

SALT LAKE CITY-COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL HEALTH
Bureau of Water Quality

CORNER CANYON CREEK CHANNEL STABILITY EVALUATION

INTRODUCTION

The Corner Canyon Creek Channel Stability Evaluation was undertaken by Salt Lake County in 1984-85. The project manager, Mr. Steven F. Jensen, is certified by the Soil Conservation Society and American Registry of Agronomy as a Certified Erosion and Sediment Control Specialist. The field work for the project was subcontracted to the Salt Lake Soil Conservation District, where Mr. William D. (W.D.) Robinson was the principal investigator. Mr. Robinson possesses an undergraduate degree in Watershed Management from Utah State University.

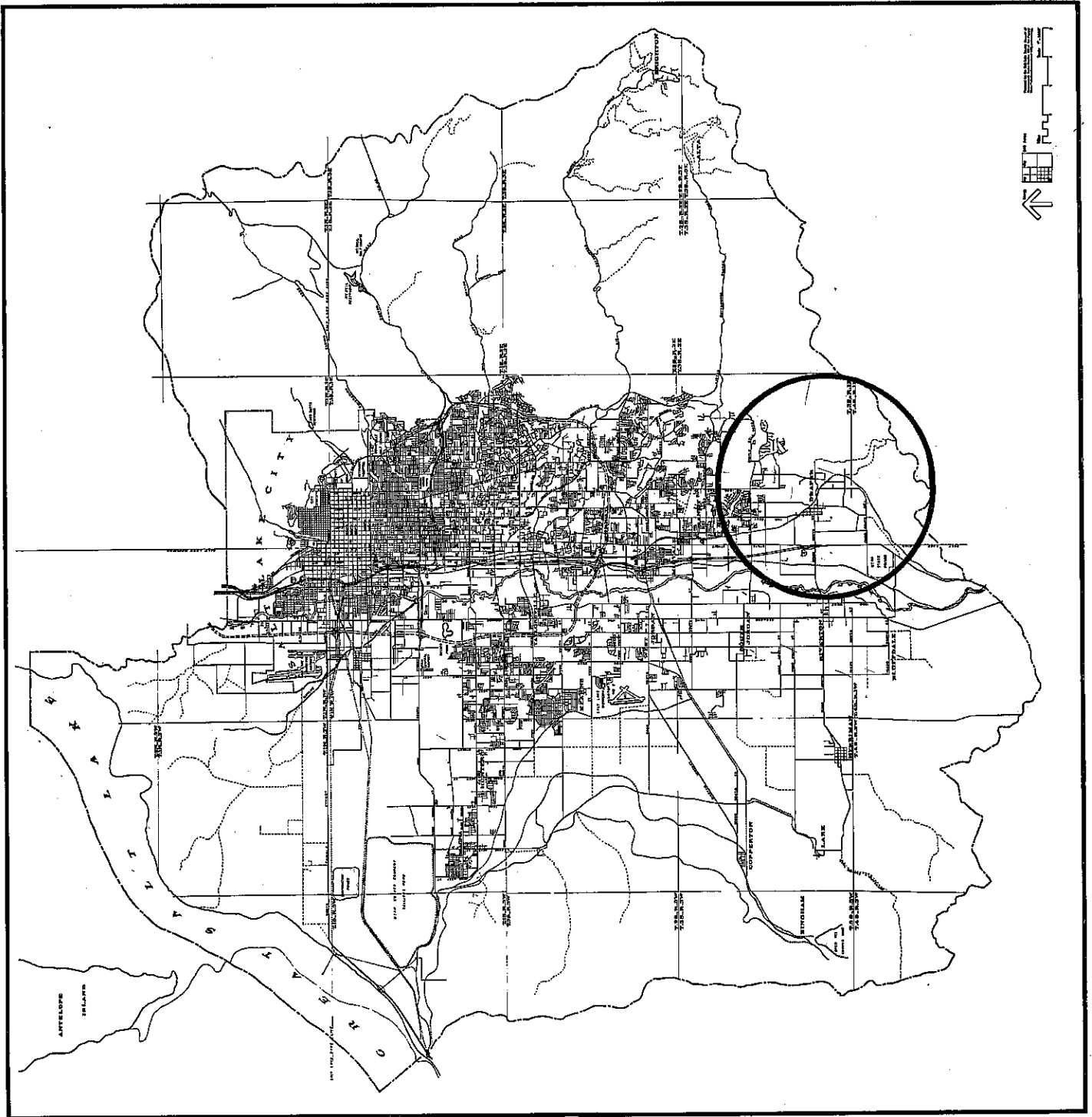
This evaluation follows closely to those subcontracted earlier by Salt Lake County to the local Soil Conservation District. Previous studies have been made and published on the valley tributary segments of Big Cottonwood, Little Cottonwood and Millcreek, by Mr. Jeff Harris. This most recent series of evaluations include City Creek, Red Butte Creek, and Emigration Creek.

The Channel Stability Evaluation series is based on a field observation model developed by the U.S. Forest Service Northern Region and was first applied in watersheds of Montana in the mid to late 1970's. It offers a useful qualitative planning guide to detailed assessment and engineering studies on specific stream reaches. It is not intended to be used as a quantitative planning tool, since detail in measurements of soil loss, channel erodibility and sediment delivery are necessary to prescribe alternative management strategies.

The Corner Canyon Assessment can be used in conjunction with the 1981 Agricultural Non-point Water Quality Assessment to prioritize reaches on the stream recommended for remedial or permanent runoff controls. It is also noted that Salt Lake County Public Works (Flood Control) has proposed three major stormwater and snowmelt detention basins on Corner Canyon Creek. Problems on the Creek have been known and reasonably understood for about 10 years. Funding has precluded any substantial implementation of erosion or pollution control measures.

If preventive erosion controls continue to be ignored on the Corner Canyon drainage, future plans to expand residential growth on Draper foothills and in the Traverse highlands will aggravate and worsen present problems of flooding, property damage, road damage, sedimentation and water pollution. This will degrade the pristine quality of life in the Draper community, and cause excess burden on taxpayers to rectify recurrent problems and wage on-going battles with un-checked runoff.

FIGURE 1.
LOCATION OF THE CORNER
CANYON CREEK STUDY AREA



A. STUDY METHODOLOGY: RATING FACTORS

The Stream Reach Inventory and Channel Stability Evaluation rates conditions for three major stream components: Upper Channel Banks, Lower Channel Banks, and Channel Bottom.

1. UPPER CHANNEL BANKS. For the immediate zone above the normal high water mark, the procedure rates the following factors:

A. Landform Slope. "The steepness of the land adjacent to the stream channel determines the lateral extent and ease to which banks can be eroded and the potential volume of slough which can enter the water....the steeper the land adjacent to the stream, the greater the potential volume of slough material."

1. Excellent: Side slopes less than 30% on both banks.
2. Good: Side slopes up to 40% on one or occasionally both banks.
3. Fair: Side slopes to 60% common on one or both banks.
4. Poor: Steep slopes over 60% on both banks.

B. Mass Wasting Hazard. Mass movement of banks by slumping or sliding introduces large volumes of soil and debris into the channel suddenly causing constrictions or complete damming, and grossly increasing sedimentation rates.

1. Excellent: No evidence that conditions does or could exist.
2. Good: Evidence of infrequent or small slumps.
3. Fair: Frequency & magnitude increasing; high water aggravates the condition with subsequent undercutting.
4. Poor: Potential slides from any increase in flow causes year-round sedimentation.

C. Debris Jam Potential. Tree trunks, limbs, and other debris cause deflection of flows.

1. Excellent: Debris on banks, but not situated to enable stream to entrain it into channel.
2. Good: Debris present offers bank protection but could float away forming only small jams.
3. Fair: Noticeable accumulation of all sizes and stream is enough to float it away.
4. Poor: Moderate to heavy accumulation present that, during high flows, could cause severe debris jams.

D. Vegetative Bank Protection. Soil is held in banks by plant roots. Root mats increase in density with proximity to the open channel. Trees and shrubs have deeper roots than grasses and forbs. The density of both understory and overstory vegetation, the more resistance to high-flow bank erosion. Damage from flow turbulence is greatest at the bank endge and diminishes with distance from the normal channel. Vegetal variety is more desirable than a monotypic plant community. Young plant, growing and reproducing vigorously, are better than old, decadent stands.

1. Excellent: 90% coverage by trees, shrubs, grass, and forbs. Variety present. Reproduction evident. Dense root mass.
2. Good: 70%-90% coverage, with shrubs prevalent. Deep root mass more prevalent than dense root mass.
3. Fair: 50%-70% coverage by any plant species. Reproduction is small or non-existent.

2. LOWER CHANNEL BANKS.

The lower channel zone is located between the normal high water and low water lines. Both aquatic and terrestrial plants grow but normally density is sparse. Lower channel banks define present stream width. Stability of channel banks is indicated under a given flow regimen by minor, imperceptible changes in channel width from year to year. Erosion encroachment is nil.

Under conditions of increasing channel flow, banks weaken and both cutting and deposition begin, USUALLY AT BENDS AND POINTS OF CONSTRICTION. Cutting is evidenced by steepening of lower banks, which begin to undercut, crack, and slump.

