Water Quality Management Plan for for the Lake Tahoe Region

Volume VII. Technical Appendix

TAHOE REGIONAL PLANNING AGENCY

November 30, 1988

WATER QUALITY MANAGEMENT PLAN
FOR THE
LAKE TAHOE REGION

VOLUME VII. TECHNICAL APPENDIX

Tahoe Regional Planning Agency

November 30, 1988

WATER QUALITY MANAGEMENT PLAN

FOR THE

LAKE TAHOE REGION

VOLUME VII

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Population Projections

Tahoe Regional Planning Agency

October 12, 1988

POPULATION PROJECTIONS

I. ABSTRACT

TRPA prepared population projections for the year 2005 for the assessment of environmental, social, and economic impacts in the final Water Quality Management (208) Plan amendments. TRPA made projections for El Dorado, Placer, Washoe, and Douglas counties, and for the five sewage collection and treatment districts.

II. CONCLUSIONS

The population projections are included in this appendix and in Tables 21 and 30 of the final 208 plan amendments, Volume I.

III. METHOD

Base data for making the projections came from TRPA's transportation planning data inventory, described in the Regional Transportation Plan, Lake Tahoe Basin (TRPA, 1988). TRPA calculated population projections based on the following data: total housing units, occupied hotel and motel units, occupied campground units, resident housing units, persons per resident housing unit, visitor housing units, total visitor units, persons per visitor unit, and overnight recreational PAOTs. TRPA calculated population projections for total population, resident population, and visitor population. Projections are for the average peak summer day, and do not include day use.

To make the projections, TRPA used the following assumptions regarding growth in residential units for 20 years:

- 400 additional hotel/motel units
- 1,600 additional multi-family units
- 6,114 PAOTs (persons-at-one-time) in overnight recreation sites, and
- 6,000 (Alternative 3 and 4) or 9,000 (Alternative 2) additional single-family homes.

Occupancy rates for all additional units were set at 100 percent. The distributions of additional single-family, hotel/motel, multi-family, and recreational overnight uses are set forth herein and in Table 22 of the final 208 amendments, Volume I.

Detailed population and other base data appear in the following tables:

- 1985 population estimates (baseline)
- 2005 population projections, 9000 additional single-family homes on land capability districts 4-7, no multi-family units
- 2005 population projections, 6000 additional single-family homes on land capability districts 4-7, no multi-family units
- 2005 population projections, 6000 additional single-family homes on land capability districts 1-3 in accordance with implementation of IPES, no multi-family units
- Distribution of multi-family units, by county, resident and visitor
- Distribution of additional hotel/motel units, by QRS traffic zone
- Distribution of additional multi-family units, by QRS traffic zone
- Distribution of additional residential units (single-family plus multi-family), by QRS traffic zone

Distribution of additional multi-family units, by county, resident and visitor.

County	Resident Units	Visitor Units
El Dorado	680	230
Placer	153	140
Douglas	73	25
Washoe	196	101
Total	1102	496

Distribution of additional hotel/motel units, by QRS traffic zone.

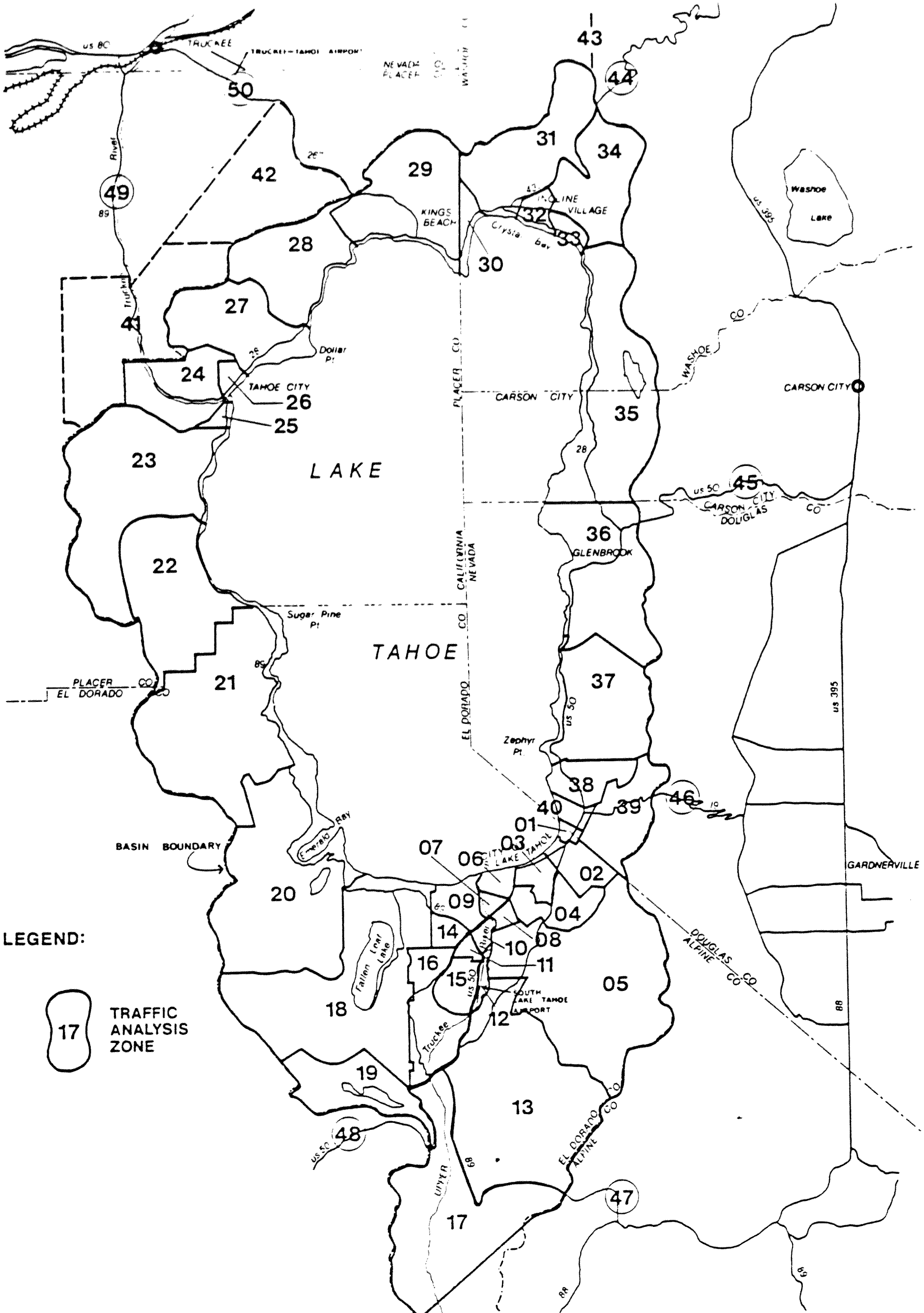
Units	QRS Zone	Zone Description
80	QRS 1	So. Stateline CP
80	QRS 3	So. Stateline CP
80	QRS 26	Tahoe City CP
60	QRS 29	Kings Beach/Tahoe Vista CP
20	QRS 30	North Stateline CP
80	QRS 33	Incline Village CP
400		Total

Distribution of additional multi-family units, by QRS traffic zone.

Units	QRS Zone	TRPA Plan Area
86	QRS 1	089B
282	QRS 2	089B, 092
42	QRS 3	093
175	QRS 8	105
131	QRS 9	110, 102, 111
54	QRS 10	110
55	QRS 11	110
55	QRS 14	110
21	QRS 18	129
5	QRS 21	153
43	QRS 26	002
2	QRS 27	004
217	QRS 29	028
8	QRS 31	036
22	QRS 32	046
108	QRS 33	046, 048
110	QRS 34	041, 044
8	QRS 35	055
154	QRS 38	072, 073, 074
21	QRS 40	077
1600		total

Distribution of additional residential units (single-family plus multi-family), by QRS traffic zone.

