) Detail Map	150

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Barren Scores, Subwatershed Basis	153
2. Barren Scores, Polygon Basis	154
3. Detailed Summary of Subwatershed Scores	155
4. Summary of BMPs and Their Functions	158

LIST OF GRAPHS

<u>Graph</u>	<u>Page</u>
ES-1. Summary of Barren Scores, Subwatershed Basis	v
ES-2. Summary of Barren Scores, Polygon Basis	v

LIST OF PHOTOGRAPHS

Photograph

1. Looking NW from the Clear Creek Road. Gullied mid slopes in CL-11, characterized by grey and white soils.
2. Looking SE from Clear Creek Road. Mature soils in inner gorge slopes in CL-6.
3. Looking E-NE from the western ridge of CL-20. View of mature soils along interfluvium.
4. Looking S from the center of CL-16. View of armored well used motorcycle trail.
5. Looking SE from top of CL-18. View of large ephemeral drainage.
6. Looking NE from SW corner of LC-2. View of large hill climb play area.
7. Looking SE from CL-25 western ridge line. Top of well armored hill climb.
8. Looking NE from CL-22 western ridge line. Well armored small play area.
9. Looking NW from CL-25 eastern ridge line. Barren bordered by moderate canopy.
10. Looking west from NE corner of CL-28. Scattered patches of vegetation that serve as buffers.
11. Looking E-SE from CL-28 western ridge line. View of mature well armored soils.
12. Looking N from the Clear Creek Road in CL-29. Incised gullies perpetuated by OHV use.
13. Looking NW from CL-24. Well armored steep inner gorge leading to Clear Creek.
14. Looking SW from CL-17A. Well armored mature inner gorge soils, potential area for a sediment.
15. Looking W-SW from CL-15. Denuded well used hill climb play area.
16. Looking SE from CL-15 toward PC-3B. Denuded play area in foreground.
17. Looking NW from CL-31C inner gorge slope. Area exhibiting signs of slides.
18. Looking SE from CL-31B ridge line. Multiple play areas along the interfluvium.
19. Looking S from PC-2A. Large play area with some soil and armor denudation.
20. Looking SE from bottom of Indian Hills. Well used play area.
21. Looking S from Indian Hill. Smaller play areas and evidence of mass wasting.
22. Looking NE from the bottom of CL-30. Evidence of mass wasting due to slides.
23. Looking SE from from the SB-4 ridge line. Large mine converted into a play area.

LIST OF PHOTOGRAPHS (Continued)

Photograph

24. Looking S from SB-4 ridge line. Mature well armored soils along interfluves.
25. Looking SE from CL32A inner gorge ridge line. Undisturbed steep inner gorge slopes.
26. Looking SW from CL-32A eastern ridge. Disturbed steep inner gorge slope (play area).
27. Looking NE from CL-37 at San Benito Mountain. Large denuded play area adjacent to naturally eroded inner gorge slope.
28. Looking N from CL-37 at inner gorge play area depicted in Photo 27.
29. Looking S from SM-2B. Mature well armored soils along ridge line and interfluve.
30. Looking E from CL-37. Inner gorge ridge line with characteristic motorcycle trail.
31. Looking SW from middle elevation of SM-1B. Ridge line with moderate OHV use.
32. Looking N from adjacent subwatershed CL-36. Heavily used and denuded hill climb play area, exhibiting massive gully induced by OHV use.
33. Looking N-NW from adjacent subwatershed CL-35. Little used, naturally eroded barren.
34. Looking NE from CL-33 western ridge. Denuded soils due to play area and hill climb.
35. Looking NW from adjacent subwatershed CL-32B. Little used, naturally eroded barren.
36. Looking E-NE from CL-33 western ridge. Mining disturbance on otherwise little used barren.
37. Looking NE from CL-33 western ridge. Mining disturbances used as play areas.
38. Looking N-NE from CL-33. Inner gorge slopes denuded due to OHV use (play areas).
39. Looking N from SC-1. Large gully caused by alteration of natural terrain (road cut).
40. Looking S-SW from SC-1. Mining disturbance exhibiting severe erosional features.
41. Looking NE from CL-33 ridge line.
42. Looking NW from CL-33 northern ridge line. Series 768 barren with heavy vegetative buffer.
43. Looking N-NE from EF-1A. Naturally occurring immature soils.
44. Looking SW from SC-1. Play area that has caused denuded soils on an interfluve ridge line.
45. Looking N from SC-1. Well armored naturally gullied mid slopes, with sediment pile.
46. Looking E-NE from SC-1 NE ridge line. Mature well armored protected barren area.
47. Looking E from EF-1B. Mining disturbance that has been protected.
48. Looking N from SW corner of LC-1B. Mature well armored soils with good canopy buffer.
49. Looking NE from LC-1A southern ridge. Minor mining disturbance used as a play area.
50. Looking N from LC-1A southern ridge line. Naturally denuded soils adjacent to mature soils.
51. Looking S-SE from SB-3A KCAC Road. Gullied play area adjacent to drainage course.
52. Looking N-NE from SB-3C. Patchy vegetation associated with 768 series barren.
53. Looking NE from SB-3C northern ridge line. Mining disturbance heavily used as a play area.
54. Looking N-NE from SB-3C northern ridge. Same disturbance exhibiting denuded soils.
55. Looking from SB-3C. Same disturbance exhibiting good vegetative buffer.
56. Looking N from SB-3C northern ridge. Well armored hill climb and trail area.
57. Looking NW in WC-3B. Narrow inner gorge experiencing severe natural erosion.
58. Looking NW on WC-3 northern ridge. Large mine disturbance used as a play area.

LIST OF PHOTOGRAPHS (Continued)

Photograph

59. Looking NE from the CC-1A southern ridge. Isolated barrens surrounded by canopy buffer.
60. Looking W from CC-1B. Play area atop ridge line with canopy border.
61. Looking N from CC-1C. Well armored play areas established on inner gorge slopes.
62. Looking W from SM-1A ridge line. Play area with denuded (whitesoils).
63. Looking N from SM-1A. Play area located atop ridge line that exhibits bowl-like topography.
64. Looking E from SN-2. Little used barrens that are well armored.
65. Looking S from SB-2. Isolated barrens bordered by dense chaparral.
66. Looking SE from SB-2. Lower barren area with play area on inner gorge slope.

1.0 INTRODUCTION

1.1 Authorization and Objective

The U.S. Department of the Interior, Bureau of Land Management, Hollister Resource Area authorized Dynamac to conduct a geomorphic field evaluation of the serpentinite soil barren areas (barrens) located within the Clear Creek Management Area (CCMA). The objectives of the geomorphic field evaluation were to complete an evaluation of soil erosion and sedimentation taking place within the barrens, evaluating both natural and anthropogenic influences, and development of a barren inventory and ranking system.

The project was divided into three phases: (1) preparation of a work plan identifying the planned approach, staffing requirements, and milestone schedule; (2) performance of the field mapping; and (3) development of the barren inventory data base and ranking system, and preparation of a final report summarizing the field mapping activities, ranking results, and recommendations for Best Management Practices (BMPs) to be implemented in the field. The project was performed under the Technical Assistance Contract, Work Assignment 94-021, Clear Creek Management Area.

1.2 Field Survey Approach

Due to the large size of the study area as a whole and the respective watersheds investigated, each watershed was broken down into several subwatersheds. The subwatersheds, delineated by regional drainage patterns within each watershed, formed significantly more manageable units for evaluation. Subwatersheds were often broken down even farther when necessary to maintain the integrity of separate barren units. For example, it was common to find two barren units within a subwatershed; one at the ridge line, the other along the drainage. Each of these barren areas were evaluated separately to accurately represent their often drastically different physical characteristics.

Prior to the field evaluation, a checklist was developed by Dynamac and BLM personnel to aid the field teams in collecting all pertinent information on the barren areas. The checklist included the following physical characteristics that play a part in sedimentation and erosion: drainage area size, relative size of barren within the drainage, soil color, vegetation type and percent of cover, amount of gullying, slope of ground surface, number and order of streams present, off-highway-vehicle (OHV) use density, amount and type of armoring present, mining history, proximity to access routes, and sediment trapping features.

The checklist items are described in more detail in the sections to follow. The discussions provide some insight into the development of scoring database, relative weights of the parameters, and overall rationale for generating sediment and erosion potential scores for the barrens.

1.2.1 Drainage Area Size

Drainage area defines acreage of the subwatershed. This value does not change in the event that multiple barren complexes were evaluated within a single watershed. Size of the drainage influences drainage density and sediment transport potential.

1.2.2 Barren Area Percent of Drainage Area

Barren Area Percent defines the percentage of the subwatershed occupied by barrens. When more than one polygon exists in the subwatershed, the percent barren value represents the sum of all polygons; that is, the value represents the percentage of total barren area within the watershed.

The relative size of the barren areas is an indicator of erosion and sedimentation potential. The degree of erosion and sedimentation is directly proportional to the acreage of the barren.

1.2.3 Soil Color

Soil color describes the “condition” of the barren, which more specifically defines the amount of erosion taking place, as well as the state of denudation present. White soils indicate a minimal soil horizon or bedrock, and therefore a high degree of erosion. Grey soils represent regressing soils impacted by erosion and sedimentation. Red soils indicate moderately deep and stable soils associated with relatively stable barrens. Brown soils indicate well established, deep soils, closely associated with vegetated areas, and are indicative of a low degree of erosion.

Soil condition describes the degree of erosion and sedimentation occurring. The degree of erosion and sedimentation increases as the percent of unstable/erodible soils (i.e., white or grey) increases.

1.2.4 Vegetative Cover

Vegetative cover defines the percentage of the subwatershed covered by vegetation, and is usually a combination of canopy, shrub, and forb. Sedimentation and erosion potential decreases as the percentage of vegetative cover increases due in part to the connection between deep, stable soils and more dense vegetation.

Some areas of vegetative cover also serve as a vegetative boundary. Vegetative boundaries along the perimeter of a subwatershed, such as at the toe of a slope or along a stream, form a buffer zone both for down-slope movement of sediment and along the stream bank. Vegetative boundaries around the flanks and heel of subwatersheds can reduce sedimentation and erosion potential because they can restrict access to the subwatershed and, depending on the down slope extent, significantly reduce maximum possible overland flow lengths.

1.2.5 Gullying

Gullying describes down cutting fluvial erosional features developed on slope faces. The number of gullies occurring on a barren slope depicts the extent of erosion, while the size of the gullies depict the degree or intensity of erosion and potential for continued erosion and sedimentation. For example, large, deep gullies can carry greater volumes of water and sediment than a series of small gullies. The location of the gullies within the barren area is also important when considering sediment delivery potential; gullies near the bottom have greater potential than those at the top.

1.2.6 Slope

Degree of slope impacts erosion potential, both by fluvial and gravimetric processes; that is, the greater the degree of slope, the greater the stream power and sedimentation and erosion potential.

1.2.7 Stream Order

Stream order describes the stream magnitude within the drainage system. The minor streams, especially first order, are less erosive and contribute less sedimentation than higher order streams. Perennial streams are constantly in a state of down cutting, eroding, and moving sediment, albeit to a minor degree during low flow conditions. On the other hand, ephemeral streams are intermittent perpetuators and conveyors of eroded material and sediment.

1.2.8 OHV Use Density

OHV density describes the percent area of the barren that is used by OHVs. OHV track is categorized as either "distributed" or "localized." Distributed OHV use is defined as being indiscriminately scattered across the barren, in general with approximately equal intensity. Localized use, on the other hand, is limited to definitive pockets within the barren, each of which show significantly higher OHV use intensity than the remainder of the barren. The OHV use density may also be categorized according to how the riders utilize it: play area, hill climb, or trail. The amount of OHV use can infer one of two conditions: that the area is popular with heavy use which has had a significant impact on the soils (i.e., stripping/denuding, leading to white or grey soils); or, that the area is used sparingly or for isolated purposes such as trails, and have a limited impact on the soils. The amount of sedimentation and erosion potential related to OHV use density is a combination of amount of use, type of use, and whether the use is distributed or localized.

1.2.9 Armoring

Armoring describes the percentage of the barren that is covered with a protective gravel lag. The size or coarseness of the gravel lag also plays a part in the sedimentation and erosion potential because: the larger the gravel, the greater the resistance to sheet flow; armored slopes are more resistant to precipitation events; and armored slopes are more resistant to OHV use.

1.2.10 Mining History

Indicates the presence of mine workings greater than one acre in size within a subwatershed that exhibits OHV use. While no clear connection exists between mining history and sedimentation and erosion potential, it is possible that because these areas tend to attract more OHV users than other areas, they exhibit slightly increased potential.

1.2.11 Proximity to Access Roads

This parameter indicates the number of roads, trails, or other forms of access by which the barren area may be reached. The degree of accessibility can provide an indication of the popularity, use type, and volume of OHV use in the area.

1.2.12 Sediment Trapping Capability

Barren sediment trapping capability describes the inherent features (i.e., terraces, basins, dense vegetation, narrow interfluves) that act as sediment traps or erosion arrestors, or other features that when combined with engineering controls or BMPs could reduce sedimentation and erosion potential.

1.3 Barren Scoring

Once the twelve parameters by which the barrens would be examined were in place, Dynamac personnel developed the scoring model by which the raw field data would be transformed into useable values, capable of estimating the sedimentation and erosion potential of a particular barren area. It was established that the total score of a single barren area may range from zero to 100, with a score of 100 indicating a barren with a maximum sedimentation and erosion potential. A score of zero does not indicate that there is no potential for sedimentation and erosion within the barren area; rather, it indicates the potential is at a minimum when compared with the other barren areas evaluated. Generally speaking, high scores are most often characterized by high OHV use, obvious signs of gullyng, white or grey soils with little armoring, steep slopes, in close proximity to major streams, few or no sediment trapping features, and minimal vegetative cover. Low scores are indicative of lower OHV traffic, undisturbed, heavily armored, brown and red soils, gentle slopes, sediment trapping features, and an absence of major streams in the subwatershed.

As detailed in the previous sections, some of the parameters are representative of high sedimentation and erosion potential, while others bring about a reduction in that potential. With this in mind, a certain nomenclature has been developed. Those parameters which are indicative of high sedimentation and erosion rates are "positive" values; that is, they add to the score of the barren, and hence show an increased sedimentation and erosion potential. These include: OHV use density; barren area percent of drainage area; soil color; drainage area size; gullyng; slope; stream order; and, proximity to routes of access. "Negative" values, on the other hand, are those which reduce sedimentation and erosion potential, and hence, the score of a barren. They include: vegetative cover (and vegetation type); armoring; presence of a vegetative boundary; and, sediment trapping capability. With this information in mind, the total score of a barren is equal to the summation of the "positive" scores, minus the sum of the "negative" scores.

The following sections provide the formulas used to calculate the contribution of each parameter to the total score for a barren. These formulae and their respective weights in determining the total score for a barren, were determined by knowledge of site conditions, standards for generating empirical models, and professional judgement. In these sections, variables for which values were obtained during the field activities are indicated with brackets (e.g., [OHV_use_den]). All other variables are derived from manipulations of those obtained in the field.

1.3.1 Positive Values

Positive values are obtained for those parameters which add to the sedimentation and erosion potential score for a barren. The maximum value that each parameter can contribute to the total score of a barren is specified for each. These maximum contributions were determined using

knowledge of the site conditions, standards for generating empirical models, and professional judgement.

1.3.1.1 Drainage Area Size

$$DA = 10 * [DA_size]^{-1}$$

where:

DA = contribution of drainage area size to sedimentation and erosion potential; maximum score contribution of 10.

[DA_size] = 1 if >300 acres; 2 if 200-300 acres; 3 if 100-200 acres; 4 if <100 acres.

1.3.1.2 Barren Area Percent of Drainage Area

$$BA = 3.75 * \{ [%W](4) + [%G](3) + [%R](2) + [%B](1) \} * [percent_BA]^{-1}$$

where:

BA = contribution of barren area percent of drainage area to sedimentation and erosion potential; maximum score contribution of 15.

[percent_BA] = 1 if >75%; 2 if 50-75%; 3 if 25-50%; 4 if <25%.

[%W] = percent white soil observed

[%G] = percent grey soil observed

[%R] = percent red soil observed

[%B] = percent brown soils observed

1.3.1.3 Gullying

$$GL = 0.3 * GRF$$

$$GRF = 0.6 * \{ [T>4](3) + [T2-4](2) + [T0-2](1) \} + 0.3 * \{ [M>4](3) + [M2-4](2) + [M0-2](1) \} + 0.1 * \{ [B>4](3) + [B2-4](2) + [B0-2](1) \}$$

where:

GL = contribution of gullying within barren area to sedimentation and erosion potential;
maximum score contribution of 10.

GRF = "gully ranking factor"; a term generated to reduce the number of terms being multiplied to obtain GL.

[T>4] = number of gullies in top of barren of cross-sectional length greater than 4 ft

[T2-4] = number of gullies in top of barren of cross-sectional length between 2 and 4 ft

[T0-2] = number of gullies in top of barren of cross-sectional length between 0 and 2 ft

[M>4] = number of gullies in middle of barren of cross-sectional length greater than 4 ft

[M2-4] = number of gullies in middle of barren of cross-sectional length between 2 and 4 ft

[M0-2] = number of gullies in middle of barren of cross-sectional length between 0 and 2 ft

[B>4] = number of gullies in bottom of barren of cross-sectional length greater than 4 ft

[B2-4] = number of gullies in bottom of barren of cross-sectional length between 2 and 4 ft

[B0-2] = number of gullies in bottom of barren of cross-sectional length between 0 and 2 ft

1.3.1.4 Slope

$$SL = 4 * [>50] + 3 * [30-50] + 2 * [15-30] + 1 * [0-15]$$

where:

SL = contribution of slope within barren area to sedimentation and erosion potential;
maximum score contribution of 10.

[>50] = 1 if there are representative slopes >50° in the barren; otherwise the value is zero

[30-50] = 1 if there are representative slopes between 30° and 50° in the barren; otherwise the value is zero

[15-30] = 1 if there are representative slopes between 15° and 30° in the barren; otherwise the value is zero

[0-15] = 1 if there are representative slopes >50° in the barren; otherwise the value is zero

1.3.1.5 Stream Order

$$SO = 0.53 * \{ [3^{\circ}_p](4.5) + [2^{\circ}_p](3) + [1^{\circ}_p](1.5) + [3^{\circ}_e](3) + [2^{\circ}_e](2) + [1^{\circ}_e](1) \}$$

where:

SO = contribution of streams within barren area to sedimentation and erosion potential; maximum score contribution of 10.

$[3^{\circ}_p]$ = number of third order perennial streams located within the barren area

$[2^{\circ}_p]$ = number of second order perennial streams located within the barren area

$[1^{\circ}_p]$ = number of first order perennial streams located within the barren area

$[3^{\circ}_e]$ = number of third order ephemeral streams located within the barren area

$[2^{\circ}_e]$ = number of second order ephemeral streams located within the barren area

$[1^{\circ}_e]$ = number of first order ephemeral streams located within the barren area

1.3.1.6 OHV Use Density

$$OHV = 17.5 * [LD] * [OHV_use_den]^{\dagger}$$

where:

OHV = contribution of OHV use within barren area to sedimentation and erosion potential; maximum score contribution of 35.

$[OHV_use_den]$ = 1 if >75%; 2 if 50-75%; 3 if 25-50%; 4 if <25%.

$[LD]$ = 1 if the OHV use is distributed throughout the barren area; 2 if the OHV use is localized to one or several high impact areas.

1.3.1.7 Accessibility/Proximity to Access Roads

$$ACC = [Access] * 5$$

where:

ACC = contribution of accessibility to sedimentation and erosion potential; maximum score contribution of 5.

$[Access]$ = 1 if there are any county roads, light-duty improved roads, or unimproved roads; 0 if the barren is accessible only by trail.

1.3.1.8 Mining History

$$MH = [Mine_HST]*5$$

where:

MH = contribution of presence of mine workings to sedimentation and erosion potential; maximum score contribution of 5.

[Mine_HST] = 1 if significant mining activities were observed within the barren area; 0 if no significant mining activities were observed.

1.3.2 Negative Values

Negative values are obtained for those parameters which reduce the sedimentation and erosion potential score for a barren. The maximum value that each parameter can subtract from the total score of a barren is specified for each. These maximum values were determined using knowledge of the site conditions, standards for generating empirical models, and professional judgement.

1.3.2.1 Vegetative Cover

$$VC = 5*[Veg_cov]^{-1}$$

where:

VC = amount by which sedimentation and erosion potential within the barren is reduced as a result of the presence of the vegetative cover; maximum deduction is 5.

[Veg_cov] = 1 if >75%; 2 if 50-75%; 3 if 25-50%; 4 if <25%.

1.3.2.2 Armoring

$$AR = 3.5*[ARM]^{-1}*\{[A_CG](3)+[A_MG](2)+[A_FG](1)\}$$

where:

AR = amount by which sedimentation and erosion potential within the barren is reduced as a result of the presence of armoring on the barren surface; maximum deduction is 10.

[ARM] = 1 if >75%; 2 if 50-75%; 3 if 25-50%; 4 if <25%.

[A_CG] = percent of course gravel armoring observed

[A_MG] = percent of medium gravel armoring observed

[A_FG] = percent of fine gravel armoring observed

1.3.2.3 Percent of Barren With Vegetative Boundary

$$VB = 5 * [Veg_bound]^{-1}$$

where:

VB = amount by which sedimentation and erosion potential within the barren is reduced as a result of the presence of vegetative boundaries; maximum deduction is 5.

[Veg_bound] = 1 if >75%; 2 if 50-75%; 3 if 25-50%; 4 if <25%.

1.3.2.4 Sediment Trapping Capability

$$STC = 0.2 * \{ [SED_B](3) + [SED_M](2) + [SED_T](1) \}$$

where:

STC = amount by which sedimentation and erosion potential within the barren is reduced as a result of the presence of sediment trapping features; maximum deduction is 5.

[SED_B] = Number of sediment trapping features in bottom of barren.

[SED_M] = Number of sediment trapping features in middle of barren.

[SED_T] = Number of sediment trapping features in top of barren.

1.3.3 Interpretation of Scores

As detailed in the preceding paragraphs, the study area was broken down into subwatersheds and the barrens were examined on a subwatershed basis. Similarly, the barren scoring model was originally designed to provide scores based on these subwatersheds. However, previous barren studies at CCMA were performed based on "barren polygons" (polygons). These polygons are loosely defined as continuous, uninterrupted barren units. Under this definition, a barren unit may extend past watershed, subwatershed, or other boundaries; provided it is a single, uninterrupted unit, it is considered a polygon. In order to provide continuity with previous studies, the scoring model was expanded in such a way as to transform the subwatershed scores into scores for the polygons. Generally speaking, a polygon score can be derived from a weighted average of the scores of the subwatersheds of which it is comprised. The weighted average is calculated based on the areal percent that the polygon crosses a subwatershed. For example, if a barren polygon crosses two subwatersheds equally, its total score is equal to sum of 50% multiplied by each of the individual subwatershed scores. This methodology is effective in all but one type of situation: when several small polygons lie entirely within a single watershed which has been evaluated as a single unit. In this case, "manual" adjustments of the scores have been performed based on field observations in order to better represent the characteristics of each of the discrete units. In other words, if three polygons reside within one subwatershed, each is first assigned the score of the subwatershed, then each is adjusted based on the conditions observed. For example, Subwatershed CL-33 contains four discrete polygons: PG-18, PG-19, PG-20, and PG-21. Based on the field investigation, it was found that PG-18 and PG-19 are much more heavily used by OHVs and in general show a greater sedimentation and erosion potential. Knowing this, the polygon scores for PG-18 and PG-19 were increased slightly over the baseline score of Subwatershed CL-33, while the scores for PG-20 and PG-21 were reduced to several points

below the baseline. More detail is provided in the individual polygon writeups when this type of manual adjustment was used, and a description of the assumptions leading to the adjustment are provided therein. The delineation of the subwatersheds and polygons in the study area is shown in Drawing 1.

The scores for each polygon investigated during the field activities are presented in the individual subsections in Section 3, Field Data Analysis. For the purpose of dividing the scores into manageable units, three categories of barren were developed: minor contributors, "at risk," and major contributors. Minor contributors are barrens which do not appear to have significant sedimentation and erosion potential, while major contributors tend to contribute large volumes of sediment off site due to their specific characteristics. The "at risk" category includes those barrens which fall within the grey area between the "major" and "minor" contributors, and which may be either recovering or worsening depending upon degree of anthropogenic influence and site conditions. It is not possible within the scope of this study to determine which path these "at risk" barrens are following; however, it is possible to use the scores as a guide by which further study may be directed.

2.0 SITE CHARACTERISTICS

2.1 Site Location

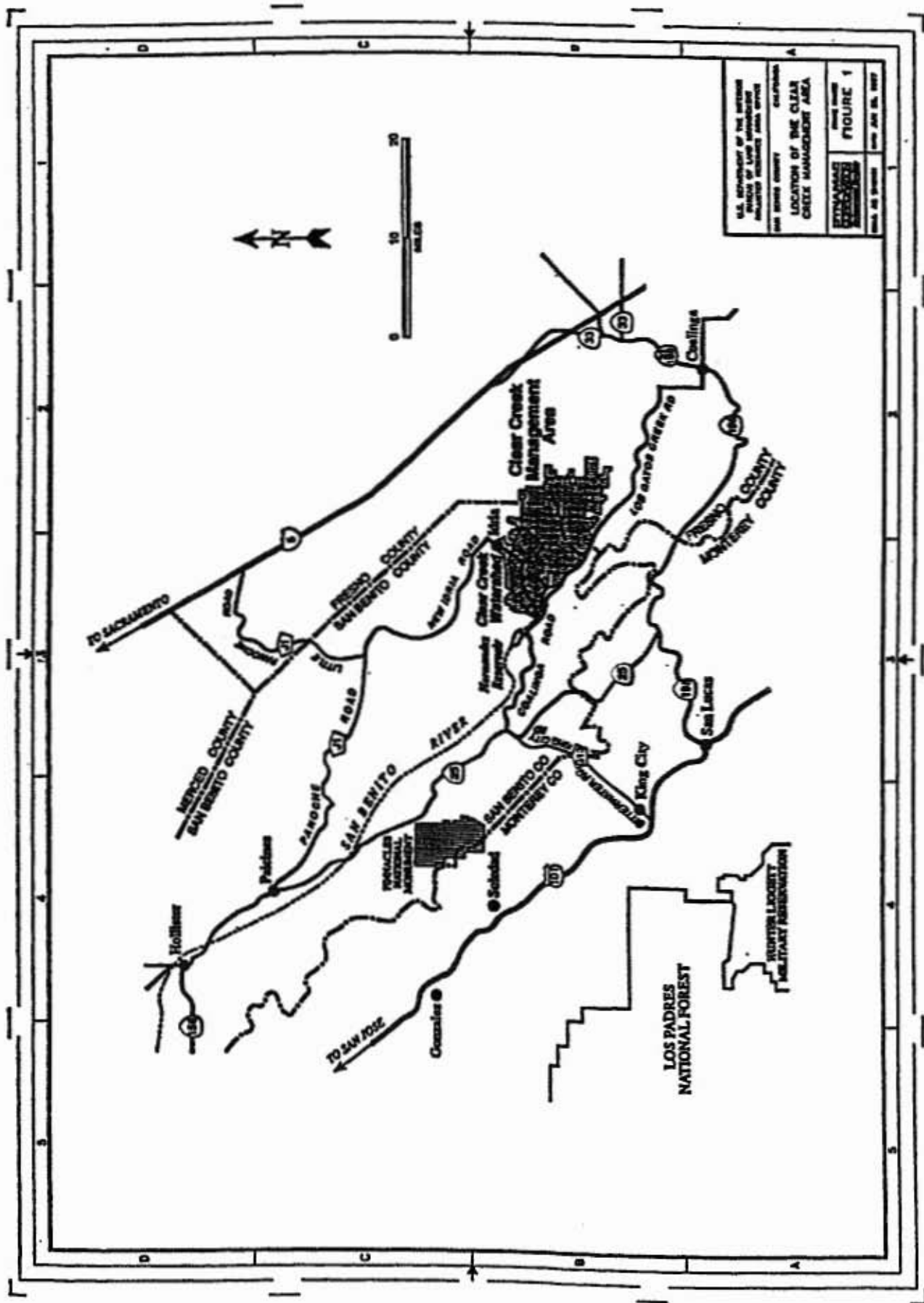
The study area encompasses eleven watersheds located within the CCMA containing barrens: Clear Creek, Larios Canyon/Creek, San Benito River, San Carlos Creek, East Fork San Carlos Creek, Cantua Creek, Sawmill Creek, Picacho Creek, Diaz Canyon, Leona Arroya, and White Creek. The CCMA is located approximately 25 miles northwest of Coalinga, California, and can be reached by traveling northwest on Los Gatos Creek Road from Coalinga. Access to the majority of the study area is then gained via Clear Creek Road, which traverses all but the upper reaches of the majority of watersheds. The exceptions are the White Creek, Leona Arroya, and Diaz Canyon watersheds which are reached via the Atlas Mine Road, and the San Benito River, Cantua Creek, and Sawmill Creek watersheds which are accessible via the KCAC Mine Road. Figure 1 shows the location of the CCMA relative to nearby cities and features, while Drawing 1 shows a detailed view of the study area in its entirety.

2.2 Site Description

The watersheds are drained by higher order perennial streams that, with the exception of White Creek, descend from San Benito Mountain. White Creek descends from Wright Mountain and flows to the southeast. Clear Creek flows to the west until it reaches the San Benito River, where it discharges. Larios and San Carlos Creek flow to the north where they discharge to Silver Creek. The topography of the study area is dominated by convex gently sloping ridges and interfluvies (less than 15 percent). Closer to the stream channels, slopes become planar, quite steep (greater than 50 percent), and are referred to as inner gorges. Elevations in the CCMA range from approximately 2,500 feet at the mouth of the drainage to nearly 5,000 feet along the crest of the Diablo Range. The ridges and interfluvies are dominated by naturally occurring areas void of vegetation, which are known locally as "barrens." The sparse vegetation that does exist is dominated by chaparral and conifers with very little vegetation at the grass/forb layer.

Soils in the CCMA are typical lithic argixerolls of the Atravesada, Henneke, and Shadeleaf series, which are characteristic of serpentinite. The soils are comprised of gravelly clay loam to gravelly loam textures and generally are relatively thin, averaging between 2 and 3 feet in depth over bedrock. Left undisturbed, the serpentinite soils found in the barrens typically develop a gravel lag or armor at the ground surface and are fairly resistant to erosion. This is evident by the lack of erosional features, such as rills and gullies, that are found in undisturbed barrens. The soils are extremely sensitive to anthropogenic disturbances, such as OHV use. Another geomorphic feature common in the study area is mass wasting caused by slides.

The climate in the study area can generally be characterized as Mediterranean, with cool winters and hot summers. Mean annual rainfall averages between 17 and 20 inches per year, with the majority of precipitation occurring between December and April. Temperatures are moderate year round, averaging 60.9°F. The hottest months occur during the summer when temperatures can reach 100°F, while cooler temperatures (e.g. 40°-50°F) occur during the winter months.



The asbestos and associated mineralization in the New Idria serpentinite mass and on the border of the diapir resulted in early mining activity in the CCMA. These activities included exploration, prospecting, and mining of asbestos, chromite, copper, gemstones, magnesite, and mercury. Mercury was mined in Idria, just north of the study area, as late as the 1970s. To accommodate mining, exploration roads were built throughout the watershed and expanded during the 1930s and 1940s. Currently, the CCMA is used extensively for recreation, particularly for OHV and rockhounding activities. These activities are facilitated by the large network of exploration roads that exist in the CCMA. In addition to the exploration roads, OHV activities have created an extensive network of trails and camping areas.

The CCMA is located in the Diablo Range of Central California and is primarily underlain by asbestos-rich serpentinite of the New Idria diapiric body. This unit contains mostly sheared serpentinite that forms an elliptical-shaped, northwest-trending intrusive mass, and is the core of the Coalinga anticline. Several distinct rock units are also present in the Clear Creek Watershed, including Franciscan sandstones and meta-sedimentary rocks that crop out near the mouth of the Clear Creek, and a nearly continuous northwest-southeast trending calcareous silicate rock that crops out in the middle of the Clear Creek Watershed.

The geology of the study area is the result of a complex history of plate tectonics. In summary, the serpentinite mass was originally part of the Pacific Ocean sea floor that was subducted under the North American continent. This unit was later uplifted and intruded through the overlying sediments that comprised the core of various anticlines within the Diablo Range. The rock unit underwent further deformation, shearing, and redistribution as a result of right lateral movement along the San Andreas fault system. Within the Diablo Range, the study area is situated in the Coalinga anticline.

During the uplift, associated erosion, and piercement of the serpentinite mass into the core of the Coalinga anticline (which is the present-day New Idria serpentinite mass), some of the rock unit became exposed during the Miocene epoch. Subsequent landslides to the east, off of the flanks of the rising anticline, resulted in the emplacement of serpentinite bodies in Miocene sediments, such as the Big Blue Member of the Temblor Formation. Other strata of Miocene and younger age also contain detritus eroded from serpentinite bodies, indicating that uplift in the Coast Ranges has continued since the Miocene epoch. The Coast Ranges underwent a major regional uplift sometime during the Pliocene and Pleistocene epochs, which defined the boundary between the Coast Ranges and the Great Valley of California. As a result of this uplift and subsequent erosion, large alluvial fans were formed along the western edge of the Great Valley. Evidence of continued uplift and mass wasting indicate that uplift on some of the folds continues to date.

2.3 Watersheds Investigated

Eleven major watersheds within the CCMA were evaluated during the field survey, which took place in late July 1997. The watersheds found to contain barren areas, shown in Drawing 1, include: Clear Creek, Larious Canyon/Creek, San Benito River, San Carlos Creek, East Fork San Carlos Creek, Cantua Creek, Sawmill Creek, Picacho Creek, Diaz Canyon, Leona Arroya, and White Creek. Detailed, location-specific descriptions will be provided in Section 3.

3.0 FIELD DATA ANALYSIS

3.1 Polygon Descriptions

The following sections contain discussions of the findings of the field surveys of each of 47 polygons within the study area. These discussions contain detailed physical descriptions, including locations of OHV play areas and other major features contributing to the sedimentation and erosion potential of the barren. Also presented are delineations of areal percentages of the subwatersheds comprising the polygon. This will provide insight regarding how the polygon scores were calculated.

3.1.1 Polygon 1 (PG-1)

Location and Physical Description

PG-1 is a 768 series polygon located midway between the mouth and central bend of Clear Creek on the southern flank of Clear Creek Canyon. The polygon spans the gorges and canyon walls bordering Clear Creek subwatersheds CL-6, CL-7, CL-8, CL-9, CL-10, and CL-11. The exterior border of the polygon consists of thick vegetation, and there is no definitive drainage system within the barren. Two ephemeral first order streams run into the barren polygon; one originating in the upper reaches of CL-9, the other near the ridge line of CL-8. In both cases, thin vegetative boundaries exist between the barren areas and each stream, providing minimal sedimentation trapping capability. The proximity of the barren to Clear Creek presents the potential for easy transport of sediment from the barren into Clear Creek itself, either directly or via the two ephemeral drainages.

The barren polygon is uniformly well armored consisting mainly of fine to medium gravels. The majority of the soil is red in color with greys and whites lining the deeper gullies and areas of higher historical OHV use. There are small, scattered patches of vegetation within the polygon, representative of 768 series barrens.

As a whole, these areas are moderately gullied. Most are shallow, but a few of the larger gullies appear to have at one time been exacerbated by intense OHV traffic.

Much of the polygon area bordering Clear Creek road is fenced; however, there is evidence of at least one hill climb and four apparently seldom used motorcycle trails. Couple this fact with the extremely steep slopes, gullies, and scattered vegetation, and PG-1 likely presents unattractive terrain for significant OHV use. OHV use contributes minimally to erosion within this barren, but it is clear that additional use would significantly increase sedimentation and erosion into Clear Creek.

The surface water runoff pattern in the polygon appears to be divided between sheet flow and transport to Clear Creek via gullies. The barren is situated on moderately steep slopes directly bordering Clear Creek, which allows for easy transport of sediment from the barrens into Clear Creek. There are no apparent sediment trapping capabilities in this polygon.

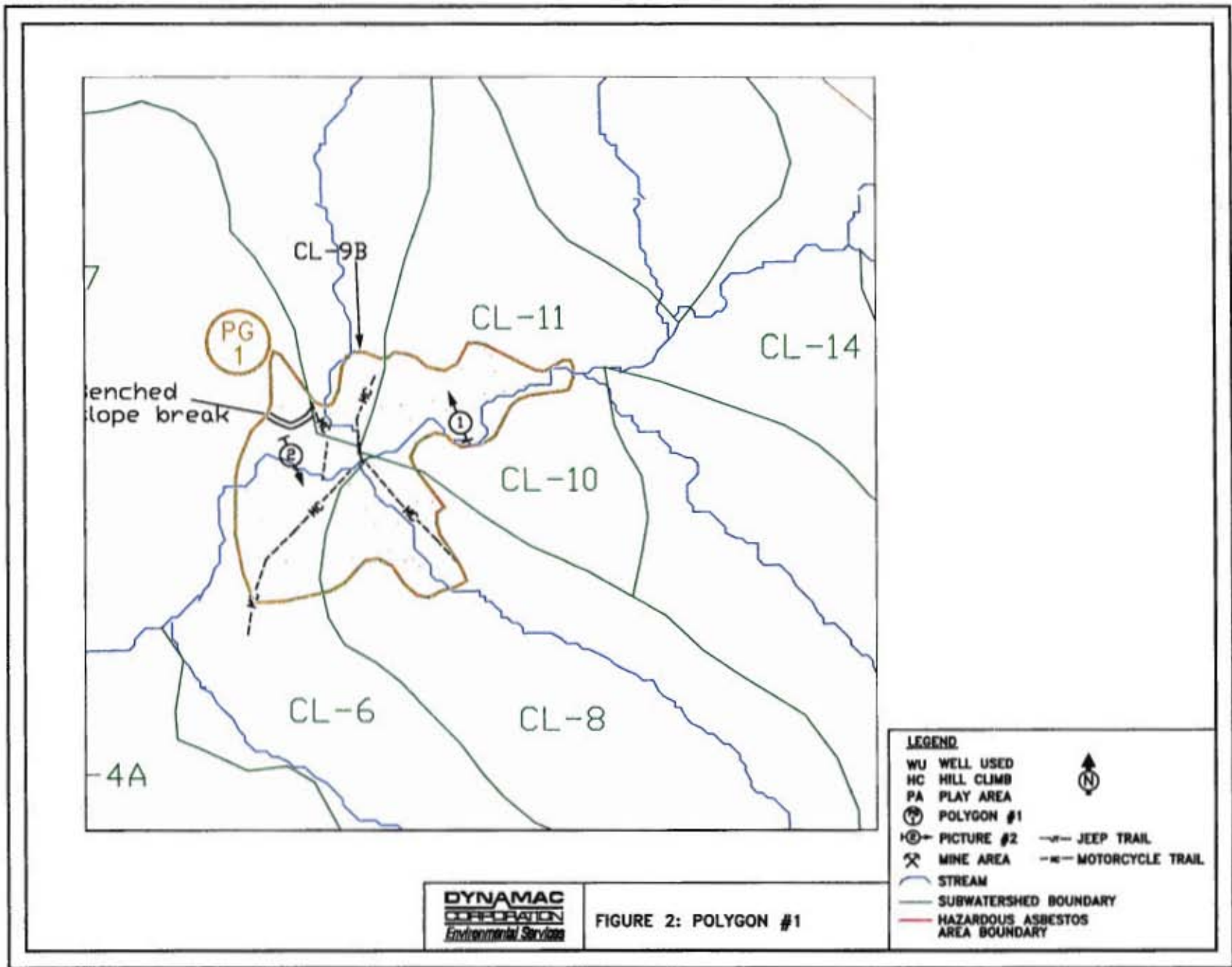
A graphical representation of PG-1 is shown in Figure 2, and Photographs 1 and 2 present views which further depict the site conditions.

Polygon Score

PG-1 has the following composition:

Subwatershed	Areal Percent of PG-1
CL-6	20%
CL-7	20%
CL-8	25%
CL-9B	10%
CL-10	2%
CL-11	23%

The database yielded a total score of 12 for this polygon, placing it at the high end of the “minor contributor” category. This is consistent with the field observations because although the potential exists for erosion and sedimentation, at present the contribution is minimal due to the physical conditions and installed fencing.



Polygon PG-1



1) Looking NW from the Clear Creek Road. Gullied mid slopes in CL-11, characterized by grey and white soils.



2) Looking SE from Clear Creek Road. Mature soils in inner gorge slopes in CL-6.