A. Channel Capacity. Channel width, depth, gradient, and roughness determine the volume of water which can be transmitted. Some indicators of channel capacity are widening or deepening, which are expressions of the most recent flood event.

1. Excellent: Stream cross-section is ample for present peak volumes plus some additional. Over-bank floods are rare.
2. Good: Adequate cross-sections contain most peak flows.
3. Fair: Channel barely contains peak runoff in average years.
4. Poor: Channel capacity inadequate, over-bank floods common.

B. Bank Rock Content. Where vegetation cannot grow, it is the size and shape of the rock component which determines resistance to flow.

1. Excellent: Rock comprises 65% or more of bank content. Angular 12" boulders are numerous.
2. Good: Rocks comprises 40%-65% of bank content, at 6"-12" sizes.
3. Fair: Rock comprises 20%-40% of bank volume at 3"-6" size.
4. Poor: Less than 20% rock fragments, mostly of gravel sizes 1"-3" in diameter.

C. Obstructions and Flow Deflectors. Embedded logs or boulders which change direction of flow and form sediment traps.

1. Excellent: Logs, rocks, and other flow obstructions are firmly embedded and produce non-erosive flow patterns. Pool riffle relationships are stable.
2. Good: Obstructions present which create some erosive cross-currents, and some sediment is trapped in pools decreasing their capacity.
3. Fair: Moderate and unstable obstructions which cause noticeable erosion of the channel. Considerable sediment deposition behind obstructions.
4. Poor: Frequent unstable obstructions and traps, causing continuous seasonal shifts. Channel migration and widening.

D. Cutting. Loss of aquatic vegetation by scouring or uprooting. Beginning near the top, and later extending to the total depth, the lower channel bank becomes a near vertical wall.

1. Excellent: Very little or no cutting is evident. Raw, eroding banks are infrequent, short and less than 6" high.
2. Good: Intermittent cutting along channel outcurves and at constrictions. Vertical cuts less than 12" high.
3. Fair: Significant bank cutting occurs frequently along the reach. Vertical banks 12" to 24" high are prevalent as are root mat overhangs and sloughing.
4. Poor: Nearly continuous bank cutting. Vertical cut faces over 2' high with frequent overhangs and side failures.

E. Deposition. The appearance of sand & gravel bars where they did not previously exist may be one of the first signs of stream erosion.

1. Excellent: Very little or no deposition of fresh silt, sand or gravel in channel bars in straight reaches or point bars on the inside banks of curved reaches.
2. Good: Some fresh deposits behind obstructions. Coarse gravel size class.
3. Fair: Deposits of fresh, coarse sands and gravels with bars enlarging and pools filling with riffles predominate.
4. Poor: Extensive deposits of fresh sand, silts, and small gravels. Rapid bar development common (no vegetation) Sediment storage full and moving during low flows.

3. CHANNEL BOTTOM.

The channel bottom is almost totally an aquatic environment, composed of inorganic rock constituents and a complex community of plant and animal life. Both components offer clues to stability of the stream bottom. Rock angularity, brightness, packing of bottom particles, distribution of bottom materials, scouring and depositional indicators, and aquatic vegetation are the factors to be rated.

A. Excellent to Poor ratings for angularity relate to the roundness exhibited and the smoothness or polish on the rock surface.

B. Brightness ratings relate to the lack of algae on the rocks, which, if present, produce a dulling of the rock surface;

1. Excellent: Less than 5% of the total bottom should be bright. Mostly covered by growths of film of organic stain.
2. Good: 5%-35% of the bottom appears brighter.
3. Fair: 50-50 mixture of bright and dull surfaces
4. Poor: Bright, freshly exposed rock surfaces predominate.

C. Consolidation of Bottom Materials. Under stable conditions, rock particles are packed together creating some overlap of larger materials like shingles. This creates high resistance to bottom scouring flows.

1. Excellent: Tightly packed array of rock sizes with overlapping sufficient to resist dislodge by kicking.
2. Good: Packing can be dislodged by higher than average flows.
3. Fair: Moderately loose with no overlap pattern and moveable by average high flows.
4. Poor: Loose array moved easily by average flows and move under foot. Similar size and assortment of mostly round rocks.

D. Bottom Size Distribution and Stable Materials. Large boulders and cobbles are considered more stable in average conditions.

1. Excellent: No noticeable change in rock size distribution, stable rock materials between 80%-100%.
2. Good: Slight shift in distribution. Stable rocks 50%-80%.
3. Fair: Moderate shift in size classes. Stable rocks 20%-50%.
4. Poor: Marked, pronounced shift in size distribution. Stable materials less than 20%.

E. Scouring and Deposition.

1. Excellent: Neither scouring nor deposition are evident. 5% may be present along the length of the reach.
2. Good: Affected reaches from 5%-30%.
3. Fair: 30%-50% of the bottom is in a state of flux.
4. Poor: 50% of more of the bottom is constantly moving.

F. Aquatic Vegetation. The existence of clinging moss and algae indicate bottom stability adequate to promote growth within a single season.

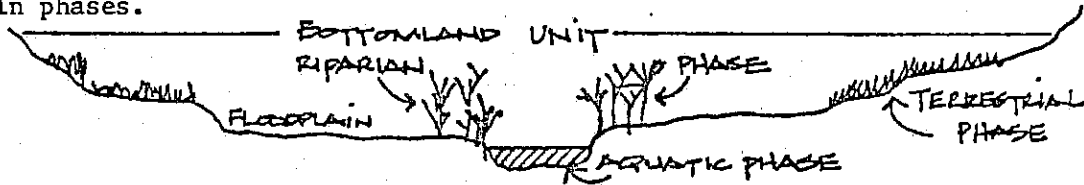
1. Excellent: Clinging plants are abundant throughout reach from bank to bank, and moss/algae are apparent in all directions.
2. Good: Plants common in slower portions but absent in swift water
3. Fair: Plants are found but occurrence is spotty. Absent from rocks in swift and even slow areas.
4. Poor: Plants rarely found anywhere in the reach.

The rating sheet used to record observations is shown in Figure 2. Each stream segment reach was rated, with reaches averaging 300'-800'.

Figure 2

Major Drainage SALT LAKE SUB-BASIN Date _____
 Observer(s) _____ Stream Name JORDAN Reach Number _____
 Elevation _____ to _____ feet Watershed # _____

A valley bottomland is that total area of land which includes the stream channel, the adjacent floodplain, benches or terraces, and other gentle terrain, and normally those valley toe slopes which may directly affect or be affected by the stream. Valley bottomlands may be stratified into aquatic, riparian, terrestrial, and floodplain phases.



Directions: Circle the appropriate response or fill in the blank as required.

Valley Shape: U V U U U
 NOTCH V-SHAPED U-SHAPED BOX-SHAPED BROAD
 Valley Width: narrow (100') moderately wide (100'-325') wide (325')
 Side slope Gradient: low (30') moderately steep (30-60%) steep (60%)
 Valley Gradient: low (4%) moderately steep (4-8%) steep (8%)
 Channel Gradient: very low (2%) low (2-3%) moderately steep (3-6%) steep (6%)
 Channel Size: width _____ ft. Average depth _____ ft. Flow pattern _____
 Geologic materials in bottom: _____
 Landform/Type _____

	RIPARIAN PHASE	FLOODPLAIN	TERRESTRIAL PHASE
vegetative type:	_____	_____	_____
vegetative cover density:	_____	_____	_____
type of debris:	_____	_____	_____
sediment buffer potential:	_____	_____	_____

Number of debris jams &/or fish blocks/mile _____. Upstream watershed impacts (Type) _____.

Size Composition of Bottom Material (Total to 100%)	1. Exposed bedrock _____ %	5. Small rubble, 3"-6" _____ %
	2. Large boulders, 3' + Dia. _____ %	6. Coarse gravel, 1"-3" _____ %
	3. Small boulders, 1-3' _____ %	7. Fine gravel, 0.1"-1" _____ %
	4. Large rubble, 6"-12" _____ %	8. Sand, silt, clay, muck _____ %

R-1 STREAM REACH INVENTORY and CHANNEL STABILITY EVALUATION

REACH LOCATION: Survey Date _____ Time _____ Obs. _____

TS/R: _____

Stream JORDAN RIVER Approx. Address: _____

Reach Description & Other Identification _____

Key #	Stability Indicators by Classes	(Fair and Poor on reverse side)
1	Bank slope gradient < 30%.	GOOD (4)
2	No evidence of past or any potential for future mass wasting into channel.	(3)
3	Essentially absent from immediate channel area.	(2)
4	90%+ plant density. Vigor and variety suggests a deep, dense, soil binding, root mass.	(3)
5	Ample for present plus some increases. Peak flows contained. W/D ratio < 7.	(1)
6	65%+ with large, angular boulders 12"+ numerous.	(2)
7	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	(2)
8	Little or none evident. Infrequent raw banks less than 6" high generally.	(4)
9	Little or no enlargement of channel or point bars.	(4)
10	Sharp edges and corners; plane surfaces roughened.	(1)
11	Surfaces dull, darkened, or stained. Gen. not "bright".	(1)
12	Assorted sizes tightly packed and/or overlapping.	(2)
13	No change in sizes evident. Stable materials 80-100%.	(4)
14	Less than 5% of the bottom affected by scouring and deposition.	(6)
15	Abundant. Growth largely moss-like, dark green, perennial. In swift water too.	(1)
EXCELLENT COLUMN TOTAL →		GOOD COLUMN TOTAL →

Add values in each column and record in spaces below. Add column scores.