QRS Zone	Units
QRS 1	86
QRS 2	341
QRS 3	66
QRS 4	12
QRS 5	480
QRS 6	105
QRS 7	105
QRS 8	187
QRS 9	1255
QRS 10	66
QRS 11	67
QRS 13	550
QRS 14	102
QRS 15	12
QRS 16	398
QRS 17	246
QRS 18	33
QRS 21	216
QRS 22	246
QRS 23	258
QRS 25	(77)
QRS 26	55
QRS 27	84
QRS 28	410
QRS 29	416
QRS 31	535
QRS 32	256
QRS 33	167
QRS 34	450
QRS 35	8
QRS 36	23
QRS 37	129
QRS 38	189
QRS 39	105
QRS 40	21



TRAFFIC ANALYSIS ZONES

Tahoe Regional Planning Agency

1986 Regional Transportation Plan

0 1 2 4 8 miles

Alternative 1 (No Growth)

1985 SOCIO-ECONOMIC DATA

POLITICAL UNIT	TOTAL POPULATION	RESIDENT POPULATION	VISITOR POPULATION	OCCUPIED HOTEL AND MOTEL UNITS	OCCUPIED CAMPGROUND UNITS	TOTAL HOUSING UNITS	RESIDENT HOUSING UNITS BY INCOME CLASS LOW	MEDIUM	HIGH	VISITOR HOUSING UNITS BY INCOME CLASS LOW	MEDIUM	HIGH	RESIDENT HOUSING UNITS	PERSONS PER UNIT	VISITOR HOUSING UNITS	TOTAL VISITOR UNITS	PERSONS PER UNIT	NEW OVERNIGHT FAOTS
CITY OF SLT	35,215	18,925	16,289	4,857	112	10,133	3,945	3,344	951	303	973	617	8,240	2.30	1,893	6,862	2.37	0
EL DORADO	13,603	7,139	6,464	48	1,246	4,199	867	1,625	407	137	785	377	2,900	2.46	1,299	2,593	2.49	0
PLACER	20,418	8,631	11,786	1,000	123	7,059	1,351	1,447	667	314	1,257	2,023	3,465	2.49	3,594	4,717	2.50	0
DOUGLAS	11,156	5,084	6,073	1,759	184	3,147	673	1,108	541	72	480	272	2,322	2.19	825	2,768	2.19	0
CARSON CITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0
WASHOE	11,698	5,861	5,837	683	0	3,996	583	985	714	0	812	901	2,283	2.57	1,713	2,396	2.44	0
TOTAL	92,090	45,641	46,450	8,347	1,665	28,534	7,421	8,509	3,281	826	4,307	4,190	19,211	2.00	9,323	19,335	2.00	0

Alternative 2 (No Action)

2005 POPULATION WITH 9,000 NEW HOMES

Political unit	Occupied H/M	Occupied Camp	Total House Unit	Resident Houses	Visitor Houses	Total Visitor Unit	Resident Persons/Unit	Visitors Persons/Unit	Total Population	Res Population	Vis Population
El Dor	5,[illegible]5.00	2,001.00	20602	15842.5	4759.5	11,925.50	2.38	2.43	56,441.12	37,705.15	26,735.97
Placer	1,140.00	612.00	9149	4551.8	4597.2	6,349.20	2.49	2.56	27,206.93	11,333.93	15,873.00
Douglas	2,305.00	482.00	3227	2381.2	845.8	3,532.30	2.19	2.19	13,170.66	5,214.83	7,955.83
Washoe	753.00	0.00	4556	2652.6	1903.4	2,686.40	2.57	2.44	13,372.00	6,817.18	6,554.82
						0.00					
	9,293.00	3,095.00	37534	62962.1	12105.9	24,493.90			120,190.76	61,071.14	59,119.61

Alternative 3 (Hybrid Plan)

2005 POPULATION WITH 6,000 NEW HOMES

Political Unit	Occupied H/M	Occupied Camp	Total House Unit	Resident Houses	Visitor Houses	Total Visitor Unit	Resident Persons/Unit	Visitors Persons/Unit	Total Population	Res Population	Vis Population
El Dor	5,065.00	2,001.00	18352	14155	4197	11,263.00	2.38	2.43	61,057.99	33,688.90	27,369.09
Placer	1,140.00	612.00	8399	4161.8	4237.2	5,989.20	2.49	2.50	25,335.88	10,362.88	14,973.00
Douglas	2,305.00	482.00	3227	2381.2	845.8	3,632.80	2.19	2.19	13,170.66	5,214.83	7,955.83
Washoe	783.00	0.00	4556	2652.6	1903.4	2,686.40	2.57	2.44	13,372.00	6,817.18	6,554.82
						0.00					
	9,293.00	3,095.00	34534	57884.6	11183.4	23,571.40			112,936.53	56,083.79	56,852.74

Alternative 4 (Proposed Amendments)

2005 POPULATION WITH 6,000 NEW HOMES

Political Unit	Occupied H/M	Occupied Camp	Total House Unit	Resident Houses	Visitor Houses	Total Visitor Unit	Resident Persons/Unit	Visitors Persons/Unit	Total Population	Res Population	Vis Population
El Dor	5,065.00	2,001.00	18412	14200	4212	11,278.00	2.38	2.43	61,201.54	33,796.00	27,405.54
Placer	1,140.00	512.00	8089	4000.6	4088.4	5,840.40	2.49	2.50	24,562.49	9,961.49	14,601.00
Douglas	2,305.00	482.00	3422	2525.5	896.5	3,683.50	2.19	2.19	13,597.71	5,530.85	8,066.87
Washoe	793.00	0.00	4611	2688.9	1922.1	2,705.10	2.57	2.44	13,510.92	6,910.47	6,600.44
						0.00					
	9,293.00	3,095.00	34534	57949	11119	23,507.00			112,872.66	56,198.81	56,673.85

APPENDIX B

Land Coverage and SEZ Disturbance Estimates

Tahoe Regional Planning Agency

October 12, 1988

LAND COVERAGE AND SEZ DISTURBANCE ESTIMATES

I. ABSTRACT

TRPA estimated additional land coverage and disturbance associated with four alternative scenarios for the assessment of environmental, social, and economic impacts of the final Water Quality Management (208) Plan for the Tahoe Region. The four alternatives were No Growth, No Action, Hybrid Plan, and proposed amendments. TRPA estimated additional land coverage and SEZ disturbance in the following categories: single-family houses; commercial, tourist, and multi-family development; public service (non-transportation); public service (transportation); recreation; and excess coverage mitigation. TRPA projected land coverage in land capability districts 1 through 3 and 4 through 7.

II. CONCLUSIONS

The estimates of additional land coverage for the four alternatives appear in the final 208 amendments, Volume I, Table 23. The estimates of additional SEZ disturbance appear in the final 208 amendments, Volume I, Table 27.

III. METHOD

A. Land Coverage

Single-Family Houses. TRPA assumed additional land coverage for new single-family houses was 2,500 sq. ft. for all alternatives. Numbers of additional single-family houses were 9,000 (Alternative 2, No Action) and 6,000 (Alternatives 3, Hybrid Plan, and 4, proposed 208 amendments).

Commercial, Multi-Family, and Tourist. TRPA estimated additional coverage in these categories using the same assumptions for all alternatives except No-Growth. For commercial coverage, TRPA assumed there would be 850,000 sq. ft. of additional commercial floor area over the next 20 years. Assuming a land coverage to floor area ratio of 2:1 results in 1,700,000 sq. ft. of land coverage or 39 acres. Assuming a land coverage to floor area ratio of 1.75:1 results in 1,487,500 sq. ft. of land coverage or 34 acres. CTRPA studies in the early 1980's indicated that 2:1 was an accurate coverage to floor area ratio, but as a result of the community planning process, the ratio in the future may be lower.

For multi-family coverage, TRPA assumed a land coverage of 1000 sq. ft. per unit for 1600 units, resulting in 1.6 million sq. ft. or 37 acres.

For tourist coverage, TRPA assumed a land coverage of 1000 sq. ft. per unit. If all the projected 400 units result in additional land coverage, the result is 400,000 sq. ft. or 9 acres. If one-half the projected 400 units result in additional land coverage, the result is 200,000 sq. ft. or about 5 acres. If one-quarter of the projected 400 units result in additional land coverage, the result is 100,000 sq. ft., or about 2 acres.

Given the range within the various estimates and assumptions, total additional land coverage for commercial, tourist, and multi-family development was estimated to be between 73 and 85 acres. For convenience, TRPA used an estimate of 80 acres in Table 23, Volume I. Under Alternative 4, TRPA assumed that 48 acres of the 80 acres would be placed in community plan areas and other areas as a result of transfers of existing land coverage, resulting in restoration of 48 acres of land coverage elsewhere in the Region.