3.1.2 Polygon 2 (PG-2)

Location and Physical Description

PG-2 is a 769 series polygon which is located west of the central bend of Clear Creek on the northern flank of Clear Creek Canyon, and which stretches into the southwest corner of the Larious Canyon/Creek Watershed. The polygon extends east-west, encompassing subwatersheds CL-9, CL-16, CL-18, and CL-21, and extends northward into Subwatershed LC-2. The center section of the polygon (CL-16, CL-18) extends southward almost all the way to Clear Creek, but the outer edges (CL-9, CL-20, CL-21) remain concentrated near the ridge top. Despite the close proximity of the southernmost areas to Clear Creek, a vegetative buffer zone provides some relief from sedimentation. On the south side of the ridge line, there are three ephemeral first order streams of note. One is a deep cut, ephemeral drainage system that runs through CL-16; one runs directly down the center of Subwatershed CL-18; the other along the eastern terminus of the polygon. There is an additional ephemeral first order stream that begins to the north of the polygon and then winds around the Larious Peak to the west, bisecting the polygon at the base of the slopes between the peak and the Clear Creek Watershed northern ridge line.

The southern section of the polygon is well armored, consisting mainly of fine gravel with some medium to coarse gravel. The soils in the barren are mostly red with scattered patches of gray and strips of white along the inner gorges and walls of the drainage channels. The section of the polygon along the Clear Creek ridge line contains little to no vegetation while the remainder of the southern section of the barren contains larger patches of vegetation, especially along the drainage channels. The armoring in the northern section near Larious Peak consists of mostly fine gravel and is worn away in many areas due to high OHV use. The soils are mostly red with strips and patches of grey and white. These characteristics are all representative of 769 barren complexes.

The drainage systems in this polygon are generally characterized by steep slopes, both in terms of their descent path and sidewall alignment. The upper reaches of the polygon along the Clear Creek ridge line contain particularly deep, wide gullies, with less defined specimens developing closer to Clear Creek, and all of these gullies trend diagonally towards the ephemeral drainages. The scattered patches of vegetation within the drainage system provide minimal sediment trapping, but because the southward draining channels lead directly into a heavily vegetated area, there is some buffering capability. The vegetation lining the drainage channel in the southernmost portion of the barren and the vegetative boundary between the barren area and Clear Creek appear to provide adequate sediment trapping capabilities of erosion from the barrens into Clear Creek. The northern section of the polygon does not have the benefit of heavier vegetation and sedimentation and erosion potential appears significantly higher in those areas.

Relatively speaking, PG-2 is easily accessible. Several motorcycle trails are located within the polygon; Clear Creek Road runs along the southern boundary of the polygon to the north of Clear Creek; a trail leads up Serpentine Hill from Clear Creek Road to the northern Clear Creek ridge line, running along the boundary between CL-16 and CL-18; a trail leads up Halfway Hill from Clear Creek Road to the northern Clear Creek ridge line, running through CL-21; a Jeep Trail runs east-west for nearly the entire length of the Clear Creek Watershed.

The majority of the OHV use in this polygon is at the top of the Clear Creek ridge line and on Larious Peak, and consists mainly of motorcycle trail and play area use. OHV use is restricted in several areas on the Clear Creek side of PG-2 by fences. The majority of the fenced sections appears to be unused, and erosion and sedimentation potential appears to have been reduced in these areas as a result. Due to this fencing, OHV use appears to currently contribute little to sedimentation and erosion in the southern section of this barren polygon. The northern section around Larious Peak contains no such controls, and as a result is a major contributor to sedimentation and erosion within PG-2. In this part of the polygon, hill climbs and play areas form a complex network of OHV-intensive areas from near the top of Larious Peak to the first order stream far below.

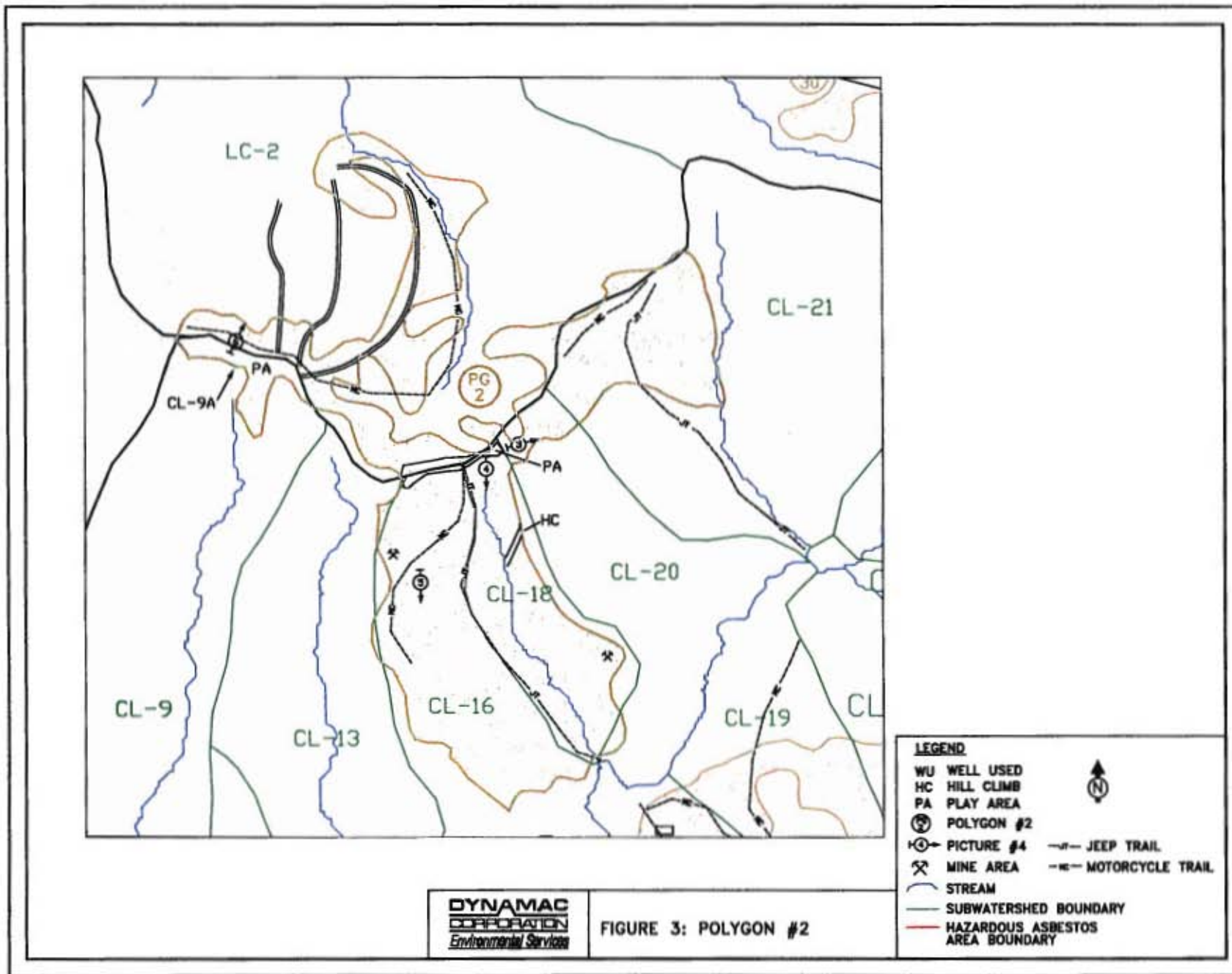
A graphical representation of PG-2 is shown in Figure 3, and Photographs 3, 4, 5, and 6 present views which further depict the site conditions.

Polygon Score

PG-2 has the following composition:

Subwatershed	Areal Percent of PG-2
CL-9A	5%
CL-16	25%
CL-18	20%
CL-20	10%
CL-21	20%
LC-2	20%

The database yielded a total score of 21 for this polygon, placing it in the middle of the “at risk” category. This is consistent with the field observations because it appears that while some areas, particularly those which are fenced, are not worsening, erosion and sedimentation rates continue to be high in the areas near Larious Peak. The individual subwatershed score for LC-2 was 32; however, when mixed in with the other, more stable areas scored within PG-2, the overall polygon score is “diluted” significantly.



Polygon PG-2



3) Looking E-NE from the western ridge of CL-20. View of mature soils along interfluv.



4) Looking S from the center of CL-16. View of armored well used motorcycle trail.

Polygon PG-2



5) Looking SE from top of CL-18. View of large ephemeral drainage.



6) Looking NE from SW corner of LC-2. View of large hill climb play area.

3.1.3 Polygon 3 (PG-3)

Location and Physical Description

A relatively small 768 series polygon located north of Clear Creek just east of the central bend, PG-3 spans subwatersheds CL-21, CL-22, and CL-25A. The polygon is concentrated along the northern ridge above the jeep trail, and thick vegetation borders this polygon to the south and east, with slightly more sparse growth to the west. Two ephemeral first order streams originate from the upper reaches of this polygon and trend southward.

Armoring in PG-3 is quite varied, with minimal armoring present in the vicinity of the jeep trail due to OHV use, and consists of equal parts medium and fine gravel. Some distance from the jeep trail, the barren is well armored and consists primarily of medium and fine gravels. Throughout, the soils are mostly red with very little grey along the edges of the jeep trail and in a few of the more pronounced gullies. There is no vegetation within the section of the barren above the jeep trail; however, there are large patches of vegetation in the sections of the polygon below it. There are heavily vegetated drainage channels which begin just below the jeep trail and trend southward into the densely vegetated section just south of the polygon. Dense vegetation surrounding the polygon provides good sedimentation trapping capability, and appears to prevent sediment transport from PG-3 into Clear Creek.

Gullying in this polygon is limited to those sections below the jeep trail, with the majority of those observed located along the western edge of PG-3.

Due to its proximity to Halfway Hill and the Clear Creek northern ridge line jeep trail, PG-3 is easily accessible. OHV traffic appears to run along the jeep trail as, but is most concentrated in the east and center sections of the polygon, within Subwatersheds CL-22 and CL-25A. Compared to other locations within the study area, OHV use is minimal, and consists mainly of trail use and small play areas. Because of this limited OHV use, as well as its significant distance from Clear Creek, PG-3 contributes little to sediment transport into Clear Creek. Additional OHV use would increase erosion and sedimentation within the barren; however, the presence of the vegetative boundary between the polygon and Clear Creek appears as though it will prevent any major impact on Clear Creek.

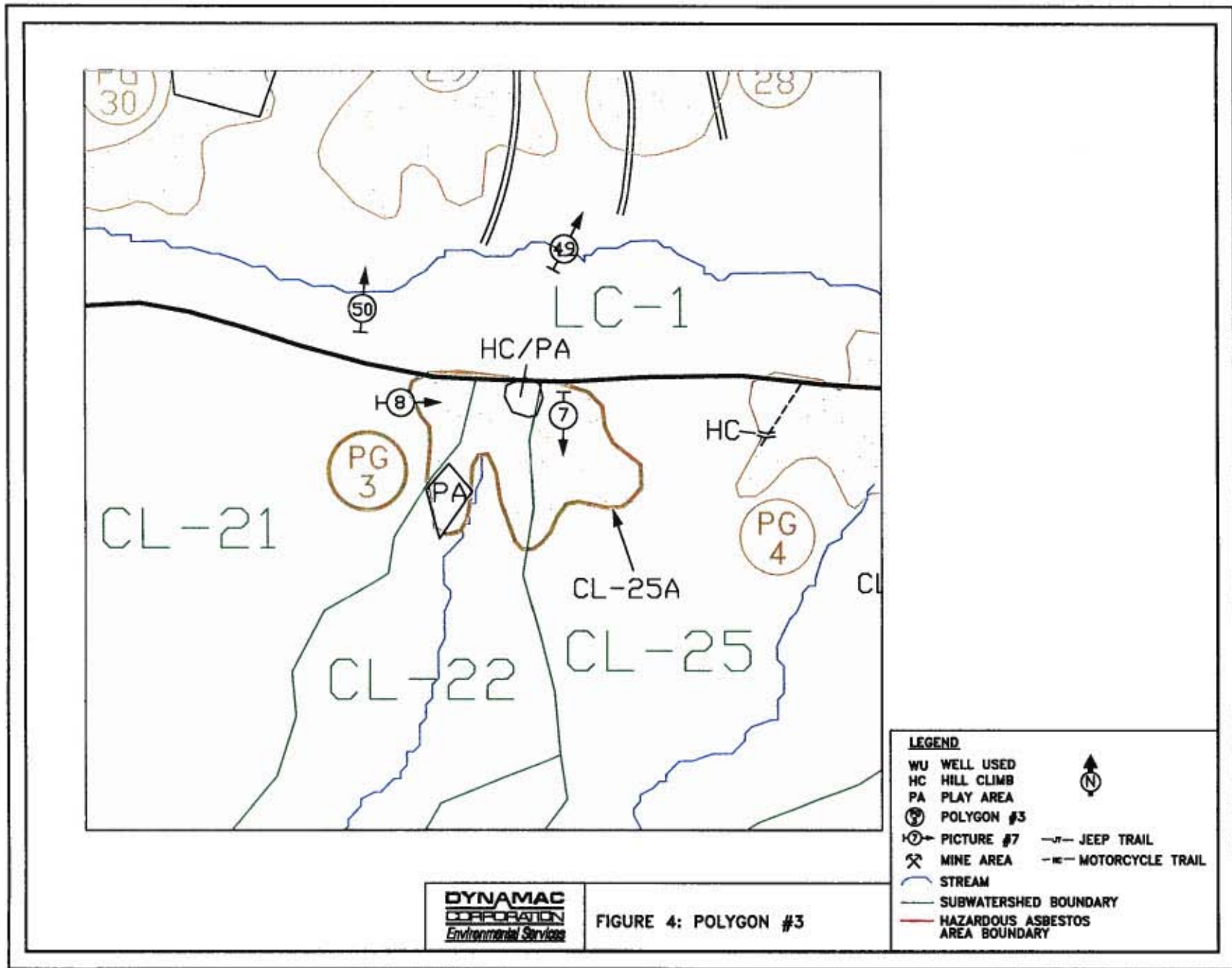
A graphical representation of PG-3 is shown in Figure 4, and Photographs 7 and 8 present views which further depict the site conditions.

Polygon Score

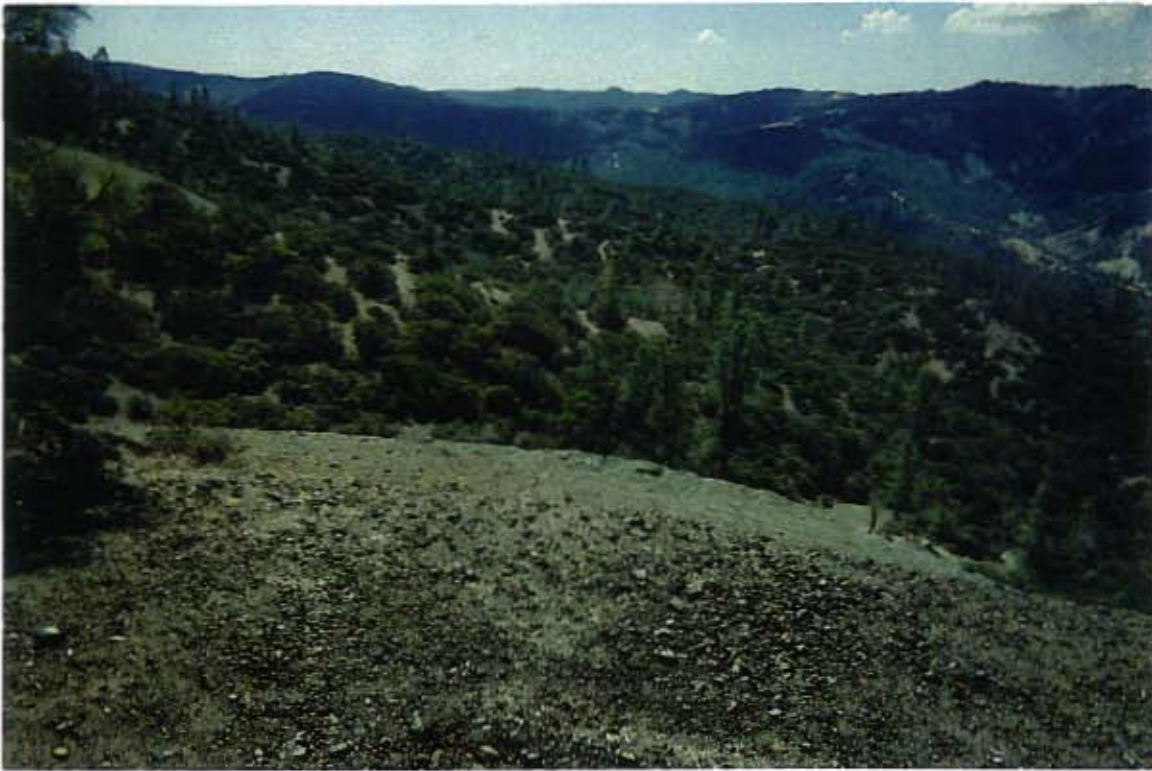
PG-3 has the following composition:

Subwatershed	Areal Percent of PG-3
CL-21	15%
CL-22	45%
CL-25A	40%

As discussed in previously, the relative distance of this polygon from a major drainage and the presence of a significant vegetative buffer make the sedimentation and erosion potential of PG-3 relatively low. This is reflected in the fact that the database yielded a total score of 17 for this polygon, placing it at the very low end of the “at risk” category.



Polygon PG-3



7) Looking SE from CL-25 western ridge line. Top of well armored hill climb.



8) Looking NE from CL-22 western ridge line. Well armored small play area.

3.1.4 Polygon 4 (PG-4)

Location and Physical Description

PG-4 is a 769 series polygon located on the northern flank of Clear Creek Canyon within Subwatershed CL-25, east of the central bend of Clear Creek, and lies due east of PG-3. An ephemeral first order stream originates at the base of this polygon and trends southwest through dense vegetation into PG-6 (discussed in Section 3.1.6 to follow), and subsequently to Clear Creek itself. Relatively thick vegetation extends on all sides of PG-4 except the north; just upgradient from the barren to the north is the ridge line dividing the Clear Creek and Larious Canyon/Creek Watersheds.

The polygon is thoroughly armored with medium to coarse gravel and is only slightly worn in a few scattered areas of OHV use. The soil is mostly red with scattered patches of grey with more greys and a small amount of white along the western edge of the polygon. As is typical to 769 series barrens, virtually no patches of vegetation exist within the barren. This indicates potentially easy transport of sediments out of the polygon itself; however, the thick vegetation surrounding the barren provides good trapping capability, and appears to prevent any sediments from PG-4 from reaching Clear Creek. Gulling within the polygon moderately low.

As with the other polygons located along the northern ridge of Clear Creek, PG-4 is relatively easily accessible due to the close proximity of Halfway Hill to the west, the County Road to the east, and the jeep trail which runs along the ridge. Very little evidence of OHV activity was observed, and for the most part this consisted of motorcycle trail use. Increased OHV use would obviously increase sedimentation and erosion within the barren, but it is apparent that the large distance from Clear Creek, coupled with the thick vegetation surrounding the polygon would mean that the potential contribution to Clear Creek is low.

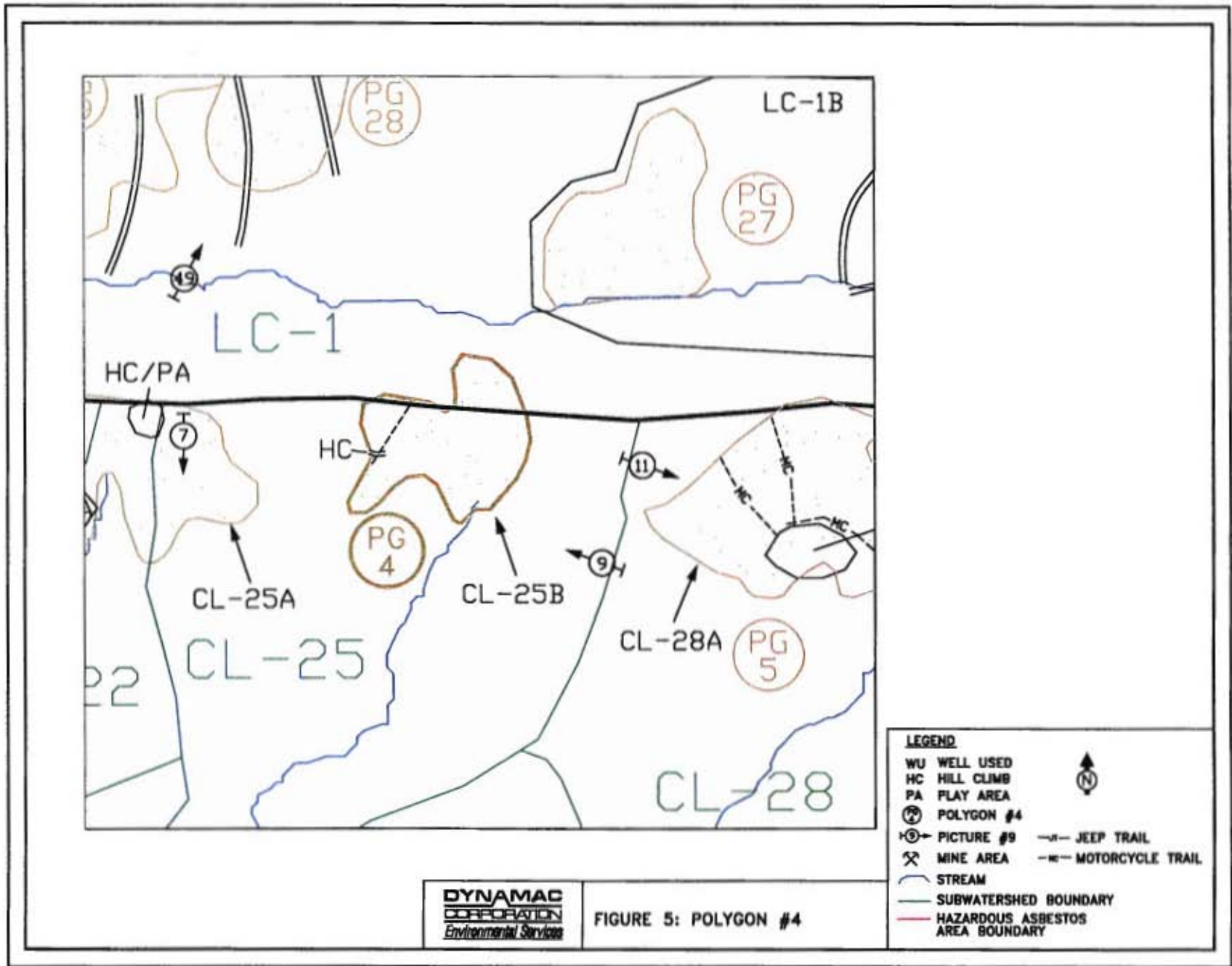
A graphical representation of PG-4 is shown in Figure 5, and Photograph 9 presents a view which further depicts the site conditions.

Polygon Score

PG-4 has the following composition:

Subwatershed	Areal Percent of PG-4
CL-25B	100%

As discussed in previously, the relative distance of this polygon from a major drainage and the presence of a significant vegetative buffer make the sedimentation and erosion potential of PG-4 relatively low. This is reflected in the fact that the database yielded a total score of 15 for this polygon, placing it as a "minor contributor."



DYNAMAC
CORPORATION
Environmental Services

FIGURE 5: POLYGON #4

Polygon PG-4



9) Looking NW from CL-25 eastern ridge line. Barren bordered by moderate canopy.

3.1.5 Polygon 5 (PG-5)

Location and Physical Description

Another 769 series barren polygon located along the norther ridge of Clear Creek Canyon east of the central bend of Clear Creek, PG-5 is due east of PG-4 and occupies much of the upper portion of Subwatershed CL-25. The barren is bordered to the north and west by the subwatershed boundary ridges, and to the east and south by thick vegetation that extends the entire length of the subwatershed until reaching Clear Creek. There are large, scattered patches of vegetation throughout the polygon, especially concentrated within the larger gullies. A first order stream originates to the east of the polygon and trends southward towards Clear Creek.

The barren is well armored and exhibits minimal wearing in areas of OHV use. The soil is mostly red with only few scattered patches of gray. There is a large mounded area located in the center of the polygon which is equal parts red and grey with strips of white. Several of the larger gullies lead into the first order stream. The slope of the barren is not very steep. This gentle slope and heavy vegetation at the southern edge of the polygon appear to provide good sediment trapping capability.

As with the other polygons located along the northern ridge of Clear Creek, PG-5 is relatively easily accessible due to the close proximity of Halfway Hill to the west, the County Road to the east, and the jeep trail which runs along the ridge. Due to the relative accessibility, there appears to be moderately high OHV use in this barren. The mound in the center of the barren appears to be frequently used as a play area. Increased OHV use would obviously increase sedimentation and erosion within the barren, but it is apparent that the relatively large distance from Clear Creek, coupled with the thick vegetation surrounding the polygon would mean that the potential contribution to Clear Creek is low.

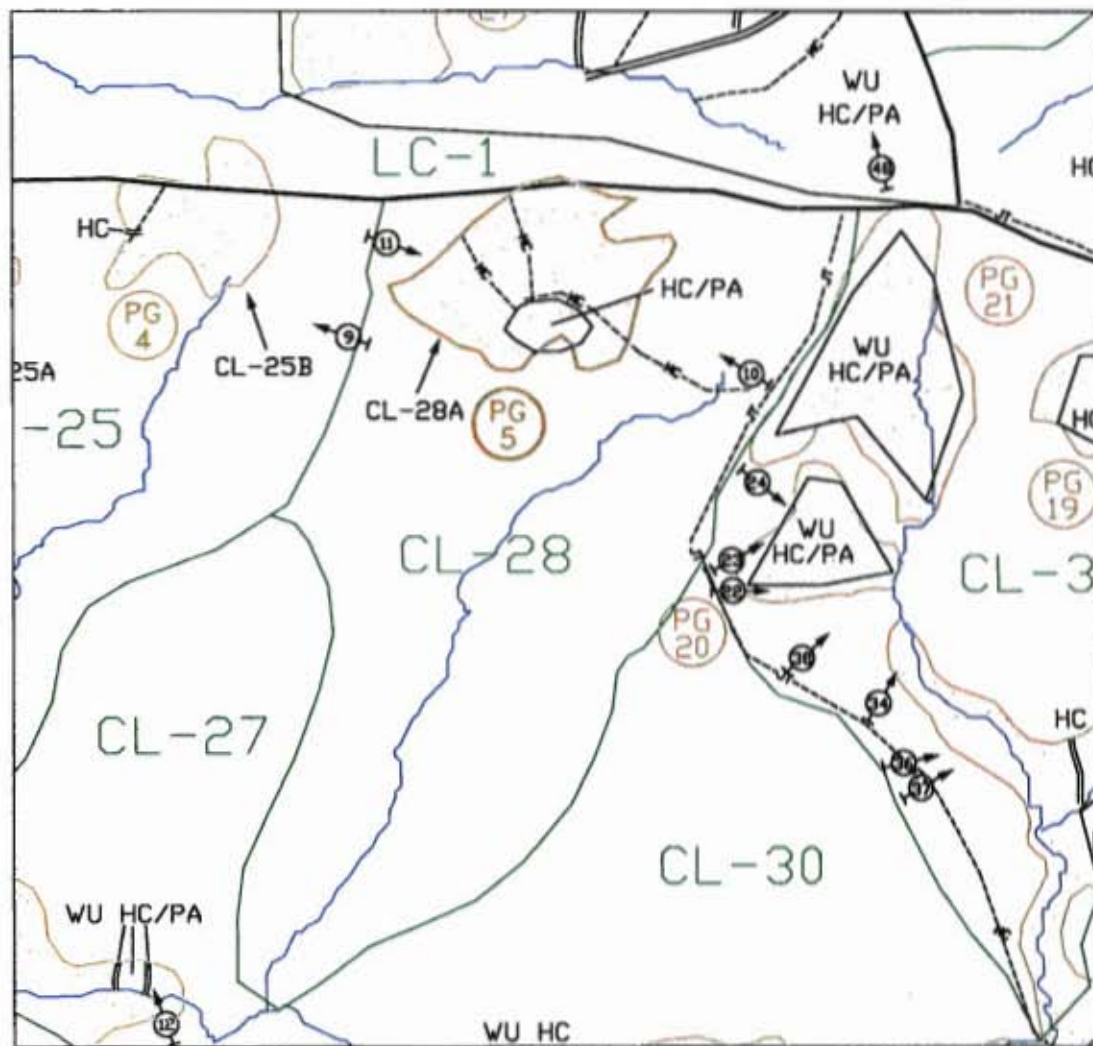
A graphical representation of PG-5 is shown in Figure 6, and Photographs 10 and 11 present views which further depict the site conditions.

Polygon Score

PG-5 has the following composition:

Subwatershed	Areal Percent of PG-5
CL-28A	100%

The database yielded a total score of 12 for this polygon, causing it to fall within the "minor contributor" category. This is consistent with field observations in that PG-5 has both moderately low OHV use, and sufficient buffering capacity to prevent significant impacts to Clear Creek via offsite sediment transport.



LEGEND

WU	WELL USED	
HC	HILL CLIMB	
PA	PLAY AREA	
PG #	POLYGON #	
Picture #	Picture #	
Mine Area	MINE AREA	--- JEEP TRAIL
		--- MOTORCYCLE TRAIL
	STREAM	
	SUBWATERSHED BOUNDARY	
	HAZARDOUS ASBESTOS AREA BOUNDARY	



FIGURE 6: POLYGON #5

Polygon PG-5



10) Looking west from NE corner of CL-28. Scattered patches of vegetation that serve as buffers.



11) Looking E-SE from CL-28 western ridge line. View of mature well armored soils.

3.1.6 Polygon 6 (PG-6)

PG-6 is a massive barren spanning much of south-central section of the Clear Creek Watershed. Although most of the polygon is south of Clear Creek, a small section lies to its north in Subwatershed CL-25C. PG-6 extends southward all the way to the southern ridge line of Clear Creek, and eventually past it and into the Picacho Creek Watershed. In total, PG-6 occupies space in 12 subwatersheds: CL-15, CL-17A, CL-17B, CL-19, CL-24, CL-25C, CL-26, CL-27, CL-31B(C), CL-31C, PC-3A, and PC-3B. Due to the relative enormity of this barren polygon and the heterogeneity of the different sections, it is difficult to describe it as a unit with any significance. For this reason, the discussion to follow will be of segments of PG-6 on a subwatershed basis; the score and conclusions, however, will summarize findings for the entire polygon.

Location and Physical Description

Subwatershed CL-15

This section of PG-6 is located on the southern ridge line between the Clear Creek and Picacho Creek Watersheds, and is the southwestern most portion of the polygon. Most of the soils in this section are grey and white, with only about 40% red and brown. The white and grey soils appear to be associated with a hill climb, a major OHV use feature in the area. There is one first order perennial stream around which well-established vegetation was observed. Gullies in this section of the polygon are fairly large, with several over four feet across.

OHV use is very prevalent on the hill climb and other smaller play areas. Armoring is moderately low and consists of primarily medium and fine gravel. The sediment trapping capability within CL-15 is good due to the topographic breaks that act as troughs.

Subwatershed CL-17A and CL-17B

Located along the western rim of PG-6, the two sections of the polygon which are within CL-17A and CL-17B are located approximately three quarters of the way up to the Clear Creek/Picacho Creek ridge line and directly adjacent to Clear Creek, respectively. Both areas are bordered on the east by additional segments of PG-6 to the east, and dense vegetation to the east. One ephemeral first order stream begins in the eastern fringe of CL-17A and trends to the northwest, increasing the distance between it and the barren areas as it approaches Clear Creek. Coupled with a well-established shrub boundary which lies between the barren areas and the first order stream, it appears that there is little opportunity for sediments to move downstream to Clear Creek in this manner.

Armoring of the mostly brown and red soils in these areas is high, with the vast majority of the lag observed being medium in size. CL-17A contains at least one obvious sediment trapping feature; at the northwestern most downhill point, there is an area where two small ridges come together. This location appears to act as a basin which may prevent some sediment from leaving the area. Little gullying was observed in either area.

The section of the polygon in CL-17B is highly accessible due to its close proximity to Clear Creek Road, and this is demonstrated by the presence of two play areas and two well used motorcycle trails. CL-17A is less accessible, but is still home to at least four moderately used play

areas and hill climbs. Nevertheless, the sediment and erosion potential of these barrens seem low due to the network of sediment trapping features detailed in the preceding paragraphs.

Subwatershed CL-19

Another segment in the northwest corner of PG-6, within relatively close range of Clear Creek, CL-19 is bordered by thick vegetation to the south, more scattered vegetation to the north, and barren areas to the east and west. No streams run through this barren area.

CL-19 is well armored, primarily with medium gravel, and is characterized by mostly stable, well established red and brown soils. The absence of any drainages leading from this subwatershed to Clear Creek, as well as the presence of vegetation in the interstitial region between the barren and Clear Creek, appears to prevent sediment from moving offsite almost entirely. Little gullying was observed in CL-19.

OHV use is limited to motorcycle trails along the ridge line, and is fairly low considering the proximity of this barren to Clear Creek. This appears to be due to the fact that the trails lead to the other barrens nearby. It is possible that this barren is used as no more than a thoroughfare for accessing more attractive barrens in the vicinity. Due to the minimal OHV use, the sedimentation and erosion potential of CL-19 is very low.

Subwatershed CL-24

Located just south of the central bend Clear Creek, CL-24 is bordered by barren areas on all sides except the north, where it is bordered by some scattered vegetation, and eventually Clear Creek. An ephemeral first order stream runs directly through the center of this subwatershed, beginning high in the subwatershed and trending northward to Clear Creek.

The soils in this section of PG-6 are impacted by erosion and sedimentation, exhibiting grey and white color over nearly 50 percent of the barren surface. Armoring is low to moderate throughout, and consists primarily of coarse and medium gravel material. Vegetation lines the first order stream, and appears to present at least nominal sediment trapping capability.

This barren is quite accessible to OHV users due not only to its relatively close proximity to Clear Creek, but also because of the fact that motorcycle trails enter the subwatershed from all three of the neighboring barrens. Play areas and hill climbs are densely situated at the southernmost tip of CL-24, farthest from Clear Creek itself, the OHV but use is intense enough to send sediments downwards via the ephemeral drainage and overland flow. Some of the moving sediment appear to be detained by the stream bed vegetation before it reaches Clear Creek, but if the OHV use in this area continues, these features will be overwhelmed entirely.

Subwatershed CL-25C

The northernmost section of PG-6 is located within the boundaries of Subwatershed CL-25C and is located in its southern tip, just north of Clear Creek. This section of PG-6 is bordered by thick vegetation on all sides but the south, where it is bordered in a very narrow section by Clear Creek Road. An ephemeral first order stream runs through CL-25C, and eventually emerges on the easternmost edge of this subwatershed.

Armoring in this area is generally absent due to extremely heavy OHV activity and landslide activity on the steep slopes. What armoring is present mainly consists of fine gravel with some medium gravel. The soil is mostly red with large patches of grey throughout the heavily used OHV areas. There is vegetation lining the first order stream, along the east wall of the stream, and between the barren and Clear Creek Road. The vegetation between the base of the barren and the road appears to provide Clear Creek with at least nominal sedimentation trapping capabilities.

Barren CL-25A is highly accessible due to the fact that it is directly adjacent to Clear Creek Road. There is a fence between the road and the barren to in an attempt to restrict OHV use in this area; however, at the time of the field study, there was an opening in the fence allowing access. There is clear evidence of frequently used hill climbs and play areas, and a motorcycle trail leads along the eastern ridge. OHV use on these features appears to contribute heavily to sedimentation and erosion within the barren, and the proximity of this section of PG-6 to Clear Creek seems to allow for easy transport of sediments into Clear Creek.

Subwatershed CL-26

Nearly 50 percent of PG-6 is made up of barren areas found in CL-26, by far the greatest single contributor in the polygon. CL-26 lies east of the central bend of Clear Creek, and runs north-south from the Clear Creek/Picacho Creek ridge line to Clear Creek itself. Vegetation borders this barren area only to the east, while other segments of PG-6 lie to the west. Two first order drainages (one ephemeral, one perennial) begin nearly at the top ridge line, eventually combining to form a perennial second order stream just south of Clear Creek. This second order stream trends approximately to the northwest until it meets Clear Creek.

The soils in this section of PG-6 are impacted by erosion and sedimentation, exhibiting grey and white color over nearly 50 percent of the barren surface. Armoring is moderate throughout, and consists primarily of coarse and medium gravel. There is vegetation lining the stream channels, which is dense at times, especially around the perennial streams. Sediment trapping appears to be good in these area; however, no other features for deflecting sediments away from Clear Creek were observed. Much of the barren is heavily gullied.

OHV use in CL-26 is very significant due to the presence of several major trails leading into its various strata. At the top of the subwatershed near the ridge line, two highly used play areas were observed, but there are also minor hill climbs throughout the subwatershed from top to bottom. Despite the presence of some sediment trapping features in this barren, OHV use appears to contribute significantly to off site transport of eroded material, evidenced by the fact that this subwatershed received a score of 35.

Subwatershed CL-27

This section of PG-6 lies to the east of Subwatershed CL-25, just north of Clear Creek. There is vegetation lining several gullies and drainage channels and along the walls of the channels on the west side of the subwatershed. As is typical of 769 series polygons, there is virtually no vegetation within the barren.

The barren area within CL-27 is well armored in some sections, but worn in areas of OHV use. The soils are mostly red with patches of grey. The barren is situated on a very steep slope with a minor slope break at the base of the barren. The steep slope, lack of surrounding vegetation, and

the proximity of the barren to Clear Creek allows for easy transport of sediment directly into Clear Creek. The slope break provides little, if any, sediment trapping capability of material from the barren into Clear Creek.

Clear Creek road runs along the southern border of the subwatershed on the south side of Clear Creek. A motorcycle trail runs through the barren from the eastern edge of the barren. The barren is fenced; however, there is clear evidence of OHV use, mostly consisting of play areas and hill climbs. OHV use contributes moderately to sedimentation and erosion which, due to their close proximity, significantly impact sediment flow directly into Clear Creek.

Subwatershed CL-31C

This subwatershed represents the easternmost segment of PG-6 which runs from the ridge line between the Clear Creek and Picacho Creek Watersheds to a point nearly half-way down to Clear Creek. It is bordered by other barren areas to the east and west, and moderately thick vegetation along the ridge line to the south. A first order ephemeral drainage begins at the ridge line and trends to the northeast where it eventually leaves PG-6 and forms a second order stream within PG-8.

The soils in this barren area are over 65 percent grey and white, suggesting regressing and heavily impacted soil horizons. Armoring is low to moderate with some fines amongst a majority of medium and coarse gravels. This area is characterized by many large, deep gullies located primarily on the inner gorge slopes.

Several play areas exist along the inner gorges in the vicinity of the first order stream, and several are large and well used. The placement of these OHV use areas appears to facilitate the off site transport of eroded material. Only the relatively long distance from Clear Creek and the increasing vegetation in the stream channel as it moves northward prevent this barren area from being one of the largest contributors in the study area. Still, the subwatershed scored 31, placing it in the "major contributor" category.

Subwatersheds CL-31B(C), PC-3A, and PC-3B

These three subwatersheds contribute very small barren areas to PG-6, and in general, all exhibit approximately the same characteristics. All three lie at the south end of the polygon, along the ridge line between the Clear Creek and Picacho Creek Watersheds. In all three cases, there is moderate vegetation on all sides but to the north. No streams pass through these areas, but a small first order drainage does pass just to the east of CL-31B(C), and some sediment transport from the area may occur via this drainage.

The majority of soils in this area are red and brown in color and appear stable and well established. Areas of white and grey soil were observed; however, this material appears to be associated with past mining activities rather than recent OHV use. In most areas, the barrens are well armored with fine to medium gravel, and exhibited virtually no gullying. In both PC-3A and PC-3B, narrow inner gorges seem to present an opportunity for BMP (check dam) installation.

Several trails allow moderately easy access to these three subwatersheds; however, it appears that OHV use is limited to these trails as there is only one small play area in all three subwatersheds, combined. Sedimentation and erosion potential, though somewhat limited by the distance of these

areas to a major drainage, is still moderate due to the amount of loose material present as a result of past mining activities.