E. + C. + F. + P. = Total Reach Score.

Adjective ratings: < 38=Excellent, 39-76=Good, 77-114=Fair, 115+=Poor*

*(Scores above may be locally adjusted by Forest Hydrologist)

INVENTORY DATA: (observed or measured on this date)

Stream Width _____ ft. X Ave. Depth _____ ft. X Ave. Velocity _____ f/s = _____ Flow cfs
 Reach Stream _____ Turbidity _____ Stream Sinuosity _____
 Gradient _____ % Order _____ Level _____ Stage _____ Ratio _____
 Temperature _____ of _____ Air _____ Water _____, Others _____

Key #	FAIR	Stability Indicators by Classes	KOOR
1	Bank slope gradient 40-60%.	(6)	Bank slope gradient 60%+.
2	Moderate frequency & size, with some raw spots eroded by water during high flows.	(9)	Frequent or large, causing sediment nearly yearlong CR imminent danger of same.
3	Present, volume and size are both increasing.	(6)	Moderate to heavy amounts, predominantly larger sizes.
4	50-70% density. Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass.	(9)	< 50% density plus fewer species & less vigor indicate poor, discontinuous, and shallow root mass.
5	Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25.	(3)	Inadequate. Overbank flows common. W/D ratio > 25.
6	20 to 40%, with root in the 3-6" diameter class.	(6)	< 20% rock fragments of gravel sizes, 1-3" or less.
7	Moderately frequent, moderately unstable obstructions & deflectors move with high water causing bank cutting and filling of pools.	(6)	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.
8	Significant. Cuts 12"-24" high. Root mat overhangs and sloughing evident.	(12)	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.
9	Moderate deposition of new gravel & coarse sand on old and some new bars.	(12)	Extensive deposits of predominantly fine particles. Accelerated bar development.
10	Corners & edges well rounded in two dimensions.	(3)	Well rounded in all dimensions, surfaces smooth.
11	Mixture, 50-50% dull and bright, ± 1% ie. 35-65%.	(3)	Predominantly bright, 60%+, exposed or scoured surfaces.
12	Mostly a loose assortment with no apparent overlad.	(6)	No packing evident. Loose assortment, easily moved.
13	Moderate change in sizes. Stable materials 20-50%.	(12)	Marked distribution change. Stable materials 0-25%.
14	30-50% affected. Deposits & scour at obstructions, constrictions, and bends. Some filling of pools.	(18)	More than 50% of the bottom in a state of flux or change nearly yearlong.
15	Present but spotty, mostly in backwater areas. Seasonal bleeps make rocks slick.	(3)	Perennial types scarce or absent. Yellow-green, short term bleep may be present.
FAIR COLUMN TOTAL →			KOOR COLUMN TOTAL →
Size Composition of Bottom Materials (Total to 100%)			

1. Exposed bedrock, 3"-6"..... %

2. Large boulders, 3'+ Dia..... %

3. Small boulders, 1-3'..... %

4. Large rubble, 3"-12"..... %

5. Small rubble, 3"-6"..... %

6. Coarse gravel, 1"-3"..... %

7. Fine gravel, 0.1-1"..... %

8. Sand, silt, clay, muck,..... %

STREAM: Corner Canyon Creek

POINT	UPPER BANKS					LOWER BANKS					BOTTOM					REACH SCORE				
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION		CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION		ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION		WEIGHTED VALUE	RANKING
1	4	3	2	3	12	2	2	2	4	4	14	1	2	2	4	6	2	17	43	
2	4	3	4	3	14	1	2	2	4	4	13	1	3	2	4	6	2	18	45	
3	4	3	2	3	12	1	2	2	4	4	13	1	1	2	4	6	1	15	40	
4	6	3	4	3	16	1	2	2	4	4	13	1	1	2	4	6	1	15	44	
5	6	3	4	3	16	1	2	2	4	4	13	1	2	2	4	6	2	17	46	
6	2	3	2	6	13	1	4	2	4	4	15	1	1	4	4	6	1	17	45	
7	2	3	6	3	14	2	2	2	4	4	14	1	2	2	4	6	3	18	46	
8	4	3	4	6	17	1	2	2	4	4	13	1	1	4	4	6	2	18	48	
9	2	3	6	3	14	1	6	2	4	4	17	2	2	2	4	6	3	19	50	
10	6	9	4	6	25	1	6	4	8	4	23	1	2	2	8	6	3	22	70	
11	6	3	4	6	19	1	4	2	4	4	15	1	2	2	4	6	2	17	51	
12	4	6	2	6	18	1	4	2	8	4	19	1	1	2	4	6	2	16	53	
13	6	3	4	6	19	1	4	2	8	4	19	1	2	4	4	6	2	19	57	
14	4	3	4	6	17	1	4	4	8	4	21	2	2	2	4	6	2	18	56	
15					-						-							-	-	
16	6	3	2	3	14	1	4	2	4	4	15	2	1	4	4	6	2	19	48	
17	8	3	2	3	16	1	4	2	4	4	15	1	1	2	4	6	1	15	46	
18	8	3	4	3	18	1	4	2	8	4	19	1	1	2	4	6	1	15	52	
19	8	3	2	3	16	1	4	2	8	4	19	1	1	2	4	6	1	15	50	
20	4	3	2	3	12	1	2	2	4	4	13	1	1	2	4	6	1	15	40	
21	6	3	2	3	14	1	2	2	8	4	17	1	1	2	4	6	2	16	47	
22	8	3	2	9	22	1	2	2	4	4	13	1	2	2	4	6	2	17	52	
23	6	6	6	3	21	1	2	2	12	4	21	2	2	2	8	12	2	28	70	
24	8	3	2	9	22	1	2	2	4	4	13	1	2	2	4	6	2	17	52	
25	4	3	4	6	17	1	4	4	4	4	17	1	1	4	4	6	1	17	51	
26	4	3	6	6	19	1	4	2	4	4	15	1	2	2	4	6	2	17	51	
27	8	3	2	3	16	1	2	2	4	4	13	1	1	2	4	6	1	15	44	
28	8	6	4	9	27	1	2	2	4	4	13	1	4	2	8	6	1	22	62	

STREAM: *Corner Canyon Creek*

sheet 1 of 6

POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE		
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE	RANKING
1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	43	○
2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	45	○
3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	40	○
4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	44	○
5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	46	○
6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	45	○
7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	46	○
8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	48	○
9	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	50	○
10	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	70	○
11	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	51	○
12	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	53	○
13	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	57	○
14	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	56	○
15	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	○
16	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	48	○
17	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	46	○
18	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	52	○
19	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	50	○
20	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	40	○
21	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	47	○
22	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	52	○
23	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	70	○
24	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	52	○
25	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	51	○
26	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	51	○
27	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	44	○
28	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	62	○

SYMBOLS: EXCELLENT ○ FAIR ○
GOOD ○ POOR ○

STREAM: Corner Canyon Creek

POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE		
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE	RANKING
29	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	65	○
30	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	49	○
31	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	124	○
32	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	94	○
33	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	107	○
34	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	96	○
35	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	109	○
36	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	131	○
37	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	52	○
38	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	44	○
39	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	64	○
40	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	67	○
41	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	50	○
42	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	106	○
43	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	101	○
44	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	132	○
45	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	129	○
46	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	102	○
47	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	92	○
48	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	68	○
49	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	66	○
50	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
51	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
52	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
53	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
54	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
55	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
56	○	○	○	○	○	○	○	○	○	○	○	○	○	○			

SYMBOLS: EXCELLENT ○ FAIR ●
GOOD ○ POOR ●

STREAM: Corner Canyon Creek

sheet 3 of 6

POINT	UPPER BANKS					LOWER BANKS					BOTTOM					REACH SCORE				
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION		CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION		ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION		WEIGHTED VALUE	RANKING
57																				
58																				
59																				
60	6	6	4	3	19	1	2	2	8	4	17	2	1	2	4	6	2	17	53	
61	8	3	4	3	18	1	2	2	8	4	17	2	1	4	4	6	2	19	54	
62	4	3	4	6	17	1	2	2	4	4	13	2	1	2	4	6	2	17	47	
63	2	6	4	3	15	1	4	4	4	4	17	2	1	2	4	6	2	17	49	
64	2	3	4	3	12	1	4	4	8	4	21	2	3	4	8	6	2	25	58	
65	4	3	4	3	14	1	4	2	4	4	15	2	3	4	4	6	3	22	51	
66	8	9	4	6	27	1	2	4	4	8	19	2	3	4	8	12	2	31	77	
67	4	3	6	6	19	2	4	4	8	8	26	3	3	4	8	18	2	40	85	
68	6	9	4	3	22	1	4	2	4	4	15	2	3	4	8	12	2	31	68	
69	4	6	4	6	20	1	4	2	4	4	15	2	2	4	4	6	2	20	55	
70	6	3	2	3	14	1	2	2	4	4	13	1	1	2	4	6	2	16	43	
71	6	9	2	3	20	1	2	2	4	4	13	1	2	2	4	6	2	17	50	
72	6	3	2	3	14	1	2	2	4	4	13	1	2	2	4	6	2	17	44	
73	8	3	4	3	18	1	2	2	4	4	13	1	1	2	4	6	2	16	47	
74	8	3	2	6	19	1	2	2	4	4	13	1	3	2	4	6	2	18	50	
75	8	3	2	3	16	1	2	2	4	4	13	1	1	2	4	6	2	16	45	
76					-						-							-	-	
77	6	3	6	3	18	1	2	2	4	4	13	2	1	2	4	6	1	16	47	
78	4	6	2	6	18	1	2	4	4	8	19	2	2	2	8	12	3	29	66	
79	2	6	4	3	15	2	6	2	8	4	22	1	2	4	4	6	2	19	56	
80	2	3	4	6	15	2	2	2	4	4	14	2	3	4	4	12	3	28	57	
81					-						-							-	-	
82	2	6	2	9	19	1	8	4	12	12	37	2	3	8	12	18	3	46	102	
83	2	3	6	3	14	3	8	4	8	4	27	1	1	4	4	6	2	18	59	
84	2	3	4	3	12	2	8	4	4	4	22	1	1	6	4	6	1	19	53	