Public Service (Non-Transportation). Public service entities have submitted information to TRPA for the preparation of 5-year lists of public service facilities pursuant to Chapter 33 of the TRPA Code of Ordinances. Based on a review of those submissions, TRPA assumed that public service projects would result in 120 projects over 20 years, with an average land coverage of 1/4 acre, or 30 acres of land coveage. TRPA assumed that approximately 18 acres of the additional land coverage would be in land capability districts 4 through 7, and 12 acres would be in land capability districts 1 through 3. The projections of additional land coverage in this category were the same for alternatives 2 (No-Action), 3 (Hybrid Plan), and 4 (proposed amendments). However, under alternatives 3 and 4, TRPA assumed that the 12 acres of additional land coverage in capability districts 1, 2 and 3 would result in 1.5:1 offsetting restoration, or restoration of 18 acres of existing land coverage in capability districts 1, 2 and 3.

Public Service (Transportation). Additional land coverage estimates for transportation facilities over the next 20 years are set forth in Table 3, Final EIR/EIS, Regional Transportation Plan: Lake Tahoe Basin. These projections of additional land coverage were applied to alternatives 3 (Hybrid Plan) and 4 (proposed amendments). TRPA assumed that additional land coverage in capability districts 4, 5, 6 and 7 would occur by transfers of existing coverage, since most linear public facilities are already over-covered, and that additional land coverage in capability districts 1, 2 and 3 would involve 1.5:1 offsetting restoration. Alternatives 1 (No Growth) and 2 (No Action) do not contain a transportation element, and no additional land coverage was assigned.

Recreation. Public and private recreation providers have submitted information to TRPA for the preparation of 5-year recreation project lists pursuant to Chapter 33 of the TRPA Code of Ordinances. Based on a review of these submissions, TRPA estimated the additional land coverage from recreation projects for alternatives 2, 3 and 4 over 20 years as follows:

	Number	Acres (each)		Acres (total)	
Project Type	Projects	LC 1-3	LC 4-7	LC 1-3	LC 4-7
visitor ctr	8		.25		2
intens. beach	15		.25		4
boat ramp	8	.25		2	
overnight	8		.50		4
day use	30		.20		6
recr. ctr	4		.25		2
part. sport	6		.25		1.5
XC ski	10		.25		2.5
golf course	2		.50		1
ORV course	4		.25		1
trails, etc.	32	.25		8	
undev. cmpgrd.	8	.25		2	
Total				12	24

TRPA assumed that the 12 acres of additional land coverage in capability districts 1, 2 and 3 would involve offsetting restoration at the rate of 1.5:1 for alternatives 3 and 4, for 18 acres of restoration in capability districts 1, 2 and 3.

Excess Coverage Mitigation. Based on projected levels of permit activity, TRPA has estimated that the coverage mitigation program would restore about 3 acres of coverage per year. Over 20 years, the program would restore about 60 acres of land coverage. For convenience, TRPA assumed that this land coverage would be restored in capability districts 1, 2 and 3. Alternative 2 does not include the excess coverage mitigation program.

B. SEZ DISTURBANCE

Of the 12 acres of additional land coverage in capability districts 1, 2 and 3 for public service (non-transportation) and the 12 acres of additional land coverage in capability districts 1, 2 and 3 for recreation, TRPA estimated about 10 acres would involve land coverage or disturbance in SEZs. This estimate applies to alternatives 2 (No-Action), 3 (Hybrid Plan), and 4 (proposed amendments). Of the 29 acres of additional land coverage in capability districts 1, 2 and 3 for public service (transportation), 19 acres would involve land coverage or disturbance in SEZs, according to Table 3, Final EIR/EIS, Regional Transportation Plan, Lake Tahoe Basin (TRPA, 1988). This estimate (rounded upward to 20 acres) applies to alternatives 3 (Hybrid Plan) and 4 (proposed amendments), but not alternative 2 (No Action), since alternative 2 does not contain a transportation element. As set forth on p. 236, Volume I, of the final 208 plan, TRPA estimated that alternative 4 would also include about 5 acres of additional disturbance in SEZs due to access across SEZs to otherwise buildable sites.

For alternatives 3 and 4, all disturbance in SEZs was presumed to involve offsetting restoration at a rate of 1.5:1.

APPENDIX C

Classification of Watersheds in the Tahoe Region Relating to Their Priority for Watershed Improvement Projects

Tahoe Regional Planning Agency

October 12, 1988

Abstract

The watersheds of the Tahoe Region were rated for their relative ability to deliver sediments and nutrients to Lake Tahoe. The criteria used were the:

1. geomorphic, precipitation, and stream flow characteristics,
2. nutrient and sediment yields, and
3. coverage for each watershed.

The watersheds were grouped into three categories that were used for prioritizing capital improvement and stream environment zone restoration projects. Of the 64 watersheds classified, 22 were in the high priority category, 20 were in the medium priority category, and 22 were in the low priority category.

Introduction

As part of the Individual Parcel Evaluation System (IPES), the IPES technical committee developed a watershed condition classification system to rank each watershed for its relative ability to deliver nutrients and sediments to Lake Tahoe. The committee was composed of experts in the fields of soil science, hydrology, engineering, and planning. They felt that parcels located in watersheds that had a low ability to deliver nutrients and sediments to the Lake should receive higher IPES ratings than those in watersheds with higher sediment and nutrient delivery.

Methods and Materials

Each watershed in the Region was classified using the following criteria:

1. Geomorphic, precipitation, and stream flow characteristics:
   a. mean slope of the drainage basin
   b. percent of drainage basin area with slopes greater than 30%
   c. percent of drainage basin with bare rock exposed,
   d. mean channel slopes
   e. mean annual stream flow.

2. Nutrients and sediments in stream flow, expressed in production per unit area of drainage basin, e.g., pounds of nitrate-nitrogen per square mile of drainage basin:
   a. nitrate-nitrogen
   b. dissolved organic nitrogen
   c. dissolved orthophosphate
   d. suspended sediments.

3. Existing land coverage compared to allowable land coverage, as defined by the Bailey Land Capability System

Data for criteria 1 were taken from the study by Brown and Skau (unpublished manuscript) Forested Watersheds of the East Central Sierra Nevada - Studies of the Quality of Natural Waters, in press, University of Nevada at Reno. Data for criteria 2 were derived from Brown and Skau (above), Tahoe Research Group data, and data collected by the U.S. Forest Service. For criteria 3, TRPA's data system was used.

Point values were assigned to each criteria. For the geomorphic characteristics, available points ranged between 0-28; for the water quality data, available points ranged between 0-35; for the coverage criteria, available points ranged between 0-7 points for a total potential of 70 points. In IPES, the higher the point value, the lower the potential for nutrient and sediment delivery.

Results

Table 1 summarizes the results of the IPES technical committee's classifications. TRPA used this system to categorize capital improvement and stream environment zone restoration projects. TRPA grouped the watersheds into three categories: 1 - high priority, 2 - medium priority, and 3 - low priority. The high priority category represents the watersheds with the greatest relative potential for sediment and nutrient delivery to Lake Tahoe and includes those watersheds with point values ranging from 0 to 30. The medium priority watersheds were those with point values from 31 to 46 and the low priority watersheds representing those with the lowest relative potential for nutrient and sediment delivery, from 47 to 70 points. There were 22 watersheds in the high priority category, 20 in the medium priority category, and 22 in the low priority category.

Conclusions

This system provides a mechanism for addressing water quality improvement needs in a cost-effective manner. By focusing efforts on those watersheds with the highest potential for sediment and nutrient delivery, reductions in overall loading to Lake Tahoe and the tributary streams should be realized sooner.