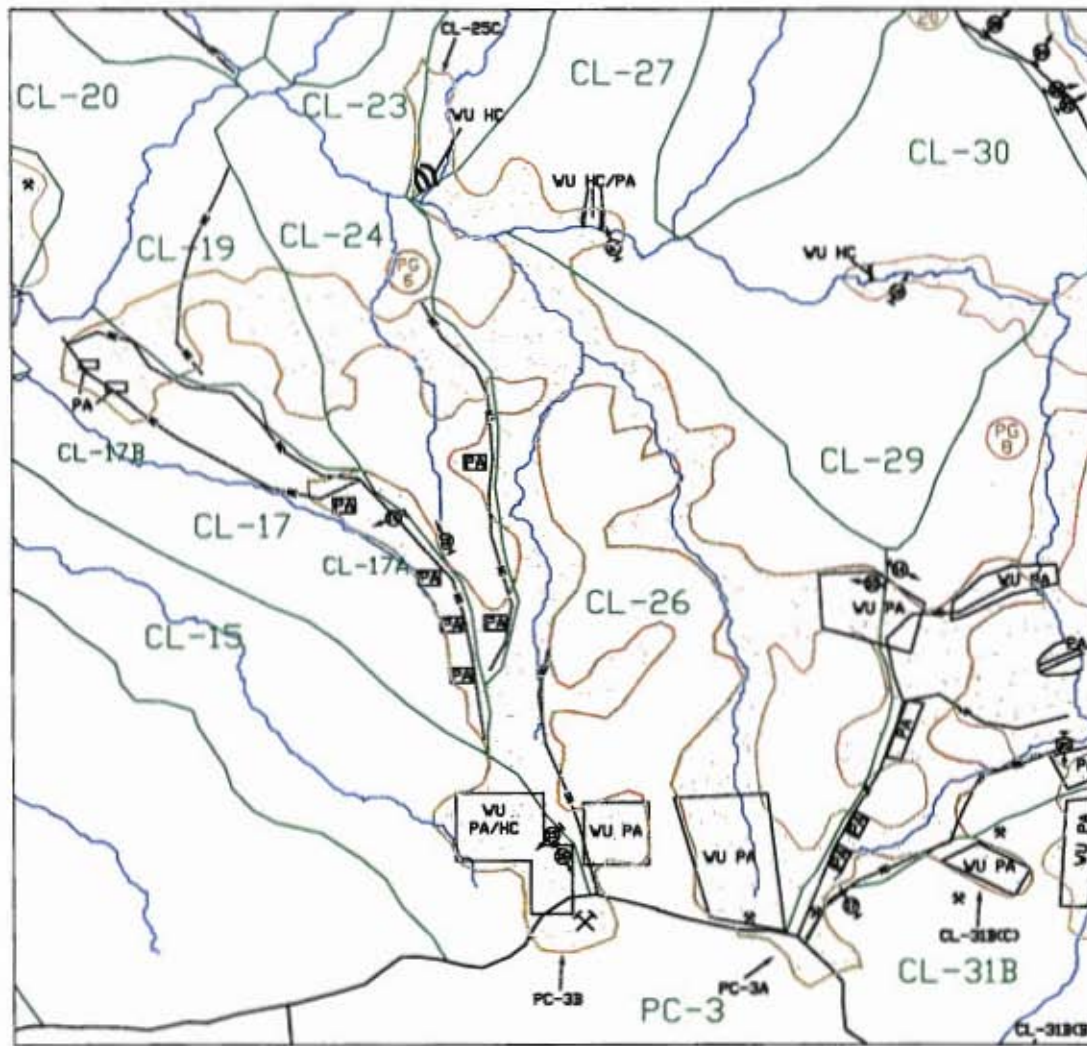
A graphical representation of PG-6 is shown in Figure 7, and Photographs 12 through 17 present views which further depict the site conditions.

Polygon Score

PG-6 has the following composition:

Subwatershed	Areal Percent of PG-6
CL-15	7%
CL-17A	5%
CL-17B	3%
CL-19	6%
CL-24	6%
CL-25C	2%
CL-26	50%
CL-27	5%
CL-31B(C)	3%
CL-31C	10%
PC-3A	2%
PC-3B	1%

The database yielded a total score of 34 for this polygon, placing it at the low end of the “major contributor” category. This is consistent with the field observations because it appears that while some areas, particularly those which are some distance from Clear Creek are not high sediment contributors, erosion and sedimentation rates continue to be high in the areas which are highly accessible and close to Clear Creek. Due to the extremely large area of PG-6, it may be more reasonable to evaluate the individual sections when considering BMPs.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 7: POLYGON #6

LEGEND

- WU WELL USED
- HC HILL CLIMB
- PA PLAY AREA
- PG POLYGON #6
- PC PICTURE #14
- MINE AREA
- STREAM
- SUBWATERSHED BOUNDARY
- HAZARDOUS ASBESTOS AREA BOUNDARY
- JEEP TRAIL
- MOTORCYCLE TRAIL



Polygon PG-6



12) Looking N from the Clear Creek Road in CL-29. Incised gullies perpetuated by OHV use.



13) Looking NW from CL-24. Well armored steep inner gorge leading to Clear Creek.

Polygon PG-6



14) Looking SW from CL-17A. Well armored mature inner gorge soils, potential area for a sediment.



15) Looking W-SW from CL-15. Denuded well used hill climb play area.

Polygon PG-6



16) Looking SE from CL-15 toward PC-3B. Denuded play area in foreground.



17) Looking NW from CL-31C inner gorge slope. Area exhibiting signs of slides.

3.1.7 Polygon 7 (PG-7)

Location and Physical Description

Located at the ridge line between the Picacho Creek and Clear Creek Watersheds, PG-7 is a 768 series barren polygon that occupies the following subwatersheds: CL-31B(A), PC-2A, and PC-2B. The polygon is a narrow band that straddles the interfluvium reaching less than 100 feet down slope from the crest. Thick vegetation borders the entire polygon, with four large (>4 feet) deeply incised gullies and one ephemeral stream leading from Subwatershed CL-31B into Clear Creek. The gullies merge to form two gullies at the base of the subwatershed. The sediment trapping capability is good due to channel armoring by large rock fragments and a dense vegetated boundary lining the gullies. The barren situated within Picacho Creek has been greatly altered by mineral exploration, and exhibited extensive OHV use including: hill climbs, play areas, motorcycle trails, and a unimproved dirt road.

The barren polygon is uniformly armored (approximately 75 % of total area) with coarse, medium, and fine gravel, while the vegetated areas contain a thick layer of duff. The majority of the soil is red and brown in color with the white and grey areas associated with the more heavily used hill climb and play areas. The more mature soils correspond to vegetated areas. The vegetation cover is 70% pine canopy, while the remaining 30% consists of shrubs. The slopes are a moderate 0-15% along the ridge line, which is favorable to OHV use.

OHV use is limited to the ridge line and flanks of the interfluvium, which is only moderately sloped. Of the total barren polygon area, approximately 75% exhibits some type of OHV use. However, the moderate slopes and heavy armoring have limited erosion, as evidenced by the fairly deep and mature soils. There appears to be a large asbestos cut and two outcrops along the ridge line, which have experienced heavy OHV use. The soils in this relatively small area are dominated by grey and white. However, the sediment trapping capability is good due to the down gradient vegetation, natural energy breaks provided by the exploration cuts, and the bowl shaped topography. The site is accessible by one unimproved dirt road and two motorcycle trails, which exhibit signs of heavy use.

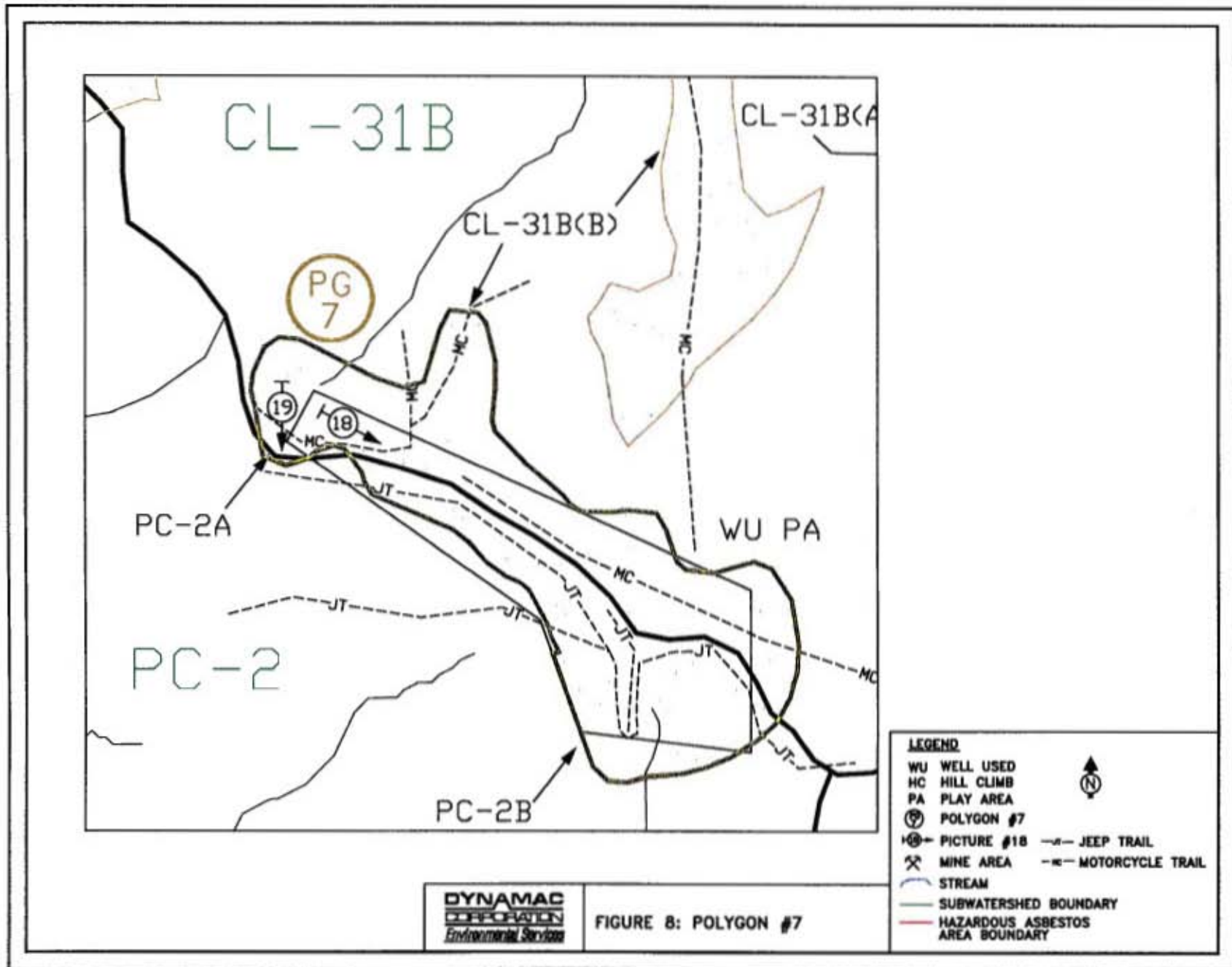
A graphical representation of PG-7 is shown in Figure 8, and Photographs 18 and 19 present views which further depict the site conditions.

Polygon Score

PG-7 has the following composition:

Subwatershed	Areal Percent of PG-7
CL-31B(B)	60%
PC-2A	10%
PC-2B	30%

Despite the relative distance of this polygon from Clear Creek or another major drainage, it received a cumulative score of 38, placing it in the upper end of the “major contributor” category. As is discussed in this section, this is reflective of the particularly intense OHV activity observed in PG-7.



Polygon PG-7



18) Looking SE from CL-31B ridge line. Multiple play areas along the interfluve.



19) Looking S from PC-2A. Large play area with some soil and armor denudation.

3.1.8 Polygon 8 (PG-8)

Location and Physical Description

Similar in size to PG-6, this barren polygon stretches southward through Clear Creek occupying both the canyon floor and ridge lines. In total, PG-8 traverses six subwatersheds: CL-29, CL-30, CL-31A, CL-31C, CL-31BZ, and CL-32B. Despite the large size of this polygon, it is much more homogeneous than PG-6 due to the fact that it is not nearly as spread out east to west across the canyon.

Subwatersheds CL-29 and CL-30

In general, barren polygon PG-8 occupies the canyon floor of Subwatersheds CL-29 and CL-30 bordering Clear Creek. There are several occurrences where the barren reaches up the mid slopes, which in turn exhibit signs of moderate OHV use (i.e., hill climb areas). These barrens are characterized by grey soils composed of fine gravel armor that is slightly worn. The mid slopes are moderately steep and contain evenly distributed small gullies (i.e., 0-2 feet). Small isolated patches of vegetation exist throughout this subwatershed and a narrow band borders Clear Creek, providing only minimal sediment trapping capability.

Subwatershed CL-31A

Barren polygon PG-8 occupies the southwest facing interfluves, slopes, and inner gorges of Subwatershed CL-31A. The subwatershed, itself, is located in the headwaters of Clear Creek Canyon, where, unlike CL-29, a well-established conifer and shrub vegetative cover protects the creek. This fairly dense cover serves as a good sediment trapping feature. The soil colors of the top portion of the barren are 20% white, 5% grey, 40% red, and 35% brown. The white and grey soils are associated with over steepened inner gorges and to a lesser extent OHV play areas. OHV use is limited to these play areas, which range in size from 1-5 acres, and to the motorcycle trails situated along the ridge line. The upper portion of the barren polygon is covered by vegetation, which limits overland flow. Access to the area can be gained rather easily by several unimproved dirt roads.

Subwatershed CL-31C

Polygon PG-8 comprises approximately 50-75% of Subwatershed CL-31C, with the majority occupying the canyon floor, mid slopes, and inner gorges. The lower sections and areas adjacent to Clear Creek are fenced restricting OHV access. However, several large play areas and hill climbs are located within close proximity, including the Indian Hills play area. The soil in these play areas are predominantly grey and white, with vegetated zones characterized by red and brown soil. The vegetation cover is predominantly shrub with a 30% conifer canopy. There are four gullies in the top of the subwatershed greater than four feet, with three on inner gorges and one in the main watershed.

OHV density is generally limited to the inner gorges, where play areas and hill climbs have been established on the flanking slopes. The soil colors in these areas are mostly white and grey. Where OHV use is limited, PG-8 is only moderately armored with 35% medium gravel, 50% coarse gravel and 15% fine gravel. In the large play areas armoring is minimal to non-existent. There is one outcrop on the north ridge line and evidence of three mineral exploration or production cuts. The barren is bounded by vegetation along the ridge line only.

There are several perennial drainages within this subwatershed, including an unnamed second order stream and Clear Creek. The unnamed second order stream is buffered with a narrow band of vegetation and appears to be choked with sediment. There are several locations within this drainage where a sediment dam could be installed. There is also evidence of a mercury mine and the remnants of an old retort within this drainage. In general, Clear Creek is bordered by moderately steep slopes with a well-established shrub canopy. These areas also have been fenced to restrict OHV traffic. However, there are several areas (located on sharp cut banks) that have over steepened slopes that exhibit signs of mass wasting. In general, these areas are naturally contributing large volumes of sediment to Clear Creek.

Subwatershed CL-32B

Barren polygon PG-8 is located on the southwestern canyon floor of Subwatershed CL-32B, and comprises less than 10% of the total barren area. In general, the barren extends from Clear Creek to the ridge line where the interfluvies are covered with vegetation comprised of 70% canopy and 30% shrub. Eight gullies ranging in width between 0-2 feet are present in the middle of the slopes, which extend and expand to between 2-4 feet at the bottom. The slopes are moderately steep ranging between 15-30%. Clear Creek also has a vegetated buffer zone of vegetation separating it from the barren polygon. It appears that this buffer provides adequate protection from erosion and sedimentation to Clear Creek.

OHV use is limited to the motorcycle and jeep trails located along the ridge line and play areas which are located along the slopes. Much of the area adjacent to Clear Creek is fenced and designated "closed" to OHV use. Where undisturbed by OHV use, the barrens are 95% armored with 70% medium gravel and 30% coarse gravel. There are two exploration cuts present in the subwatershed along with three bedrock outcrops located on the southern ridge line.

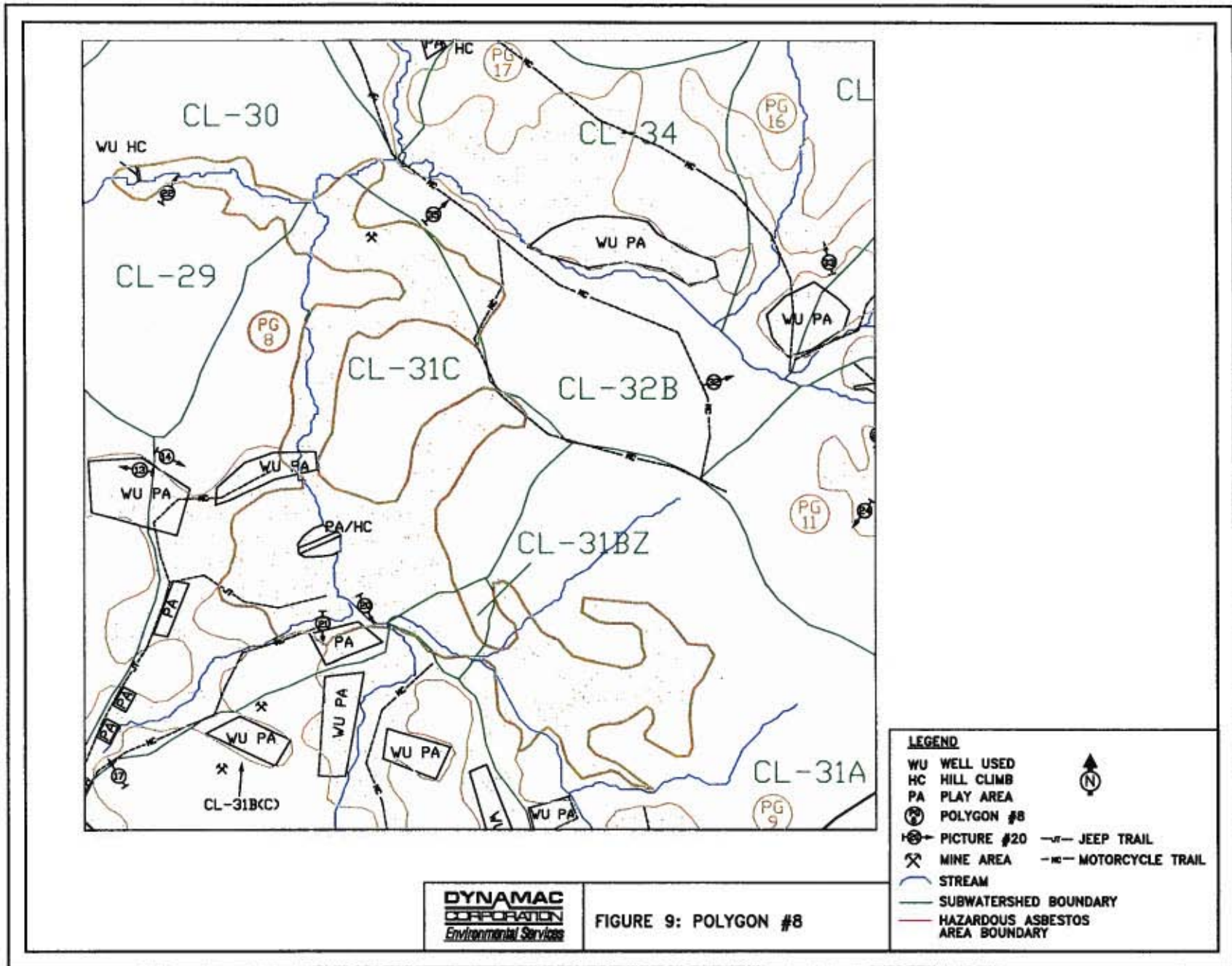
A graphical representation of PG-8 is shown in Figure 9, and Photographs 20, 21, and 22 present views which further depict the site conditions.

Polygon Score

PG-8 has the following composition:

Subwatershed	Areal Percent of PG-8
CL-29	9%
CL-30	2%
CL-31A	25%
CL-31BZ	6%
CL-31C	55%
CL-32B	3%

The database yielded a total score of 33 for this polygon, placing it at the low end of the “major contributor” category. This is consistent with the field observations because it appears that while some areas, particularly those which are some distance from Clear Creek are not high sediment contributors, erosion and sedimentation rates continue to be high in the areas which are highly accessible and close to Clear Creek.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 9: POLYGON #8

Polygon PG-8



20) Looking SE from bottom of Indian Hills. Well used play area.



21) Looking S from Indian Hill. Smaller play areas and evidence of mass wasting.

Polygon PG-8



22) Looking NE from the bottom of CL-30. Evidence of mass wasting due to slides.

3.1.9 Polygon 9 (PG-9)

Location and Physical Description

Located in the southeast corner of the Clear Creek Watershed near the Four Corners area, PG-9 also extends slightly into the northwest reaches of the San Benito River Watershed. This 769 series polygon occupies space in the following subwatersheds: CL-31A, CL-31B(A), CL-31B(B), CL-31BZ, CL-31C, and SB-4. Two first order streams pass through this polygon, the first originating above the western edge of the polygon near PG-7 and along the ridge line between the Clear Creek and Picacho Creek Watersheds; the other originates farther east near the portion of this polygon which extends into the San Benito River Watershed.

Subwatershed CL-31A

CL-31A is located in the eastern limb of barren polygon PG-9, forming the headwaters of Clear Creek and containing the Four Corners area. The barrens are scattered throughout the watershed, but occur mainly on the inner gorges and along the ridge line. Given the relative high elevation, the topography of the inner gorges and ridge lines are only moderately steep. Patches of fairly dense chaparral and conifer canopy are interspersed throughout the barrens and along the borders. The Clear Creek drainage has a well-established vegetative canopy consisting of 60% conifer and 40% shrub, which together with low topographic relief and the patches of chaparral appear to effectively limit the volume of erosion and sedimentation reaching the creek. The soil colors of the top portion of the barren are 20% white, 5% grey, 40% red, and 35% brown. The grey and white soils are limited to the hill climb trails and to a few over steepened slopes. Armoring is comprised of 60% coarse gravel, 20% medium gravel and 20% fine gravel. Gullies are quite common throughout the subwatershed, but in general are predominately lined with vegetation. It appears that this vegetative armoring effectively helps reduce the volume of sediment that can be made available to Clear Creek.

OHV use is limited to play areas, and motorcycle and jeep trails situated along the ridge line. Access to the area can be gained via several unimproved dirt roads, each originating from a different major watershed. There are nine major play areas situated within the barren polygon ranging in size from 1-5 acres. Three of these areas are used extensively as evidence by the shallow white soils. These areas also appear to contain several mine exploration or production cuts that have been used extensively by OHV users. The degree of erosion and sedimentation taking place in these areas are by far the greatest within this particular subwatershed.

Subwatersheds CL-31B(A) and CL-31B(B)

Subwatersheds CL-31B(A) and CL-31B(B), collectively referred to as CL-31B, are located in the southwestern limb of PG-9, and contain by far the largest portions of the barren polygon. The barren areas are limited to a narrow band that coincides with the interfluvial areas and to several inner gorges that are used as hill climb and play areas. The lower elevations are almost completely covered with a chaparral and conifer canopy, that extends to Clear Creek. While it appears that the motorcycle trails established on the interfluvial areas are used extensively, the hill climb and play areas appear relatively unscathed. This may be due to dense patches of chaparral and conifers scattered throughout the barren, the steepness of the inner gorge slopes, and access restrictions.

Similar to Subwatershed CL-31A, the topography of these areas are only moderately steep (excluding select inner gorges). The soils are predominantly red and brown. Armoring covers about 75% of the barrens with 50% coarse gravel and 50% medium gravel. The vegetated areas contain a heavy layer of duff, while the soils in the hill climbs and play areas are mostly grey and white.

Several gullies form just below the ridge line and extend to the canyon floor, where they merge. The gullies are rather large (i.e., greater than 4 feet), deeply incised, and contain large boulders that effectively reduce the runoff energy. There is only one ephemeral drainage within this subwatershed of the barren polygon.

Subwatershed CL-31C

Barren polygon PG-9 is situated within the mid slope section of the southeastern ridge line separating CL-31C from Subwatershed CL-31B. This 769 barren merges into the 768 PG-8 barren polygon, which comprises the majority of the subwatershed. The barren occupies the inner gorge slope which is overly steep, contains several large gullies (i.e., greater than 4 feet), and generally is unattractive to OHV users. The soil are fairly well armored with by medium and coarse gravel.

OHV use is mainly limited to a motorcycle trail that traverses the ridge line. It appears that this trail is mostly used as a means of access to the play areas in barren polygons PG-8 (i.e, Indian Hills), PG-6, and PG-7. In general, erosion and sedimentation within the barren can be attributed to natural occurrences.

Subwatershed SB-4

Barren polygon PG-9 is located along the northwest ridge line separating the San Benito Watershed from Clear Creek. The barren extends from the ridge line down several narrow inner gorges, terminating along an interstitial vegetative buffer zone bordering a first order ephemeral stream. The inner gorges are relatively narrow and contain overly steep slopes. Excluding the ridge line, the barren is completely surrounded by a dense canopy of chaparral and conifers, which serves. The narrow gorges and dense vegetation surrounding the barren provide good erosion and sediment trapping controls. The soils within the barren are predominantly red and brown, and are well armored by medium and coarse gravel. Armoring on the steep inner gorges, however, was relatively nonexistent. White soils coincided with the larger gullies situated within the steep inner gorges.

OHV use is generally limited to the ridge line, where several play areas and hill climbs have been established on former mining excavations. The steep inner gorges exhibit very little OHV use, which is fortunate due to the general lack of armoring. Access to this barren can be considered very good, due to its close proximity to the Sawmill Creek unimproved dirt road and, to a lesser extent, the Four Corners area.

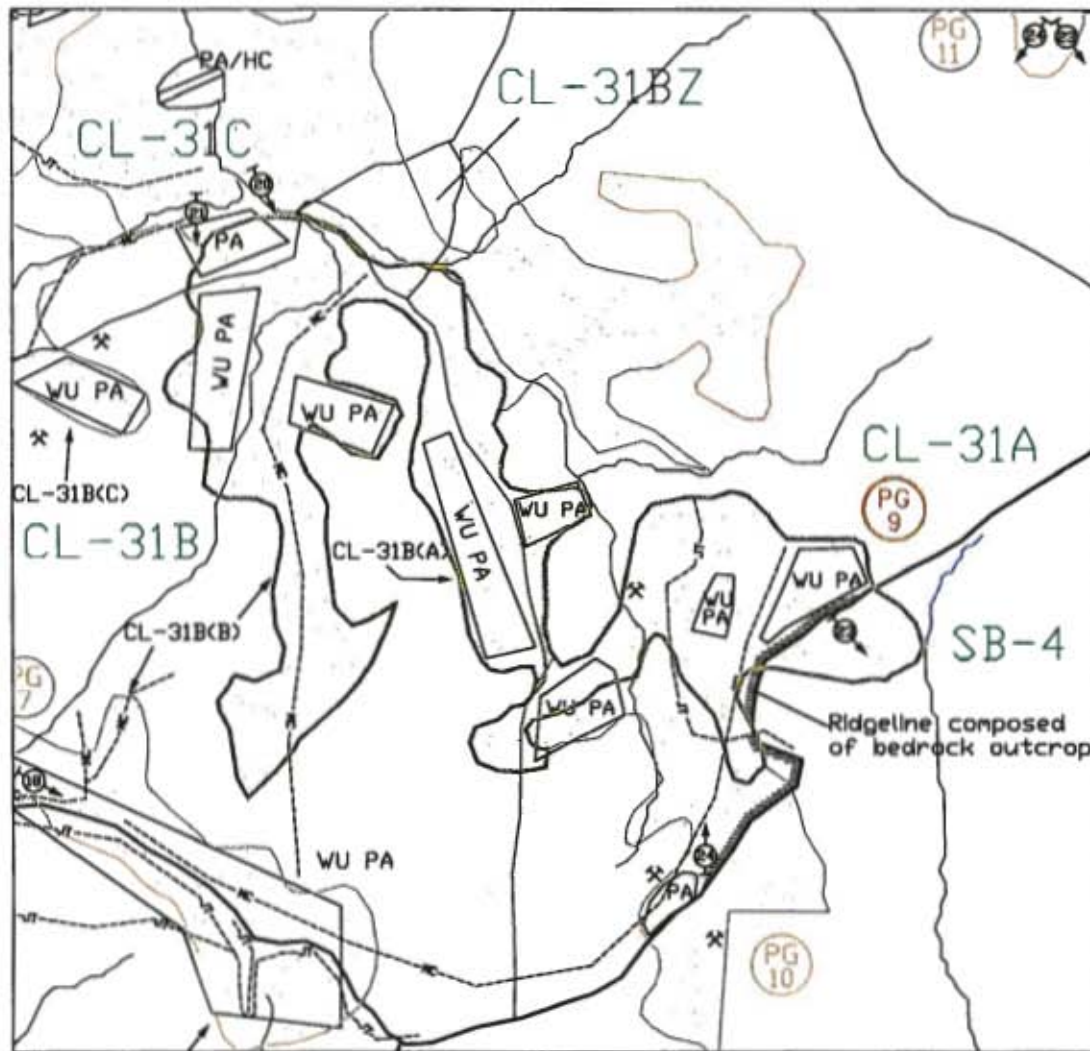
A graphical representation of PG-9 is shown in Figure 10, and Photograph 23 presents a view which further depicts the site conditions.

Polygon Score

PG-9 has the following composition:

Subwatershed	Areal Percent of PG-9
CL-31A	25%
CL-31B(A)	15%
CL-31B(B)	43%
CL-31BZ	2%
CL-31C	5%
SB-4	10%

The database yielded a total score of 36 for this polygon, placing it in the “major contributor” category. This is consistent with the field observations because the OHV use and other ranking characteristics are at times high. The highest individual subwatershed score was 50 for CL-31B(A), which makes up a relatively small portion of this polygon. The remaining 85% of PG-9 received scores primarily in the high to mid-20s, representative of the total score obtained.



LEGEND

WU	WELL USED	
HC	HILL CLIMB	
PA	PLAY AREA	
Ⓣ	POLYGON #9	
📍	PICTURE #23	--- JEEP TRAIL
✕	MINE AREA	- - - MOTORCYCLE TRAIL
~	STREAM	
—	SUBWATERSHED BOUNDARY	
—	HAZARDOUS ASBESTOS AREA BOUNDARY	

DYNAMAC
CORPORATION
Environmental Services

FIGURE 10: POLYGON #9

Polygon PG-9



23) Looking SE from from the SB-4 ridge line. Large mine converted into a play area.

3.1.10 Polygon 10 (PG-10)

Location and Physical Description

PG-10 is a relatively small 768 series polygon that extends from Clear Creek Subwatershed CL-31A to San Benito River Subwatershed SB-4. The subwatersheds are very similar in regards to topographic relief, vegetation, and drainage patterns. The barren polygon borders PG-9 to the southwest, merging along a ridge line separating two inner gorges. The headwaters of two first order perennial streams lie within this barren, one leading into Clear Creek and the second leading to the San Benito River.

In general, the barren areas are situated along the ridge line and extend to the mid slopes within the inner gorges. Topography is relatively moderate with slopes ranging between 0 and 15% along the ridge lines and mid slopes, while several of the inner gorge slopes ranged between 15% to 30%. Characteristics of 768 barrens, scattered patches of vegetation are found throughout the polygon. Buffer zones of vegetation also exist along each drainage course (i.e., ephemeral) and within each of the large gullies that were observed. The vegetative canopy is dominated by conifer, with the remaining comprised of chaparral. The play areas located along the ridge line and extending down the mid slopes are dominated by grey and white soils, which gradually turn to red and brown with distance from these areas. By far the largest portion of the barren soils are red and brown.

OHV use is limited to play areas and trails along the ridge line. Access is gained by several unimproved dirt roads, one located within each subwatershed. Several of the play areas have been completely denuded of armoring and contain white soils, which coincides with significant OHV use. A definitive transition zone exists between the white and red/brown soils. This zone can best be described as a fluff zone where eroded immature material has accumulated. Armoring found on the red and brown soils are comprised of coarse and medium gravel. The combination of vegetative buffers between the barren and the drainages, the topographic location of the barren, and moderate slopes leading off the barren has limited the amount of erosion and sedimentation that has taken place within the bottom of these subwatersheds.

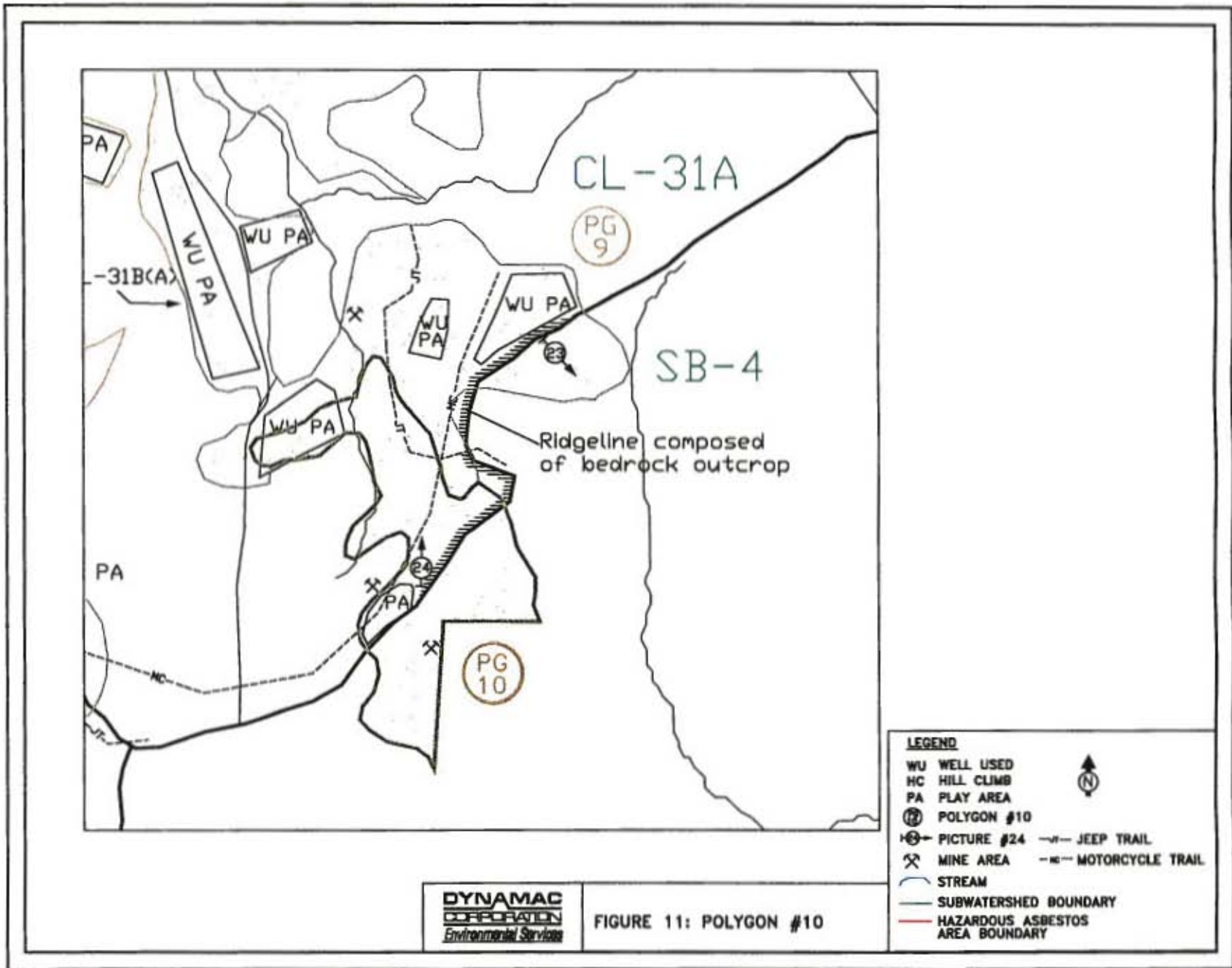
A graphical representation of PG-10 is shown in Figure 11, and Photograph 24 presents a view which further depicts the site conditions.

Polygon Score

PG-10 has the following composition:

Subwatershed	Areal Percent of PG-10
CL-31A	45%
SB-4	55%

The database yielded a total score of 36 for this polygon, placing it in the “major contributor” category. This is consistent with the field observations because the OHV use, gullying, and other major ranking characteristics are quite high, the majority of this polygon is some distance from Clear Creek and other major drainages.



Polygon PG-10



24) Looking S from SB-4 ridge line. Mature well armored soils along interfluves.

3.1.11 Polygon 11 (PG-11)

Location and Physical Description

Barren polygon PG-11 is located entirely within Subwatershed CL-32A, that forms the southeastern boundary of the Clear Creek headwaters. PG-11 is a 769 series polygon that is officially closed to OHV traffic because it lies on land owned by the State of California. Field observations showed, however, that OHV trails and play areas are present within this polygon.

The polygon spans the gorges and canyon walls extending from the ridge line to a narrow vegetated buffer bordering Clear Creek. The buffer only provides minimal sediment trapping capability. The canyon is characterized by an extremely narrow canyon floor and extremely steep slopes on the inner gorges. These features combine to present unattractive terrain for OHV use. The exterior border of the polygon consists of a thick chaparral and conifer canopy.

The barren is uniformly well armored with coarse and medium gravel. The exception is one hill climb play area, which has experienced some stripping of the armor cover. The undisturbed barren soils are predominantly red and brown, while those within the play area and lining the gullies are grey and white.

OHV use is limited to several motorcycle trials that have been established on the ridge lines and the single hill climb/play area. The type of OHV use appears to be mostly trail riding and transitional to gain access to more attractive areas.

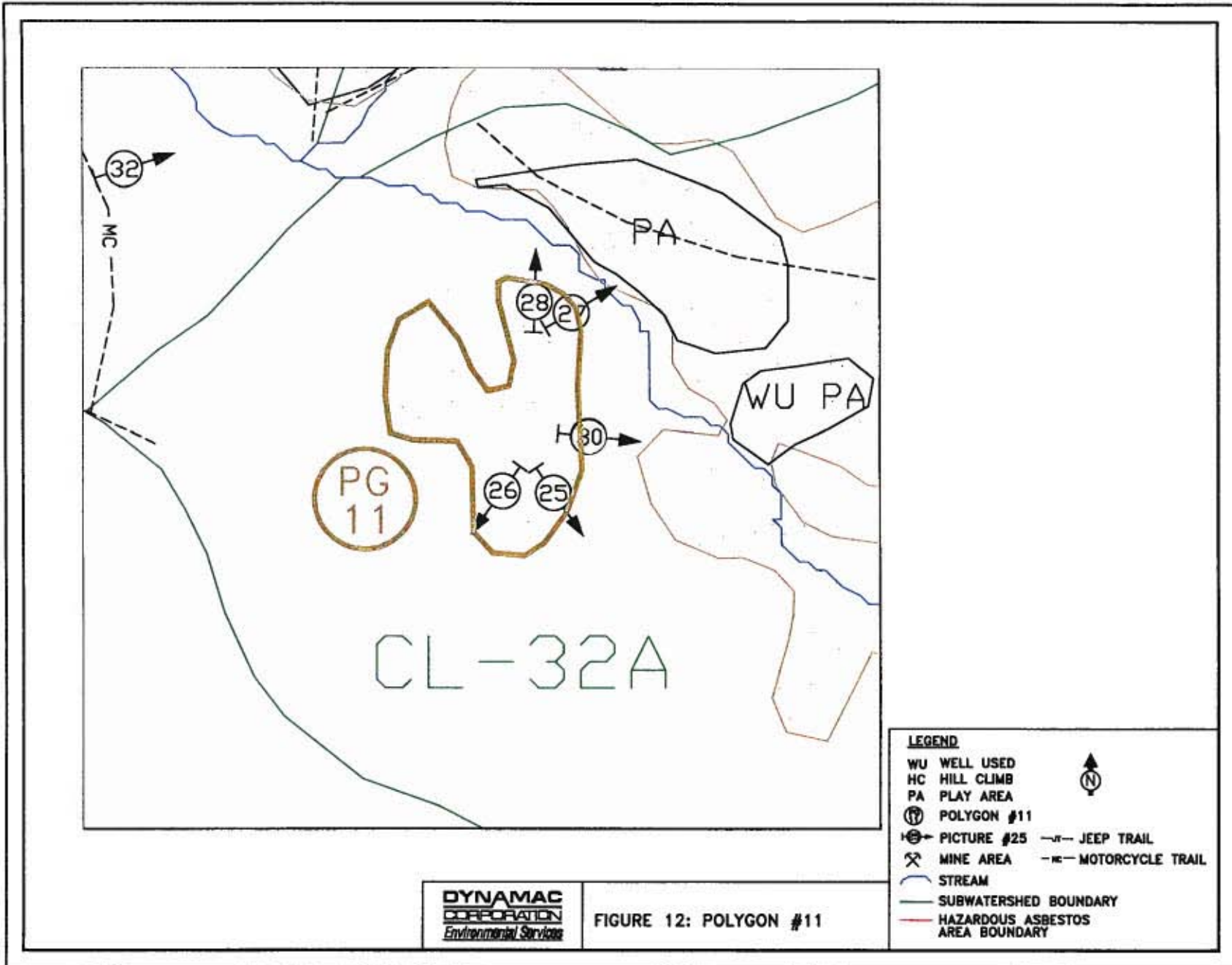
A graphical representation of PG-11 is shown in Figure 12, and Photograph 25 and 26 present views which further depict the site conditions.