STREAM: *Corner Creek Canyon*

sheet 3 of 6

POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE		
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE	RANKING
57	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
58	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
59	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
60	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	53	○
61	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	54	○
62	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	47	○
63	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	49	○
64	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	58	○
65	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	51	○
66	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	77	○
67	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	85	○
68	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	68	○
69	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	55	○
70	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	43	○
71	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	50	○
72	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	44	○
73	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	47	○
74	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	50	○
75	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	45	○
76	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	○
77	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	47	○
78	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	66	○
79	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	56	○
80	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	57	○
81	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	○
82	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	102	○
83	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	59	○
84	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	53	○

SYMBOLS: EXCELLENT ○ FAIR ○
GOOD ○ POOR ○

STREAM: Corner Canyon Creek

POINT	UPPER BANKS					LOWER BANKS					BOTTOM					REACH SCORE				
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION		CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION		ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION		WEIGHTED VALUE	RANKING
85	8	6	6	3	23	2	2	4	12	4	24	2	2	4	4	6	2	20	67	
86	4	3	6	6	19	3	4	6	8	4	25	1	3	4	8	12	2	30	74	
87	8	6	4	6	24	1	4	6	8	4	23	1	3	4	8	6	2	24	71	
88	8	9	4	9	30	1	2	6	12	4	25	1	2	4	4	6	2	19	74	
89	6	6	4	6	22	1	4	4	8	4	21	1	2	2	4	6	2	17	60	
90	6	6	4	6	22	1	4	2	8	4	19	1	2	4	8	6	2	23	64	
91	2	3	4	6	15	2	8	4	12	12	38	2	2	6	12	12	3	37	90	
92	2	3	4	3	12	2	6	4	8	8	28	2	2	6	4	12	3	29	69	
93	4	3	2	9	18	2	6	6	16	8	38	2	3	8	12	12	3	40	96	
94	4	6	4	9	23	2	6	4	12	8	32	2	3	6	8	12	3	34	89	
95	4	6	6	6	22	2	6	4	12	8	32	2	3	6	8	12	2	33	87	
96	4	6	8	3	21	1	6	4	12	8	31	3	2	6	8	12	2	33	85	
97	4	3	4	3	14	2	6	4	8	8	28	3	2	4	8	12	3	32	74	
98	6	9	8	6	29	1	4	2	8	8	23	2	2	2	8	6	2	22	74	
99	8	9	8	3	28	3	6	6	12	12	39	3	3	4	12	18	3	43	110	
100	6	9	6	6	27	1	2	4	8	8	23	2	3	4	8	12	3	32	82	
101	8	9	6	6	29	1	6	6	12	12	37	2	3	6	12	18	3	44	110	
102	6	6	2	9	23	1	4	6	8	16	35	2	3	6	8	18	3	40	98	
103	8	9	6	9	32	1	4	4	8	8	25	2	3	6	8	12	3	34	91	
104	8	9	4	12	33	1	4	4	8	12	29	2	3	4	8	12	3	32	94	
105	6	9	4	9	28	1	4	4	16	12	37	3	3	6	8	18	3	41	106	
106	4	3	4	6	17	3	6	6	8	8	31	3	3	4	8	18	3	39	87	
107	6	6	2	6	20	1	6	4	4	8	23	2	2	4	8	6	3	25	68	
108	4	6	4	3	17	2	6	4	12	8	32	2	2	4	8	12	3	31	86	
109	2	3	2	9	16	2	8	6	8	16	40	2	3	8	12	18	3	46	102	
110	4	6	4	9	23	4	8	8	12	16	48	3	4	6	16	18	3	50	121	
111	2	3	4	6	15	3	8	4	12	8	35	3	3	6	8	12	3	35	85	
112	2	3	4	6	15	2	8	4	8	16	38	2	4	6	12	18	3	45	98	

STREAM: Corner Canyon Creek

POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE		
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE	RANKING
85	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	67	○
86	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	74	○
87	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	71	○
88	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	74	○
89	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	60	○
90	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	64	○
91	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	90	○
92	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	69	○
93	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	96	○
94	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	89	○
95	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	87	○
96	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	85	○
97	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	74	○
98	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	74	○
99	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	110	○
100	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	82	○
101	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	110	○
102	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	98	○
103	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	91	○
104	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	94	○
105	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	106	○
106	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	87	○
107	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	68	○
108	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	80	○
109	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	102	○
110	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	121	○
111	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	85	○
112	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	98	○

SYMBOLS: EXCELLENT ○ FAIR ○
 GOOD ○ POOR ○

STREAM: Corrner Canyon Creek

POINT	UPPER BANKS					LOWER BANKS					BOTTOM					REACH SCORE				
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION		CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION		ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION		WEIGHTED VALUE	RANKING
113	2	3	4	3	12	2	8	4	8	16	38	3	4	8	12	18	3	48	98	
114	2	3	2	3	10	2	6	2	8	4	22	2	3	4	8	6	3	26	58	
115	2	3	4	3	12	3	8	4	8	8	31	2	2	6	12	18	3	43	86	
116	4	6	4	6	20	2	8	6	12	8	36	2	3	6	12	18	3	44	100	
117	2	3	4	3	12	2	8	6	8	16	40	3	3	8	16	18	3	51	103	
118	4	6	2	9	21	2	8	6	12	16	44	4	4	8	16	18	3	53	118	
119	2	3	2	3	10	1	8	4	8	16	37	4	4	6	12	18	3	47	94	
120	2	3	4	6	15	2	8	6	12	16	44	3	3	8	12	18	3	47	106	
121	2	3	2	3	10	2	6	4	12	8	32	2	3	6	8	18	3	40	82	
122	4	6	4	9	23	1	8	6	12	12	39	3	4	8	16	18	3	52	114	
123					-						-							-	-	
124	2	3	2	9	16	2	8	6	12	12	40	3	3	8	12	18	3	47	103	
125	2	3	2	9	16	2	8	6	16	16	48	3	3	8	16	18	3	51	115	
126	2	3	2	12	19	2	8	6	16	12	44	4	4	8	16	18	3	53	116	
127	2	3	2	9	16	2	8	6	16	16	48	3	3	8	12	18	3	47	111	
128	2	3	2	12	19	2	8	6	8	16	40	3	3	8	12	18	3	47	106	
129	2	3	2	3	10	3	8	6	12	12	41	3	3	8	12	18	3	47	98	
130	8	9	4	9	30	1	8	6	16	12	43	3	3	6	12	18	3	45	118	
131	8	9	4	6	27	1	8	6	12	16	43	3	3	8	12	18	3	47	117	
132	8	12	8	6	34	1	8	8	16	16	49	4	3	8	16	18	3	52	135	
133	6	9	4	6	25	1	8	6	8	16	39	3	3	8	12	18	3	47	111	
134	8	9	4	3	24	1	8	6	12	16	43	3	3	8	16	18	3	51	118	
135	8	9	2	6	25	2	8	6	8	12	36	3	3	8	12	18	3	47	108	
136	4	9	4	6	23	2	8	6	8	16	40	3	3	8	16	18	3	51	114	
137	2	3	4	6	15	2	8	6	12	12	40	3	3	6	12	18	3	45	100	
138	8	12	4	9	33	1	8	6	12	16	43	3	3	8	12	18	3	47	123	
139	8	9	4	6	27	1	8	6	12	12	39	3	3	8	12	18	3	47	113	
140	8	9	2	9	28	1	8	4	12	12	37	3	3	8	12	18	3	47	112	