Table 1 Condition Classing of the Watersheds

Watershed No.	Name	Pts.	Watershed No.	Name	Pts.
1	Tahoe State Park	54	36	Zephyr Creek	33
2	Burton Creek	70	37	South Zephyr Creek	61
3	Barton Creek	67	38	McFaul Creek	30
4	Lake Forest Creek	58	39	Burke Creek	63
5	Dollar Creek	67	40	Edgewood Creek	49
6	Cedar Flats	58	41	Bijou Park	40
7	Watson	53	42	Bijou Creek	40
8	Carnelian Bay Creek	61	43	Trout Creek	36
9	Carnelian Canyon	61	44	Upper Truckee River	36
10	Tahoe Vista	54	45	Camp Richardson	54
11	Griff Creek	44	46	Taylor Creek	47
12	Kings Beach	54	47	Tallac Creek	22
13	East Stateline Point	26	48	Cascade Creek	30
14	First Creek	22	49	Eagle Creek	7
15	Second Creek	0	50	Bliss State park	44
16	Burnt Cedar Creek	54	51	Rubicon Creek	33
17	Wood Creek	18	52	Paradise Flat	30
18	Third Creek	30	53	Lonely Gulch Creek	30
19	Incline Creek	18	54	Sierra Creek	26
20	Mill Creek	26	55	Meeks	25
21	Tunnel Creek	33	56	General Creek	39
22	Unnamed	33	57	McKinney Creek	18
23	Sand harbor	33	58	Quail Lake Creek	44
24	Marlette Creek	30	59	Homewood Creek	0
25	Secret Harbor Creek	33	60	Madden Creek	14
26	Bliss Creek	44	61	Eagle Rock	47
27	Deadman Point	44	62	Blackwood Creek	7
28	Slaughter House	44	63	Ward Creek	21
29	Glenbrook Creek	53	64	Truckee River	44
30	North Logan House Creek	58			
31	Logan House Creek	67			
32	Cave Rock	26			
33	Lincoln Creek	33			
34	Skyland	54			
35	North Zephyr Creek	33			

APPENDIX D

Application of Nutrient and Sediment Load
Estimating Procedures from the
EIS for the Adoption of a Regional Plan for the
Lake Tahoe Basin (TRPA, 1983)

Tahoe Regional Planning Agency

October 12, 1988

Application of Nutrient and Sediment Load
Estimating Procedures from the
EIS for the Adoption of a Regional Plan for the
Lake Tahoe Basin (TRPA, 1983)

I. ABSTRACT

In the EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983, "83 EIS"), TRPA set forth a procedure or model for estimating annual loads to Lake Tahoe of dissolved inorganic nitrogen (DIN) from large sub-regions of the Tahoe Region known as watershed associations (see map, attached). The '83 EIS estimated DIN loads from the existing (1981) situation and three alternatives: maximum regulation, development with mitigation, and redirection of development.

In the assessment of environmental, social and economic impacts in the final water quality management (208) plan amendments (TRPA, 1988), the estimated loads from the 1983 EIS were used to help describe the water quality impacts of the four alternatives: No-Growth, No Action, Hybrid Plan, and proposed amendments.

II. CONCLUSIONS

The three alternatives in the '83 EIS included a range of 8,268 to 12,174 additional single-family dwellings. Predicted annual DIN loads to Lake Tahoe after application of BMPs, restoration of disturbed areas, SEZ restoration, and fertilizer management ranged from 4.43 to 4.60 metric tons/year, or a reduction of 54 to 56 percent. Given that the model has a wide range of possible error inherent in its application, the main conclusion TRPA drew from these results was that annual DIN loads were more sensitive to implementation of BMPs, SEZ restoration, and fertilizer management than to minor differences in scenarios regarding additional development in the Region. In other words, the backlog of existing water quality problems is larger than the increment that will be added by the projected amounts of additional development.

In the environmental documentation of the proposed 208 amendments, TRPA extrapolated from the results in the '83 EIS to predict annual DIN loads to Lake Tahoe for four additional scenarios: No Growth (no additional single-family homes), No Action (9000 additional single family homes), Hybrid Plan (6000 additional single-family homes), and the proposed amendments (6000 additional single-family homes). The No Action plan did not include an SEZ restoration program; the other alternatives did. The predicted reductions in annual DIN loads to Lake Tahoe were are follows:

No Growth	59 percent
No Action	44 percent
Hybrid Plan	57 percent
Proposed Amendments	57 percent

The No Action alternative is estimated to result in lower reductions in annual DIN loads primarily because it does not contain an SEZ restoration program, as the other alternatives do. If the No Action alternative included the same SEZ restoration program as the other alternatives the range in predicted reductions would be 54 percent (No Action) to 59 percent (No Growth), again demonstrating the importance of elimination of the existing backlog of water quality problems in the Region.

III. METHODS

In 1982-83, TRPA developed a data base for the 107 large and small watersheds of the Tahoe Region (Jorgensen et al., USGS, 1978). The data base included information on acres of watershed within the various land capability districts of the Bailey Report (1974), acres of land coverage which the Bailey coefficients would allow in each watershed, acres of both "hard" and "soft" existing land coverage in each watershed, and numbers of vacant parcels within each watershed according to their Bailey land capability. "Hard" coverage associated with structures and pavement is referred to, herein, as "coverage." "Soft" coverage associated with compacted and denuded areas without structures or pavement is referred to, herein, as "disturbance."

To describe the extent to which the environmental carrying capacity of each watershed (represented by its allowed land coverage) had been utilized by development existing in the Tahoe Region as of 1981, TRPA used the variables "weighted coverage" (existing coverage divided by allowed coverage) and "weighted coverage plus disturbance" (existing coverage plus disturbance divided by allowed coverage).

For watersheds for which TRPA had reliable data on tributary water quality, TRPA investigated relationships between water quality and both weighted coverage and weighted coverage plus disturbance. A number of possible relationships between suspended sediment and inorganic nutrients and these variables were investigated through regression analysis. Although all the correlations were fairly weak, TRPA selected the two best relationships for use in the '83 EIS to describe: (1) the approximate relationship between mean suspended sediment concentrations in Tahoe Basin streams v. weighted coverage and (2) the approximate relationship between mean nitrate concentration in Tahoe Basin streams v. weighted coverage plus disturbance. These relationships were set forth Figure 6 of the '83 EIS, attached. (Complete documentation of this modeling process is set forth in the TRPA report to the Advisory Planning Commission entitled EIS Issues, May 11, 1983, Attachment 1, Water Quality Modeling.)

TRPA then estimated the annual average tributary flow to Lake Tahoe from the eight watershed associations (described in the '83 EIS) and, using relationship (2), above, predicted the annual average DIN load to Lake Tahoe by multiplying the predicted mean concentrations for each watershed association by the predicted tributary flow. Relationship (2), above, was found to overpredict the annual average DIN load to Lake Tahoe. TRPA had estimated the annual average DIN load at 10 metric tons/year, based on actual stream data for 44 percent of the annual inflow to Lake Tahoe, in the Study Report for the Establishment of Environmental Threshold Carrying Capacities (TRPA, 1982). Using relationship (2), above, TRPA predicted the annual average DIN load at 18 metric tons/year. To make the model consistent with the observed data, TRPA adjusted the slope of the line predicting mean nitrate concentrations downward until the model predicted an annual load of 10 metric tons/year. The resulting relationship is set forth in Figure 9 of the '83 EIS and is attached.

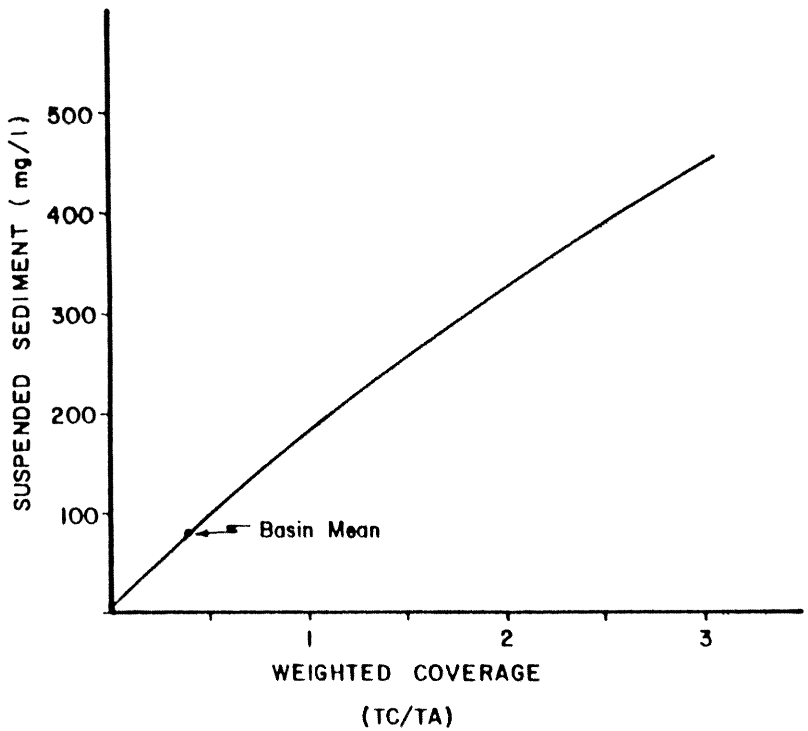
Lacking a source of reliable information on the effectiveness of best management practices at reducing DIN loads from the watershed, TRPA discussed the likely range of effectiveness with engineers who had worked on remedial projects inside and outside the Tahoe Region, and concluded that, provided the carrying capacity of the watershed was not exceeded, application of BMPs could reduce the increases in mean DIN concentrations resulting from development by 50 percent. Once the carrying capacity of the watershed was exceeded (i.e., weighted coverage plus disturbance was greater than 1), TRPA concluded that application of BMPs could only keep pace with increases in mean DIN concentrations resulting from development. The resulting relationship between weighted coverage and disturbance and mean DIN concentrations, with full application of BMPs, is set forth in Figure 9 of the 83 EIS, attached, in the line labelled "full BMPs."