Polygon Score

PG-11 has the following composition:

Subwatershed	Areal Percent of PG-11
CL-32A	100%

The database yielded a total score of 21 for this polygon, placing it in the middle 50 percent of the "at risk" category. This is consistent with the field observations because although the OHV use, gullying, and other ranking characteristics are somewhat high, the majority of this polygon is some distance from Clear Creek and other major drainages.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 12: POLYGON #11

LEGEND

WU WELL USED	↑ N
HC HILL CLIMB	
PA PLAY AREA	
Ⓜ POLYGON #11	
⊙ PICTURE #25	- - - JEEP TRAIL
⊗ MINE AREA	- - - MC - MOTORCYCLE TRAIL
— STREAM	
— SUBWATERSHED BOUNDARY	
— HAZARDOUS ASBESTOS AREA BOUNDARY	

Polygon PG-11



25) Looking SE from CL32A inner gorge ridge line. Undisturbed steep inner gorge slopes.



26) Looking SW from CL-32A eastern ridge. Disturbed steep inner gorge slope (play area).

3.1.12 Polygon 12 (PG-12)

Location and Physical Description

Polygon PG-12 is a 769 series barren that is located entirely within Subwatershed CL-37. Subwatershed CL-37 is located in the headwaters of Clear Creek and forms the northeastern boundary of the Clear Creek Watershed. The barren is predominantly situated at the mouth of the subwatershed, extending from the canyon floor halfway up the mid slopes. There is one exception on the western limb, where the barren extends all the way to the ridge line. This barren (and subwatershed) shares many of the same physical characteristics observed in PG-11 (and Subwatershed CL-32A). Similar to PG-11, the canyon is extremely narrow and contains extremely steep slopes located within the inner gorges. The barren perimeter is bounded by fairly dense chaparral, except along Clear Creek where only a narrow band of vegetation is present. While the narrow canyon and steep terrain provide relatively unattractive terrain to OHV users, these same conditions, as well as an insufficient vegetative buffer, provide the impetus for high rates of erosion and sediment loading that was observed in Clear Creek.

The polygon drainage pattern is fairly immature with multiple small gorges and one perennial stream. The stream is actively down cutting the channel, and can be described as rough with a high discharge gradient. The barren is uniformly well armored with coarse and medium gravel. The exception is one hill climb play area, which has experienced some stripping of the armor cover. The undisturbed barren soils are predominantly red and brown, while those within the play area and lining the gullies are grey and white.

OHV use is limited to several motorcycle trials that have been established on the ridge lines and the single hill climb/play area. The type of OHV use appears to be mostly trail riding and transitional to gain access to more attractive areas.

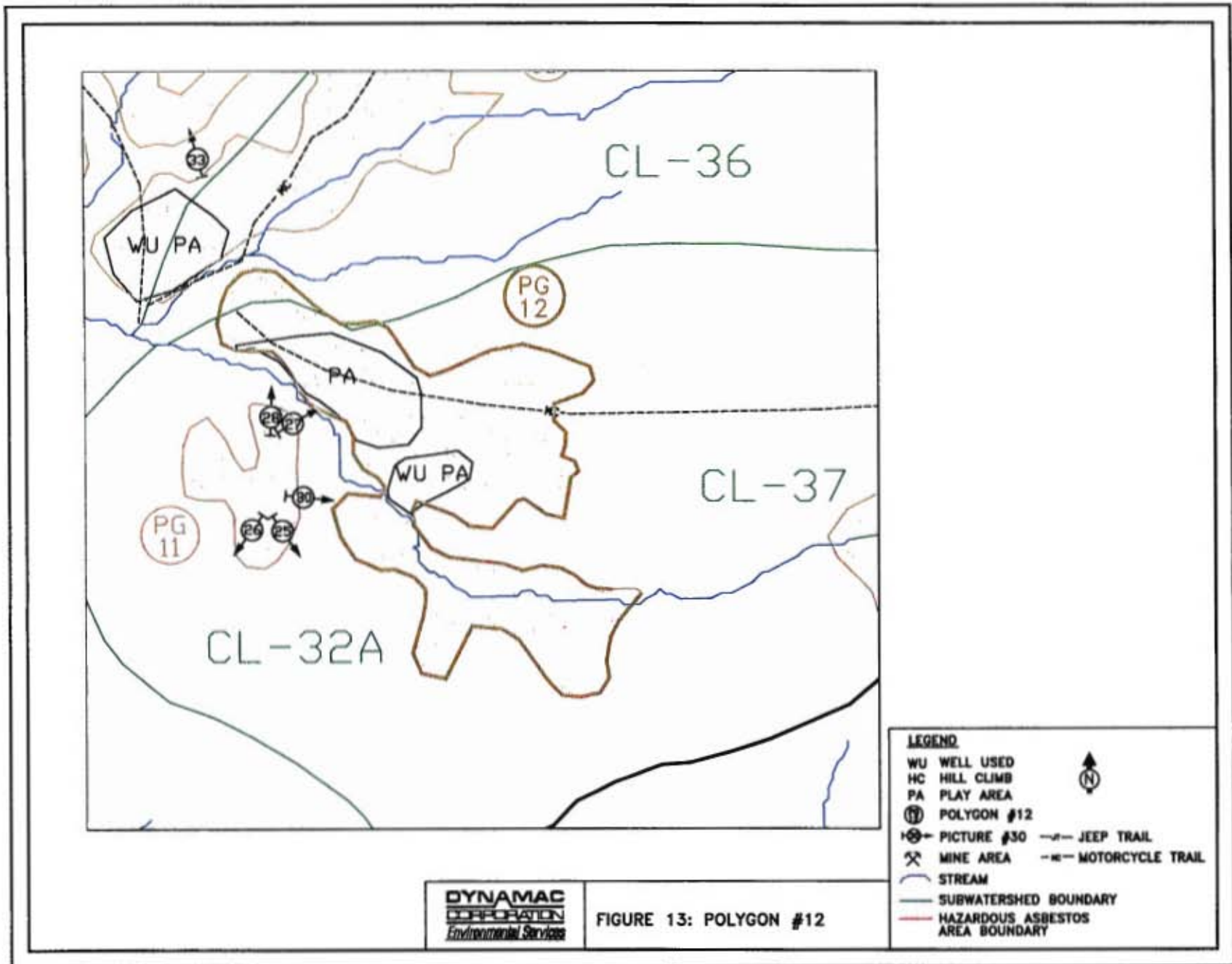
A graphical representation of PG-12 is shown in Figure 13, and Photographs 27 and 28 present views which further depict the site conditions.

Polygon Score

PG-12 has the following composition:

Subwatershed	Areal Percent of PG-12
CL-32A	30%
CL-36	5%
CL-37	65%

The database yielded a total score of 37 for this polygon, placing it firmly in the “major contributor” category. This is consistent with the field observations because of the relatively high OHV use, gullying, and other major ranking characteristics, and the close proximity to Clear Creek.



Polygon PG-12



27) Looking NE from CL-37 at San Benito Mountain. Large denuded play area adjacent to naturally eroded inner gorge slope.



28) Looking N from CL-37 at inner gorge play area depicted in Photo 27.

3.1.13 Polygon 13 (PG-13)

Location and Physical Description

Polygon PG-13 is a 768 series barren that is primarily located within Subwatershed SM-2 of the Saw Mill Creek Watershed. The barren extends to the west crossing the adjacent ridge line and terminates in Subwatershed SB-4 of the San Benito watershed. Both subwatersheds form headwaters for ephemeral first order streams that are captured by Saw Mill Creek and the San Benito River. The barren is predominantly situated along the ridge lines extending several hundred feet down the mid slopes. Unlike the subwatersheds forming the headwaters of Clear Creek, Subwatersheds SB-4 and SM-2 have a more gradual topographic relief. The perimeter of the barren is bounded by fairly dense chaparral and isolated stands of conifer, extending to the stream banks.

The drainage pattern in this barren polygon is comprised of the two ephemeral streams (one in each subwatershed) that traverse the entire length of the subwatersheds. Major drainages (Clear Creek and San Benito River) are located at the mouths of each subwatershed. The streams are actively down cutting the channel, and can be described as rough with a moderate discharge gradient. There is, in general, a lack of gullies in both subwatersheds.

The barren is uniformly well armored with coarse and medium gravel, the exception being where several exploration cuts have are present within the polygon. The undisturbed barren soils are predominantly red and brown, while those within the exploration cuts and along the trails are grey and white. Several rock ledges occur within the polygon, primarily along the ridge lines.

OHV use is limited to several motorcycle and jeep trails that have been established on the ridge lines. The type of OHV use appears to be mostly trail riding and transitional to gain access to more attractive areas. It would appear that the presence of the rock ledges cropping out along the ridge lines and extending some what down slope has reduce the attractiveness of this polygon for OHV use.

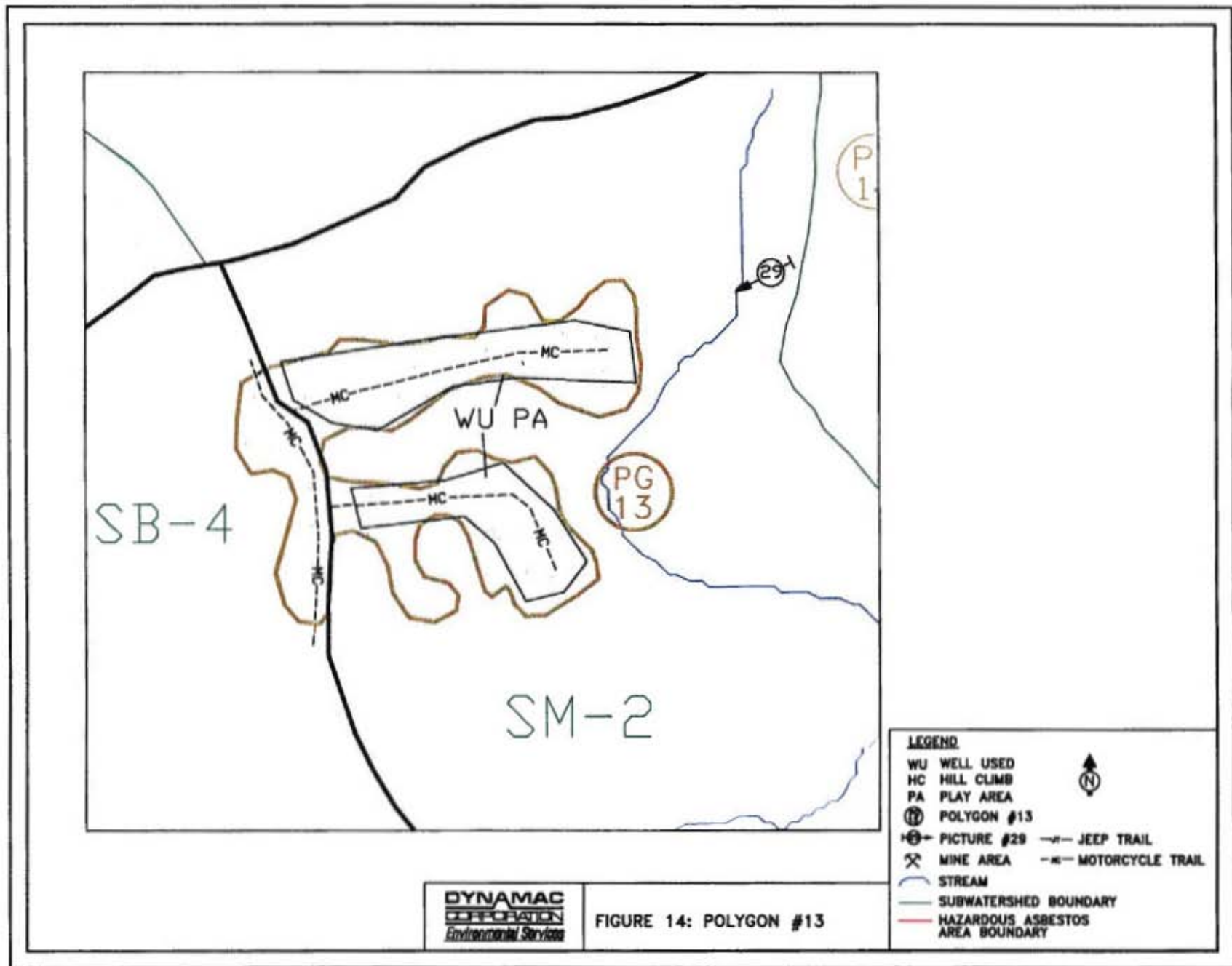
A graphical representation of PG-13 is shown in Figure 14, and Photograph 29 presents a view which further depicts the site conditions.

Polygon Score

PG-13 has the following composition:

Subwatershed	Areal Percent of PG-13
SB-4	15%
SM-2	85%

The database yielded a total score of 23 for this polygon, placing it firmly in the "at risk" category. This is consistent with the field observations because of the geographic location and small localized density of OHV use.



Polygon PG-13



29) Looking S from SM-2B. Mature well armored soils along ridge line and interfluvium.

3.1.14 Polygon 14 (PG-14)

Location and Physical Description

Polygon PG-14 is a 768 series barren polygon that is primarily located within Subwatershed SM-1 of the Saw Mill Creek Watershed. Similar to barren polygon PG-13, this barren extends marginally across the ridge line into two subwatersheds that belong in the Clear Creek watershed. The subwatersheds, which form the southern fork of the Clear Creek headwaters, include CL-37 and CL-32A. In general, the barren polygon is limited to the interfluvial area with relatively gentle topographic relief.

Subwatershed SM-1 is very similar to SM-2 in regard to topographic relief, and in the type and density of vegetative cover and armoring. The major difference is that SM-1 contains multiple gullies, while SM-2 is relatively free of gullies. The gullies have are moderately bounded by vegetation, which provides an effective buffer against erosion and sedimentation. Again, the barren is mostly located along the inner gorge ridge lines and does not extend down slope into the drainage. There is one first order ephemeral stream within SM-1, as well as within CL-32A and CL-37. The perimeter of the barren is bounded by fairly dense chaparral and isolated stands of conifer, extending to the stream banks.

The drainage pattern in this barren polygon is comprised of the three ephemeral streams (one in each subwatershed) that traverse the entire length of the subwatersheds. Major drainages are located at the mouths of each subwatershed. The streams in CL-32A and CL-37 are actively down cutting the channel, and can be described as rough with a high discharge gradient. The ephemeral stream located in SM-1 is also down cutting, but the gradient is only moderate.

Barren polygon PG-14 contains a sizeable area (approximately 60 %) that has not been disturbed by OHV users. This can be explained by the number of rocky ledges that crop out along the ridge lines and the talus slopes that occur along the toes of these slopes. The undisturbed portion of the barren is uniformly well armored with coarse and medium gravel and, generally, contains red and brown soils. Notwithstanding, there are three large hill climbs located along the ridge line, which have significantly denuded the armoring, leaving grey and white soils. Although the impact of the hill climbs are severe, it would appear that very little is migrating into the adjacent drainages. This can be attributed to the fairly dense cover of chaparral.

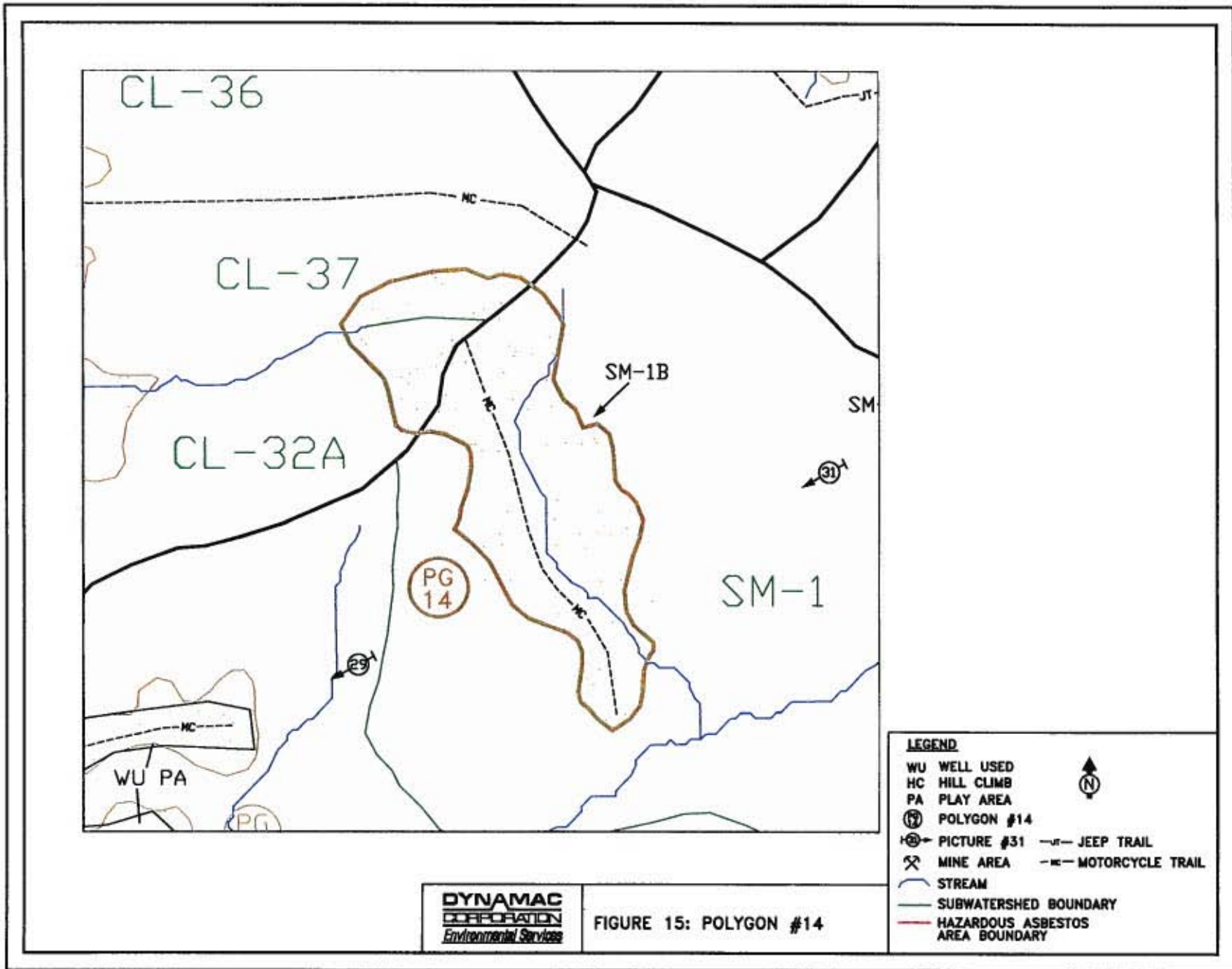
A graphical representation of PG-14 is shown in Figure 15, and Photographs 30 and 31 present views which further depict the site conditions.

Polygon Score

PG-14 has the following composition:

Subwatershed	Areal Percent of PG-14
CL-32A	13%
CL-37	7%
SM-1B	80%

The database yielded a total score of 25 for this polygon, placing it fir This is consistent with the field observations because the OHV use, gullying, and other major ranking characteristics are quite high, the majority of this polygon is some distance from Clear Creek and other major drainages. This is consistent with the field observations because of the undisturbed state that the majority of the barren exhibited coupled with the proximity of nearby drainages.



Polygon PG-14



30) Looking E from CL-37. Inner gorge ridge line with characteristic motorcycle trail.



31) Looking SW from middle elevation of SM-1B. Ridge line with moderate OHV use.

3.1.15 Polygon 15 (PG-15)

Location and Physical Description

Polygon PG-15 is a 769 series barren that traverses three subwatersheds that are contained in two separate major drainages. The subwatersheds include CL-35 and CL-36, which comprise the northern headwaters of the Clear Creek Watershed, and Subwatershed SC-1 which forms the southwestern headwater boundary of the San Carlos Watershed. The majority of PG-15 is contained within CL-36 with only minor segments extending across the ridge lines into CL-35 and SC-1. In general, PG-15 extends from a ridge line situated in the central portion of CL-36, west to the ridge line separating the subwatershed from CL-35. Within CL-36, the barren spans several inner gorges and encompasses Clear Creek. From CL-36 the barren extends north crossing the ridge line into SC-1.

In general, the three subwatersheds share very similar physical characteristics including topographic relief, vegetative cover, drainage pattern, and armoring type. Topographic relief is considerable within the subwatersheds. The inner gorges have very steep planar slopes that are incised with numerous gullies. Characteristically, the gullies merge as they approach the canyon floor and appear capable of transporting large volumes of sediment. This is due to the fact that the gullies are fairly large and have moderately incised channels, and lack of a vegetative buffer. These gullies also facilitate events of mass wasting, which is apparent by the numerous slides that are present in the area. The vegetative cover is predominantly situated along the ridge lines extending half down the mid slopes. The drainage courses contain very little vegetation.

The barren is predominantly covered with coarse and medium gravel, excluding the gullies, trails, and play areas. The soils are red to brown, while the orthogenic and naturally disturbed soils are grey and white. It is apparent by the volume of sediment contained within the Clear Creek canyon floor that the CL-35 and CL-36 experience extensive erosion and sedimentation. It would appear, however, that these are the results of naturally occurring events rather than by OHV use.

OHV use is limited to jeep and motorcycle trails that are located along the ridge lines. This is due, in general, to the very steep topography and narrow canyons. There is, however, a single hill climb located adjacent to Clear Creek within CL-36. Based on the condition of the armoring, it would appear that this hill climb is only moderately used and contributes very little in the way of sediment to Clear Creek.

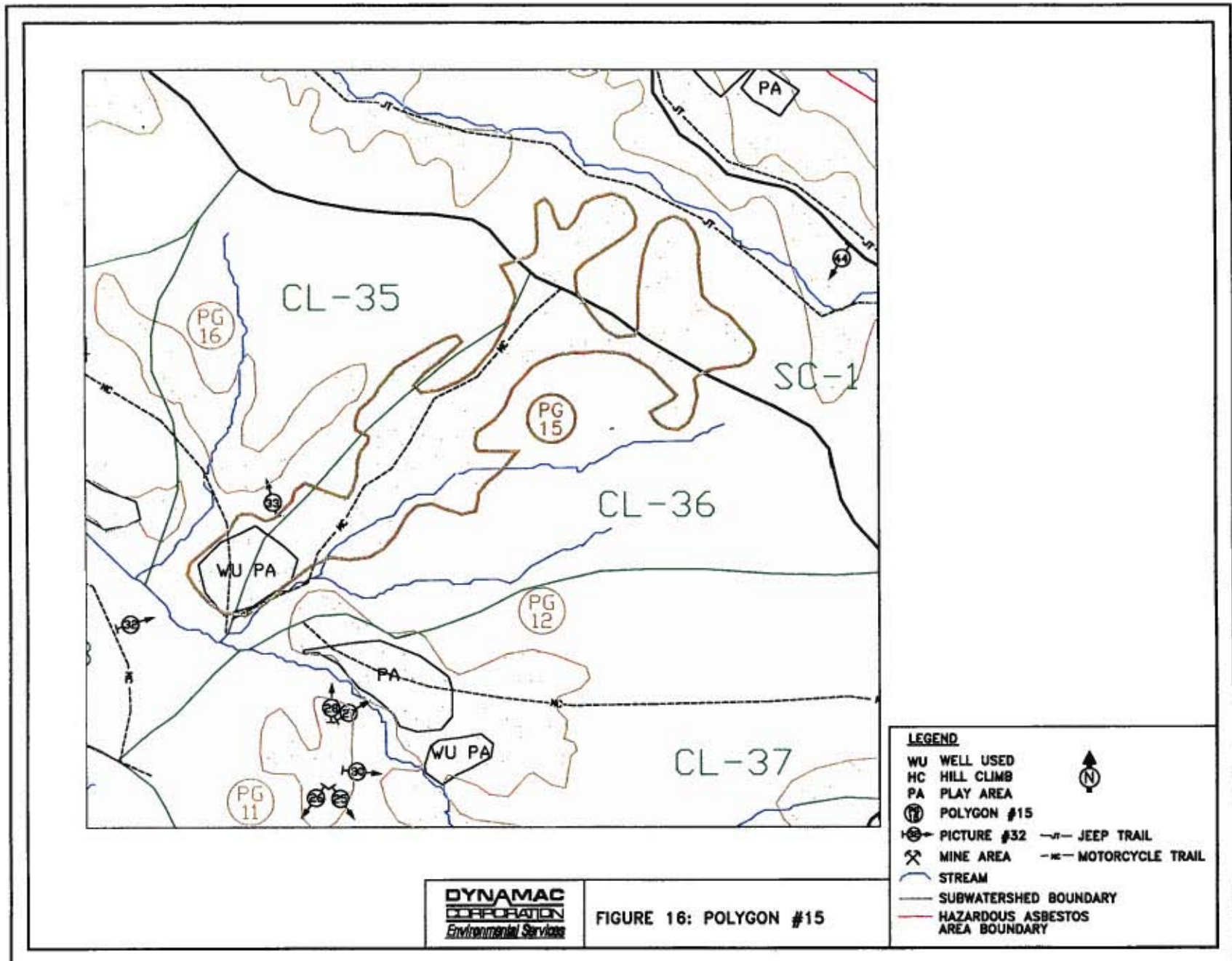
A graphical representation of PG-15 is shown in Figure 16, and Photograph 32 presents a view which further depicts the site conditions.

Polygon Score

PG-15 has the following composition:

Subwatershed	Areal Percent of PG-15
CL-35	10%
CL-36	65%
SC-1	25%

The database yielded a total score of 24 for this polygon, placing it firmly in the “at risk” category. This is consistent with the field observations because of the relative lite OHV density and mature well armored soils, coupled with the steep slopes and proximity of a nearby drainage.



Polygon PG-15



32) Looking N from adjacent subwatershed CL-36. Heavily used and denuded hill climb play area, exhibiting massive gully induced by OHV use.

3.1.16 Polygon 16 (PG-16)

Location and Physical Appearance

Polygon PG-16 is a 769 series barren that is almost entirely contained within subwatershed CL-35. A small portion (i.e., less than 10 % total area) crosses the western ridge line, which defines the subwatershed boundary, into subwatershed CL-34. The barren polygon is positioned geographically in the middle of the subwatershed; that is, both in elevation and geographic location. The barren extends from the eastern to the western ridge lines that form the subwatershed boundaries, traversing the ephemeral drainage in the process. After crossing into subwatershed CL-34 the barren follows the ridge line, where it terminates.

Subwatersheds CL-35 and CL-34 share very similar physical characteristics. Both subwatersheds have very steep planar inner gorge slopes forming narrow side canyons, which discharge directly to Clear Creek. The interfluvies and ridge lines are fairly narrow and moderately steep. Soils within the inner gorges are predominantly grey and white, which is due to slope failure and mass wasting. Soils along the interfluvies and ridge lines are a more mature brown and red. The barren is well armored with coarse and medium gravel.

A thick canopy of chaparral and conifer borders PG-16 along the ridge lines and between the barren terminus and Clear Creek. The canopy provides a buffer effect from sheet wash, although the majority of sediment delivered to Clear Creek appears to be transported by several gullies that traverse the entire barren and the ephemeral stream. The ephemeral stream is down cut and possess a high hydraulic gradient. In addition to the buffering effect of the chaparral, there is a terrace that extends along the entire down slope boundary of PG-16. The terrace forms a “nickpoint” that can potentially reduce down slope movement of sediment.

PG-16 exhibits very little OHV use, other than a motorcycle trail that exists along the terrace. The lack of OHV use is due to a combination of inherent physical features including steep inner gorge slopes, narrow canyons, and a lack of accessibility.

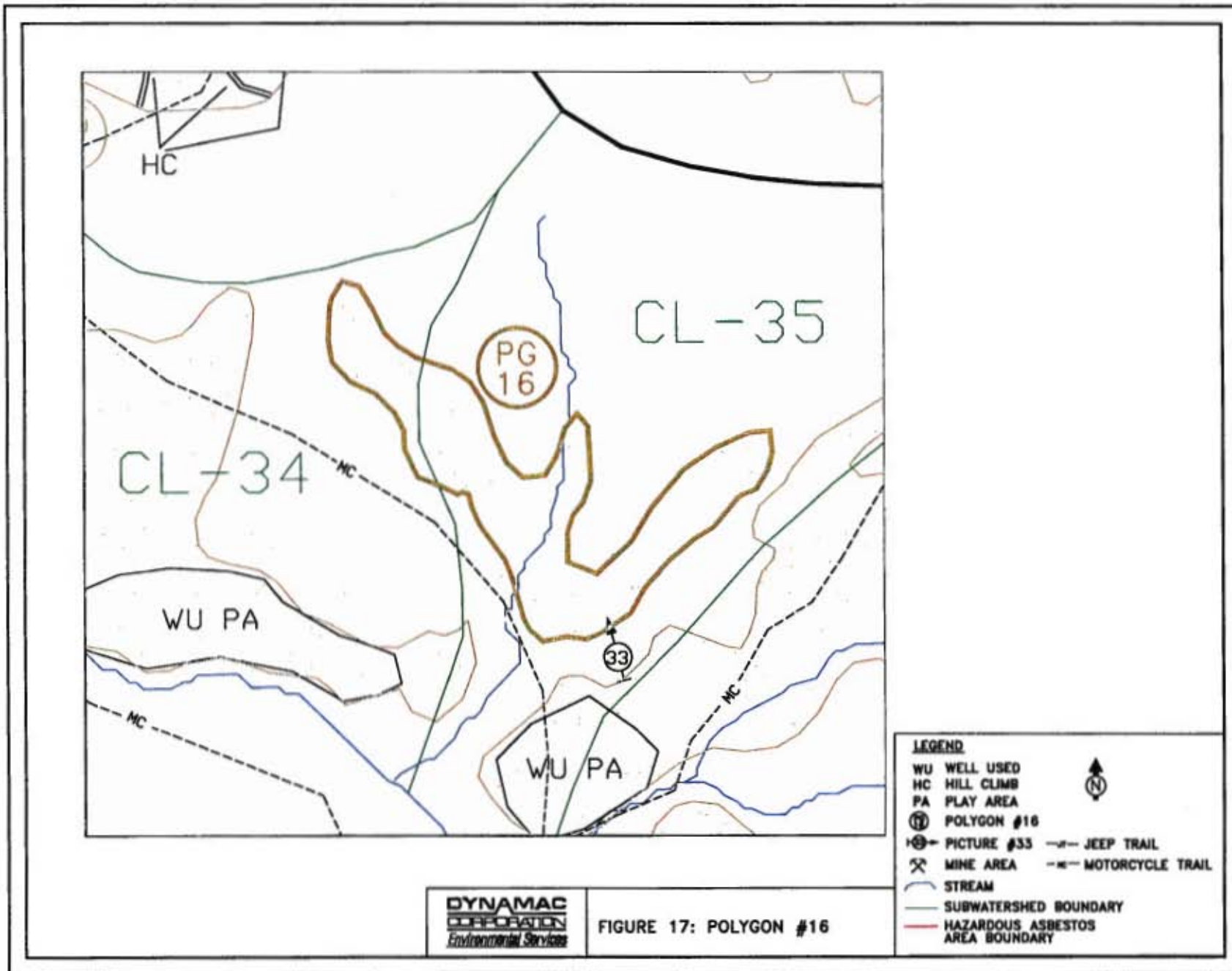
A graphical representation of PG-16 is shown in Figure 17, and Photograph 33 presents a view which further depicts the site conditions.

Polygon Score

PG-16 has the following composition:

Subwatershed	Areal Percent of PG-16
CL-34	15%
CL-35	85%

The database yielded a total score of 19 for this polygon, placing it in the low end of the “at risk” category. This is consistent with the observations because very little localized OHV use is present in the polygon, even though the topographic and geographic characteristics suggest otherwise.



Polygon PG-16



33) Looking N-NW from adjacent subwatershed CL-35. Little used, naturally eroded barren.

3.1.17 Polygon 17 (PG-17)

Location and Physical Description

Polygon PG-17 is a 769 series barren that is almost equally divided between subwatersheds CL-33 and CL-34. A small portion (i.e., less than 10 % total area) crosses the eastern boundary of CL-34 crossing into CL-35. The barren polygon is positioned geographically in the lower half of CL-34, while in CL-33 the barren extends from the mouth to the ridge line of the subwatershed. In CL-34, the barren traverses east to the west while crossing several ridge lines and a ephemeral drainage. In CL-33, the barren polygon is contained mostly within the drainage course of two first order ephemeral streams.

Both CL-33 and CL-34 can be described as having very steep planar inner gorge slopes forming narrow side canyons, which discharge directly to Clear Creek. The interfluvies and ridge lines are fairly narrow and moderately steep. Soils within the inner gorges are predominantly grey and white, which is due more to slope failure and mass wasting than to OHV use. Soils along the interfluvies and ridge lines are a more mature brown and red. The barren is well armored with coarse and medium gravel.

A thick canopy borders PG-17 along the ridge lines and between the barren terminus and Clear Creek. The canopy provides a buffer effect from sheet wash, although the majority of sediment delivered to Clear Creek appears to be transported by several gullies, present in the barren and the ephemeral streams. The streams are down cut with high hydraulic gradients.

A large play area is present in subwatershed CL-34. The base of the play area directly borders Clear Creek providing a close and ready supply of sediment to Clear Creek. The steep slopes and lack of a vegetative buffer area provide the impetus for erosion and sedimentation. Within CL-33 there is a hill climb connecting two major play areas.

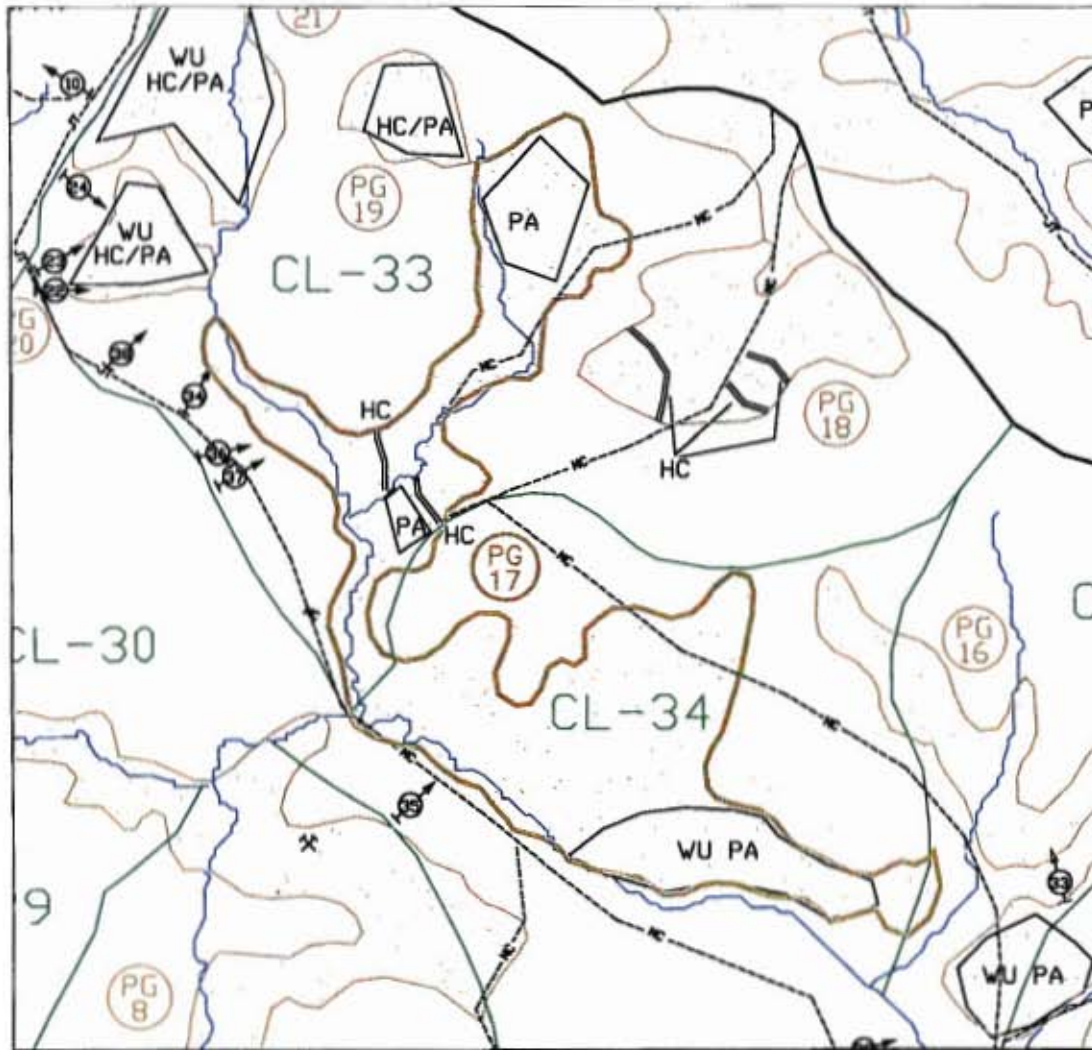
A graphical representation of PG-17 is shown in Figure 18, and Photographs 34 and 35 present views which further depict the site conditions.

Polygon Score

PG-17 has the following composition:

Subwatershed	Areal Percent of PG-17
CL-33	43%
CL-34	55%
CL-35	2%

The database yielded a total score of 29 for this polygon, placing it borderline between the “at risk” and “major contributor” categories. The score is consistent with the geographic location of the polygon, slope values, proximity to a major drainage, and the presence of a localized and heavily used play area.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 18: POLYGON #17

LEGEND

- | | | | |
|----|----------------------------------|---|------------------|
| WU | WELL USED | | |
| HC | HILL CLIMB | | |
| PA | PLAY AREA | | |
| Ⓟ | POLYGON #17 | | |
| Ⓧ | PICTURE #34 | — | JEEP TRAIL |
| ⓧ | MINE AREA | — | MOTORCYCLE TRAIL |
| — | STREAM | | |
| — | SUBWATERSHED BOUNDARY | | |
| — | HAZARDOUS ASBESTOS AREA BOUNDARY | | |

Polygon PG-17



34) Looking NE from CL-33 western ridge. Denuded soils due to play area and hill climb.



35) Looking NW from adjacent subwatershed CL-32B. Little used, naturally eroded barren.

3.1.18 Polygons 18, 19, 20, 21 (PG-18, PG-19, PG-20, PG-21)

Location and Physical Description

The four 769 series polygons PG-18, PG-19, PG-20, PG-21 are all located within subwatershed CL-33 just inside the northwestern corner of the San Benito Natural Area. Within subwatershed CL-33, PG-18 lies in the northeast corner, PG-19 in the north center, and PG-20 and PG-21 in the northwest corner. In all four polygons, barren areas are primarily situated along the ridges of the north-south drainage channels. Two ephemeral first order streams fork through the subwatershed; one originating just to the east of PG-20 and PG-21 and trending southeast, the other originating between PG-18 and PG-19 and trending approximately southwest. Both of the first order stream channels are lined with moderately dense vegetation.

All four polygons are characterized by limited armoring with medium to fine gravels. The majority of the soil is red in color with grey and white more prevalent in the deeper gullies and on OHV play areas. PG-18 and PG-19 are moderately gullied; virtually no gullying exists in either PG-20 or PG-21.

Despite being part of the San Benito Natural Area, the close proximity to the County Road and the northern ridge jeep trail make these four polygons a popular spot amongst OHV users. Of the four polygons, OHV use is most concentrated in PG-18 and PG-19, although all four see at least moderate activity in each of the three major types of use: hill climbs, play areas, and motorcycle trails. The polygons are all situated along fairly steep slopes, and despite the presence of a slope break near just above the convergence of the two first order streams, it is clear that in many areas OHV use contributes significantly to offsite transport of sediments.

A detailed view of PG-18, PG-19, PG-20, and PG-21 is shown in Figure 19. Photographs 36, 37, and 38 provide a view of the site conditions in PG-18 and PG-19.