STREAM: Corney Canyon Creek

POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE		
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE	RANKING
113	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	98	○
114	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	58	○
115	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	86	○
116	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	100	○
117	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	103	○
118	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	118	○
119	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	94	○
120	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	106	○
121	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	82	○
122	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	114	○
123	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	○
124	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	103	○
125	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	115	○
126	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	116	○
127	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	111	○
128	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	106	○
129	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	98	○
130	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	118	○
131	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	117	○
132	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	135	○
133	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	111	○
134	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	118	○
135	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	168	○
136	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	114	○
137	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	100	○
138	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	123	○
139	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	113	○
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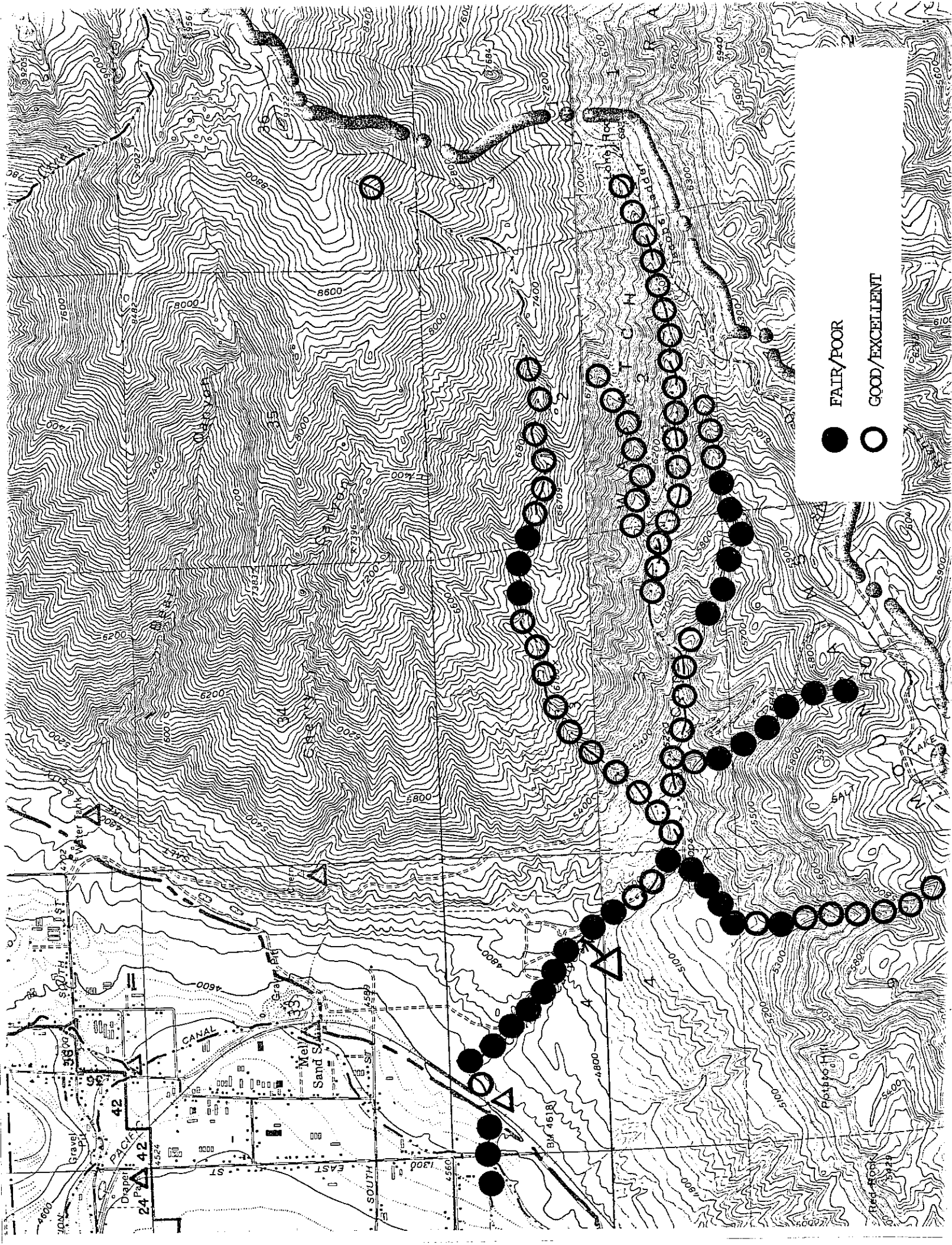
SYMBOLS: EXCELLENT ○ FAIR ○
 GOOD ○ POOR ○

STREAM: CORNER CANYON CREEK

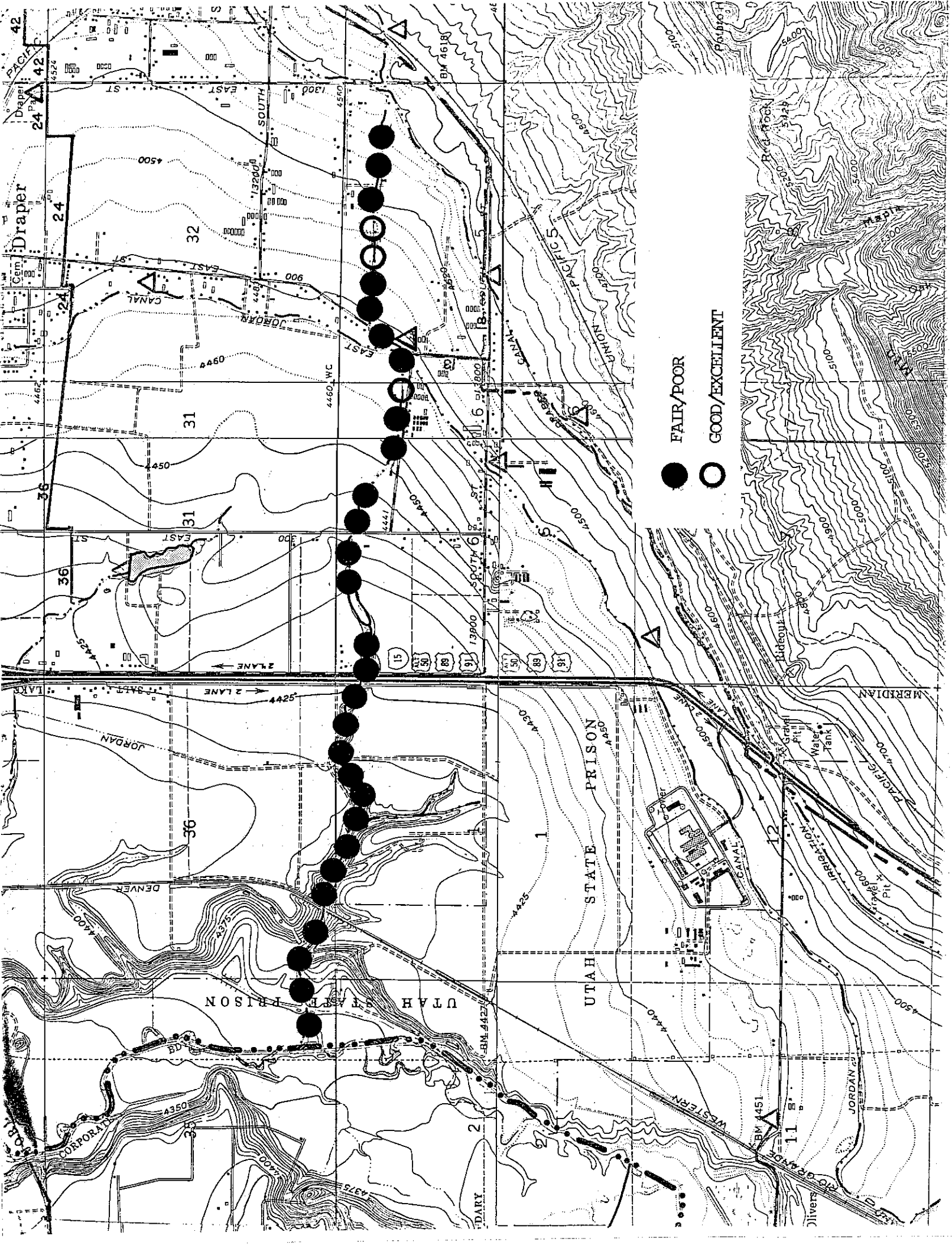
POINT	UPPER BANKS				LOWER BANKS					BOTTOM					REACH SCORE	
	LANDFORM SLOPE	MASS WASTING	DEBRIS JAM POTENTIAL	VEGETATIVE PROTECTION	CHANNEL CAPACITY	BANK ROCK CONTENT	FLOW DEFLECTORS	CUTTING	DEPOSITION	ROCK ANGULARITY	BRIGHTNESS	PARTICLE PACKING	DISTRIBUTION	SCOURING	AQUATIC VEGETATION	WEIGHTED VALUE
141	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
142	●	●	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
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	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