By applying the "full BMP" relationship to data for each watershed association representing the different levels of development (maximum regulation, development with mitigation, and redirection of development), TRPA developed the estimates of DIN loads by watershed association in Table 22 of the '83 EIS, attached. Lacking reliable information on the ability of SEZ restoration and fertilizer management to further reduce DIN loads from the watershed, TRPA estimated that SEZ restoration and fertilizer management could reduce existing (1981) loads by 10 percent, or 1 metric ton/year, as shown in Table 22.

As one would expect, annual DIN loads to Lake Tahoe were largely a function of tributary stream flow, which in turn is a function of size of watershed and amount of annual precipitation received. Watershed association 8, covering the south shore from the stateline to Fallen Leaf Lake, accounted for about 46 percent of the annual DIN load to Lake Tahoe. This watershed association contains the two largest tributaries of Lake Tahoe, Trout Creek and the Upper Truckee River. The west shore association, including Ward and Blackwood Creeks, contributed about 13 percent of the load, and the Incline Association, covering all of Incline Village, contributed about 10 percent of the load.

Attached are Figures 6 and 9 and Table 22 from the '83 EIS, and data on allowed coverage, coverage, disturbance, mean DIN concentrations, tributary flow from the watershed associations, and estimated annual DIN load for the three alternatives described in Table 22.

APPROXIMATE RELATIONSHIP:
MEAN SUSPENDED SEDIMENT CONCENTRATION
IN TAHOE BASIN STREAMS
V.
WEIGHTED COVERAGE



Regression Equation: $y \cong 171\ x^{0.87}$

y = suspended sediment (mg/l)

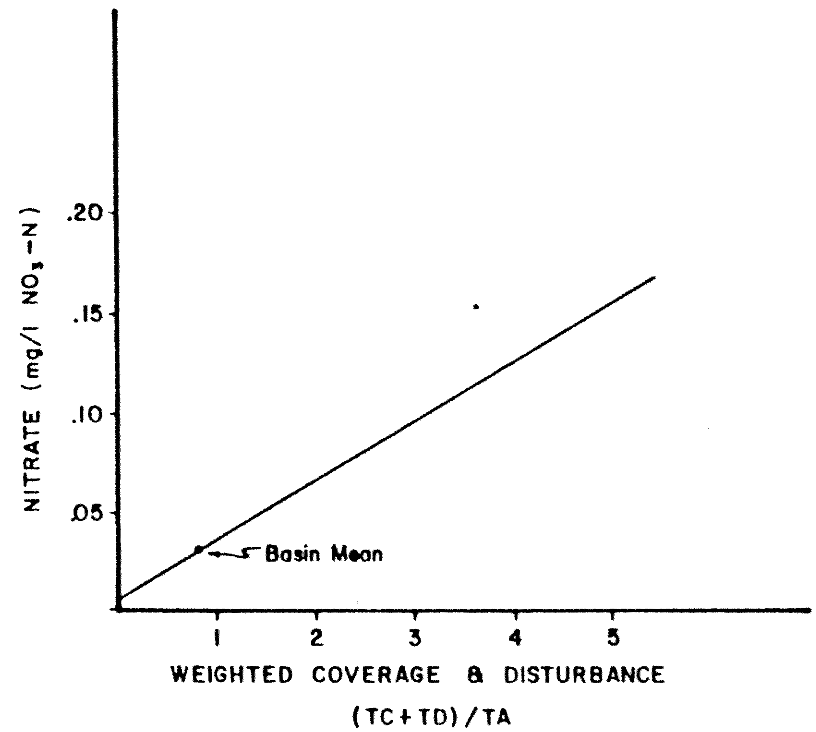
x = total coverage/allowable coverage = TC/TA

Correlation Coefficient: $r^2 = 0.39$

Basin Mean, Suspended Sediment $\cong$ 72 mg/l

Range of Observed Values: (0.01 –)400 mg/l

APPROXIMATE RELATIONSHIP:
MEAN NITRATE CONCENTRATION
IN TAHOE BASIN STREAMS
V.
WEIGHTED COVERAGE & DISTURBANCE



Regression Equation: $y \cong 0.005 + 0.03\,x$

y = nitrate, mg/l NO_3 – N

$$x = \frac{\text{total coverage + total disturbance}}{\text{allowable coverage}} = \frac{TC + TD}{TA}$$

Correlation Coefficient: $r^2 = 0.42$

Basin Mean, Nitrate $\cong$ .026 mg/l NO_3 – N

Range of Observed Values: (0.01–0.1 mg/l

Figure 9

ESTIMATING RELATIONSHIP:
MEAN DIN CONCENTRATIONS & BMP
EFFECTIVENESS V.
WEIGHTED COVERAGE & DISTURBANCE

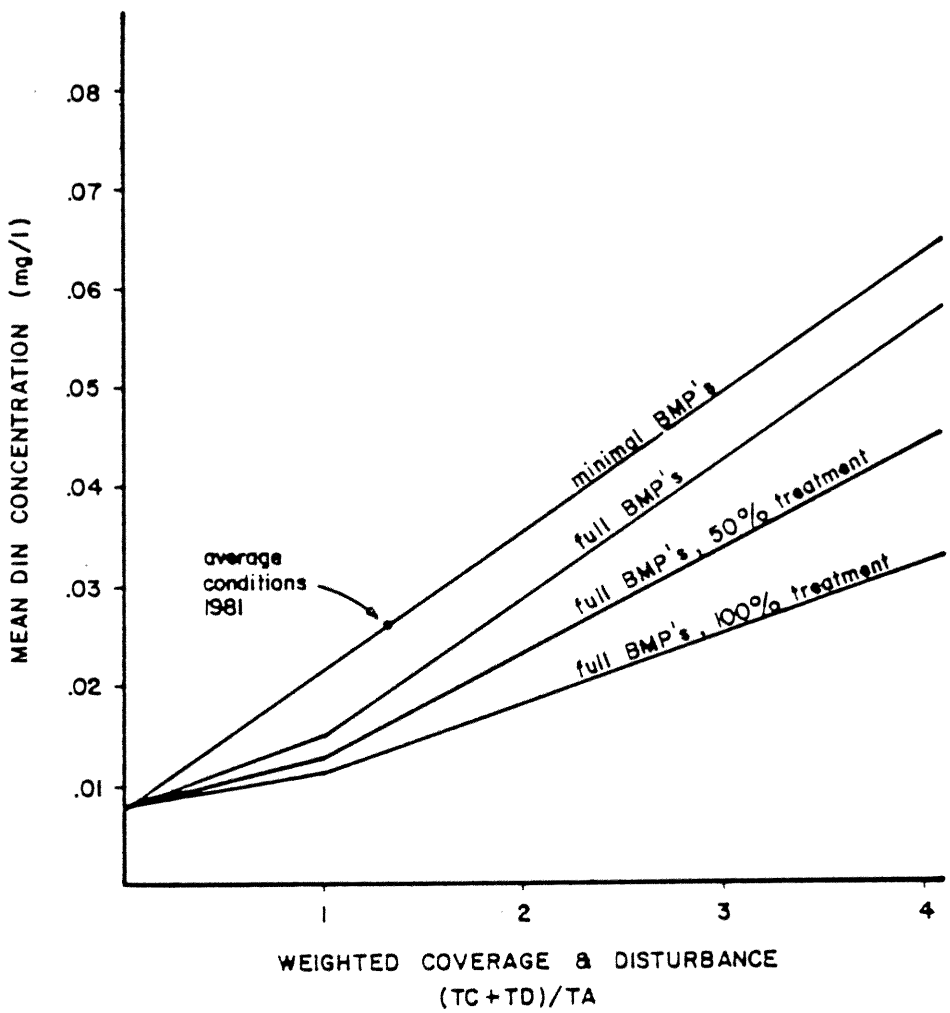


Table 22. DIN loads from surface runoff under various alternatives.