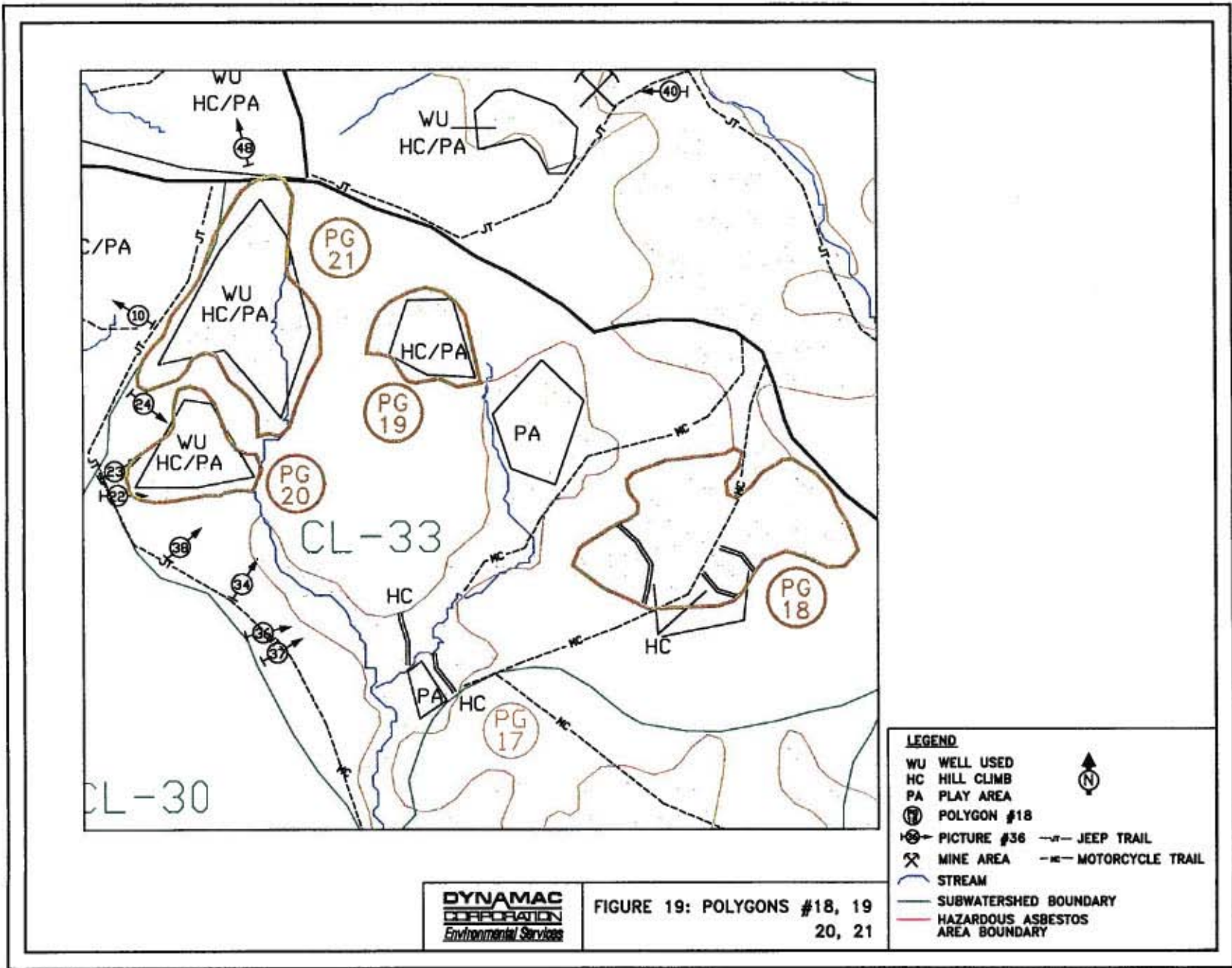
Polygon Score

PG-18, PG-19, PG-20, and PG-21 all lie completely within Subwatershed CL-33. In order to derive scores for the individual polygons from a single subwatershed score, the base score for CL-33 was adjusted for each polygon according to field observations. In other words, the polygons that showed more sedimentation and erosion potential received scores that are higher than the CL-33 base score, while the scores of those polygons with apparently lower potential were adjusted to be below the CL-33 base score.

The base score for Subwatershed CL-33 is 33, and the adjusted scores for the four polygons are as follows:

Polygon	Adjusted Score
PG-18	38
PG-19	39
PG-20	28
PG-21	31

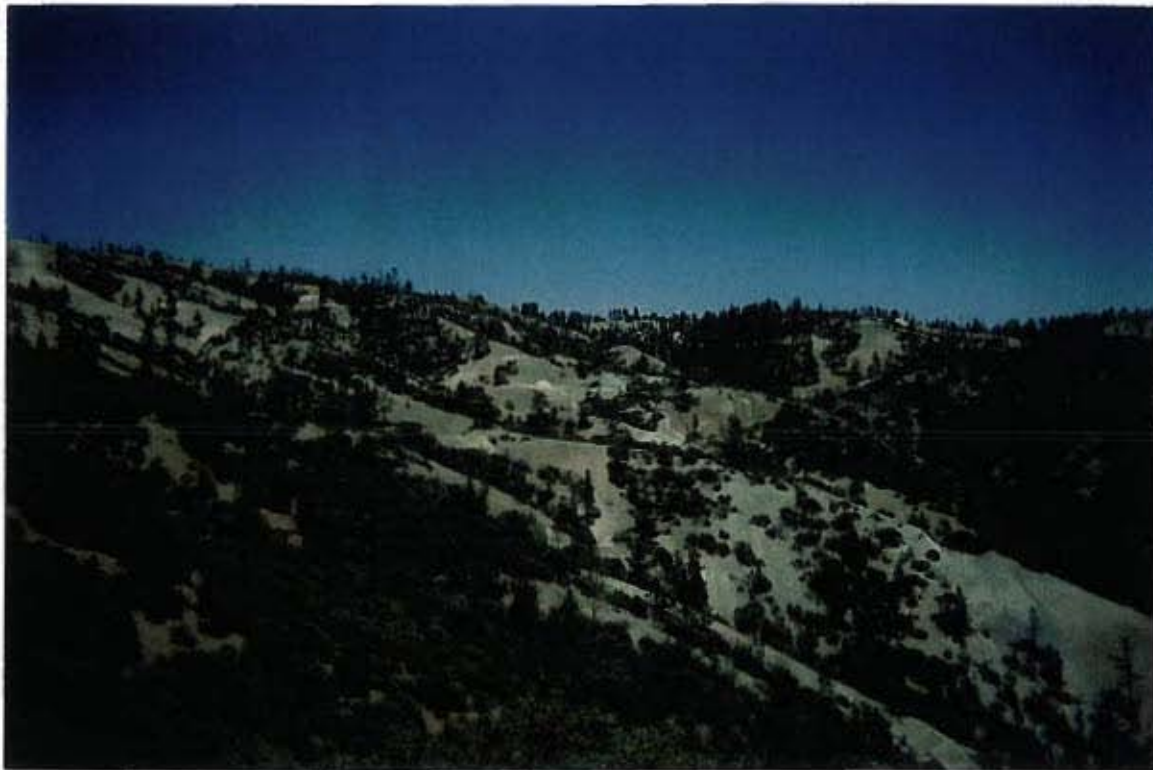
PG-18 and PG-19 exhibited significantly higher OHV use, less armoring, and whiter soils than PG-20 and PG-21; therefore, the scores for PG-18 and PG-19 were higher. With the exception of PG-20, all of the scores obtained for the four polygons discussed in the preceding paragraphs are greater than 30, placing PG-18, PG-19, and PG-21 in the "major contributor" category. The score for PG-20, though not quite high enough to be considered a "major contributor," falls within the high end of "at risk" polygons.



Polygon PG-18



36) Looking E-NE from CL-33 western ridge. Mining disturbance on otherwise little used barren.



37) Looking NE from CL-33 western ridge. Mining disturbances used as play areas.

Polygon PG-19



38) Looking N-NE from CL-33. Inner gorge slopes denuded due to OHV use (play areas).

3.1.19 Polygon 22 (PG-22)

Location and Physical Description

The vast majority of this polygon is located within Subwatershed SC-1 and spans the hillsides on both sides of San Carlos Creek, which trends to the northwest. Much of PG-22 is located within the San Benito Natural Area, as evidenced by the presence of fencing around much of the polygon. Aurora Mine is located in the northwestern most corner of PG-22, and does not have protective fencing in place; therefore, it is very heavily used by OHVs. This polygon borders San Carlos Creek along its entire length, and as a result, there is only minimal vegetative buffering between PG-22 and the drainage.

With the exception of the portion of the polygon near Aurora Mine, PG-22 is very well armored with primarily medium gravel. The soil in PG-22 is mostly red with some patches of grey, and exhibits some strips of white in the gullies. Despite the fact that this polygon is designated as a 769 series barren, there are very few completely barren areas. The majority of the polygon has at least scattered patches of vegetation throughout. There are approximately 5-10 gullies in the polygon, all of which lead almost directly into to San Carlos Creek. Most of PG-22 is situated on steep slopes.

Three major routes access PG-22: one jeep trail each on the ridges on either side of San Carlos Creek and the County Road which runs parallel to the stream itself along the canyon floor. This road running parallel to the creek acts as a benched slope break and appears to serve as sediment buffering feature between the barrens and the stream. Several areas were observed adjacent to the road with large mounds of free sediment, suggesting that this buffering may be taking place successfully without the implementation of additional BMPs.

As stated previously, much of the polygon is fenced and there is very little evidence of OHV use within the fenced areas; however, two minor play areas were observed directly adjacent to the stream in unfenced areas. The Aurora Mine lies outside the San Benito Natural Area and contains heavily used hill climbs and play areas.

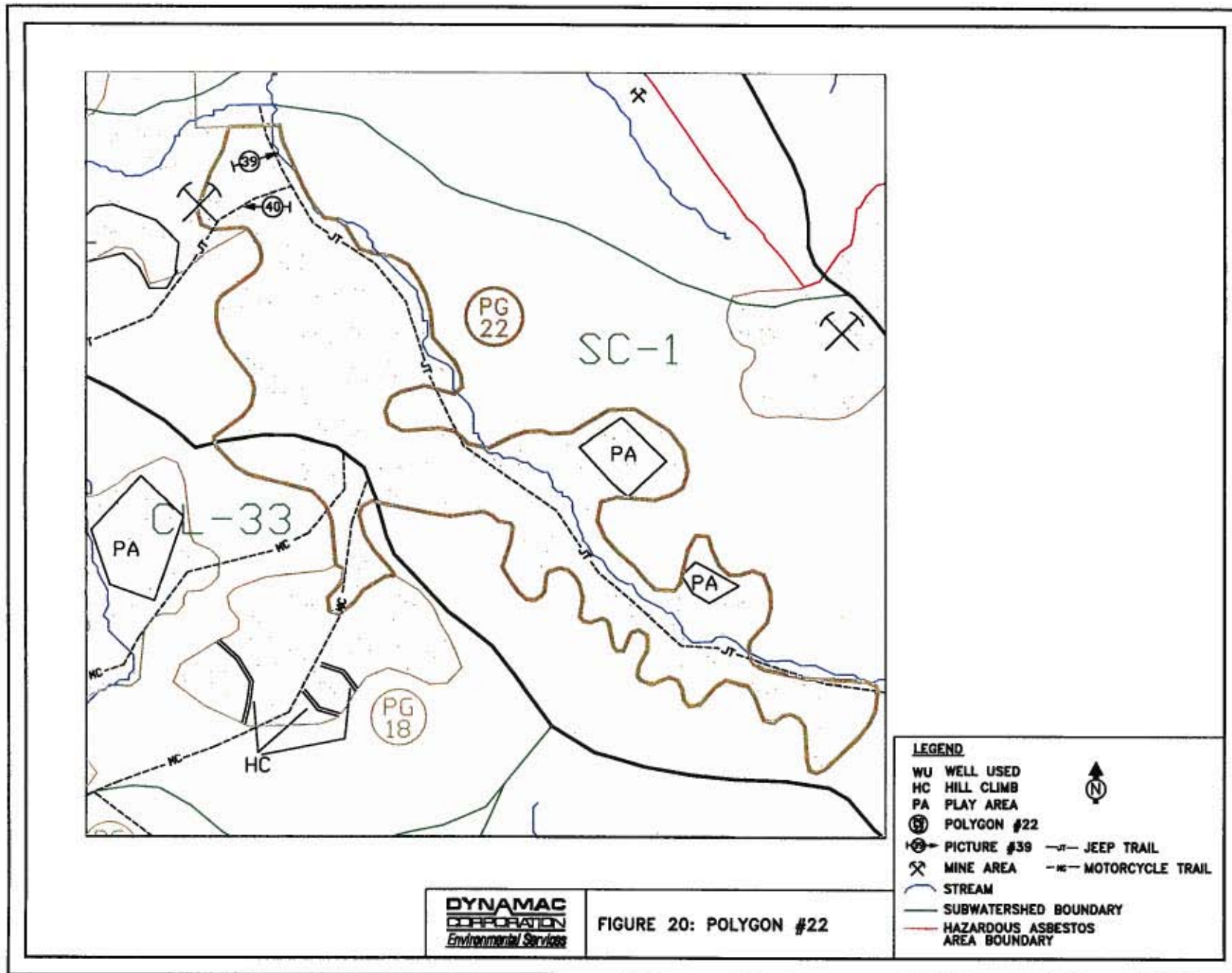
A graphical representation of PG-22 is shown in Figure 20, and Photographs 39 and 40 present views which further depict the site conditions.

Polygon Score

PG-22 has the following composition:

Subwatershed	Areal Percent of PG-22
CL-33	5%
SC-1	95%

The database yielded a total score of 24 for this polygon, placing it in upper 50 percent of the “at risk” category. This is consistent with the field observations because PG-22 is composed of two entirely distinct areas. The portion of the polygon in the Aurora Mine is heavily impacted by OHVs, but this only represents approximately 15 percent of the total polygon area. The remaining 85 percent of PG-22 is precipitously close to San Carlos Creek and could have major impacts upon the drainage if not for the protective fencing. Based on the database score and field observations, the majority of PG-22 is relatively stable with a high potential to become a “major contributor” if anthropogenic impacts increase significantly in these areas.



Polygon PG-22



39) Looking N from SC-1. Large gully caused by alteration of natural terrain (road cut).



40) Looking S-SW from SC-1. Mining disturbance exhibiting severe erosional features.

3.1.20 Polygon 23 (PG-23)

Location and Physical Description

PG-23 is located in the northwest corner of the San Carlos Creek Watershed to the west of the Aurora Mine, and occupies space in subwatersheds SC-1 and SC-2. The exterior border of the polygon consists of thick vegetation to the west and south. One ephemeral stream begins to the southwest of PG-23 and trends to the northwest through the polygon, and eventually joins with San Carlos Creek just south of the Creek Pit.

Physically very similar to PG-22, this polygon is very well armored with primarily medium gravel with the exception of the heavily used play areas directly adjacent to the Aurora Mine. The soil in PG-23 is mostly red with some patches of grey, and exhibits some strips of white in the gullies and in areas of particularly intense OHV use. Consistent with the fact that this polygon is designated as a 768 series barren, there are very few completely barren areas. The majority of the polygon has at least scattered patches of vegetation throughout. There are several networks of large, deep gullies in the polygon, all of which lead almost directly into to the first order stream or fan out in the direction of the Aurora Mine. Most of PG-23 is situated on steep slopes.

Three major routes access PG-23: one jeep trail each on the ridges on either side of San Carlos Creek and the County Road descends to this area from the Clear Creek Watershed. Several areas were observed adjacent to the road with large mounds of free sediment, suggesting that this buffering may be taking place successfully without the implementation of additional BMPs.

The section of PG-23 which lies within SC-2 is nearly free of OHV use, with the exception of one motorcycle trail which appears to be used primarily as a thoroughfare between the eastern end of the Larious Creek/Canyon Watershed and the Aurora Mine. On the other hand, the portion of PG-23 within SC-1 is very heavily used by OHVs, primarily in one major hill climb area southeast of the mine area.

A graphical representation of PG-23 is shown in Figure 21, and Photographs 41 and 42 present views which further depict the site conditions.

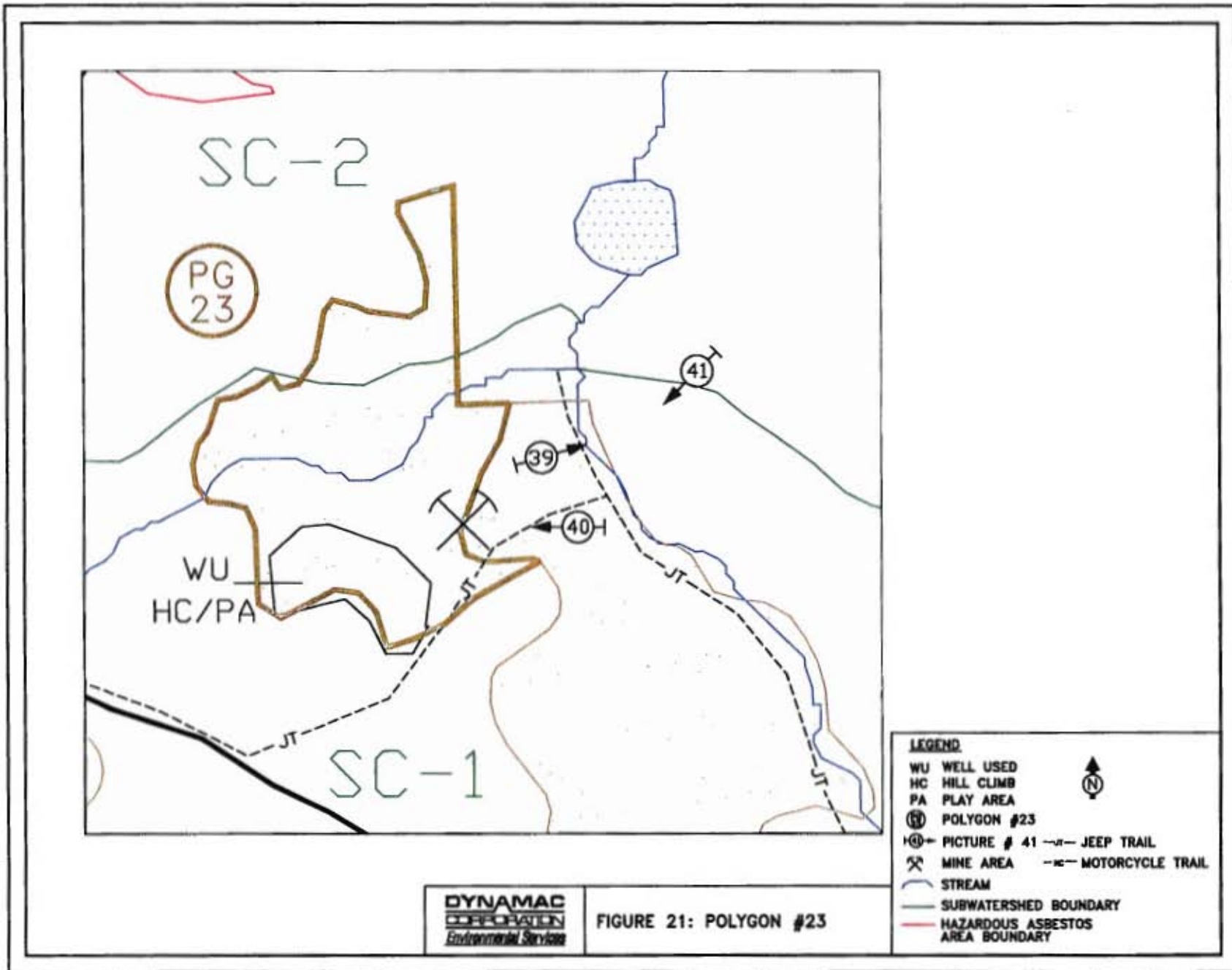
Polygon Score

PG-23 has the following composition:

Subwatershed	Areal Percent of PG-23
SC-1	75%
SC-2	25%

The database yielded a total score of 22 for this polygon, placing it in middle 50 percent of the "at risk" category. This is consistent with the field observations because PG-23 is composed of two entirely distinct areas. The portion of the polygon in the Aurora Mine is heavily impacted by OHVs, but this only represents approximately 25 percent of the total polygon area. The

remaining 75 percent of PG-22 is somewhat close to San Carlos Creek and could have major impacts upon the drainage if large volumes of sediment migrate off site. Based on the database score and field observations, the majority of PG-22 is relatively stable with a high potential to become a "major contributor" if anthropogenic impacts increase significantly in these areas.



Polygon PG-23



41) Looking NE from CL-33 ridge line.



42) Looking NW from CL-33 northern ridge line. Series 768 barren with heavy vegetative buffer.

3.1.21 Polygon 24 (PG-24)

Location and Physical Description

Located near San Carlos Peak at the junction of subwatersheds SC-1, SC-2, and EF-2, this 769 series polygon consists almost entirely of excavations which are part of the San Carlos Mines. The area of PG-24 is split approximately halfway between the San Carlos Watershed and East Fork San Carlos Creek Watershed, and is bordered by thick vegetation on all sides. Due to the dense vegetation, steep slopes, and relatively small size, the polygon remains fairly isolated from OHV traffic. No streams pass through this polygon, although two first order streams originate just to the north.

The barren is well armored in those areas without a significant mining history. In the undisturbed areas, the soil is mostly red with only few scattered patches of gray; however, heavily mined areas remain mostly grey and white despite no anthropogenic interference. The polygon is steeply sloped in undisturbed areas, but the topography of the mined areas are highly irregular, often with large terraced areas present. Gullying is almost entirely non-existent within this polygon.

In addition to the vegetation present around the edges of the polygon, the exploration cuts and other mining features present some sediment trapping capability by serving as retention basins for sediments moving down the steep slopes. Due to the relative distance from this polygon to major drainages, it appears that these features are sufficient for keeping sediments from moving off site.

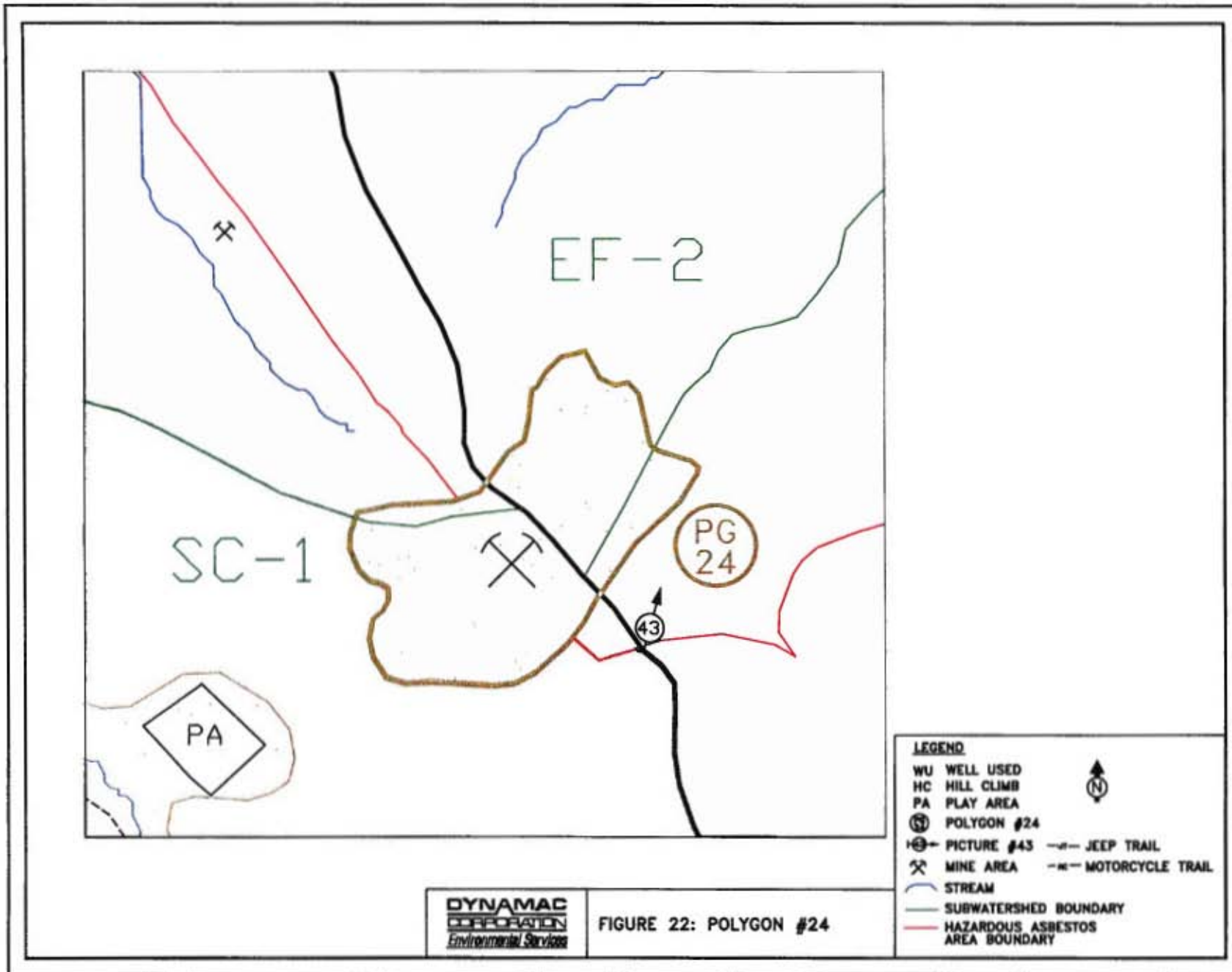
A graphical representation of PG-24 is shown in Figure 22, and Photograph 43 presents a view which further depicts the site conditions.

Polygon Score

PG-24 has the following composition:

Subwatershed	Areal Percent of PG-24
EF-2	47%
SC-1	53%

The database yielded a total score of 18 for this polygon, placing it at the low end of the "at risk" category. This is consistent with field observations since PG-24 has a fair amount of loose sediments from mining activities in the past, but is relatively isolated from OHV traffic and appears to have sufficient buffering capacity to prevent significant impacts to major drainages via offsite sediment transport.



Polygon PG-24



43) Looking N-NE from EF-1A. Naturally occurring immature soils.

3.1.22 Polygon 25 (PG-25)

Location and Physical Description

Located near the headwaters of San Carlos Creek, PG-25 is a 769 series polygon which starts at the creek and spans the ridge top which acts as the boundary between Subwatersheds SC-1 and EF-1. This barren polygon is bordered on the west by a 761 series polygon, to the north and east by PG-26, and to the south by the Clear Creek ridge line. In short, the majority of PG-25 is surrounded by barren or semi-barren areas. San Carlos Creek starts just east of this polygon, then trends to the northwest. In the process, it bisects the eastern half of PG-25. The proximity of a segment of this polygon to San Carlos Creek presents the potential for easy offsite transport of sediments. There are no apparent sediment trapping features within this polygon.

Armoring within PG-25 is uniformly distributed and densely present throughout, and soils are predominately red with a small percentage of grey soils located in the gullies located in the southeastern section of Subwatershed SC-1. Slopes within this polygon are highly variable with steeper slopes tending to be located near the ridge top. Gullying is noticeable only south of the ridge line, and is minimal.

Evidence of OHV activity is more visible to the north of the ridge, but is not particularly concentrated near the ridge top where PG-25 is located. Several play areas exist near the northeast corner of this polygon, but only the edges are inside PG-25; the majority of these play areas fall within PG-26. As a whole, this polygon appears to be an infrequent OHV use area.

A graphical representation of PG-25 is shown in Figure 23, and Photographs 44 and 45 present views which further depict the site conditions.

Polygon Score

PG-25 has the following composition:

Subwatershed	Areal Percent of PG-25
EF-1B	30%
SC-1	70%

The database yielded a total score of 22 for this polygon, placing it in the middle 50 percent of the "at risk" category. This appears consistent with field observations because OHV use and most other indicators of sedimentation and erosion potential are low to moderate.

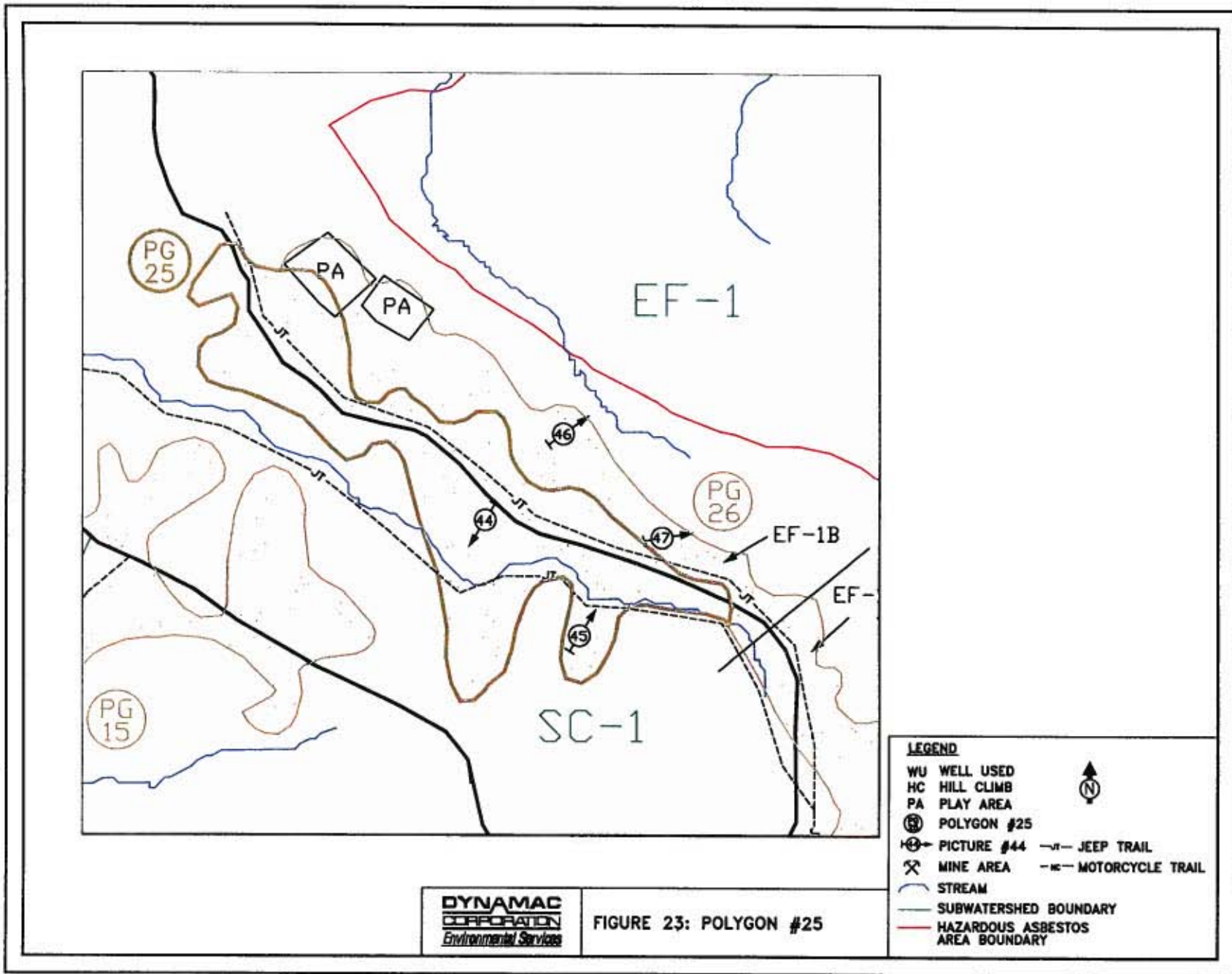


FIGURE 23: POLYGON #25

Polygon PG-25



44) Looking SW from SC-1. Play area that has caused denuded soils on an interfluvial ridge line.



45) Looking N from SC-1. Well armored naturally gullied mid slopes, with sediment pile.

3.1.23 Polygon 26 (PG-26)

Location and Physical Description

Located within the San Benito Natural Area southwest of San Carlos Peak, PG-26 is a 768 series polygon that runs parallel to the hazardous asbestos area boundary along the eastern length of PG-25. This polygon extends down slope from just below the ridge top between the San Carlos and East Fork San Carlos Watersheds. Two distinct areas of the polygon were observed during the field reconnaissance: one in the southwest corner of Subwatershed EF-1 at the headwaters of East Fork San Carlos Creek (designated Subwatershed EF-1A), the other stretching to the northwest from a small ridge past which the East Fork San Carlos Creek is no longer the primary drainage (designated Subwatershed EF-1B).

Throughout this polygon, the soil is mostly red with minor inclusions of grey and white. The entire barren area is well armored with mostly fine gravel. The southeastern section of the subwatershed surrounding PG-26 contains heavy vegetation and there are scattered patches of vegetation within the barrens, whereas the northwest section of the polygon contains no vegetation. There is thick vegetation lining the base of the polygon to the northeast. Gullying is present along the steep slopes found within PG-26, but is limited to very shallow specimens.

A jeep trail provides access to this polygon and bisects it along a northwest to southwest path. The areas above the jeep trail are fenced and closed to OHV traffic; however, no fencing is present around the section of the polygon below the trail. As a result, there are three major play areas at this location.

The vegetation present around the edges of the polygon presents some sediment trapping capability for material moving down the steep slopes. Due to the relative distance from this polygon to major drainages, the features are sufficient for keeping sediments from moving off site.

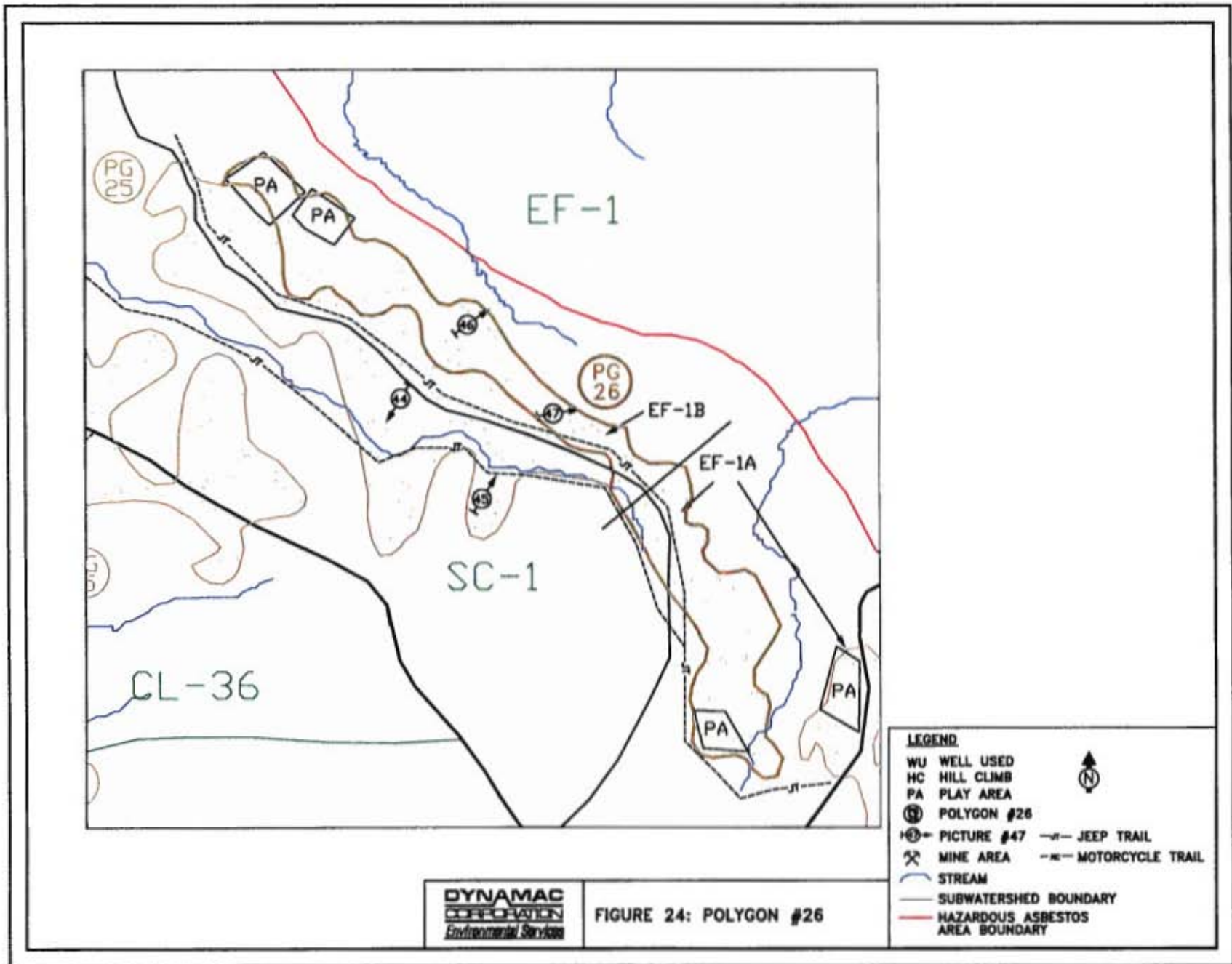
A graphical representation of PG-26 is shown in Figure 24, and Photographs 46 and 47 present views which further depict the site conditions.

Polygon Score

PG-26 has the following composition:

Subwatershed	Areal Percent of PG-26
EF-1A	45%
EF-1B	50%
SC-1	5%

The database yielded a total score of 16 for this polygon, placing it at the borderline between the "at risk" and "minor contributor" categories. This is consistent with field observations since PG-26 is relatively isolated from OHV traffic and appears to have sufficient buffering capacity to prevent significant impacts to major drainages via offsite sediment transport.



Polygon PG-26



46) Looking E-NE from SC-1 NE ridge line. Mature well armored protected barren area.



47) Looking E from EF-1B. Mining disturbance that has been protected.

3.1.24 Polygon 27 (PG-27)

Location and Physical Description

Found in the eastern most end of the area designated as Subwatershed LC-1B, PG-27 is a 769 series barren polygon which lies near the point where the San Carlos, Clear Creek, and Larious Canyon/Creek watersheds come together. PG-27 stretches from the northern watershed boundary to the first order stream which runs east-west throughout this area. A large portion of the eastern end of this polygon had been previously identified on BLM maps as a 761 series polygon (30-50% barren); however, field observations showed that this area is actually a 768/769 polygon. OHV use appeared particularly high, and this may have accelerated the transition of this area from 761 to 768/769.

The soil is mostly red with patches of grey and white in areas worn by OHV use. Armoring consists mostly of fine gravel throughout, but is virtually nonexistent in areas of frequent OHV use. There is heavy vegetation lining several drainage channels that run north-south through PG-27, as well as the first order ephemeral drainage at the base of the canyon. The vegetation lining the drainage channels and also located at the base of the polygon provide good sedimentation trapping capabilities. In addition, the ephemeral first order stream which runs near the polygon does not appear to act as a viable means by which sediments may be transported deeper into the Larious Canyon/Creek watershed. Rather, sediments leaving PG-27 appear to move down the slopes and become "detained" along the stream bed in the canyon floor.

Most of the gullies found in PG-27 run parallel to existing areas of concentrated OHV traffic. Some are quite deep and run from the watershed boundary with Sampson Creek to the canyon bottom. The polygon as a whole is situated on a moderately steep slope. A jeep trail runs along the southern ridge of the subwatershed, and allows easy access to PG-27. This polygon is a very highly used OHV area consisting of a network of motorcycle trails and three major play features.