SYMBOLS: EXCELLENT ○ FAIR ●
 GOOD ○ POOR ●

101
122

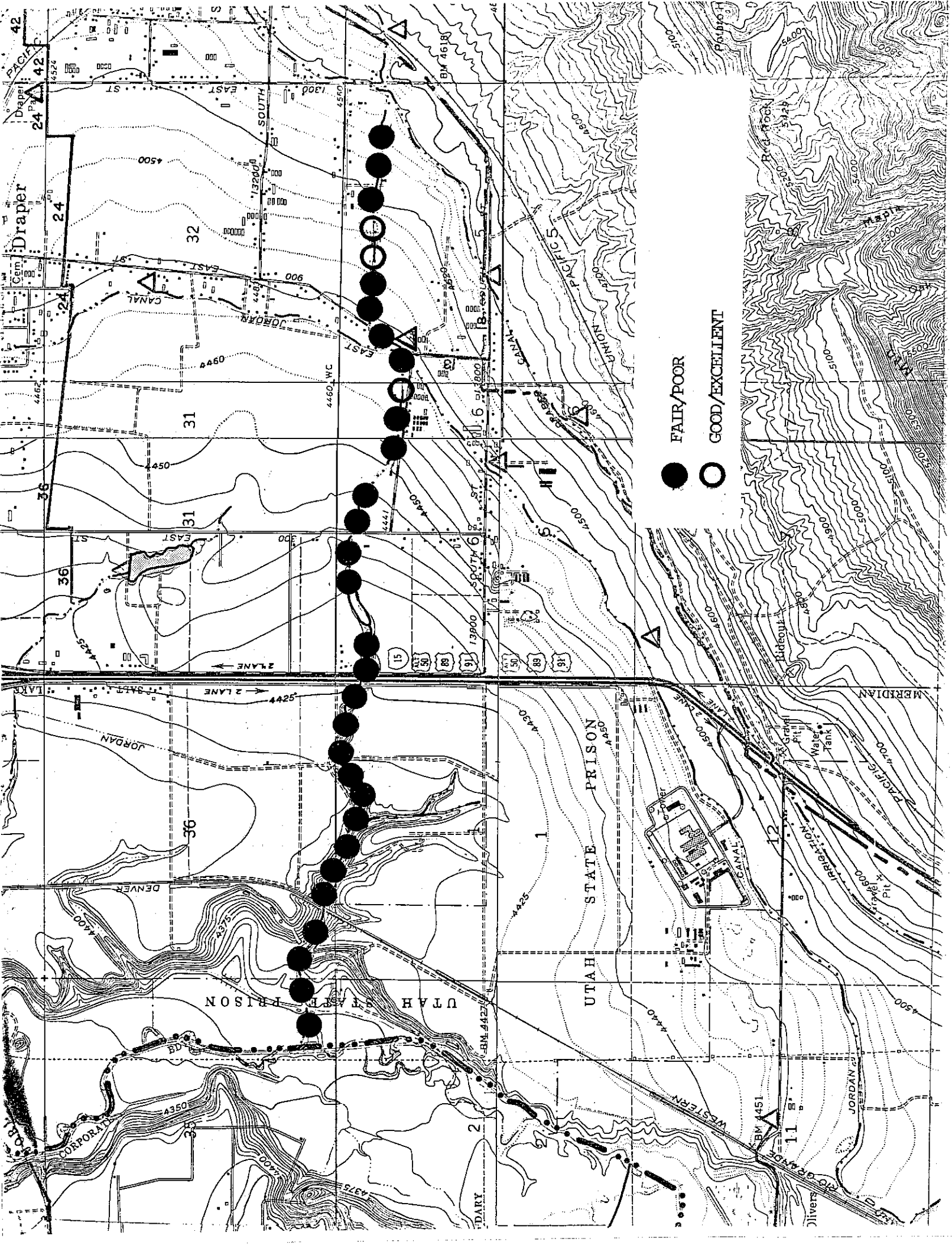


● FAIR/POOR
○ GOOD/EXCELLENT



FAIR/POOR

GOOD/EXCELLENT



3

6600

68

69

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75

77

6780 X

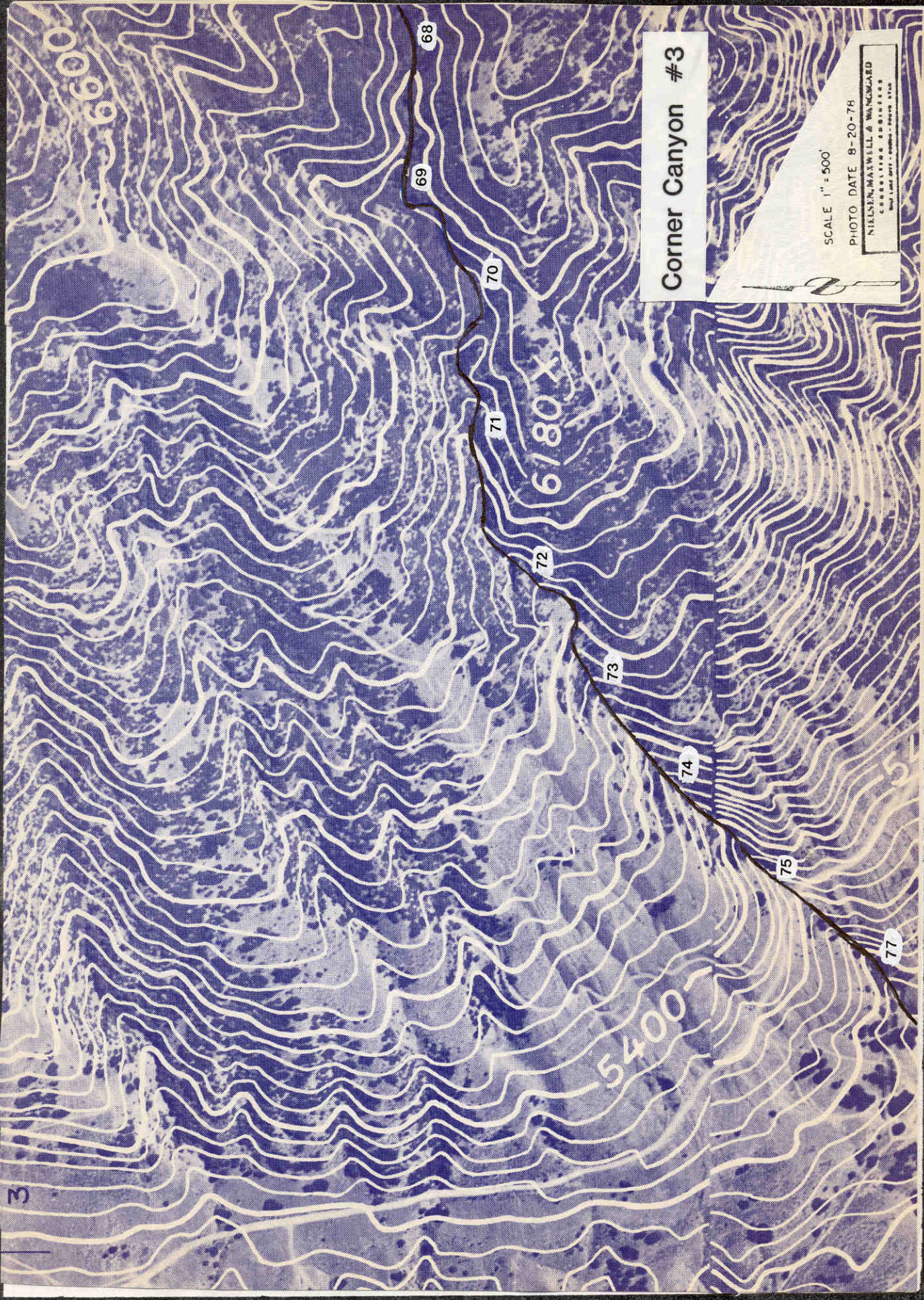
5400

Corner Canyon #3

SCALE 1" = 500'

PHOTO DATE 8-20-78

NIELSEN, MAXWELL & WILCOX
CONSULTING ENGINEERS
1001 10th St. - Denver - Phone 534-1100