DIN Loads from Surface Runoff by Watershed Association

(tonnes/year)

Watershed Association	Existing Load	Loads after application of BMP's and restoration of disturbed areas: Baseline and Alt 1	Alt 2	Alt 3	Other Load Reduction Areas: Major SEZ Restoration	Fertilizer Management
1	1.25	0.80	0.80	0.80	YES	
2	0.18	0.11	0.12	0.12		
3	0.16	0.10	0.10	0.10		
4	0.99	0.55	0.55	0.57	YES	YES
5	0.44	0.20	0.21	0.21	YES	YES
6	0.21	0.10	0.10	0.10		
7	0.43	0.21	0.21	0.21	YES	YES
8	4.56	2.56	2.56	2.56	YES	YES
9	0.70	0.33	0.33	0.33		
10	0.79	0.42	0.42	0.42		
11	0.29	0.17	0.17	0.17		
SUB-TOTAL	10.00	5.53	5.57	5.60		
Load Reduction from SEZ restoration and fertilizer mgmt		[1.00]	[1.00]	[1.00]		
TOTAL	10.00	4.43	4.57	4.60		
%-Reduction	---	56	54	54		

BASELINE SCENARIO (1981)

Watershed Association	(A) Allowed Coverage (ac)	(C) Coverage (ac)	(D) Disturbance (ac)	C+D / A	[DIN] mg/l	Q (afa)	DIN Load (metric tons/yr)
1	1979	693	875	0.79	.019	53,850	1.25
2	1161	290	369	0.57	.016	8,900	0.18
3	778	295	299	0.76	.019	6,800	0.16
4	695	1059	961	2.90	.048	17,000	0.99
5	339	216	352	1.68	.031	11,750	0.44
6	168	195	202	2.36	.041	4,200	0.21
7	291	439	538	3.36	.055	6,450	0.43
8	3837	2893	2853	1.50	.029	129,250	4.56
9	100	37	95	1.32	.026	21,900	0.70
10	468	116	275	0.84	.020	32,150	0.79
11	438	203	275	1.09	.023	10,250	0.29
						302,500	10.00

BASELINE WITH FULL BMPs AND 80% RESTORATION

Watershed Association	(A) Allowed Coverage (ac)	(C) Coverage (ac)	(D) Disturbance (ac)	C+.2D / A	[DIN] mg/l	Q (afa)	DIN Load (metric tons/yr)
1	1979	693	875	0.44	.011	53,850	0.73
2	1161	290	369	0.31	.010	8,900	0.11
3	778	295	299	0.46	.011	6,800	0.09
4	695	1059	961	1.80	.026	17,000	0.55
5	339	216	352	0.85	.014	11,750	0.20
6	168	195	202	1.40	.020	4,200	0.10
7	291	439	538	1.88	.027	6,420	0.21
8	3837	2893	2853	0.90	.014	129,250	2.24
9	100	37	95	0.56	.012	21,900	0.33
10	468	116	275	0.37	.010	32,150	0.40
11	438	203	275	0.59	.012	10,250	0.15
							5.11

ALTERNATIVE 1 (MAXIMUM REGULATION)
WITH FULL BMPs AND 80% RESTORATION

Watershed Association	(A) Allowed Coverage (ac)	C + 0.2D / A	[Din] mg/l	Q (afa)	DIN Load (metric tons/yr)
1	1979	0.57	.012	53,850	0.80
2	1161	0.37	.010	8,900	0.11
3	778	0.56	.012	6,800	0.10
4	695	1.80	.026	17,000	0.55
5	339	0.96	.014	11,750	0.20
6	168	1.40	.020	4,200	0.10
7	291	1.90	.027	6,420	0.21
8	3837	1.10	.016	129,250	2.56
9	100	0.56	.012	21,900	0.33
10	468	0.39	.010	32,150	0.40
11	438	0.79	.013	10,250	0.17
					5.53

ALTERNATIVE 2 (DEVELOPMENT WITH MITIGATION)
WITH FULL BMPs AND 80% RESTORATION

Watershed Association	Allowed Coverage (ac)	$\frac{C + 0.2D}{A}$	[Din] mg/l	Q (afa)	DIN Load (metric tons/yr)
1	1979	0.56	.012	53,850	0.80
2	1161	0.37	.0105	8,900	0.12
3	778	0.56	.012	6,800	0.10
4	695	1.90	.026	17,000	0.55
5	338	0.97	.0145	11,750	0.21
6	168	1.42	.019	4,200	0.10
7	291	1.91	.026	6,420	0.21
8	3837	1.08	.016	129,250	2.56
9	100	0.56	.012	21,900	0.33
10	468	0.40	.0105	32,150	0.42
11	438	0.78	.013	10,250	0.17
					5.57

ALTERNATIVE 3 (REDIRECTION OF DEVELOPMENT)
WITH FULL BMPs AND 80% RESTORATION

Watershed Association	Allowed Coverage (ac)	$\frac{C + 0.2D}{A}$	[Din] mg/l	Q (afa)	DIN Load (metric tons/yr)
1	1979	0.56	.012	53,850	0.80
2	1161	0.37	.0105	8,900	0.12
3	778	0.57	.012	6,800	0.10
4	695	1.99	.027	17,000	0.57
5	338	0.97	.0145	11,750	0.21
6	168	1.45	.205	4,200	0.11
7	291	1.92	.026	6,420	0.21
8	3837	1.11	.016	129,250	2.56
9	100	0.59	.012	21,900	0.33
10	468	0.41	.0105	32,150	0.42
11	438	0.79	.013	10,250	0.17
					5.60

APPENDIX E

Simulation of Runoff Volumes, Nutrient Loads and Sediment Loads from Hydrologically Related Areas on Lake Tahoe's West and North Shores

Tahoe Regional Planning Agency

October 12, 1988

Note: Reprinted from Final Environmental Impact Statement: Plan Area Statements and Implementing Ordinances of the Regional Plan; Appendix 1, Tahoe Regional Planning Agency, January 10, 1987, Revised January 20, 1987

SIMULATION OF RUNOFF VOLUMES, NUTRIENT LOADS,

AND SEDIMENT LOADS FROM HYDROLOGICALLY RELATED AREAS

ON LAKE TAHOE'S WEST AND NORTH SHORES

Introduction

To determine the impacts on runoff volume and pollutant loads of the Goals and Policies, the TRPA staff prepared two simulations of hydrologically related areas. The two areas simulated are on the West Shore (Tahoma) and the North Shore (Incline) of Lake Tahoe. The simulations apply cause-effect relationships from the 1983 EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin and runoff estimation techniques of the Soil Conservation Service to four alternative land use scenarios representing the base case (with and without application of Best management Practices) and two build-out scenarios, one under the existing water quality management ("208") plan and one under the 1986 Goals and Policies.

Conclusions

The simulation of runoff volume and pollutant loads showed that the policies of the Goals and Policies (specifically, application of BMPs and required capital improvements, the IPES, the community planning process, the coverage mitigation program, and the coverage transfer program) would: 1) decrease nitrate-nitrogen loads from the two hydrologically related areas by about 40%, as compared to the existing condition; 2) decrease suspended sediment loads by about 50% for the Tahoma model and by about 10% for the Incline model, as compared to the existing condition; and 3) decrease runoff volumes, nitrate-nitrogen loads, and sediment loads slightly compared to build-out under the existing water quality management ("208") plan for the Tahoe Basin.