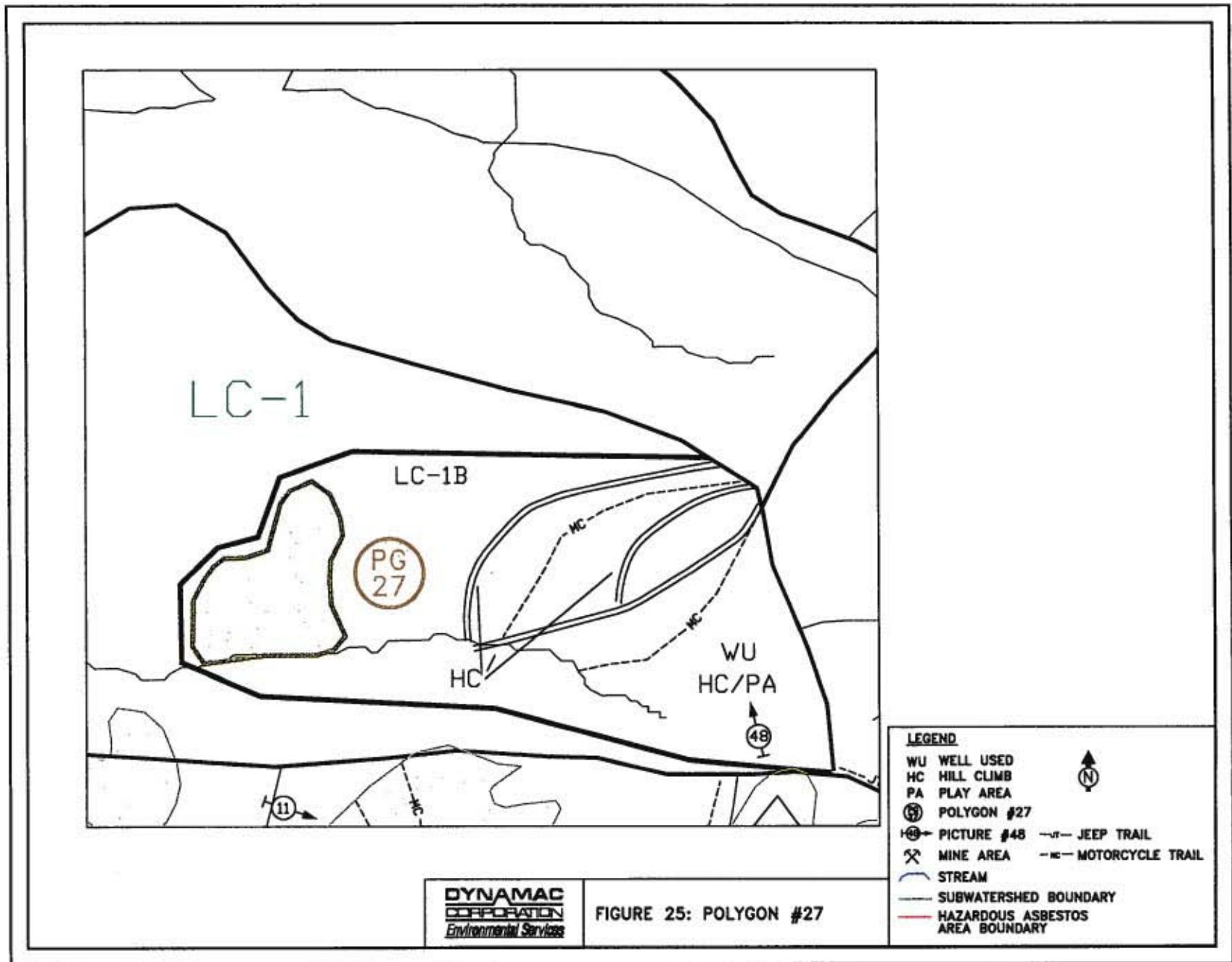
A graphical representation of PG-27 is shown in Figure 25, and Photograph 48 presents a view which further depicts the site conditions.

Polygon Score

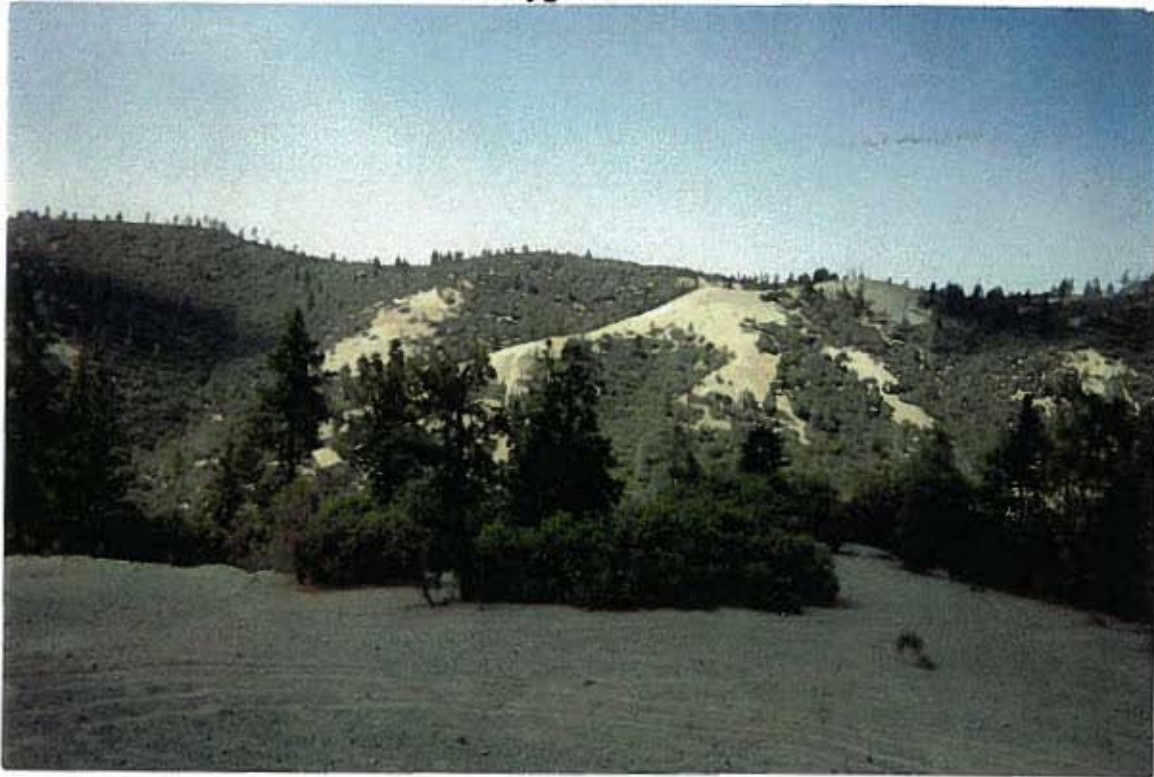
PG-27 has the following composition:

Subwatershed	Areal Percent of PG-27
LC-1B	100%

The database yielded a total score of 26 for this polygon, placing it in the middle of the "at risk" category. This is consistent with field observations in that while PG-27 has high OHV use, sufficient buffering capacity appears to exist as to prevent significant impacts to major drainages via offsite sediment transport.



Polygon PG-27



48) Looking N from SW corner of LC-1B. Mature well armored soils with good canopy buffer.

3.1.25 Polygons 28, 29, 30 (PG-28, PG-29, PG-30)

Location and Physical Description

The three 768/769 series polygons PG-28, PG-29, PG-30 are all located within subwatershed LC-1A almost due north of the central bend of Clear Creek. Within subwatershed LC-1A, PG-28 lies the farthest east, PG-29 in the center, and PG-30 to the west. As in PG-27, a single ephemeral first order stream runs east-west through the subwatershed; the stream channel is lined with moderately dense vegetation, representing a reasonable sediment trapping feature.

All three polygons are characterized by limited armoring with mostly fine gravels. The soil in PG-28 and PG-30 is predominantly red in color with grey soils more prevalent in the deeper gullies and on OHV play areas. PG-29 is equal parts red and grey soils throughout, with strips of white found in the gullied areas. PG-29 is highly gullied; virtually no gullying exists in either PG-28 or PG-30.

The relatively close proximity to the Clear Creek northern ridge jeep trail and several motorcycle trails running east-west along the northern ridge of Larious Canyon makes two of these three polygons a popular spot amongst OHV users. Presumably, PG-29 is too steep and too deeply gullied to allow OHV use; however, PG-28 and PG-30 are heavily used in this capacity. PG-28 is home to at least three hill climbs, two of which run all the way from the ridge top to the canyon floor. Nearly half of the total surface area of PG-30 is a heavily used play area. The three polygons are all situated along moderately steep slopes, and if not for the relative isolation of this end of Larious Canyon from a major drainage, PG-28, PG-29, and PG-30 could be a much more significant contributor of sediments.

A detailed view of PG-28, PG-29, and PG-30 is shown in Figure 26. Photographs 49 and 50 provide views of the site conditions in PG-28 and PG-29, respectively.

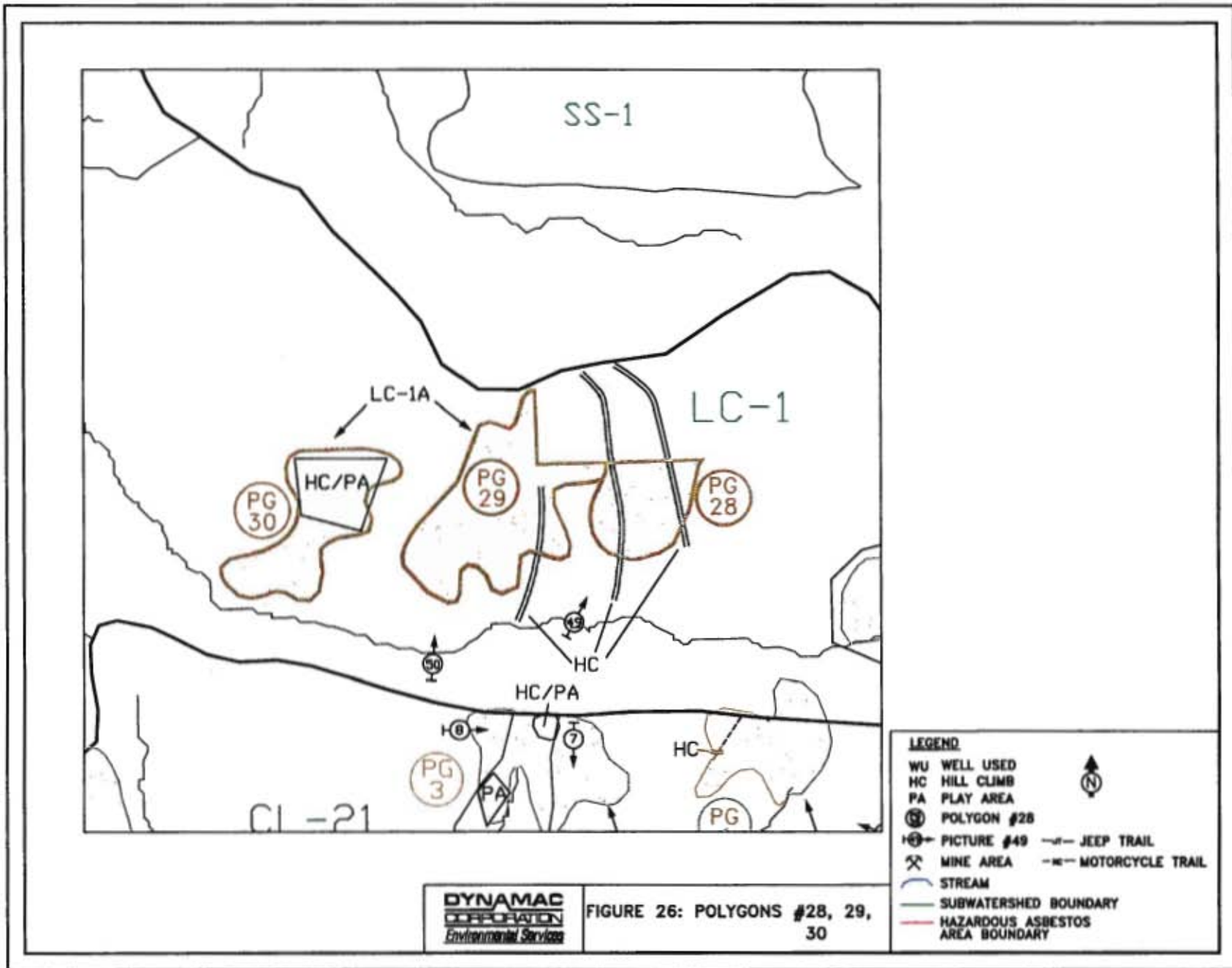
Polygon Score

PG-28, PG-29, and PG-30 all lie completely within Subwatershed LC-1A. In order to derive scores for the individual polygons from a single subwatershed score, the base score for LC-1A was adjusted for each polygon according to field observations. In other words, the polygons that showed more sedimentation and erosion potential received scores that are higher than the LC-1A base score, while the scores of those polygons with apparently lower potential were adjusted to be below the LC-1A base score.

The base score for LC-1A is 23, and the adjusted scores for the three polygons are as follows:

Polygon	Adjusted Score
PG-28	20
PG-29	26
PG-30	28

PG-28 and PG-30 exhibited significantly higher OHV use than PG-29; however, PG-29 was observed to have significantly more gullying and less stable soils than the other two polygons. The relative score for PG-28 came out lower than PG-29 and PG-30 because of the more distributed nature of the OHV use there. All three scores obtained for the polygons discussed in the preceding paragraphs are between 25 and 30, placing PG-28, PG-29, and PG-30 in the high end of the "at risk" range. This is consistent with field observations in that while the three polygons have relatively high OHV use, some buffering capacity exists to prevent intense impacts to major drainages via offsite sediment transport.



Polygon PG-28



49) Looking NE from LC-1A southern ridge. Minor mining disturbance used as a play area.

Polygon PG-29



50) Looking N from LC-1A southern ridge line. Naturally denuded soils adjacent to mature soils.

3.1.26 Polygon 31 (PG-31)

Location and Physical Description

PG-31 is a 768 series barren polygon situated on the slopes along both sides of the San Benito River near the westernmost end of Subwatershed SB-3. The polygon is bisected by the KCAC Mine Road over the entire length, and is surrounded on all sides by thick vegetation. During the field evaluation, this polygon was identified as Subwatershed SB-3A.

Due to particularly heavy OHV use in this polygon, armoring is very limited with mostly fine gravels present. Soils are primarily red in color with grey and white streaks not uncommon in those areas of most intense OHV use. The polygon is characterized by moderately steep slopes and several small gullies running perpendicular to the San Benito River.

Despite the vegetation present around the edges of the polygon, the particularly close proximity of PG-31 to the San Benito River presents the potential for easy transport of sediment from the barren into the drainage. Moreover, the presence of the particularly steep slopes facilitate the deposition of sediments into the river, as evidenced by the presence of two landslides. Three major play areas were observed, all directly bordering the San Benito River.

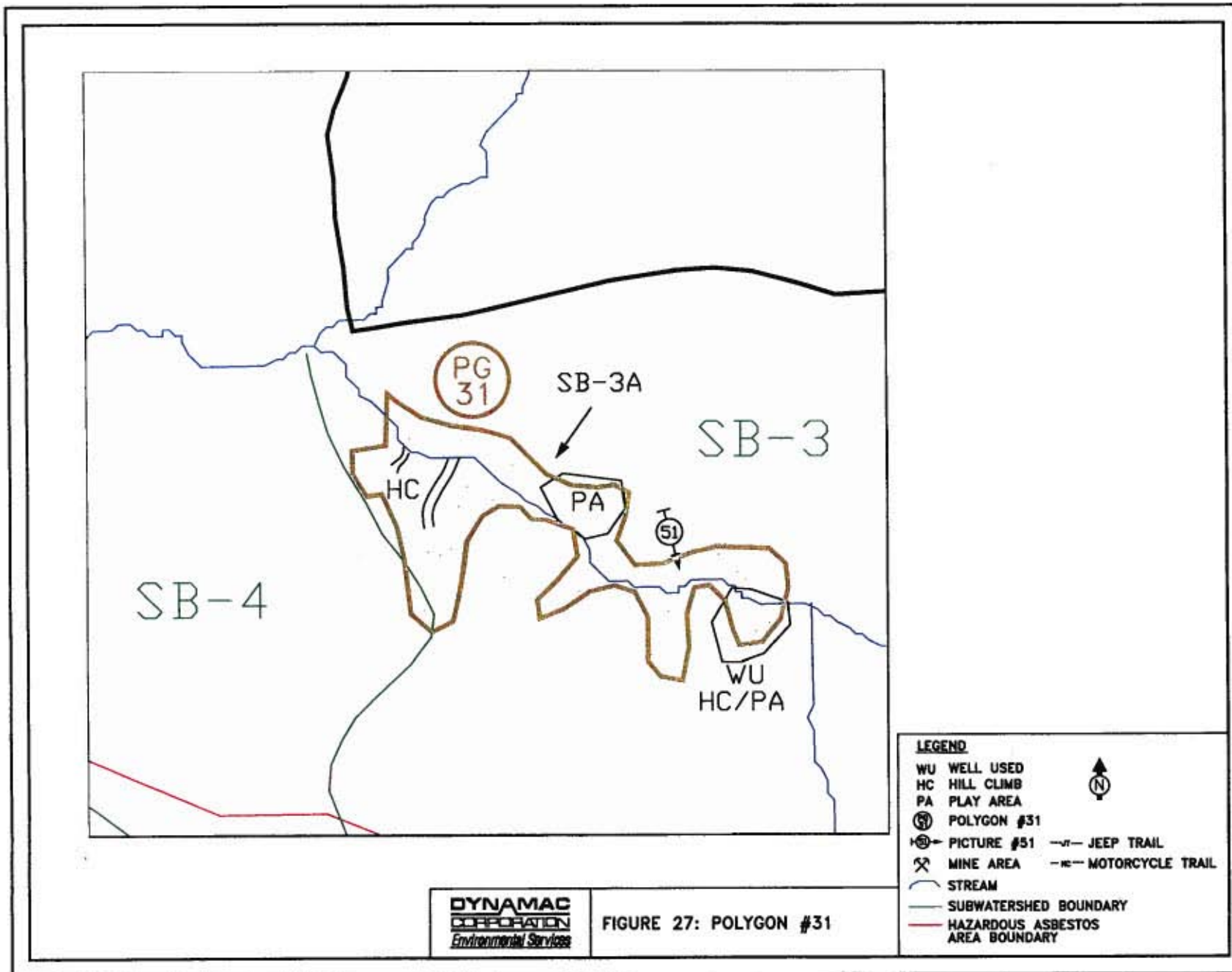
A graphical representation of PG-31 is shown in Figure 27, and Photograph 51 provides a view which further depicts the site conditions.

Polygon Score

PG-31 has the following composition:

Subwatershed	Areal Percent of PG-31
SB-3A	100%

The database yielded a total score of 40 for this polygon, placing it in the "major contributor" category. This is consistent with field observations since, as described previously, PG-31 is an area of high OHV use, steep slopes, and unstable soils directly bordering a major drainage.



Polygon PG-31



51) Looking S-SE from SB-3A KCAC Road. Gullied play area adjacent to drainage course.

3.1.27 Polygons 32, 33 (PG-32, PG-33)

Location and Physical Description

PG-32 and PG-33 are located in the northeast corner of Subwatershed SB-3 between the San Benito River and Sawmill Creek, about one-half mile west of the KCAC Mine. During the field investigation, the section of Subwatershed SB-3 in which these polygons lie was designated SB-3B to segregate it from other distinctly separate polygons in the area. PG-32 lies due north and uphill from PG-33. Within the interstitial zone between the two polygons lies a large 761 series polygon which serves to connect the two polygons. No streams pass directly through this polygon; however, an ephemeral first order stream begins in the 761 series polygon between them and trends southwest towards the San Benito River.

Both polygons exhibit approximately the same physical characteristics. Armoring is mostly fine material over only approximately 50 percent of PG-32 and PG-33. Soils are mostly brown in color and appear stable, except in the single area of OHV use within PG-33. Slopes in these polygons are gentle to moderate, and gullying is virtually nonexistent. OHV traffic was not observed within PG-32, and only a single motorcycle trail was present in PG-33.

Relatively thick vegetation is present around the western and eastern edges of the polygons; however, because of the presence of the 761 series polygon between PG-32 and PG-33, sediments may easily move down slope towards the San Benito River when disturbed. It does not appear that the sediment moving offsite from PG-33 has the opportunity to reach the river because of a slope break beginning in the southwest corner of PG-33. This sediment trapping feature appears to prevent nearly all eroded material leaving these two polygons from reaching the San Benito River.

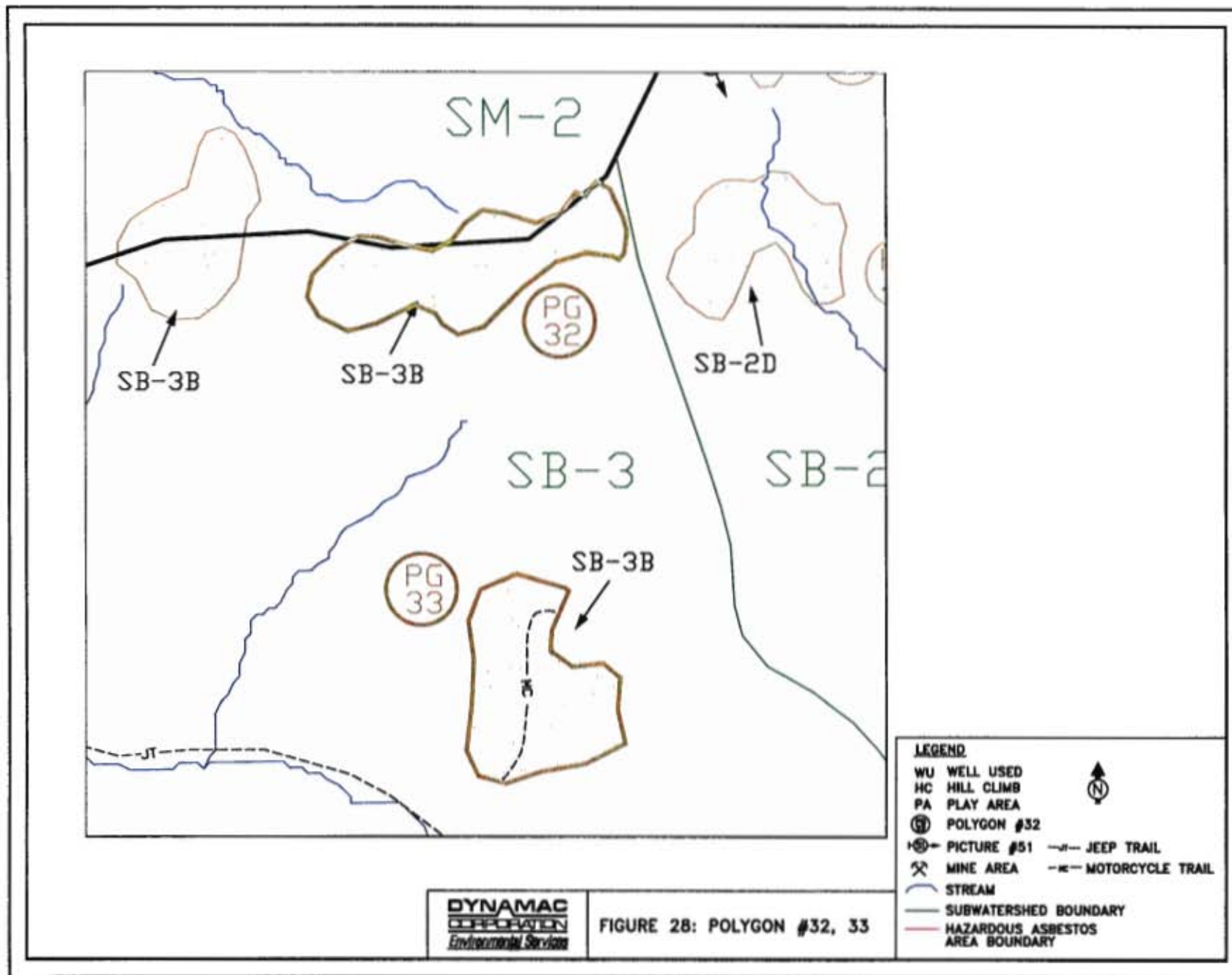
A detailed view of PG-32 and PG-33 is shown in Figure 28.

Polygon Score

PG-32 and PG-33 both lie completely within Subwatershed SB-3B. In order to derive scores for the individual polygons from a single subwatershed score, the base score for SB-3B was adjusted for each polygon according to field observations. In other words, the polygon that showed more sedimentation and erosion potential received a score that is higher than the SB-3B base score, while the score of the polygon with apparently lower potential was adjusted to be below the SB-3B base score. The base score for SB-3B is 16, and the adjusted scores for the two polygons are as follows:

Polygon	Adjusted Score
PG-32	14
PG-33	18

The scores detailed above place PG-32 in the “minor contributor” category and PG-33 in the very low end of the “at risk” category. This is consistent with field observations which showed that, in general, the polygons have little or no OHV use, gentle slopes, and stable soils. The slightly higher score for PG-33 reflects the presence of at least nominal OHV use and closer proximity to the San Benito River.



3.1.28 Polygons 34, 35 (PG-34, PG-35)

Location and Physical Description

PG-34 and PG-35 are located in the southeastern corner of Subwatershed SB-3 just south of the San Benito River, and are easily accessed by an unimproved dirt road leading from the KCAC Road. These two 768 series barren polygons lie close to Condon Peak near the border between Subwatershed SB-3 and the White Creek Watershed, and a small portion of PG-35 spills over into the neighboring watershed. The barren areas are situated along the slopes bordering the first order stream which begins in the southeast corner of PG-35 and trends to the northwest and eventually intersects the San Benito River. In both PG-34 and PG-35, the barren areas stretch from the stream northward to the ridge line dividing Subwatersheds SB-2 and SB-3; therefore, very little vegetative buffering exists around the edges of the polygons to the north. The only area where substantial vegetation is present bordering these polygons is to the south of PG-35. During the field evaluation, PG-34 and PG-35 were identified as SB-3C2 and SB-3C3, respectively.

Both polygons exhibit heavy OHV use, and only minimal armoring with primarily medium gravel was observed. Despite the high density of OHV use features in these polygons, the soils appear stable and mostly brown in color, with grey and white observed in the deeper gullies and most intensely used hill climbs and play areas. In the areas within PG-34 and PG-35 that are for some reason unattractive to OHV users, scattered patches of vegetation are present, typical of 768 series polygons. OHV use is present in PG-34 and PG-35 in all of the major types: play areas, hill climbs, and motorcycle trails.

The two polygons are steeply sloped, particularly PG-35, and as a result, several landslides have occurred in this polygon. Both polygons are characterized by gullies, many of them deeply incised, and PG-35 again shows the more significantly developed erosion and sedimentation features.

Detailed views of PG-34 and PG-35 are shown in Figure 29. In addition, Photograph 52 provides a view which further depicts the site conditions in PG-34, and Photographs 53 through 56 provide a view of PG-35.

Polygon Score

PG-34 has the following composition:

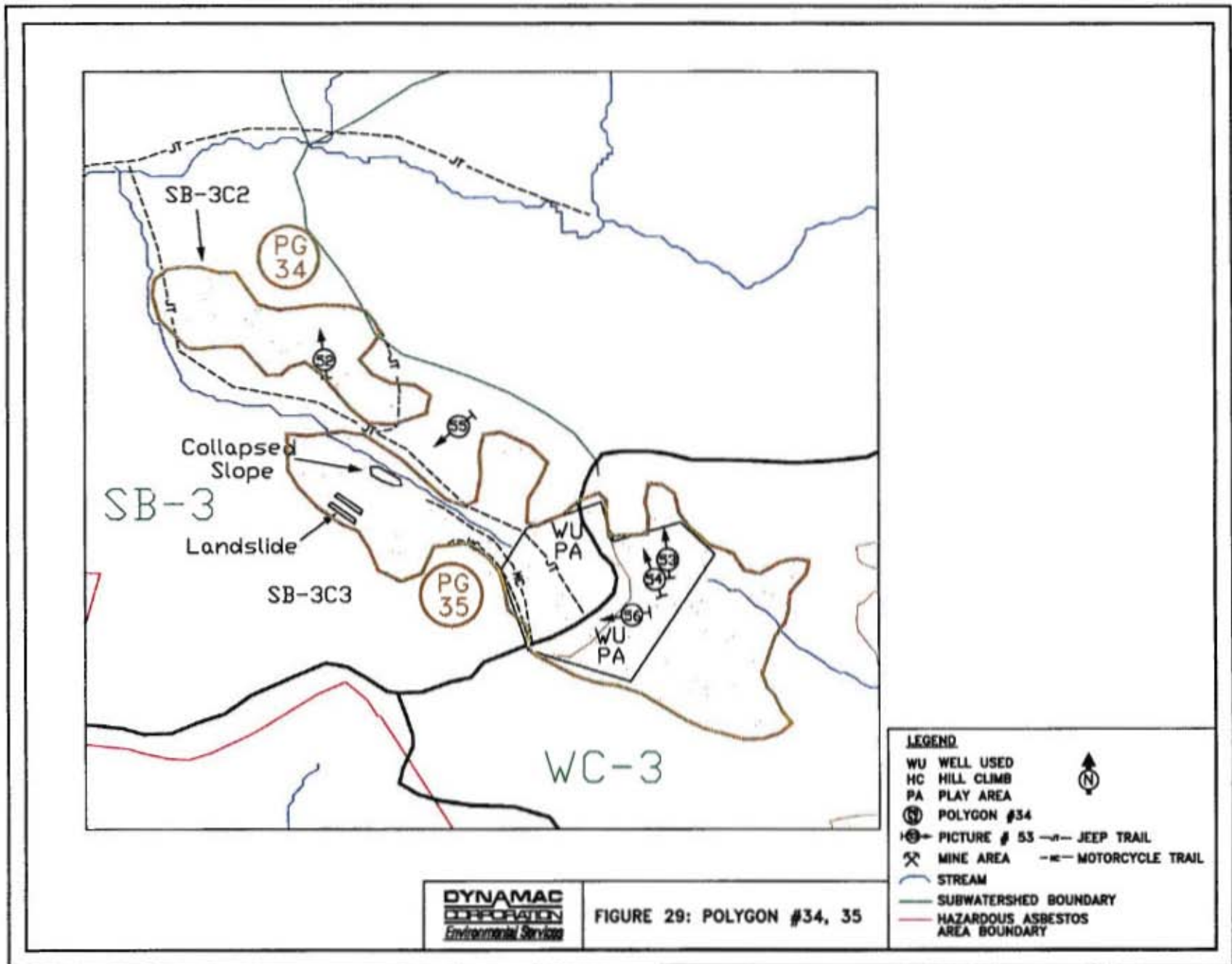
Subwatershed	Areal Percent of PG-34
SB-3C2	100%

The database yielded a total score of 23 for this polygon, placing it in the middle of the “at risk” category. This is consistent with field observations since PG-34 is a stable, but moderately used OHV area which borders a drainage that may potentially serve as a means by which sediments may reach the San Benito River. While not as impacted as PG-35, this polygon could become a “major contributor” if any of the major sedimentation and erosion potential indicators discussed previously, such as OHV use, were to increase.

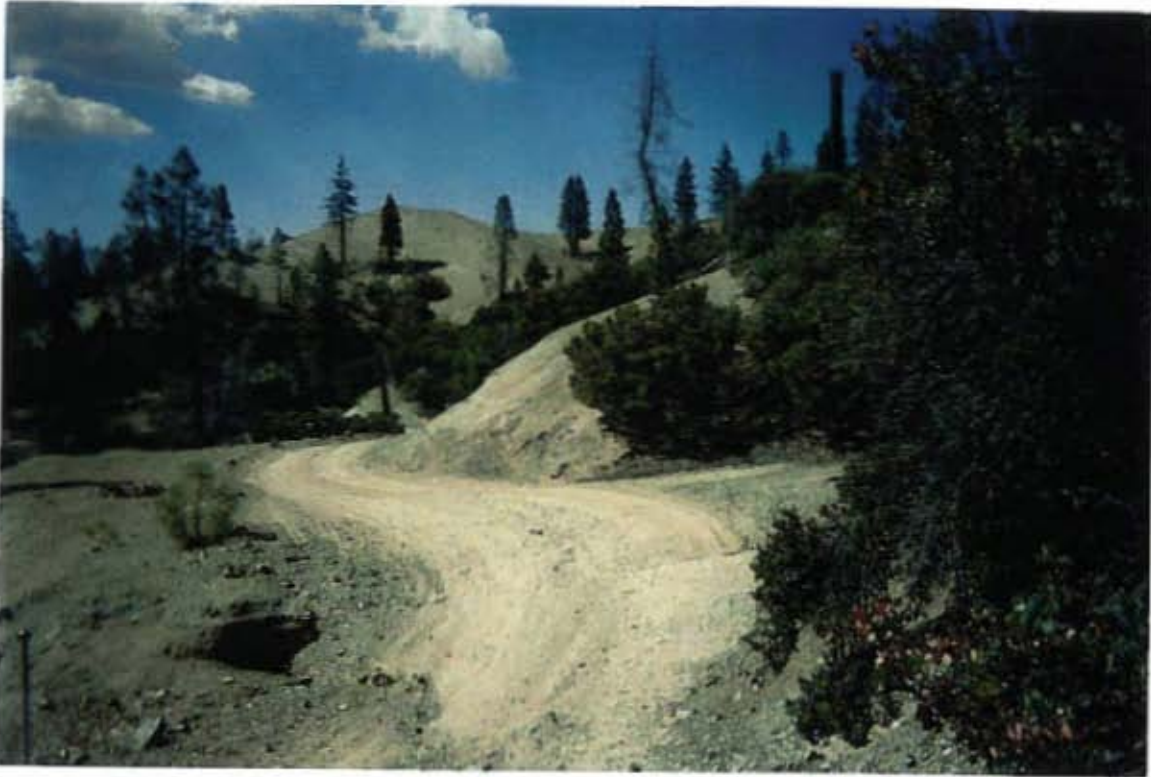
PG-35 has the following composition:

Subwatershed	Areal Percent of PG-35
SB-3C3	95%
WC-3B	5%

The database yielded a total score of 35 for this polygon, placing it in the "major contributor" category. As stated in the description of this polygon, PG-35 is heavily impacted by OHV use, intensely gullied, on steep slopes, and in near direct hydraulic contact with the San Benito River; therefore, the score is quite reflective of field observations.



Polygon PG-34

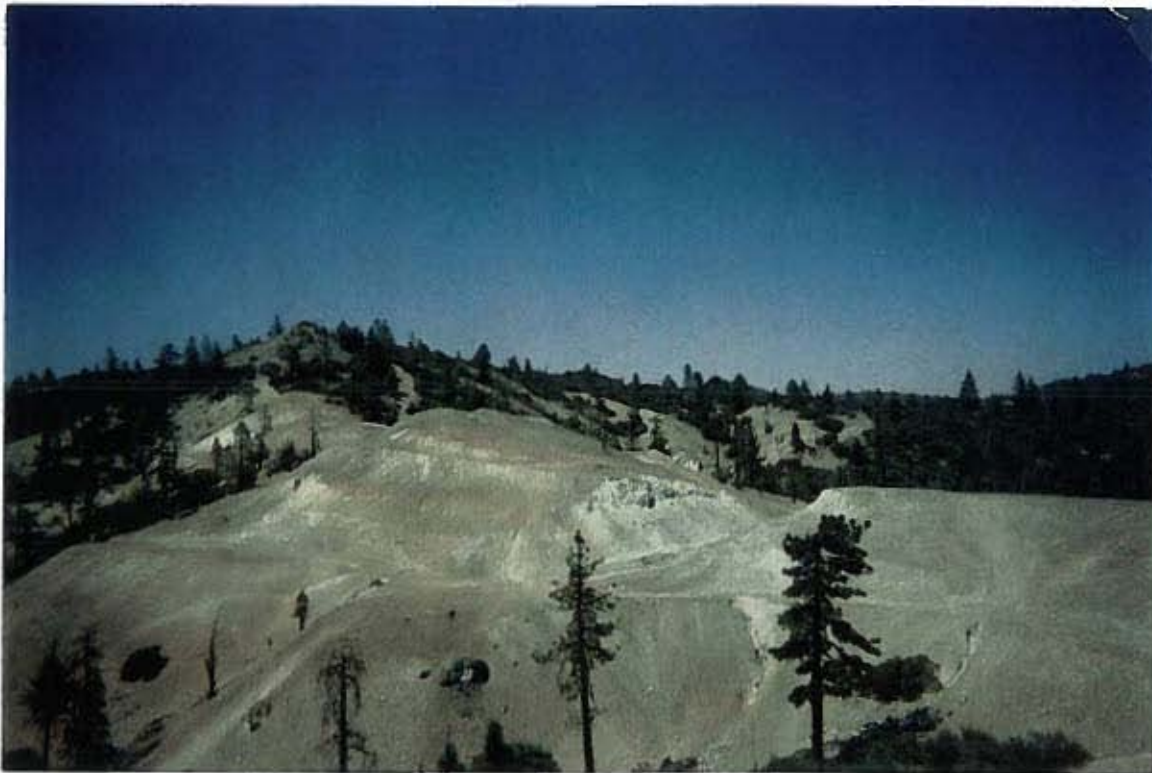


52) Looking N-NE from SB-3C. Patchy vegetation associated with 768 series barren.

Polygon PG-35



53) Looking NE from SB-3C northern ridge line. Mining disturbance heavily used as a play area.



54) Looking N-NE from SB-3C northern ridge. Same disturbance exhibiting denuded soils.

Polygon PG-35



55) Looking from SB-3C. Same disturbance exhibiting good vegetative buffer.



56) Looking N from SB-3C northern ridge. Well armored hill climb and trail area.

3.1.29 Polygon 36 (PG-36)

Location and Physical Description

The only polygon evaluated within the White Creek Watershed, PG-36 is located along the Atlas Mine Road just south of the Atlas Mine Superfund Site. The portions of this barren area that do not appear to be associated with mining related disturbance are concentrated in the south, and line the inner gorges through which the first order stream originating in the Atlas Mine runs. This polygon is confined to these chasms which are characterized by rocky, non-vegetated, and extremely steep slopes.

Outside of the enormous gullies which lead into the chasm, soils appear stable and are mostly brown in color. Grey and white soil predominate the gullies. Bedrock outcrops abound in the vicinity of this polygon; features that are clearly natural in origin and unlinked to anthropic activities. Armoring is relatively scarce due to the steep slopes, but consists primarily of medium gravel in a few scattered locations.

Due to the steep, rocky profile of this polygon, it presents near impossible terrain for OHV users. Regardless of the terrain, the proximity of PG-36 to the Atlas Mine Site has made it closed to the public. Consequently, no OHV use was observed anywhere within the White Creek Watershed.

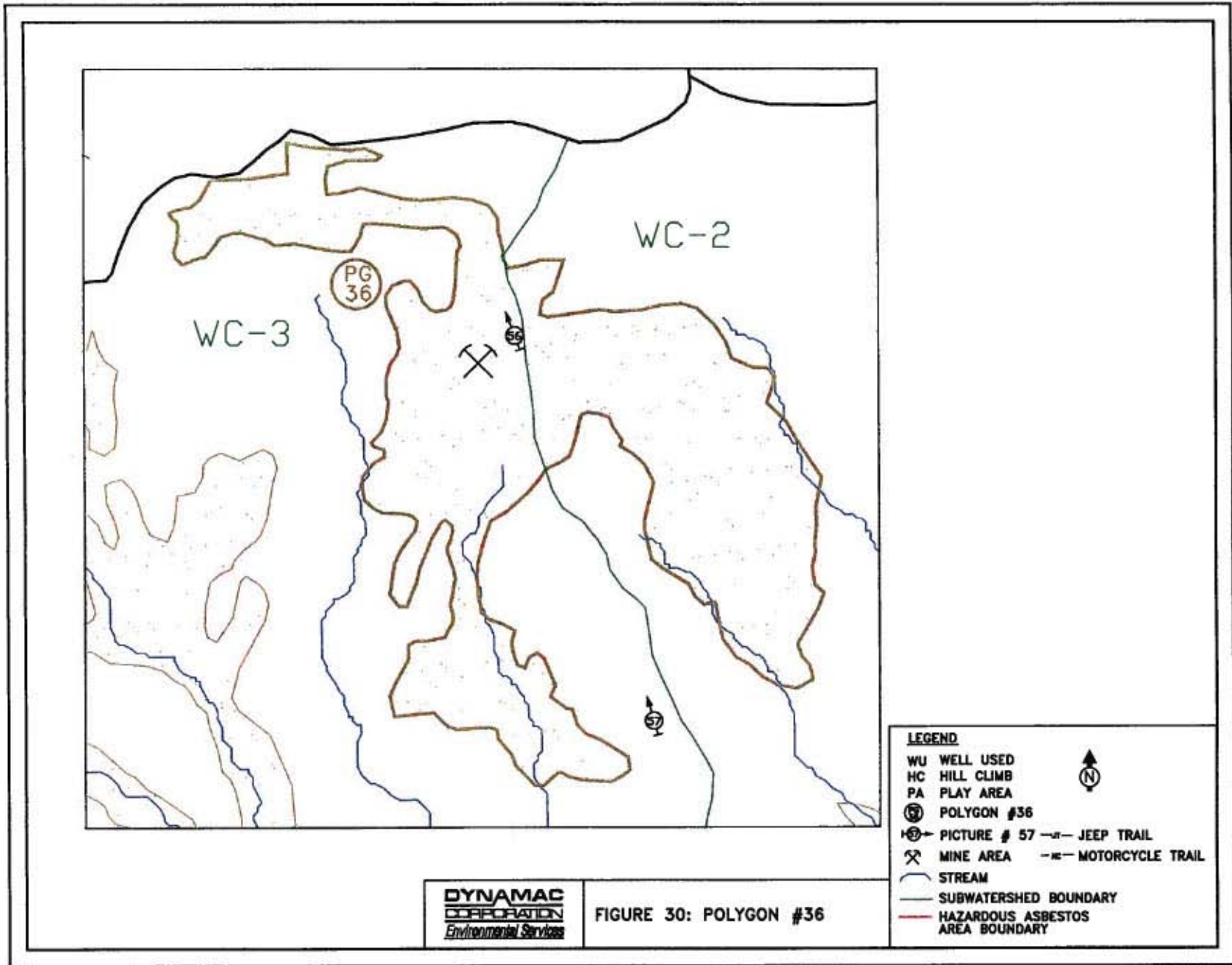
A detailed view of PG-36 is shown in Figure 30, and Photographs 57 and 58 present views which further depict the site conditions.