4

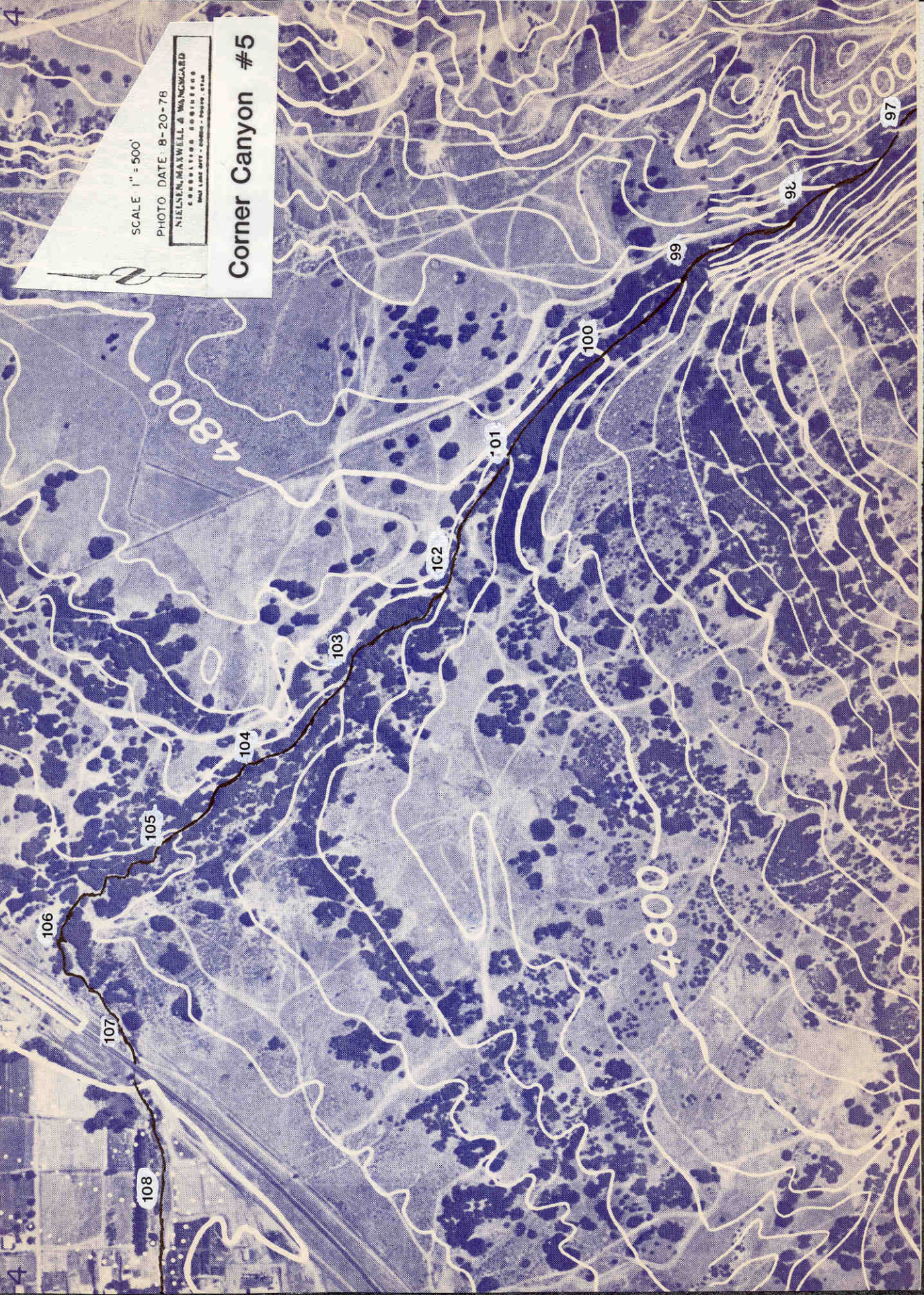
4

SCALE 1" = 500'

PHOTO DATE 8-20-78

NIELSEN, MAX WELLS & ASSOCIATES
CONSULTING ENGINEERS
2001 14TH ST. S.W. - SEASIDE, CALIF. 92138

Corner Canyon #5





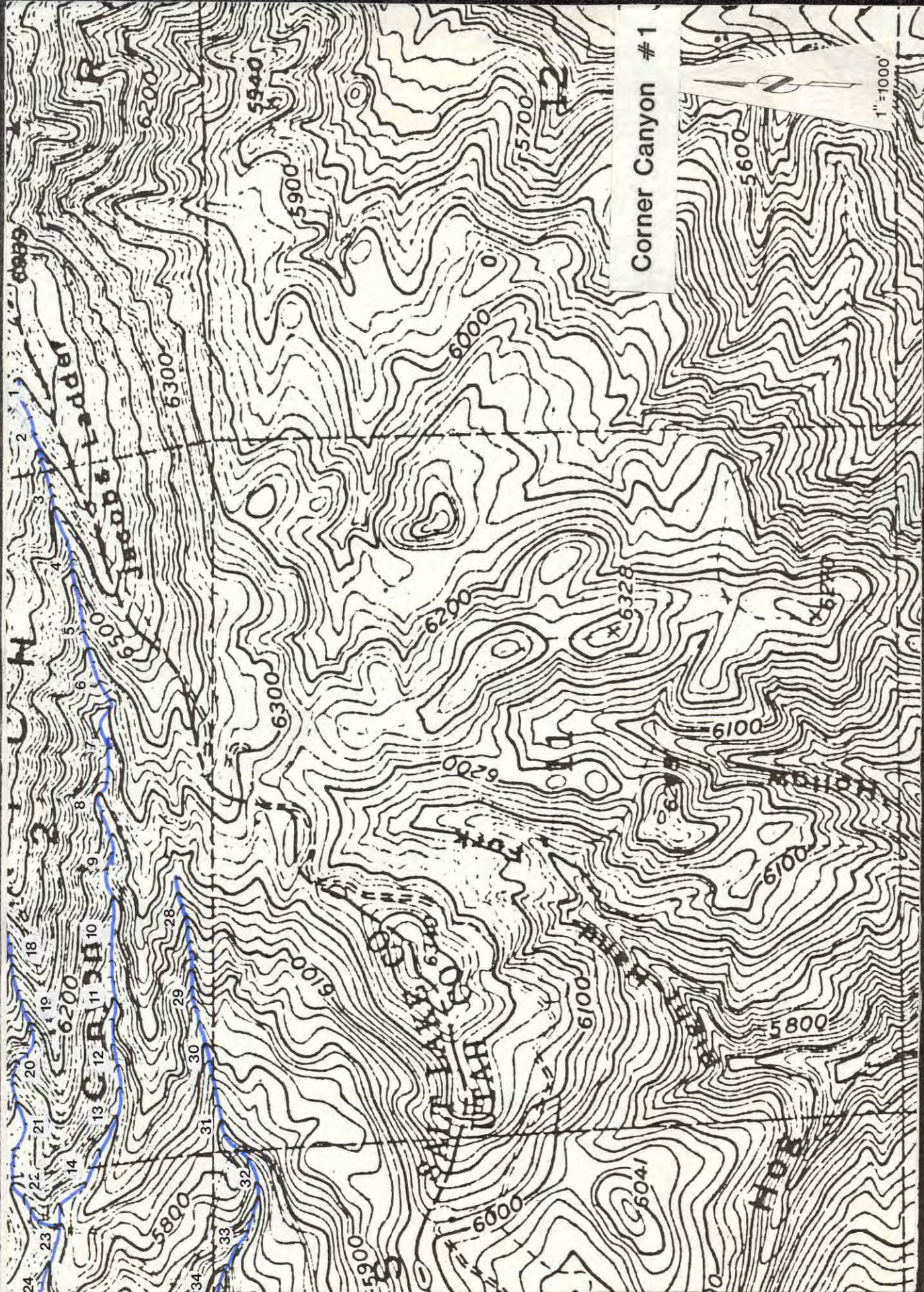
Corner Canyon #6

SCALE: 1" = 500'

PHOTO DATE: 8-20-78

NIELSEN, MAXWELL & WAINSCOBED
REGISTERED ENGINEERS
1001 EAST 5000 - CORNER CANYON, UT 84014





Corner Canyon #1



24
23
22
21
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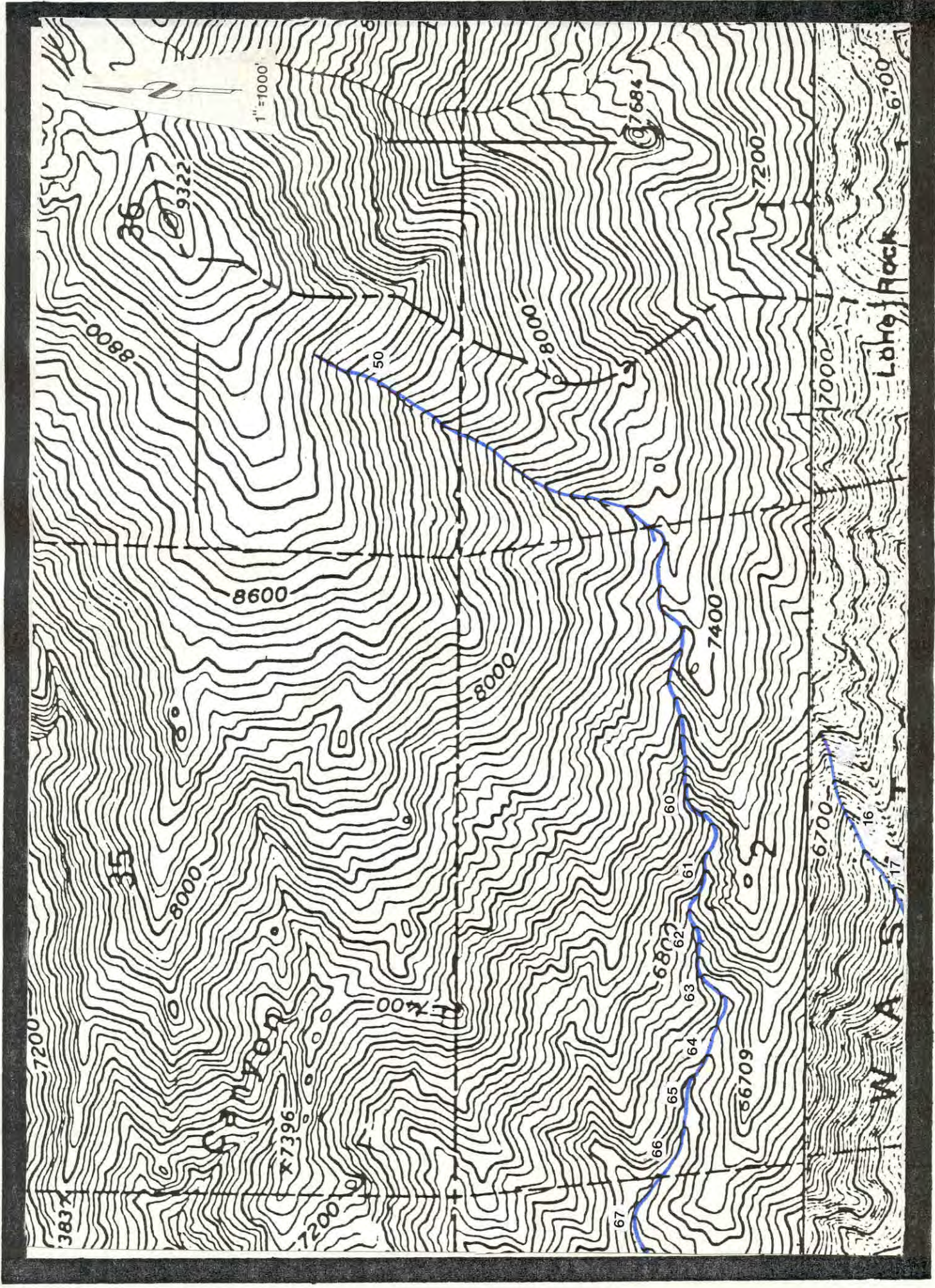
CANYON