Also, in the Incline model, the development of "surplus" commercially-zoned parcels with public service or recreational uses (not requiring development allocations) resulted in a negligible impact on pollutant loads under the 1986 Goals and Policies

Methodology

Runoff calculations and pollutant loadings were modeled from two hydrologically related areas -- the urbanized Tahoma/McKinney Creek area and urbanized Incline Village. (See drainage area location maps, Figures 6-1 and 6-2.) The Tahoma/McKinney Creek area was divided into 11 drainage areas and 26 drainage subareas. This study area represents the entire urbanized portion of a proposed "hydrologically related area" within the meaning of the Goals and Policies. The Incline Creek area was divided into 11 similar land use areas within the urbanized portion of the Incline Hydrologic Area.

The determination of runoff volumes was based on the "Urban Hydrology for Small Watersheds" published by the U.S. Soil Conservation Service (SCS). The procedure is composed of the following steps:

1. Defining major drainage area and subarea boundaries.

2. Characterization of soil groups within individual subareas to provide a basis for determining the runoff characteristics of undeveloped land.

3. Determining land use classifications within each subarea to provide a basis for defining the runoff characteristics of developed properties.

4. Calculation of the weighted hydrologic soil cover complex curve number for subareas with nonhomogeneous land use and soil type characteristics.

5. Defining the intensity-duration-frequency relationship of precipitation within the study area.

6. Selection of the storm event for which runoff flow calculations will be based.

7. Calculating the total volume of runoff produced by a given subarea for a given storm event.

Land use classifications used for this study were based on four scenarios, model numbers 1 through 4. For each model, land use was classified into five types: paved streets, impervious coverage of developed lots, disturbed areas of developed lots, open areas (Soil Group B), and open areas (Soil Group C).

Model #1 represents existing land use with all Best Management Practices (BMP's) applied and all water quality and erosion control Capital Improvements Program (CIP) in place on public rights-of-way. For the Incline area 127 case-by-case parcels were considered as developed.

Model #2 represents existing land use with few if any BMPs applied. The Tahoma simulation for model #2 also considered three CIP projects in Tahoma and McKinney Estates as completed. The projects are scheduled to be constructed by 1988.

Model #3 represents ultimate build-out of the drainage area under the existing 208 Plan. All future development conforms to the Bailey coverage standards, all BMPs are applied, and the CIP is completed. The staff assumed that every vacant residential parcel in land capability districts 4-7 would be developed at the allowed Bailey coverage, and that every vacant commercial or tourist commercial parcel in capability districts 4-7 would also be developed at the allowed Bailey coverage. Because of the restrictions on modifications to existing coverage in excess of Bailey, the staff assumed that the propensity to reduce coverage on existing residential or commercial property under model #3 was nil. All vacant parcels in capability districts 1-3 would remain vacant.

For the Tahoma/McKinney Estates area, model #4 represents ultimate build-out of the drainage area under the proposed 1986 Plan. All future development on residential property conforms to the coverage standards of the Goals and Policies. The staff assumed that all vacant parcels in land capability districts 4-7 would be developed at allowed Bailey coverage, and that 20% of all vacant parcels in districts 1-3, but not in SEZ's would be developed at 20% coverage, with the difference between Bailey coverage and 20% requiring retirement of coverage elsewhere within the hydrologically related area. The staff assumed that commercial and tourist properties would be developed in accordance with Goals and Policies regarding community planning; Class 1B land would be prohibited from development; all BMPs would be applied; and the CIP completed.

In the Tahoma model #4, the staff assigned a projected 20-year commercial square footage allocation of 20,000 ft^2 to vacant commercial parcels within the Community Plan incentive area, and assumed that land coverage would equal 70%, or twice the allocated floor space, whichever value was smaller. All coverage greater than that allowed by the Bailey coefficients was assumed to be transferred from existing hard coverage within the hydrologically related area. The staff also assumed that one public service use would occupy an existing vacant commercial lot within the incentive area, with 50% coverage, 25% obtained by transfer of hard coverage.

For each existing improved commercial property in the incentive zone, the staff assumed that one significant structural rehabilitation would occur every 20 years, at a cost of $50,000 each time. For the 21 existing improved properties, this represents a total cost (in constant dollars) of $1.05 million. Assuming a coverage mitigation fee of 2.5%, this rehabilitation activity would result in $26,250 for hard coverage reductions in the hydrologically related area or, at a cost of $5/$ft^2$, would result in a hard coverage reduction of 5,250 ft^2.

For existing improved residential properties in the study area, the staff assumed that all the properties exceeded the allowed Bailey coverage, and that each would undergo one significant structural improvement every 40 years, at a cost of $15,000 each time. This represents a total cost (in constant dollars) of $8.78 million in 20 years. Assuming a coverage mitigation fee of 2.5%, and a cost of soft coverage reduction of $5/$ft^2$, this activity would result in retirement of 43,912 ft^2 over 20 years.

The hard and soft coverage retired was assigned to likely donor zones, and subtracted from the projected ultimate coverage in those zones.

For the Incline Village area, model #4 also represents ultimate build-out of the drainage area under the proposed 1986 plan. Like the Tahoma area the staff assumed that all vacant parcels in land capability districts 4-7 would be developed at allowed Bailey coverage, however, 33% of all vacant parcels in districts 1-3, but not in SEZs, would be developed at 20% coverage, with the difference between Bailey coverage and 20% requiring retirement of coverage elsewhere within the hydrologically related area.

In Incline model #4, the staff assigned a projected 20-year commercial square footage allocation of 48,750 ft^2 to vacant commercial parcels within the Community Plan incentive area. Three vacant lots were considered at 70% coverage and one vacant lot at 58% coverage to account for the allocated floor space. Again all coverage greater than that allowed by the Bailey coefficients was obtained by transfer of hard coverage. All other vacant commercial or tourist commercial parcels were modeled for two situations -- remaining vacant and developed at Bailey coverages. Developing these lots at Bailey coverages resulted in a negligible impact on pollutant loads in the Incline model #4. The staff also assigned a projected 20-year commercial square footage allocation of 7,200 ft^2 to a vacant commercial parcel outside the Community Plan incentive area.

For all the models, a 10-year, 24-hour storm was selected as the design storm for calculating runoff. The staff further assumed that the antecedent hydrologic conditions were saturated. These two assumptions represent a reasonable worst case scenario for a runoff event.

Nitrogen (NO_3) and suspended sediment (SS) loads for each drainage subarea were calculated by multiplying the runoff volume for each subarea by the estimated concentration of NO_3 and SS. The concentrations depend on the ratios of total coverage (TC) and total disturbance (TD) to allowable coverage (TA). The relationships on page 38 of the 1983 EIS for Adoption of a Regional Plan for the Lake Tahoe Basin were used to determine the concentrations for Model #2.

Modifications of these relationships which account for application of BMPs were used to determine concentrations for Models 1, 3 and 4. The modifications for $[NO_3]$ are:

(1) Given (TC/TA) less than 1, $[NO_3] = 0.005 + 0.015((TC + TD)/TA)$

(2) Give (TC/TA) greater than 1, $[NO_3] = -0.01 + 0.03((TC + TD)/TA)$

The modifications for [SS] are:

(3) Given (TC/TA) less than 1, $[SS] = 43(TC/TA)$

(4) Given (TC/TA) greater than 1, $[SS] = -128 + 171(TC/TA)$

The relationships used for model #2 are:

(1) $[NO_3] = 0.005 + 0.03((TC + TD)/TA)$

(2) $[SS] = 171(TC/TA)$

In the Incline simulation the ratios of TC/TA and (TC + TD)/TA in some of the land use areas were twice (10:1) the ratios graphed on page 38 of the 1983 EIS for Adoption of a Regional Plan for the Lake Tahoe Basin (5:1). Arbitrarily extrapolating these ratios may explain the relatively small decreases in suspended sediments calculated between models 3, 4 and model #2.