Polygon Score

PG-36 has the following composition:

Subwatershed	Areal Percent of PG-36
WC-3B	100%

The database yielded a total score of 25 for this polygon, placing it in the middle of the "at risk" category. This is consistent with field observations in that the PG-36 is characterized by extremely steep slopes, white soils, severe gullying, and close proximity to a first order stream, but is bereft of OHV use or any other means by which to deliver sediments offsite.



Polygon PG-36



57) Looking NW in WC-3B. Narrow inner gorge experiencing severe natural erosion.



58) Looking NW on WC-3 northern ridge. Large mine disturbance used as a play area.

3.1.30 Polygon 37 (PG-37)

Location and Physical Description

Polygon PG-37 is a 769 series barren that is located almost entirely within the Leona Arroyo watershed. PG-37 is situated along the southeastern ridge line of subwatershed LA-5, which forms the watershed divide with the San Benito River watershed. A small section (i.e., less than 20 percent) of the barren extends into the San Benito River watershed in subwatershed SB-1.

PG-37 is completely contained along a broad and relatively flat ridge line. The barren appears to have been completely disturbed by mining activity. What once may have been a 769 series barren has undergone extensive excavation and exploration that has eliminated any physical characteristics typically associated with a 769 series barren; that is, the area is blanketed with multiple excavations. As a result of the mining activity, the soils are a very immature white and grey. However, the area is completely surrounded by a dense canopy of chaparral, which limits the available soil that can be transported off site.

OHV use is limited to the mining excavation where play areas have been established. Although it is apparent that OHV use in these play areas is not the cause for the immature soils, the continued use does not abet the immature soils.

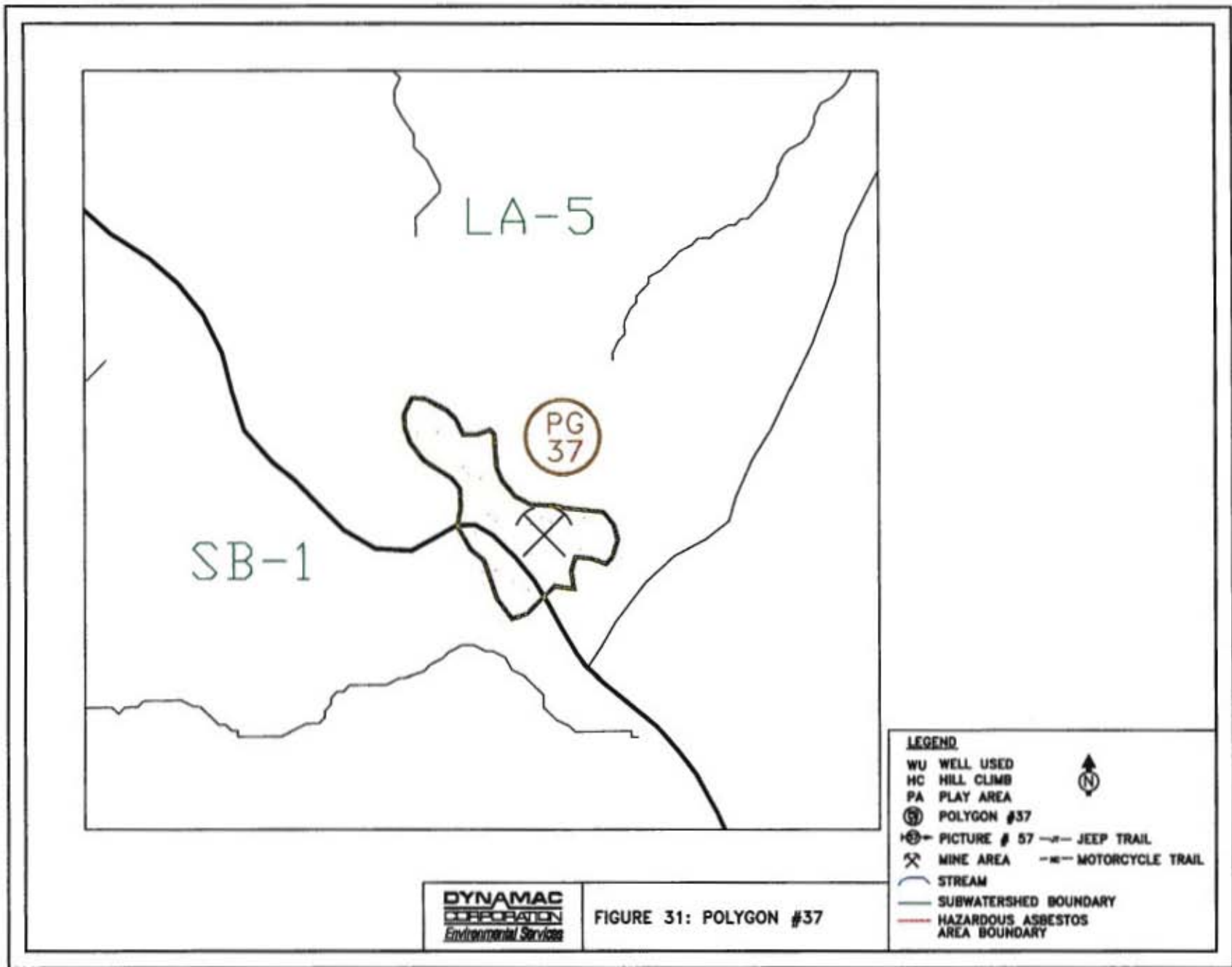
A graphical representation of PG-37 is shown in Figure 31.

Polygon Score

PG-37 has the following composition:

Subwatershed	Areal Percent of PG-37
LA-5	100%

The database yielded a total score of 47 for this polygon, designating it as part of the "major contributor" category. This is consistent with the field observations because of the major disturbance due to the mining and perpetuated by the localized OHV use. However, this site should not be considered as a large contributor due to its geographic location.



3.1.31 Polygons 38 and 39 (PG-38, PG-39)

Location and Physical Description

Polygons PG-38 and PG-39 are both 769 series barrens that are located entirely within the Cantua Creek watershed. The barrens are several among many small isolated barrens in this watershed. PG-38 and PG-39 are located along the eastern ridge line that separates Cantua Creek from Leona Arroyo. The barrens are limited to the main and inner gorge ridge lines. In general, the barrens do not extend beyond the interfluvial slopes.

Polygons PG-38 and PG-39 share very similar physical characteristics. Both barren polygons have very gentle slopes and are surrounded by a dense chaparral canopy. Geographically, they are fairly well removed from the major drainage course that drains this portion of the watershed. Soils within the inner gorges are predominantly grey and white, which is due to slope failure and mass wasting. Soils along the interfluvial and ridge lines are a more mature brown and red. The barren is well armored with coarse and medium gravel.

A thick canopy of chaparral completely borders PG-38 and PG-39. The canopy provides a buffer effect from sheet wash that effectively reduces the volume of sediment that could be made available to Cantua Creek.

PG-38 and PG-39 exhibit very little OHV use, other than a several motorcycle and jeep trails. The lack of OHV use is due to a combination of inherent physical features including heavy vegetation, gentle slopes, and a lack of accessibility.

Graphical representations of PG-38 and PG-39 is shown in Figure 32, and Photograph 59 provides a view of the site conditions.

Polygon Score

PG-38 has the following composition:

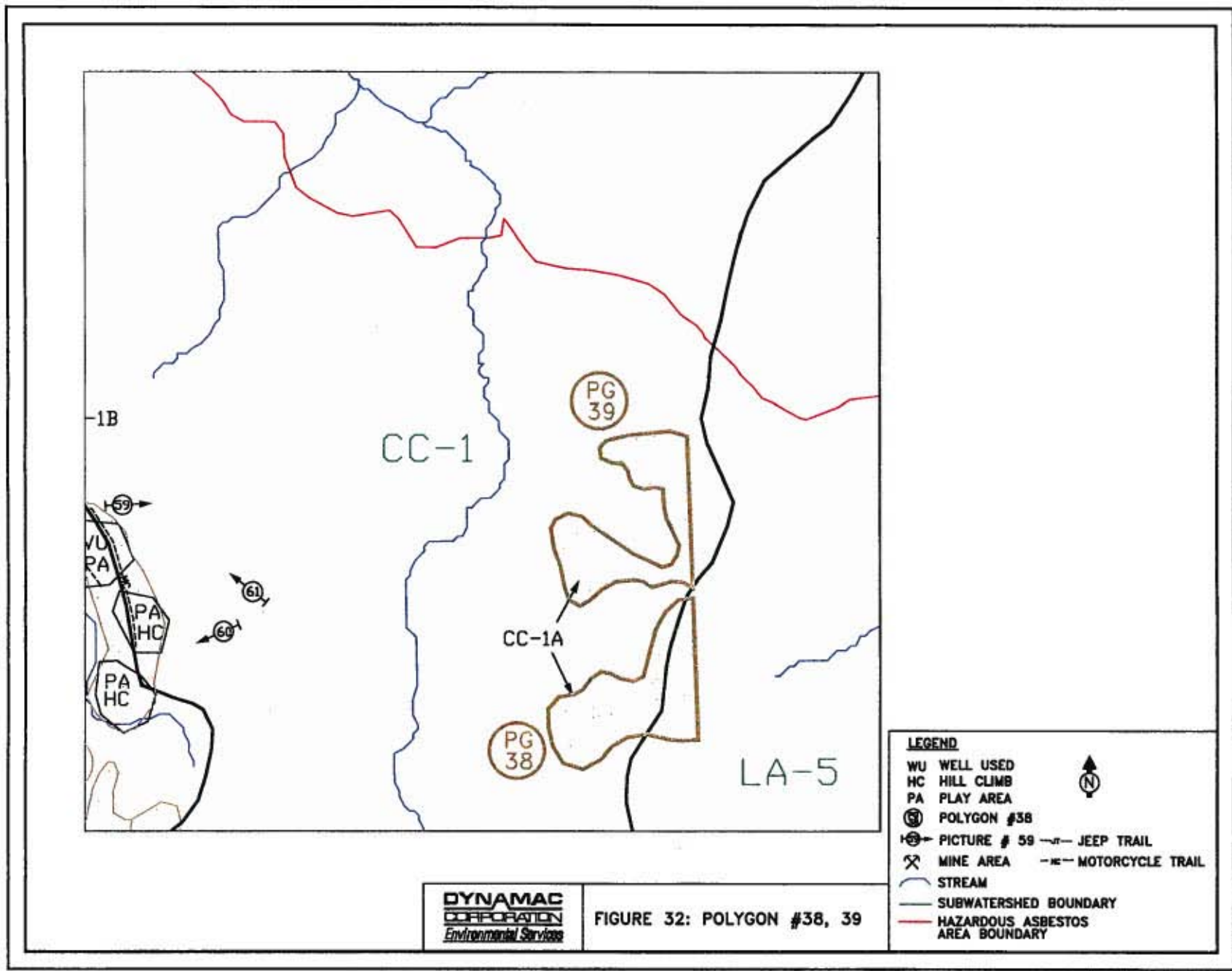
Subwatershed	Areal Percent of PG-38
CC-1A	70%
LA-5	30%

The database yielded a total score of 23 for this polygon, placing it in the middle 50 percent of the "at risk" category. This is consistent with the field observations because of the condition of the inner gorge slopes, which have been caused naturally, coupled with a general lack of OHV use.

PG-39 has the following composition:

Subwatershed	Areal Percent of PG-39
CC-1A	100%

The database yielded a total score of 13 for this polygon, designating it as part of the “minor contributor” category. This is consistent with the field observations because of the lack of OHV use and undisturbed soils.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 32: POLYGON #38, 39

LEGEND

WU WELL USED ↑ N

HC HILL CLIMB

PA PLAY AREA

⊗ POLYGON #38

⊗ PICTURE # 59 - - - JEEP TRAIL

⊗ MINE AREA - - - MOTORCYCLE TRAIL

— STREAM

— SUBWATERSHED BOUNDARY

— HAZARDOUS ASBESTOS AREA BOUNDARY

Polygon PG-38



59) Looking NE from the CC-1A southern ridge. Isolated barrens surrounded by canopy buffer.

3.1.32 Polygon 40 (PG-40)

Location and Physical Description

Polygon PG-40 is a 769 series barren that straddles the ridge line separating Cantua Creek from Saw Mill Creek. The barren polygon is almost equally divided in area between the two watersheds and is encompassed within two subwatersheds. The subwatersheds include SM-1A in Saw Mill Creek and CC-1B in Cantua Creek. Both subwatersheds form the headwaters of their respective drainages. The barren encompasses only a limited area of either watershed.

Subwatersheds SM-1A and CC-1B have very similar physical characteristics. Both share a relatively broad ridge line which has a gentle topographic relief. This gentle relief is carried through to the mid slopes in both subwatersheds. The canyons are relatively shallow and have gentle inner gorge slopes. A dense canopy of chaparral and scattered stands of conifers extend from the barren terminus to the canyon floors. In general, the barren terminates prior to the mid slopes. Several ephemeral drainage courses descend through the barrens and pass through the chaparral. The drainages, although down cut, have moderate hydraulic gradients and are bordered with dense vegetation. The soils in barren polygon PG-40 are the mature reds and browns typically associated with undisturbed areas. Armoring, which is comprised of coarse and medium gravel, covers the majority of the barren, with the exception of the play areas, and the jeep and motorcycle trails.

OHV use appears to be evenly distributed between subwatersheds CC-1B and SM-1A. The majority of OHV use is contained in eight hill climb play areas and several motorcycle trails. The play areas exhibit signs of heavy use, which is evident by the white and grey soils, and general lack of armoring. Although the play areas exhibit heavy OHV use, there appears to be only a minor volume of sediment that is being transported downgradient.

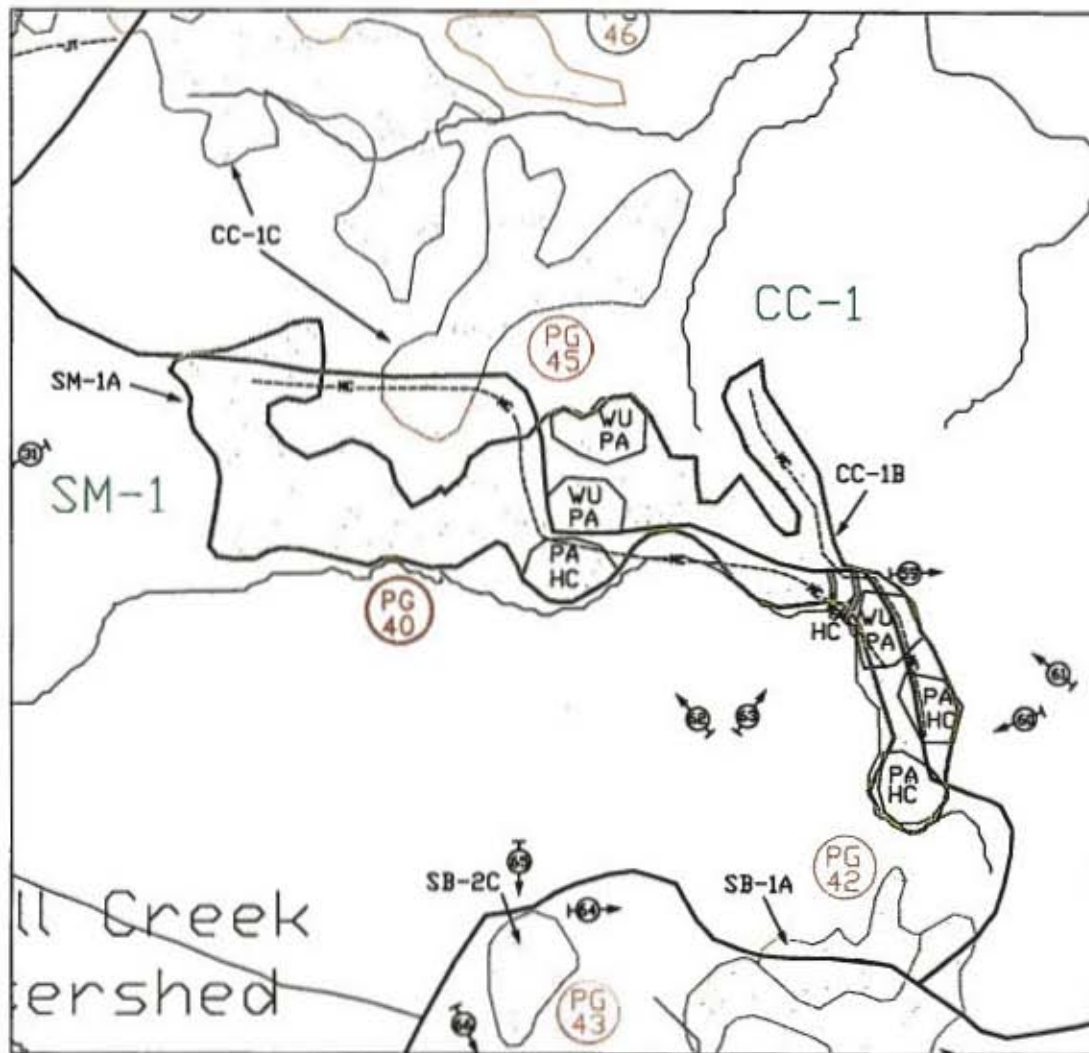
A graphical representation of PG-40 is shown in Figure 33, and Photographs 60 through 63 present views which further depict the site conditions.

Polygon Score

PG-40 has the following composition:

Subwatershed	Areal Percent of PG-40
CC-1B	30%
SM-1A	70%

The database yielded a total score of 20 for this polygon, placing it at the low end of the "at risk" category. This is consistent with field observations that show a considerable number of play areas, yet geographically located in an area that has very little potential to contribute to the score.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 33: POLYGON #40

LEGEND

- WU WELL USED
- HC HILL CLIMB
- PA PLAY AREA
- 📷 POLYGON #40
- 📷 PICTURE # 60
- ⛏ MINE AREA
- 🌊 STREAM
- SUBWATERSHED BOUNDARY
- HAZARDOUS ASBESTOS AREA BOUNDARY
- 📍 JEEP TRAIL
- ⋯ MOTORCYCLE TRAIL
- 📍

Polygon PG-40

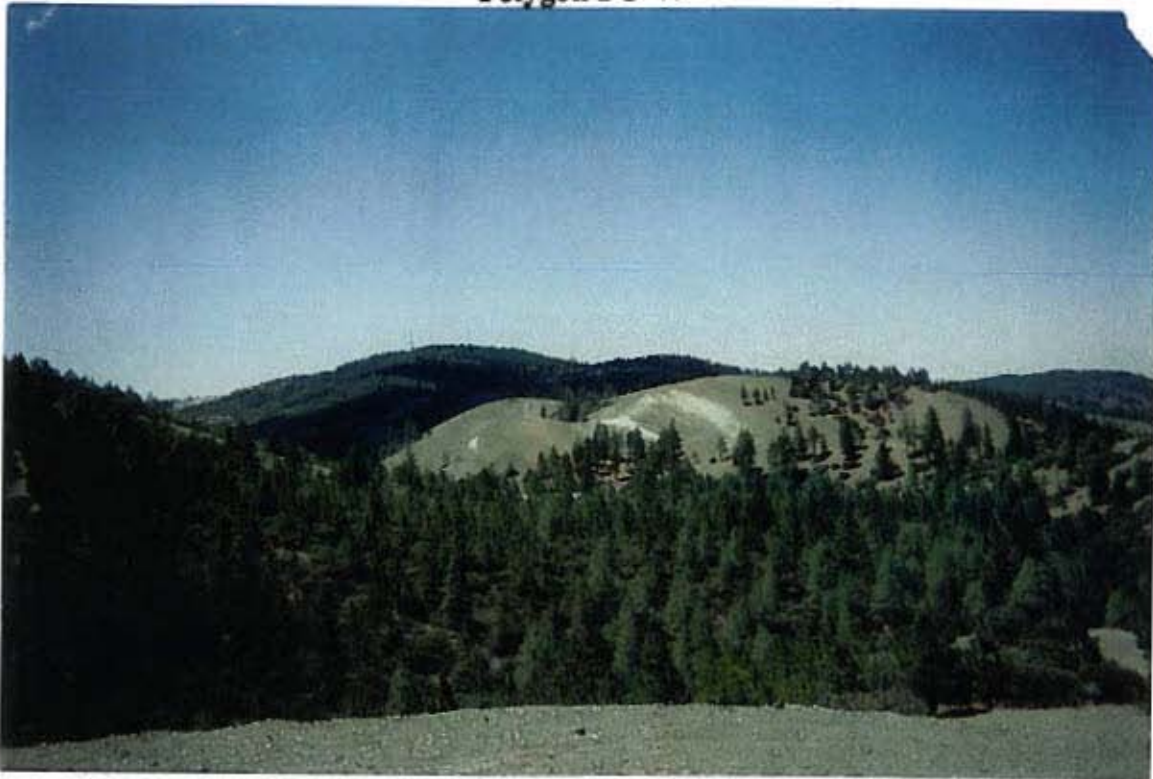


60) Looking W from CC-1B. Play area atop ridge line with canopy border.

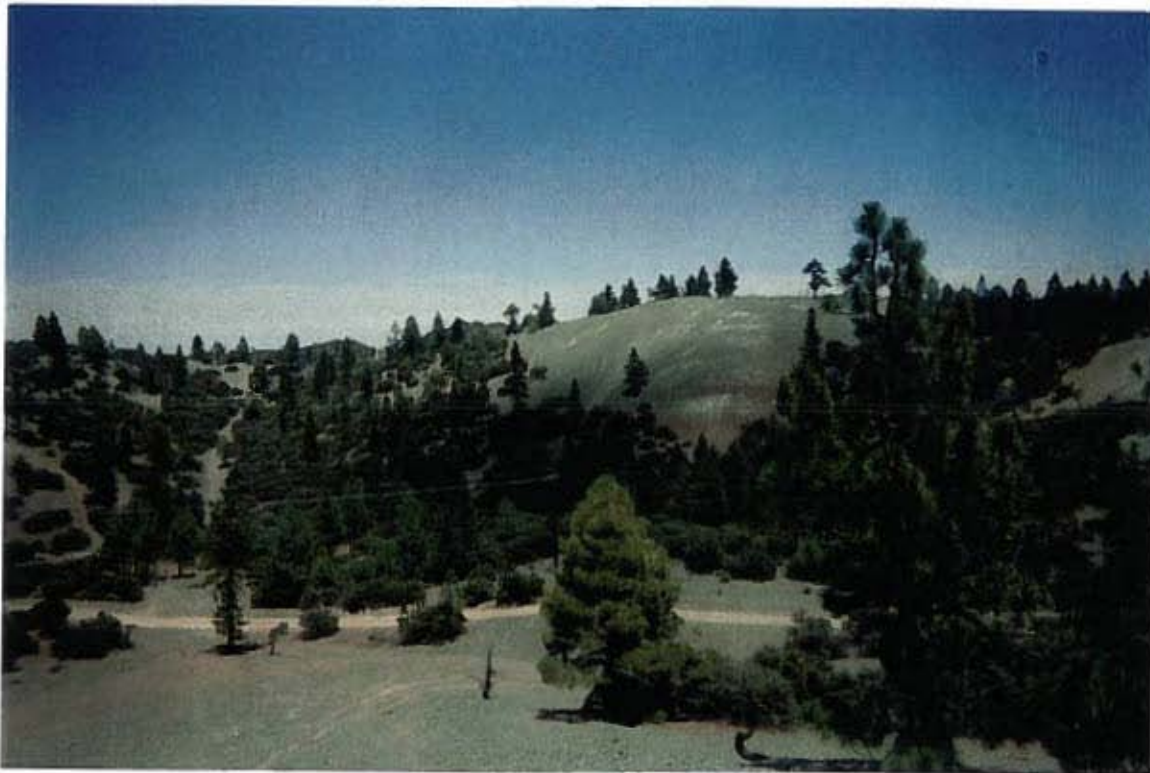


61) Looking N from CC-1C. Well armored play areas established on inner gorge slopes.

Polygon PG-40



62) Looking W from SM-1A ridge line. Play area with denuded (white) soils.



63) Looking N from SM-1A. Play area located atop ridge line that exhibits bowl-like topography.

3.1.33 Polygons 41, 42 (PG-41, PG-42)

Location and Physical Description

Polygons PG-41 and PG-42, respective 769 and 768 series barrens, are adjoining barren polygons located at the convergence of three major watersheds, which include Cantua Creek, San Benito River, and Saw Mill Creek. The convergence forms the headwaters for each watershed. PG-41 is largely located within subwatershed SB-2 of the San Benito watershed, with minor segments extending into subwatersheds CC-1A of Cantua Creek and SM-1 of Saw Mill Creek. PG-42 is equally divided between subwatersheds SM-1A and SB-2.

Characteristic of this region, subwatersheds CC-1A, SB-2, and SM-1A have very similar physical characteristics. Both share a relatively broad ridge line which has a fairly gentle topographic relief. This gentle relief is carried through to the mid slopes in all three subwatersheds. The canyons are relatively shallow and have gentle inner gorge slopes. A dense canopy of chaparral and scattered stands of conifers extend from the barren terminus to the canyon floors. In general, the barren terminates before reaching the mid slopes. Several ephemeral drainage courses descend through the barrens and pass through the chaparral. The drainages, although down cut, have moderate hydraulic gradients and are bordered with dense vegetation. The soils in barren polygon PG-42 are the mature reds and browns typically associated with undisturbed areas, which is the case with this 768 series barren. Armoring, which is comprised of coarse and medium gravel, covers the majority of the barren. Also typical of 768 series barrens, PG-42 is populated with scattered patches of chaparral. Excluding the scattered patches of chaparral, PG-41 is very similar to PG-42.

OHV use appears to be strictly limited to PG-41 where the majority of OHV use is divided between motorcycle and jeep trails. There were no obvious signs of play areas.

A graphical representation of PG-41 and PG-42 are shown in Figure 34, and Photograph 64 presents a view which further depicts the site conditions.

Polygon Score

PG-41 has the following composition:

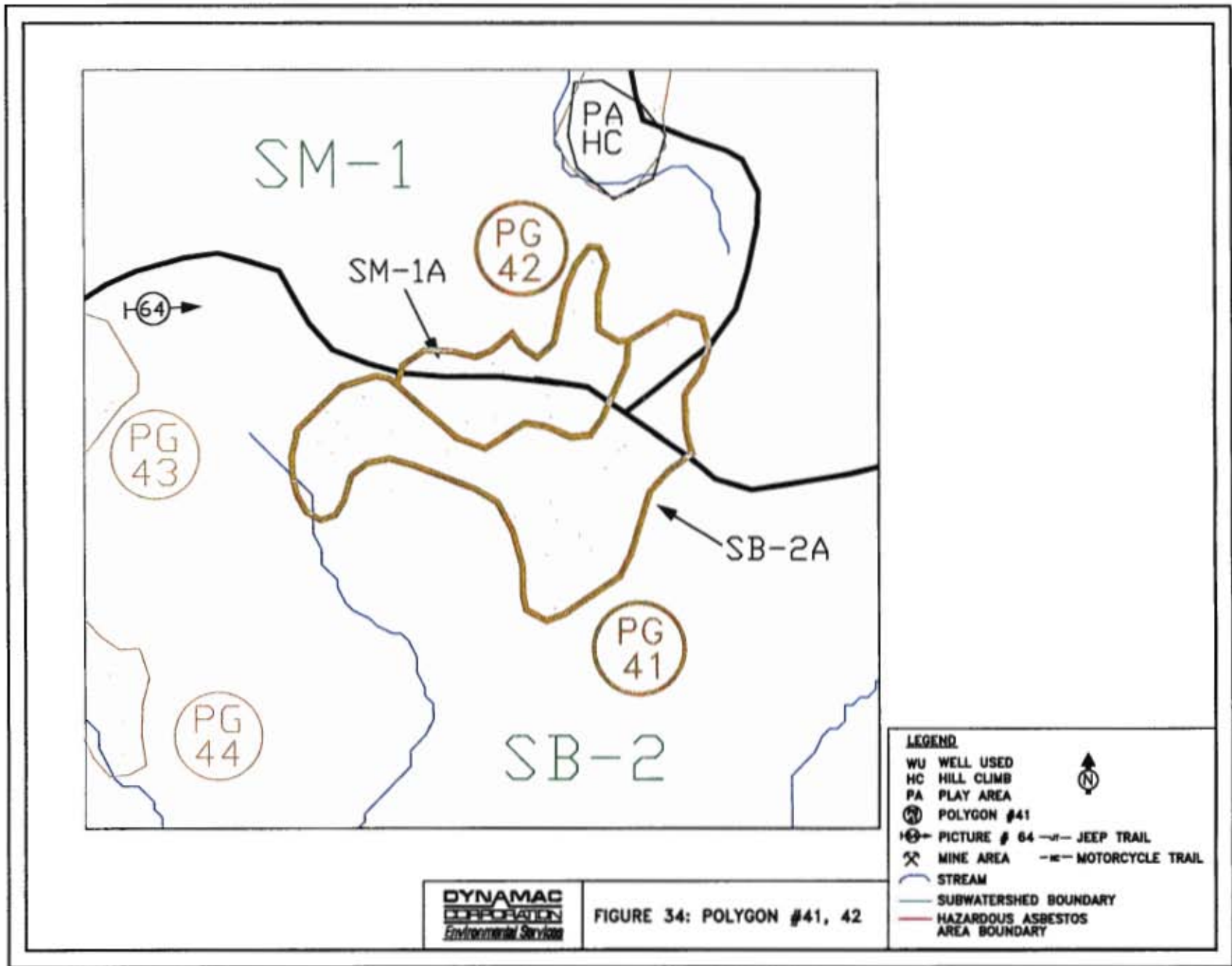
Subwatershed	Areal Percent of PG-41
CC-1A	7%
SB-2A	85%
SM-1A	8%

The database yielded a total score of 13 for this polygon, denoting it as a "minor contributor." This is consistent with field observations that show a geographic location that has very little potential to contribute to the score and distributed OHV use.

PG-42 has the following composition:

Subwatershed	Areal Percent of PG-42
SB-2A	45%
SM-1A	55%

The database yielded a total score of 23 for this polygon, placing it in the middle of the "at risk" category. This is consistent with field observations that show a geographic location that has very little potential to contribute to the score and distributed OHV use.



Polygons PG-41 & PG-42



64) Looking E from SN-2. Little used barrens that are well armored.

3.1.34 Polygons 43, 44 (PG-43, PG-44)

Location and Physical Description

Barren polygons PG-43 and PG-44 are entirely located within subwatershed SB-2 of the San Benito River drainage. The polygons are generally located in the western-most drainage course of SB-2. PG-43, a 769 series barren polygon, starts just below the ridge line separating the San Benito River drainage from the Saw Mill Creek watershed and extends several hundred feet down slope within an ephemeral drainage course. PG-44, a 769 series barren polygon, is situated down gradient from PG-43 roughly in the middle elevations of the subwatershed. However, PG-44 extends from the canyon floor, and the drainage, to the top of the inner gorge slopes.

Both barrens, although belonging to different polygon series, have very similar physical characteristics. In general, both polygons are surrounded by a dense vegetative buffer comprised of conifer and chaparral. Topographic relief in PG-43 and PG-44 are relatively moderate, although PG-44 does contain some inner gorge slopes in excess of 30 percent. The soils found in the barrens are comprised predominantly of mature reds and browns, with only isolated patches of white and grey soils found within gullies. PG-43, however, does contain a play area that has exposed some grey and white soils. PG-44 also contains several areas that have exposed immature soils. These are associated with two exploration cuts that have left immature soils scattered on the surface. Finally, both barrens are relatively small when considering total acreage (i.e., probably less than 10 acres) and areal percentage of the subwatershed.

OHV use is mostly limited to PG-43, where there is a hill climb play area, which is accessed by a unimproved dirt road, motorcycle trail, and a jeep trail. PG-44 contains several motorcycle trails, but otherwise remains mostly undisturbed. It appears that very little sediment is eroded and transported from these barrens to the major drainages. This can mostly be attributed to the surrounding vegetation which provides an excellent sediment trapping buffer.

A graphical representation of PG-43 and PG-44 are shown in Figure 35, and Photographs 65 and 66 present views which further depict the site conditions in PG-43 and PG-44, respectively.

Polygon Score

PG-43 has the following composition:

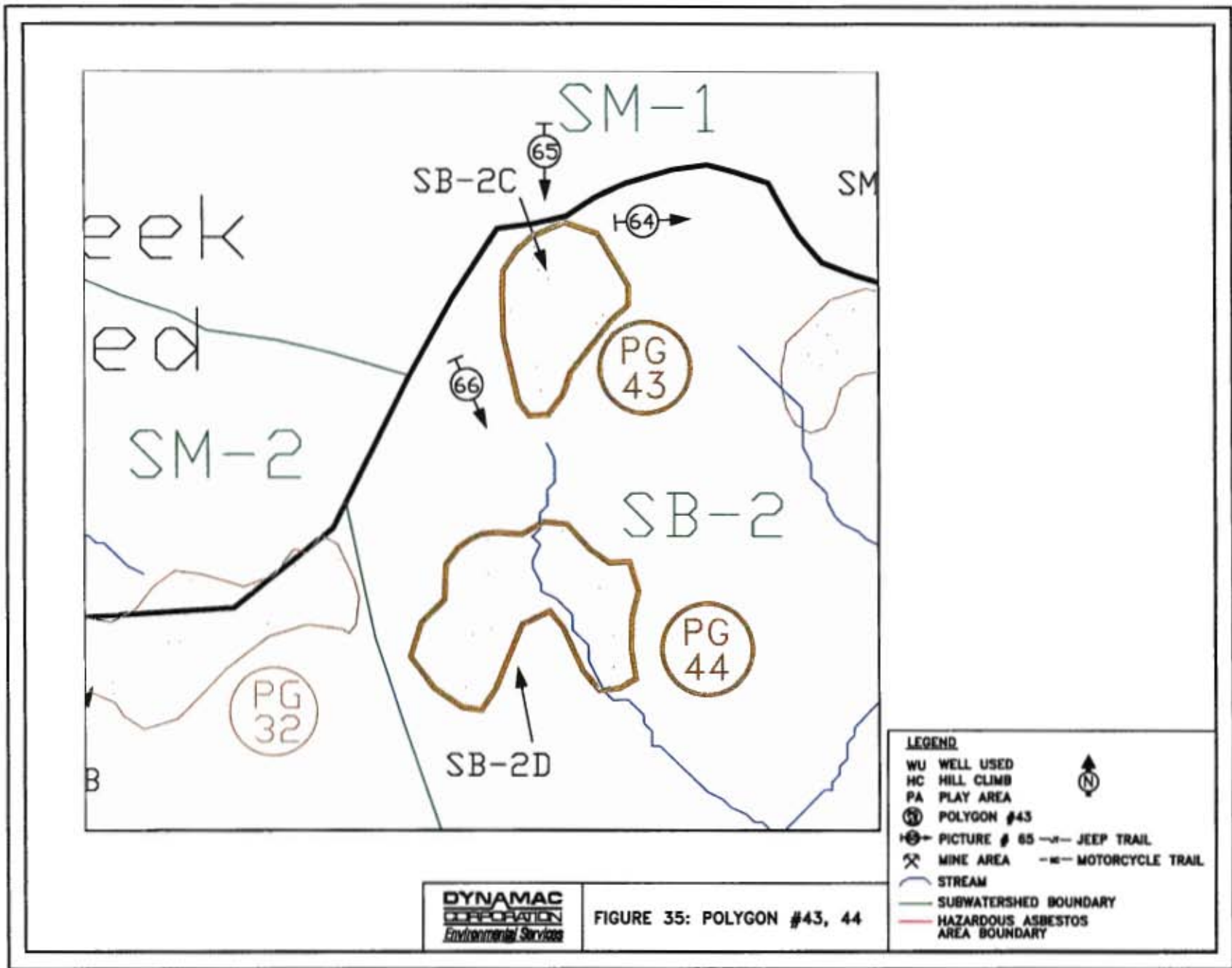
Subwatershed	Areal Percent of PG-43
SB-2C	100%

The database yielded a total score of 3 for this polygon, giving it the lowest single polygon score recorded during the field investigation, and denoting it as a "minor contributor." This is consistent with field observations due to the relative obscurity of the barren, due to its size, location, and accessibility.

PG-44 has the following composition:

Subwatershed	Areal Percent of PG-44
SB-2D	100%

The database yielded a total score of 8 for this polygon, giving it the second lowest polygon score recorded during the field investigation, and denoting it as a "minor contributor." This is consistent with field observations, again, because of the relative obscurity of the barren, due to its size, location, and accessibility.



DYNAMAC
CORPORATION
Environmental Services

FIGURE 35: POLYGON #43, 44

Polygon PG-43



65) Looking S from SB-2. Isolated barrens bordered by dense chaparral.

Polygon PG-44



66) Looking SE from SB-2. Lower barren area with play area on inner gorge slope.

3.1.35 Polygon 45 (PG-45)

Location and Physical Description

Polygon PG-45 is a 769 series barren that expands into two major drainages; the Cantua Creek and the Saw Mill Creek watersheds. The majority of the barren, however, is contained within subwatershed CC-1C of Cantua Creek, with only a minor portion extending across the watershed divide into SM-1A. At the higher elevations along the watershed divide, PG-45 remains atop the ridge lines. Down gradient, the barren extends down the mid slopes of the inner gorges terminating at the canyon floor.

For the most part, the barren is surrounded by dense vegetation that serves as an adequate buffer to retard the movement of sediment into adjacent drainages. The canopy is mainly comprised of chaparral and isolated conifer stands. Two ephemeral streams are situated on either side (east and west) of the barren. The ephemeral drainages are bordered by vegetation. The topographic relief is fairly gentle along the watershed divide and increases in steepness as you travel toward the mouth of the subwatershed. At the base of the barren polygon, the inner gorge slopes increase in steepness to greater than 30 percent. PG-45 is generally well armored, excluding the play area (which there is one) and gullies, and contains fairly mature soils.

OHV use is limited to less than 25 percent of the total barren area. This can be attributed to the steepness of the inner gorge slopes and the narrow canyons. There are, however, two play areas and several motorcycle trails within the barren polygon. The play areas are well used, although they remain fairly well armored and contain only a small volume of white and grey soils.

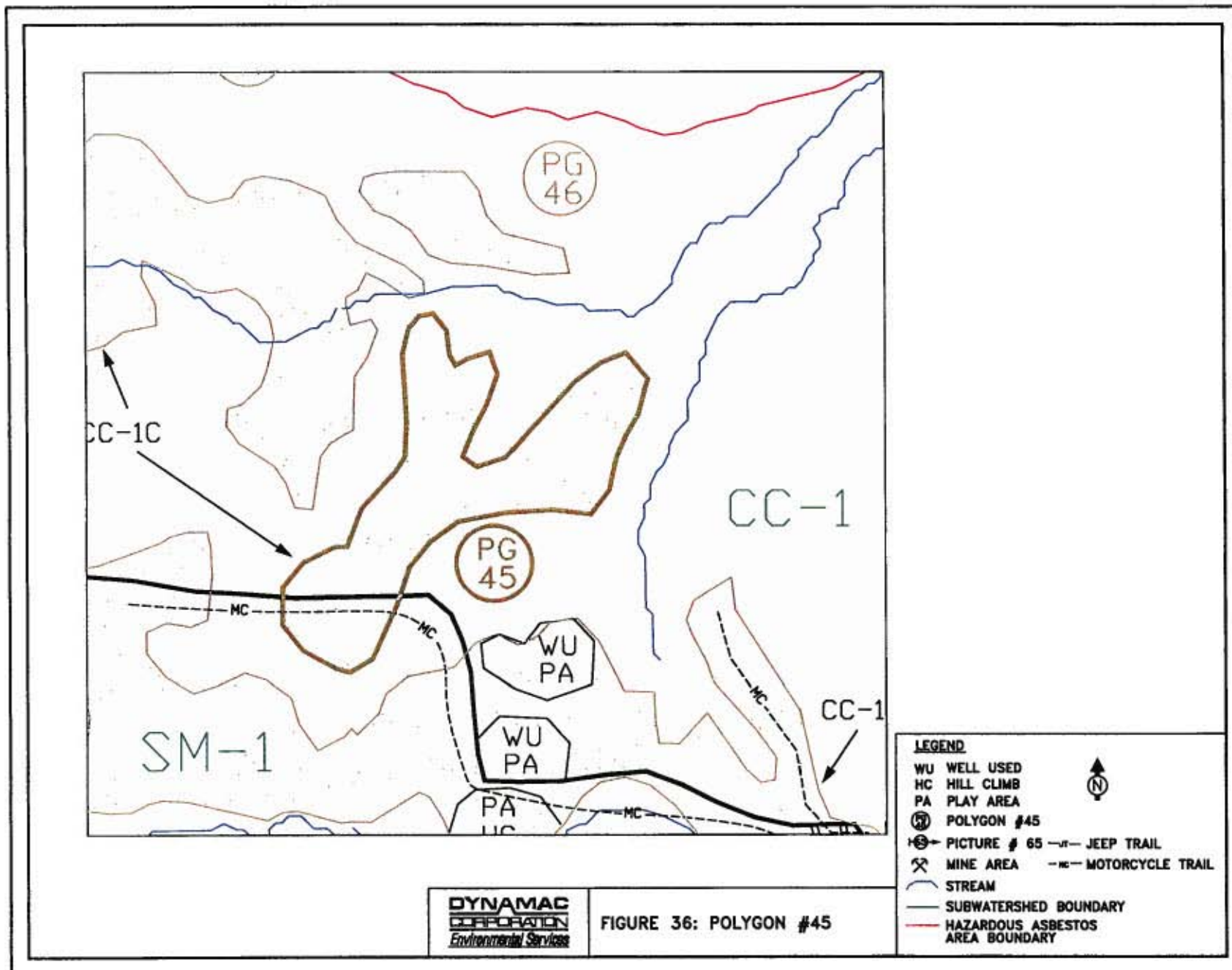
A graphical representation of PG-45 is shown in Figure 36.