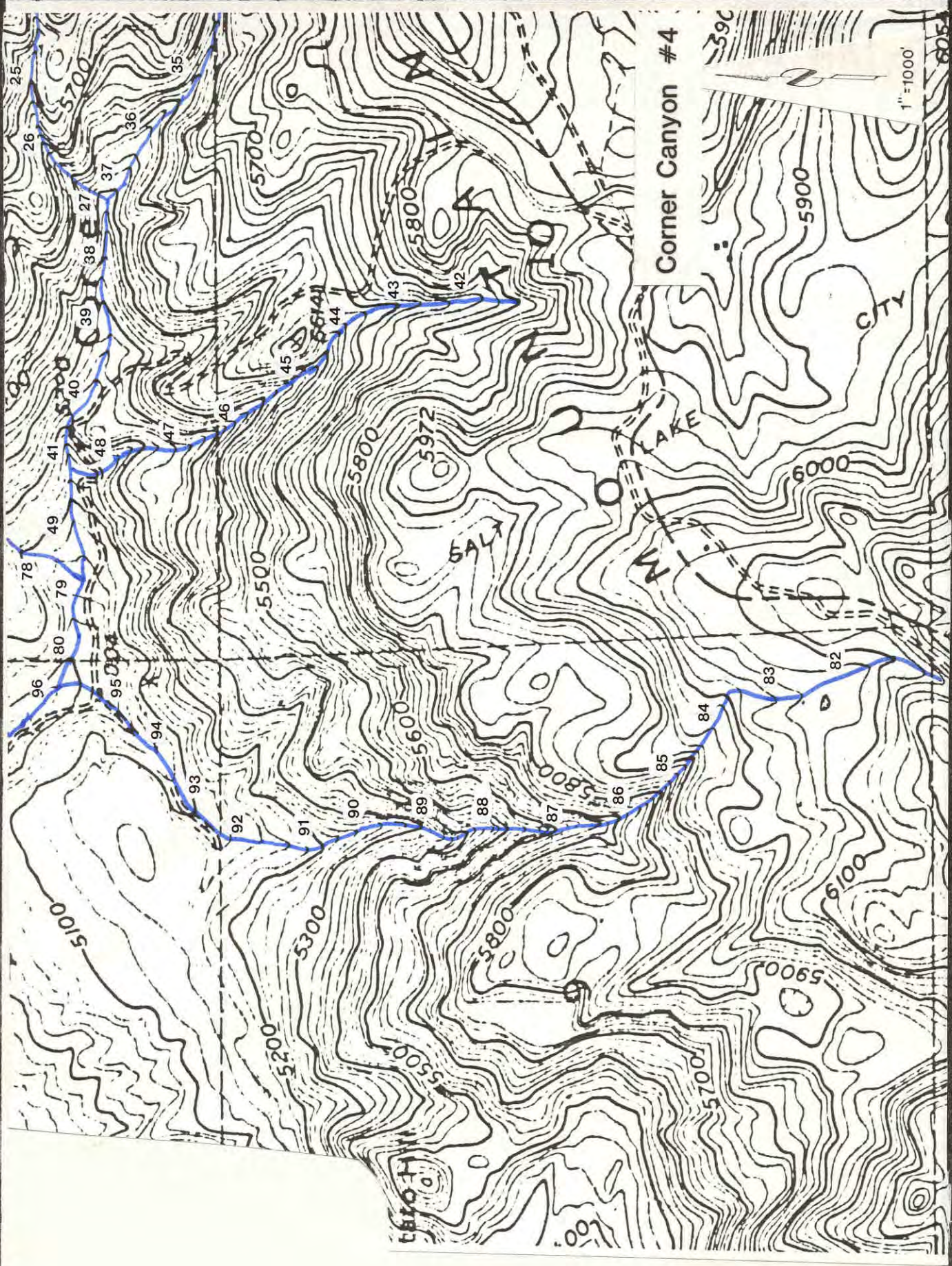
BEAR HOLE

HOB

HOLLOW

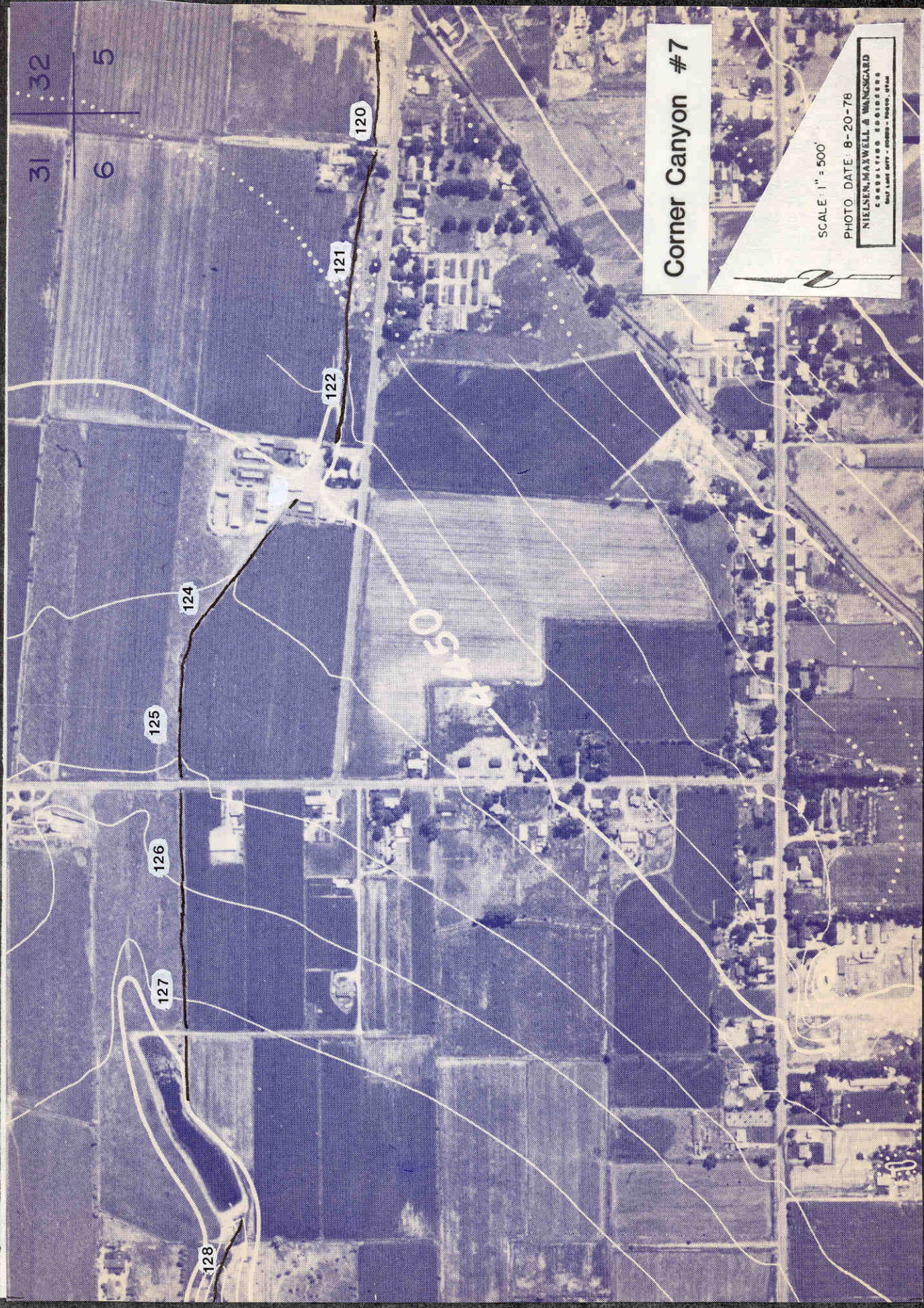
FORK





Corner Canyon #4

1" = 1000'



Corner Canyon #7

SCALE: 1" = 500'

PHOTO DATE: 8-20-78

NIelsen, Maxwell & WANGGARD
CONSULTING ENGINEERS
3417 LAKE DRIVE - BOZEMAN - MONTANA 59717





Corner Canyon #8

SCALE: 1" = 500'

PHOTO DATE: 8-20-78

NIELSEN, MAXWELL & WAINWRIGHT
CONSULTING ENGINEERS
2001 EAST 5000 S. SUITE 200, SALT LAKE CITY, UTAH





Corner Canyon #9

SCALE: 1" = 500'

PHOTO DATE: 8-20-78

NIELSEN, MAXWELL & WAINSCARD
CARTOGRAPHERS
1001 EAST 10TH - DENVER, COLORADO, 80202