Polygon Score

PG-45 has the following composition:

Subwatershed	Areal Percent of PG-45
CC-1C	90%
SM-1A	10%

The database yielded a total score of 15 for this polygon, placing it on the borderline between the "minor contributor" and "at risk" categories. This is consistent with the field observations that noted a relatively remote barren that did not exhibit an overabundance of localized OHV density, coupled with a very dense vegetative buffer.



3.1.36 Polygons 46, 47 (PG-46, PG-47)

Location and Physical Description

Polygons PG-46 and PG-47 are separate but adjacent 769 series barrens that are located in Cantua Creek, in the far western section of subwatershed CC-1C. PG-46 is entirely contained within CC-1C, while PG-47 extends from CC-1C across the ridge line dividing Cantua Creek from the East Fork of San Carlos Creek where it comprises less than 10 percent of subwatershed EF-1A. An ephemeral first order stream traverses almost the entire length of PG-47 and borders the southern boundary of PG-46.

The barren is almost entirely surrounded by a vegetative buffer that provides an adequate buffer to retard sediment migration. The canopy is mainly comprised of chaparral and isolated conifer stands. The ephemeral stream is down cut, has a moderate hydraulic gradient, and is bordered by vegetation. The topographic relief is fairly gentle along the watershed divide and increases in steepness as you travel toward the mouth of the subwatershed and PG-46. At the base of barren polygon PG-46, the slopes in the inner gorges steepen to greater than 30 percent. Polygons PG-46 and PG-47 are generally well armored, excluding the motorcycle trails and gullies, and have fairly mature soils. A large slide is located in the eastern section of PG-47, which forms the mouth of the subwatershed. The slide appears to have been caused by the stream, which is adjacent.

OHV use is less than 5 percent of the total barren area and is limited to motorcycle trails. This can be attributed to the steepness of the inner gorge slopes and the narrow canyons. The trails appear to be well used, although they remain fairly well armored and contain only a small volume of white and grey soils.

A graphical representation of PG-46 and PG-47 is shown in Figure 37.

Polygon Score

PG-46 has the following composition:

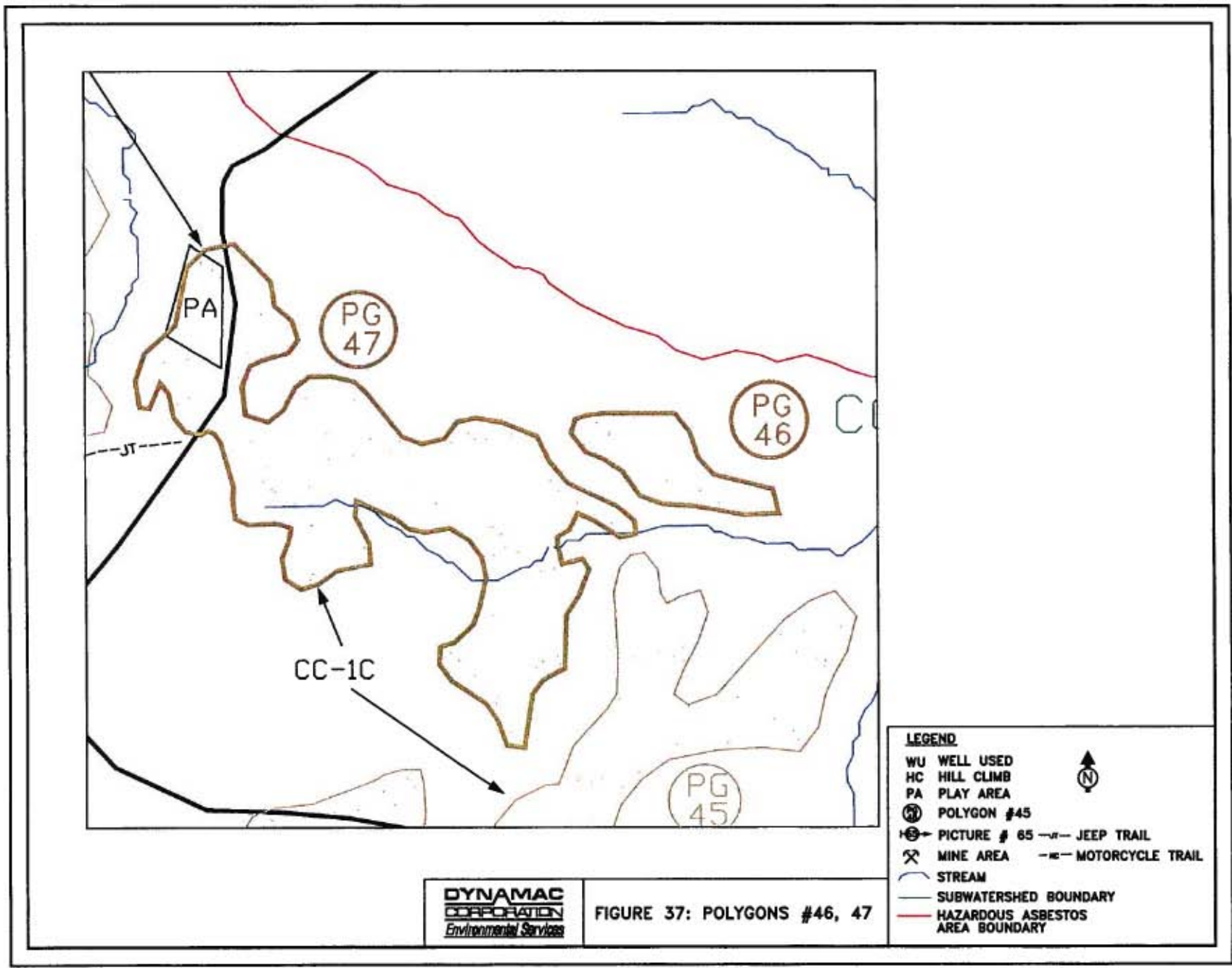
Subwatershed	Areal Percent of PG-46
CC-1C	100%

The database yielded a total score of 14 for this polygon, placing it in the "minor contributor" category. This is consistent with field observations that noted that PG-46 was fairly isolated and did not exhibit an over abundance of localized OHV density. Coupled with the fact that the polygon exhibited fairly mature, well armored soils.

PG-47 has the following composition:

Subwatershed	Areal Percent of PG-47
CC-1C	90%
EF-1A	10%

The database yielded a total score of 14 for this polygon, placing it in the "minor contributor" category. This is consistent with field observations that revealed low localized OHV density, coupled with the fact that the polygon contained well armored mature soils and a fairly dense vegetative buffer.



3.2 Study Area Summary of Results

The potential erosion and sedimentation that can take place in each barren can be evaluated, in general, by categorizing the polygons according to their specific geographic location. In general, the geographic location of a polygon can be described in either one of two ways: the polygon is located atop of a ridge line or series of ridge lines having relatively gentle slopes and far removed from drainage courses; or the polygon extends from the ridge lines through the mid slopes (which have steep slopes) and onto the canyon floor containing drainage courses. Obviously, the potential is greater for erosion and sedimentation to occur in barrens placed in the second category, rather than the first. This was the general observation noted during the field survey. There were, however, several occasions where a polygon fit into both categories, most notably PG-6 whose relative enormity transcended every other polygon. In these cases, the overall evaluation and score of the polygon must be tempered to take into consideration those areas along the ridge lines less likely to contribute to erosion and sedimentation.

The general observation made during the field survey was that the greatest degree of erosion and sedimentation attributable to OHV use was localized in play areas and hill climbs. The hill climbs were especially damaging because they tended to denude the soils of the armor protection and displace the mature soils, if any. In those areas where the width of the hill climb was restricted to a few yards by physical features (e.g., a narrow trail bounded by vegetation), excessive usage tended to cause the formation of small gullies. These particular gullies, cultivated over time by natural forces, appeared to have the potential to quickly form larger gullies. A general trend was the denser the OHV use the greater the degree of soil erosion and displacement (i.e., denuding of armor and mature soil). Heavily used play areas located atop ridge lines, although severely denuded of armor and mature soils, appeared to contribute very little to erosion and sedimentation being delivered to the major drainages. This was especially true in play areas that were either bounded by vegetation or were contained within a topographic "bowl".

Natural erosion and sediment rates within the CCMA are inherently high. This can be attributed to a variety of physical characteristics and the density of the plant biome. In general, the area is intrinsically susceptible to erosion and any outside influence would appear to intensify the effect. Several physical characteristics were observed consistently at polygons undergoing high rates of erosion including: gullies (either natural or OHV induced); steep slopes; drainage course(s); high OHV density; easy routes of accessibility; and limited armoring and immature soils.

Scores were generated for a total of 67 subwatersheds within the study area, from which scores for 47 polygons were derived. The average score for the subwatersheds was 23, with a maximum score of 50 found in a subwatershed along a ridge line in the southern section of Clear Creek Canyon, and minimum scores of 2 and 3 in each of two relatively small barrens in the central section of the Clear Creek Watershed and San Benito River Watershed, respectively. Distribution of the scores for the subwatershed were approximately Gaussian, with nearly 50 percent of the scores falling between 11 and 20. A summary of the scores generated on a subwatershed basis is presented in Table 1. The polygon scores had an average of 24, with a maximum of 47 for a polygon located along a ridge line between Clear Creek Canyon and the Picacho Creek Watershed. A minimum score of 3 was obtained for a small, relatively inaccessible polygon in the San Benito River Watershed. The distribution of scores for the polygons was slightly less uniform, and this is anticipated based on how these scores were derived. Nevertheless, the vast

majority of the polygon scores fell between 11 and 30, with only 25 percent outside of this range. A summary of the scores generated on a polygon basis is presented in Table 2.

The score ranges for each of the three categories into which the barrens were placed have been determined by a statistical analysis performed upon the entire population of polygon scores. The breakdown is as follows:

Ranking Category	Range of Scores	Number of Polygons in Range
Minor Contributor	Less than 15	11
At Risk	$16 < X < 30$	24
Major Contributor	Greater than 31	12

Consistent with the fact that the distribution of the polygon scores are approximately Gaussian, approximately 50 percent of the scores are in the "at risk" category, while the outliers make up the remaining 50 percent.

A comprehensive summary of the entire population of subwatershed scores, as well as the scores of the individual ranking parameters that were used to calculate the total scores, is provided in Table 3.

Table 1: Barren Scores, Subwatershed Basis

Subwatershed	Score	Subwatershed	Score	Statistical Analysis	
CC-1A	13	EF-1A	13		
CC-1B	9	EF-1B	18	Mean	23
CC-1C	14	EF-2	12	Median	23
CL-6	15	LA-5	47	Mode	23
CL-7	16	LC-1A	23	SD	11.09229
CL-8	9	LC-1B	26	Variance	123.038896
CL-9A	23	LC-2	32		
CL-9B	14	PC-2A	46	Number of Scores:	
CL-11	9	PC-2B	41		
CL-15	24	PC-3A	34	x<5	2
CL-16	11	PC-3B	17	6<x<10	5
CL-17A	14	SB-2A	12	11<x<15	13
CL-17B	14	SB-2B	20	16<x<20	11
CL-18	23	SB-2C	3	21<x<25	16
CL-19	2	SB-2D	8	26<x<30	5
CL-20	7	SB-3A	40	31<x<35	6
CL-21	26	SB-3B	16	36<x<40	3
CL-22	20	SB-3C2	23	41<x<45	2
CL-24	26	SB-3C3	35	x>46	4
CL-25A	11	SB-4	37		
CL-25B	15	SC-1	24		
CL-25C	29	SC-2	16		
CL-26	46	SM-1A	25		
CL-27	23	SM-1B	24		
CL-28A	12	SM-2	21		
CL-28B	20	WC-3B	25		
CL-29	23				
CL-30	24				
CL-31A	35				
CL-31B(A)	50				
CL-31B(B)	32				
CL-31B(C)	24				
CL-31BZ	18				
CL-31C	36				
CL-32A	21				
CL-32B	17				
CL-33	33				
CL-34	27				
CL-35	18				
CL-36	25				
CL-37	45				



Table 2: Barren Scores, Polygon Basis					
Polygon	Score	Polygon	Score	Statistical Analysis	
PG-1	12	PG-41	13		
PG-2	21	PG-42	23	Mean	24
PG-3	17	PG-43	3	Median	23
PG-4	15	PG-44	8	Mode	28
PG-5	12	PG-45	15	SD	9.5685
PG-6	34	PG-46	14	Variance	91.556
PG-7	38	PG-47	14		
PG-8	33			Number of Scores:	
PG-9	36				
PG-10	36			x<5	1
PG-11	21			6<x<10	1
PG-12	37			11<x<15	9
PG-13	23			16<x<20	7
PG-14	25			21<x<25	12
PG-15	24			26<x<30	5
PG-16	19			31<x<35	4
PG-17	29			36<x<40	7
PG-18	38			41<x<45	0
PG-19	39			x>46	1
PG-20	28				
PG-21	31				
PG-22	24				
PG-23	22				
PG-24	18				
PG-25	22				
PG-26	16				
PG-27	26				
PG-28	20				
PG-29	26				
PG-30	28				
PG-31	40				
PG-32	14				
PG-33	18				
PG-34	23				
PG-35	35				
PG-36	25				
PG-37	47				
PG-38	23				
PG-39	13				
PG-40	20				

Occurrence of Ranking Scores Polygon Basis

Range of Scores	Number of Scores Within Range
x<5	1
6<x<10	1
11<x<15	9
16<x<20	7
21<x<25	12
26<x<30	5
31<x<35	4
36<x<40	7
41<x<45	0
x>46	1

Note: Italicized entries indicate that a barren polygon score has been adjusted to accurately represent field observations when multiple polygons lie within a single subwatershed.

Table 3: Detailed Summary of Subwatershed Scores

<i>SW</i>	<i>OHV</i>	<i>BA</i>	<i>DA</i>	<i>GL</i>	<i>SL</i>	<i>SO</i>	<i>MH</i>	<i>ACC</i>	<i>VC</i>	<i>AR</i>	<i>VB</i>	<i>STC</i>	<i>TOTAL</i>
CC-1A	4.4	1.4	10.0	1.1	5.0	0.5	0.0	5.0	5.0	4.5	5.0	0.4	13
CC-1B	4.4	1.1	10.0	1.6	7.0	0.5	0.0	5.0	5.0	9.4	5.0	0.8	9
CC-1C	8.8	2.4	10.0	0.4	2.0	3.5	0.0	5.0	2.5	9.1	5.0	1.2	14
CL-11	3.5	2.8	2.5	0.2	6.0	2.4	0.0	5.0	2.5	6.3	5.0	0.0	9
CL-15	8.8	2.6	10.0	2.7	5.0	0.8	5.0	5.0	5.0	2.8	5.0	3.6	24
CL-16	4.4	4.4	3.3	1.9	6.0	0.0	0.0	0.0	1.7	4.2	2.5	0.2	11
CL-17A	8.8	1.3	5.0	0.5	5.0	0.5	0.0	5.0	5.0	6.1	1.3	0.0	14
CL-17B	11.7	1.7	5.0	0.1	5.0	3.2	0.0	5.0	5.0	6.7	5.0	0.6	14
CL-18	4.4	8.6	2.5	2.4	6.0	0.5	5.0	0.0	1.3	4.2	1.3	0.0	23
CL-19	4.4	1.3	3.3	0.1	5.0	0.5	0.0	5.0	5.0	6.7	5.0	0.6	2
CL-20	4.4	2.0	3.3	3.6	6.0	0.0	0.0	0.0	5.0	2.1	5.0	0.0	7
CL-21	11.7	2.1	10.0	3.9	6.0	0.0	0.0	5.0	5.0	2.1	5.0	0.4	26
CL-22	17.5	2.1	3.3	1.1	3.0	0.5	0.0	5.0	5.0	1.9	5.0	0.4	20
CL-24	11.7	2.8	5.0	0.0	4.0	0.5	5.0	5.0	1.7	4.4	1.7	0.6	26
CL-25A	8.8	1.9	5.0	1.6	1.0	0.0	0.0	5.0	5.0	1.8	5.0	0.4	11
CL-25B	8.8	2.2	5.0	2.6	5.0	0.0	0.0	5.0	5.0	3.1	5.0	1.0	15
CL-25C	17.5	0.0	5.0	0.1	6.0	2.9	0.0	5.0	5.0	1.1	1.7	0.0	29
CL-26	17.5	8.8	10.0	5.0	5.0	2.9	5.0	5.0	1.3	8.8	2.5	1.0	46
CL-27	8.8	2.0	10.0	0.3	6.0	2.4	0.0	5.0	5.0	0.9	5.0	0.6	23
CL-28A	4.4	2.1	10.0	0.5	2.0	2.9	0.0	0.0	5.0	2.8	1.7	0.8	12
CL-29	8.8	2.7	5.0	0.5	6.0	2.4	0.0	5.0	2.5	2.2	2.5	0.0	23
CL-30	11.7	3.4	5.0	0.3	5.0	2.4	0.0	5.0	2.5	1.5	5.0	0.0	24
CL-31A	17.5	3.9	10.0	3.8	3.0	1.6	5.0	5.0	2.5	7.0	5.0	0.4	35
CL-31B(A)	35.0	2.0	10.0	2.7	6.0	0.5	0.0	5.0	2.5	3.5	5.0	0.4	50
CL-31B(B)	11.7	2.6	10.0	3.3	6.0	0.8	5.0	5.0	2.5	3.5	5.0	1.2	32
CL-31B(C)	17.5	2.0	10.0	0.5	5.0	2.9	0.0	0.0	5.0	2.6	5.0	1.2	24
CL-31BZ	5.8	6.9	2.5	0.4	2.0	2.4	5.0	5.0	2.5	6.0	2.5	1.2	18
CL-31C	8.8	4.4	10.0	3.3	10.0	2.9	5.0	0.0	1.7	4.1	1.7	1.0	36

<i>SW</i>	<i>OHV</i>	<i>BA</i>	<i>DA</i>	<i>GL</i>	<i>SL</i>	<i>SO</i>	<i>MH</i>	<i>ACC</i>	<i>VC</i>	<i>AR</i>	<i>VB</i>	<i>STC</i>	<i>TOTAL</i>
CL-32A	4.4	4.3	10.0	5.4	6.0	0.8	5.0	5.0	1.7	9.4	5.0	3.6	21
CL-32B	8.8	2.1	3.3	1.2	5.0	2.4	5.0	5.0	2.5	8.1	5.0	0.6	17
CL-33	5.8	4.1	10.0	3.1	10.0	4.5	0.0	5.0	1.7	1.7	5.0	1.0	33
CL-34	17.5	5.1	5.0	1.1	6.0	1.6	0.0	0.0	1.3	5.1	1.7	1.0	27
CL-35	4.4	4.4	5.0	4.0	5.0	3.7	0.0	0.0	1.3	4.7	1.7	0.4	18
CL-36	4.4	1.3	5.0	4.8	9.0	5.3	5.0	0.0	5.0	1.8	2.5	0.6	25
CL-37	11.7	2.6	10.0	13.6	5.0	2.9	5.0	5.0	1.7	4.8	2.5	1.4	45
CL-6	8.8	2.3	3.3	0.5	6.0	2.4	0.0	5.0	5.0	2.9	5.0	0.0	15
CL-7	8.8	2.3	5.0	0.1	5.0	2.4	0.0	5.0	5.0	2.5	5.0	0.6	16
CL-8	4.4	1.9	5.0	0.2	6.0	2.9	0.0	5.0	5.0	6.1	5.0	0.0	9
CL-9A	8.8	2.6	10.0	2.0	6.0	2.9	5.0	5.0	5.0	7.0	5.0	1.8	23
CL-9B	5.8	2.2	10.0	0.2	3.0	2.9	0.0	5.0	5.0	4.5	5.0	0.6	14
EF-1A	5.8	2.2	10.0	1.3	3.0	0.0	0.0	0.0	5.0	2.4	1.7	0.4	13
EF-1B	8.8	2.1	10.0	3.6	6.0	0.0	0.0	0.0	5.0	2.3	5.0	0.4	18
EF-2	4.4	2.5	10.0	2.2	6.0	0.0	0.0	5.0	5.0	7.0	5.0	1.0	12
LA-5	35.0	2.3	10.0	0.0	3.0	1.1	5.0	5.0	5.0	3.0	5.0	1.2	47
LC-1A	11.7	2.6	10.0	1.4	6.0	0.0	0.0	0.0	5.0	1.1	1.7	0.6	23
LC-1B	17.5	2.2	10.0	2.5	3.0	0.0	0.0	0.0	5.0	1.6	2.5	0.6	26
LC-2	17.5	2.8	10.0	1.4	6.0	0.5	0.0	0.0	2.5	1.0	2.5	0.4	32
PC-2A	35.0	2.5	10.0	1.1	3.0	0.0	5.0	5.0	5.0	4.9	5.0	0.6	46
PC-2B	35.0	1.7	10.0	0.8	1.0	0.8	5.0	5.0	5.0	6.3	5.0	1.6	41
PC-3A	17.5	1.6	10.0	0.0	6.0	0.0	5.0	5.0	5.0	2.4	2.5	0.8	34
PC-3B	3.5	2.1	10.0	0.2	3.0	0.0	5.0	5.0	5.0	3.3	2.5	1.4	17
SB-2A	4.4	1.1	10.0	3.2	3.0	0.5	5.0	5.0	5.0	8.8	5.0	1.0	12
SB-2B	11.7	1.1	10.0	1.1	3.0	0.0	5.0	5.0	5.0	8.4	1.7	2.0	20
SB-2C	3.5	1.1	10.0	0.5	3.0	0.0	5.0	0.0	5.0	8.8	5.0	1.2	3
SB-2D	3.5	1.1	10.0	0.4	3.0	0.5	5.0	5.0	5.0	9.3	5.0	1.2	8
SB-3A	17.5	2.3	10.0	0.6	6.0	2.4	5.0	5.0	1.3	1.6	5.0	0.6	40
SB-3B	8.8	2.2	10.0	0.3	2.0	0.5	0.0	5.0	5.0	1.7	5.0	1.2	16

<i>SW</i>	<i>OHV</i>	<i>BA</i>	<i>DA</i>	<i>GL</i>	<i>SL</i>	<i>SO</i>	<i>MH</i>	<i>ACC</i>	<i>VC</i>	<i>AR</i>	<i>VB</i>	<i>STC</i>	<i>TOTAL</i>
SB-3C2	11.7	2.1	10.0	0.2	3.0	0.5	0.0	5.0	5.0	2.0	1.7	0.8	23
SB-3C3	17.5	3.1	2.5	2.2	6.0	0.5	5.0	5.0	2.5	1.6	1.7	1.0	35
SB-4	17.5	1.1	10.0	4.3	7.0	3.2	5.0	5.0	5.0	3.5	5.0	2.4	37
SC-1	4.4	2.8	10.0	4.5	6.0	2.1	5.0	5.0	2.5	7.0	5.0	1.2	24
SC-2	4.4	2.0	10.0	0.7	6.0	2.6	0.0	5.0	5.0	3.1	5.0	1.6	16
SM-1A	6.8	1.3	10.0	6.3	3.0	3.5	5.0	5.0	5.0	8.8	2.5	1.2	25
SM-1B	11.7	1.3	10.0	1.0	3.0	0.8	5.0	5.0	5.0	2.9	5.0	1.2	24
SM-2	17.5	4.4	10.0	0.0	1.0	0.0	0.0	5.0	5.0	4.2	5.0	2.4	21
WC-3B	3.5	2.9	10.0	0.5	5.0	2.9	5.0	5.0	2.5	2.2	2.5	3.0	25

Legend:

SW = Subwatershed Title

OHV = OHV Use Density

BA = Barren Area % of Drainage

DA = Drainage Area Size

GL = Gullying

SL = Slope

SO = Stream Order

MH = Mining History

ACC = Accessibility

VC = Vegetative Cover

AR = Armoring

VB = Vegetative Boundary

STC = Sediment Trapping Capability

$$\text{Total Score} = \text{OHV} + \text{BA} + \text{DA} + \text{GL} + \text{SL} + \text{SO} + \text{MH} + \text{ACC} - \text{VC} - \text{AR} - \text{VB} - \text{STC}$$

4.0 BEST MANAGEMENT PRACTICES

4.1 Introduction

The purpose of this section is to present sediment and erosion control BMPs that are potentially applicable for active OHV play areas. Due to the unique conditions at the Clear Creek Management Area (i.e., topography, climate, soil types, vegetation, and recreational OHV use), the effectiveness of the proposed BMPs is difficult to predict. There is very limited practical experience with BMPs for conditions similar to those found at Clear Creek.

In order to directly evaluate the efficiency of the proposed BMPs at Clear Creek, it is recommended that a BMP pilot program be implemented. Under the pilot program, the BMPs considered by BLM to be most feasible based on the available budget will be implemented on a limited scale. Each selected BMP is implemented at one or two sites that meet its applicability criteria and using different designs where possible. The effectiveness of each BMP is then evaluated over the course of one year. At the end of the evaluation, BLM will identify the most effective BMPs and designs and will expand their use at other sites with similar features within the Clear Creek Management Area.

Table 4: Summary of BMPs and Their Functions

No.	Name	Vegetative Stabilization	Runoff Diversion	Flow Velocity Reduction	Sediment Retention	Energy Dissipation
1	Silt fence			•	•	•
2	Erosion control blankets	•		•		
3	Rock backfilling of gullies			•	•	•
4	Check dams			•	•	•
5	Interceptor dyke and swale		•	•		•
6	Sediment basin		•	•	•	•
7	Rock filter			•	•	•
8	Gabion mattresses			•	•	•

4.1.1 Silt Fences

Description

A silt fence consists of a geotextile fabric attached to supporting poles, which is used to intercept, reduce velocity, and filter surface runoff.

Applicability

Silt fences are effective in areas where sheet flow occurs, such as:

- At lower end of active play areas, particularly at the interface between a play area and a vegetation buffer.
- Base (i.e., toe) of slopes.
- Along streams.

Benefits/Advantages

- Provide retention of runoff sediments.
- Decrease runoff flow velocity and energy.
- Protect downslope vegetation from sedimentation and wash-out.
- Provide visual indication of play area lower boundary.
- Installation does not require construction equipment (however, a walk-behind trenching machine decreases installation time and effort considerably).
- Installation does not require skilled labor.
- Low cost BMP.

Installation

- The alignment of the silt fence should be parallel to topographic contour lines.
- The ends of the silt fence should be turned uphill to prevent stormwater from flowing around the fence.
- The geotextile fabric should be embedded 8 inches into the ground.

Maintenance

- Periodic inspections.
- Repairs, as necessary.
- Sediment should be removed when they reach one half the height of the fence.

Limitations

- Should not be used where drainage area exceeds approximately 2 acres.
- Require removing and disposing of the sediments that accumulate behind the silt fence.
- Silt fences are susceptible to damage by OHVs and may need to be protected by barriers.

4.1.2 Erosion Control Blankets

Description

An erosion control blanket is a mat made of synthetic or natural material, or a combination of the two, which is stapled to the soil on steep slopes to control erosion and promote the establishment of vegetation.

Applicability

The use of erosion control blankets is limited to narrow strips adjacent to the lateral boundaries of vegetated areas located downgradient of active OHV use areas. In order for the blankets to be effective, the soil over which they are installed should be of sufficient quality to support vegetation growth. The soil surface must be relatively smooth, without rocks, deep depressions, or debris. The blankets may be seeded to improve the vegetation establishment process. This BMP may be combined with the use of silt fences, which are described earlier in this section. A

silt fence may be installed upgradient of a vegetated area and extended laterally to protect the erosion protection blanket strips.

Benefits/Advantages

- Provide effective protection of soils on highly erodible slopes.
- Absorb and hold moisture near the soil surface.
- Promote vegetation establishment.
- May be installed on steep slopes.
- Installation does not require construction equipment.
- Installation does not require skilled labor.

Installation

- Place the blanket strips parallel to the direction of flow.
- Anchor blanket firmly to the ground using product-specific staples.
- Overlap blanket strips according to manufacturer's recommendations.
- Bury the upslope end of each strip a minimum of six inches below ground surface.

Maintenance

- Periodic inspections.
- Re-anchor loosened blanket areas and replace missing blanket and staples as necessary.
-

Limitations

- The great variety of similar products complicates the selection and the evaluation of the effectiveness of this BMP.
- The success of the vegetation establishment depends on numerous factors, including: blanket type; soil characteristics; and blanket installation and maintenance.
- Are not usable on uneven surfaces (e.g., over rills or gullies).

4.1.3 Rock Backfilling of Gullies

Description

This practice consists of filling gullies with loose angular rock to prevent their further deterioration from water erosion. The practice may be scaled down to just armoring a natural channel with one or two layers of rock (in which case the practice is called riprap).

Applicability

This BMP is primarily applicable in naturally incised drainage channels that concentrate flow and significantly contribute to sediment generation and transport. This method can be combined with the check dam BMP, described later in this section. For example, the lower and more accessible sections of a gully may be backfilled with rock, whereas check dams may be constructed in the higher sections of the gully.

Benefits/Advantages

- Decrease runoff flow velocity and energy.
- Provide retention of runoff sediments.
- Sediment retention over time tends to clog the void spaces and "heal" the gully.
- When properly constructed, maintenance is minimal.

Installation

- A filter fabric has to be placed directly under the rock if soil in the gully is sand-size or finer.
- The rock is placed beginning from the base of the slope.
- When filter fabric is used, the rock should be placed in a manner that prevents damage to the fabric.

Maintenance

- Inspect periodically.
- Add rock to damaged areas.

Limitations

- May require a permit.
- The use of filter fabric and size of the rock should be specified by a qualified engineer based on the anticipated peak discharge, slope, and type of soil.
- Limited to areas where rock can be transported by truck.
- Typically require small construction equipment for placement (however, in smaller projects, the rock can be placed by hand).

4.1.4 Check Dams

Description

A check dam is a small structure (made of logs, stone, or silt fence) constructed across a gully or ephemeral stream in order to lower the speed, retain sediments, and diminish the erosion potential of concentrated flows.

Applicability

The applicability is similar to that of the previous BMP (i.e., rock backfilling of gullies). Check dams can be used in natural drainage channels that concentrate flow and significantly contribute to sediment generation and transport. As mentioned previously, check dams can be combined with rock backfilling of gullies in different sections of a channel.

Benefits/Advantages

- Decrease runoff flow velocity and energy.
- Provide retention and settling of runoff sediments.
- Installation does not require construction equipment (however, the construction of stone dams is limited to areas where stone is available or can be delivered).
- Installation does not require skilled labor.
- Low cost BMP.

Installation

For all types of materials:

- Dams should be spaced so that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- The top of the dam should be constructed so the center is approximately six inches lower than the outer edges, forming a weir to allow water to flow across.
- Maximum height of the check dam at the center should not exceed two feet

- If possible, a sump may be provided immediately in front of the check dam to capture excessive sediment.

For log check dams:

- Should be constructed using four to six-inch diameter logs.
- The dam consists of vertical logs (i.e., wooden piles) embedded into the soil and nailed to a horizontal log embedded into the channel banks.
- The logs should be embedded into the soil at least 18 inches.

For stone check dams:

- Should be constructed of four to seven-inch stone.
- The upstream side of the check dam should be lined with 0.75 to 1.5-inch aggregate.
- The sides of the dam should have a slope of approximately 2 (horizontal) to 1 (vertical).
- A filter fabric has to be placed directly under the stone check dam if soil in the gully is sand-size or finer.

For silt fence check dam

- Silt fence check dams are susceptible to damaged from concentrated flows and therefore, they are considered temporary measures.
- The installation is similar to the placement of regular silt fences but requires observing the spacing, height, and weir requirements of the check dams.

Maintenance

- Periodic inspections.
- Repairs, as necessary.
- Silt fence check dams require more frequent inspections and repairs.
- Sediment should be removed when it reaches one half the height of the dam.

Limitations

- Require removing and disposing of the sediments that accumulate behind each check dam.
- May create turbulence, resulting in the erosion of channel banks.
- May result in erosion at edges and development of new gullies, particularly if sediments removal maintenance is not adequately performed and/or the dam is not provided with a weir.

4.1.5 Interceptor Dyke and Swale

Description

Interceptor dykes (ridges of compacted soil) and swales (excavated depressions) are used to intercept upslope runoff and divert it laterally. A dyke is constructed adjacent and downslope of the swale from materials excavated for the construction of the swale. In most cases the swale is stabilized with riprap. The purpose of this BMP is to protect downslope areas that are susceptible to erosion and degradation. Dyke and swale systems intercept overland flow and convert it into concentrated flow with lower (and non-erosive) velocity. The diverted flow is discharged to a suitable (as described below) outlet. Functionally, this BMP differs from the silt fence BMP in that it intercepts and diverts all runoff from upslope areas (whereas silt fences allow runoff to filter through the fence and reach lower areas).

Applicability

- At lower end of active play areas, particularly at the interface between a play area and a vegetation buffer.
- At base (i.e., toe) of slopes.

Benefits/Advantages

- Decrease runoff flow energy.
- Protect downslope vegetation from sedimentation and wash-out.
- Provide visual indication of play area lower boundary.

Installation

The installation will follow the design requirements. The main work tasks include:

- Construction of dyke and trapezoidal channel (i.e., swale) with a continuous positive grade to a suitable outlet.
- Lining of channel with riprap.

Maintenance

- Periodic inspection.
- Restore riprap in damaged areas.
- Repair dyke and swale in damaged areas.
- Remove sediments accumulated in the swale.

Limitations

Interceptor dykes and swales can be constructed only in areas where all of the following conditions are met:

- The upstream slope is not greater than 50 percent.
- Runoff diverted by the dyke and swale can be discharged to a suitable outlet (i.e., an outlet which can handle the additional flow without increasing the disturbance of the lower areas).
- Access for construction equipment, such as a backhoe, is available.
- The slope of the proposed swale is less than ten percent.

Other limitations include:

- Swales are susceptible to being easily damaged by OHVs and may need to be protected by barriers.
- May require a permit.
- Require a design prepared by a qualified engineer.
- The width of the structure is significant: for a swale with the bottom width of two feet (typically considered a minimum), side slopes of 1:1, and a dyke with a base width of six feet, the total width of the structure is 12 feet.
- High cost BMP.

4.1.6 Sediment Basin

Description

A sediment basin is a pond created by constructing a dam across a drainage way and is designed to detain runoff in order to allow suspended sediments to settle. The pond is provided with a riser connected to a discharge pipe, which ends downgradient of the dam. The pipe is placed perpendicular to and at the base of the dam. The discharge point is provided with rock protection in order to reduce the velocity of the water flow. In the pond, water accumulates until its level exceeds the height of the riser and the excess water discharges through the pipe to the downgradient outlet. The basin volume below the top of the riser is the sediment storage zone. The dam should be constructed of materials less permeable than gravel and clean sand. Local materials such as silty sand, clayey sand, and silt, are acceptable if they are free of debris. The storage volume may be increased by excavating the area in front of the dam, and excavated materials may be used for the construction of the dam. The structure is provided with an emergency spillway to prevent water from flowing over the dam in flood conditions. The ratio between the basin length and width should be between 2:1 and 9:1.

Applicability

- Lower sections (i.e., downgradient of active OHV play areas) of natural drainage channels concentrating large amounts of sediments.
- Areas that provide great water storage potential from the natural topography.
- Areas that are accessible to construction equipment (i.e., front-end loader, excavator, and bulldozer).
- Sites where failure of the dam would not result in loss of life or property damage.

Benefits/Advantages

- Provide retention of runoff sediments (typical designs provide sediment capture efficiencies of 60 to 70 percent).
- Decrease runoff flow velocity and energy.
- Protect downslope vegetation from sedimentation and wash-out.

Installation

The installation will follow the design requirements. The main work tasks include:

- Construction of dam and installation of riser and discharge pipe.
- Construction of pipe outlet protection.
- Construction of emergency spillway.

Maintenance

- Periodic inspections.
- Repair dam, if necessary.
- Remove sediments when the sediment storage zone is half full.

Limitations

- Require professional design.
- Require permit.
- Require periodic removal, transportation and disposal of accumulated sediments.
- Expensive BMP.

4.1.7 Rock Filter

Description

A rock filter consists of a berm of crushed rock (size 1.5 to 3-inch), wrapped in poultry wire (one inch diameter hexagonal mesh, galvanized 20 gauge), and placed parallel to topographic contour lines on a horizontal surface at the toe of a slope. The purpose of the rock filter is to intercept sediment laden runoff from disturbed areas of the site, reduce flow velocity, promote sedimentation, and release the water as sheet flow.

Applicability

Rock filters are effective at the base of slopes disturbed by OHV use and where the runoff primarily occurs in sheet flow.

Benefits/Advantages

- Provide retention of runoff sediments.
- Decrease runoff flow velocity and energy.
- Installation does not require skilled labor but requires a supply of suitable rock.
- Create physical boundary for OHVs.
- Low cost BMP.
- Low maintenance BMP.

Installation

- Chose the alignment of the filter rock on a horizontal surface close to, or at, the base of a slope, and parallel to the topographic contour lines of the slope.
- Place poultry netting on the ground along the proposed alignment (make sure that the width of the poultry net is sufficient for the wrapping of the proposed rock berm). A typically suitable standard net width is 12 feet, matching a berm with the smallest cross section.
- Construct a rock berm with a base width of a minimum of six feet, top width of a minimum of two feet, and height of a minimum of 18 inches.
- Wrap the rock berm in poultry netting and tie the end wire diaphragms using lacing wire or a ring fastener.

Maintenance

- Periodic inspections.
- Repair the rock berm and poultry netting as necessary.

Limitations

- Can be constructed only in areas where an adequate supply of crushed rock can be delivered.
- Should not be placed on uneven surfaces (e.g., over rills or gullies).

4.1.8 Gabion Mattresses

Description

A gabion mattress is a wire-mesh box (width and length much greater than height) filled with crushed rock. Typical mattress dimensions are: six to nine inches (height); nine to 12 feet (length); and six feet (width). The purpose of gabion mattresses is similar to that of the filter rock: intercept sediment laden runoff from disturbed areas of the site, reduce flow velocity, promote sedimentation, and release the water as sheet flow. The main differences between mattresses and filter rock are: gabion mattresses may be placed on the slope, before and after the slope break at the toe; gabion mattresses are more resilient; and mattresses are wider, resulting in better sediment trapping efficiency.

Applicability

Gabion mattresses are effective at the base of slopes disturbed by OHV use and where the runoff primarily occurs in sheet flow.

Benefits/Advantages

- Provide retention of runoff sediments.
- Decrease runoff flow velocity and energy.
- Create a physical boundary for OHVs.
- Low maintenance BMP.

Installation

- Unfold the gabion mattresses (they are delivered folded to occupy less space during transportation).
- Place mattresses side by side with the long side parallel to the runoff flow direction.
- Join the corners and side panels using lacing wire or a ring fastener.
- Fill the boxes with crushed rock (size four to seven inches).
- Place and fasten mattress lids.

Maintenance

- Periodic inspections.
- Repair damage wire diaphragms.

Limitations

- Can be constructed only in areas where an adequate supply of crushed rock can be delivered.
- Should not be placed on uneven surfaces (e.g., over rills or gullies).