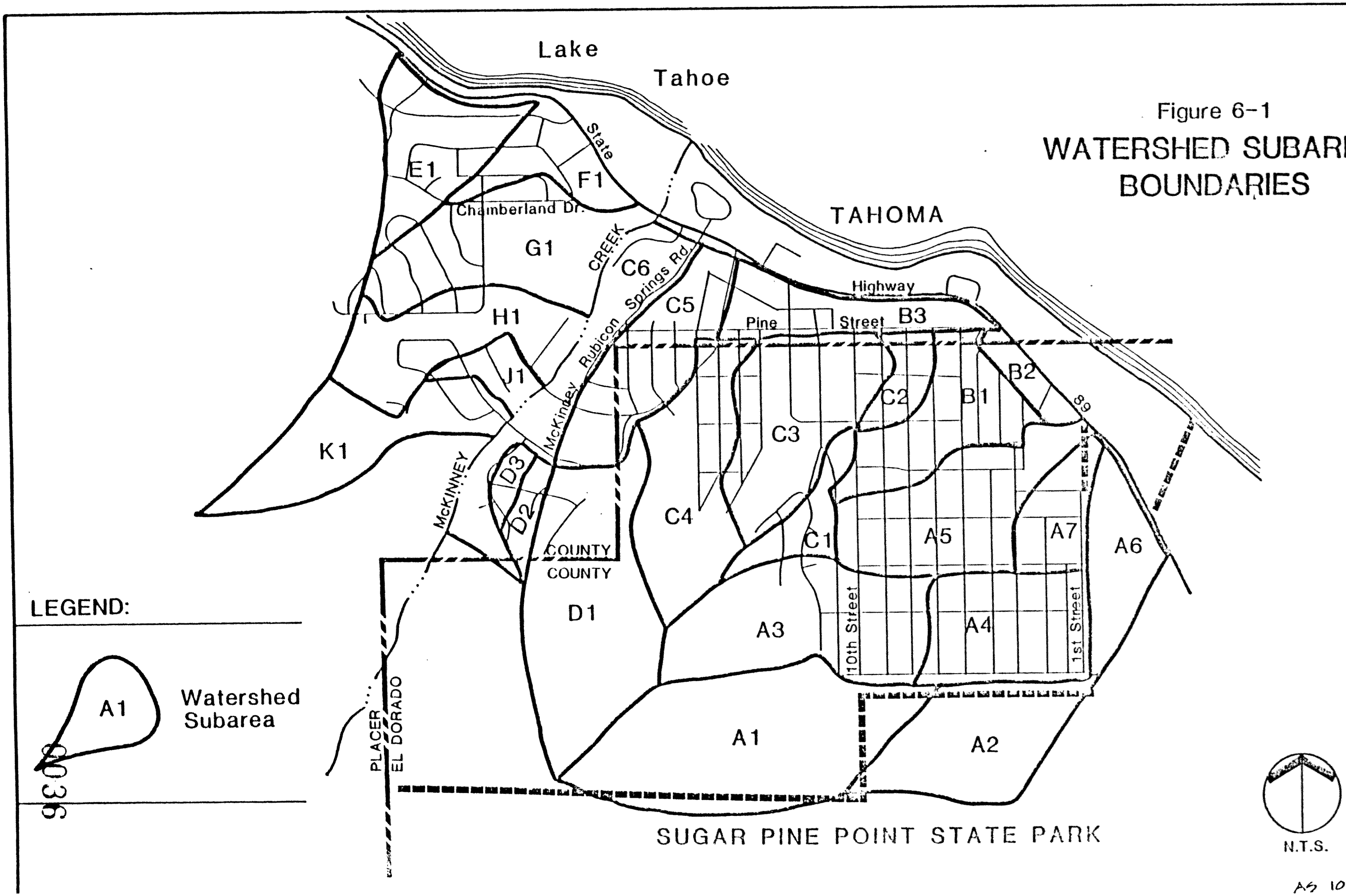


Figure 6-1
WATERSHED SUBAREA BOUNDARIES

LAND USE SUBAREAS

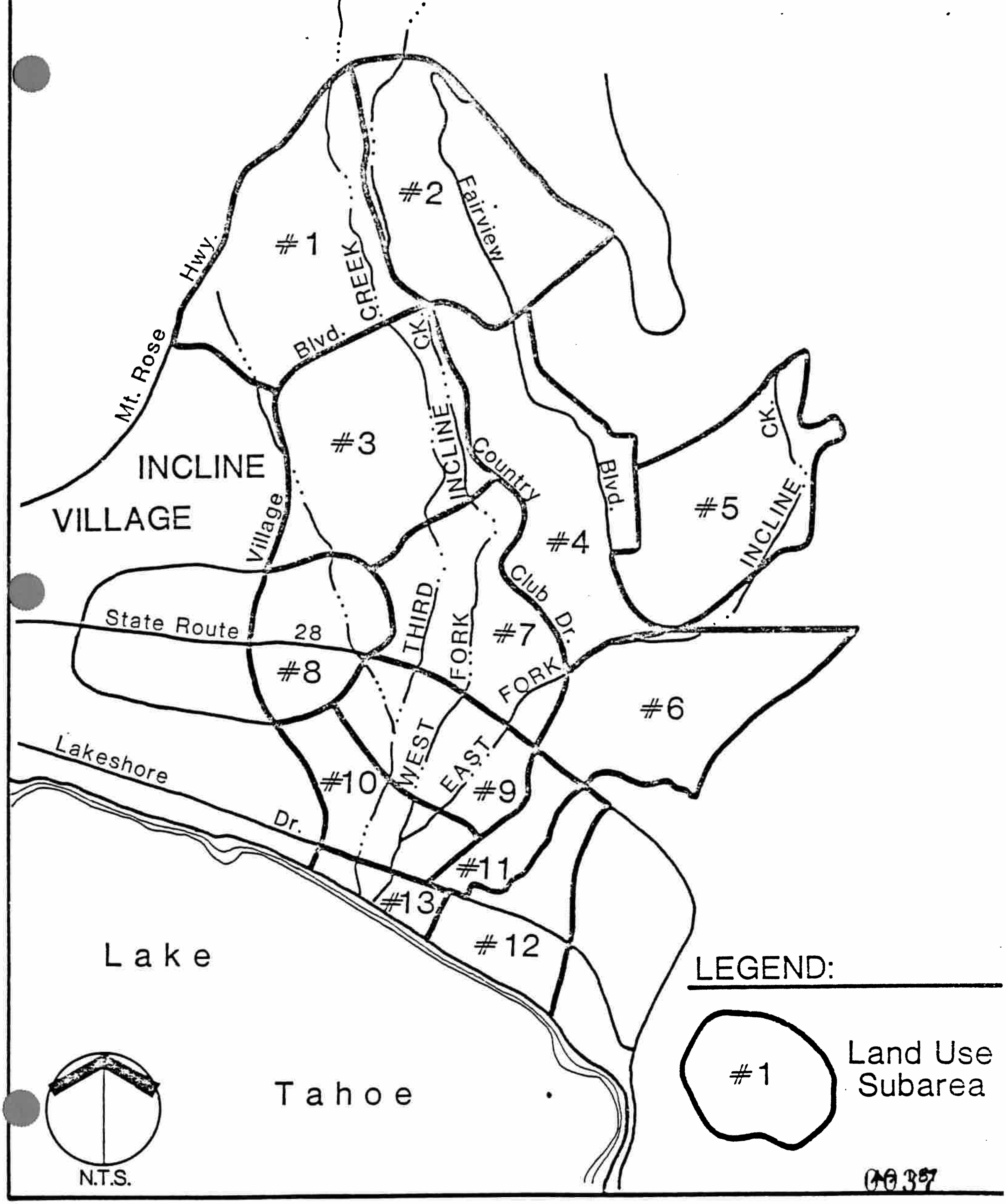


TABLE 7-1 TAHOMA
RUNOFF VOLUMES & POLLUTANT LOADS, BY SCENARIO

EXISTING DEVELOPMENT W/CIP&BMP

DRAINAGE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
A	1	1435	2113	4795
B	1	336	978	3120
C	1	827	1458	3171
D	1	398	389	1392
E	1	108	602	2641
F	1	73	179	488
G	1	233	644	1968
H	1	190	610	2094
J	1	48	87	179
K	1	164	157	207
TOTAL		3812	7217	20055

EXISTING DEVELOPMENT W/ CIP ONLY

DRAINAGE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
A	2	1455	4111	14388
B	2	348	2073	7816
C	2	842	3210	11577
D	2	400	720	2124
E	2	113	1126	4273
F	2	76	416	1501
G	2	244	1460	5277
H	2	194	1127	4684
J	2	48	184	720
K	2	167	299	840
TOTAL		3888	14726	53200

208 PLAN DRAINAGE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
A	3	1453	2700	7746
B	3	341	1208	4393
C	3	841	2027	5872
D	3	399	441	724
E	3	109	637	2838
F	3	74	231	773
G	3	234	671	2121
H	3	190	656	2352
J	3	49	145	470
K	3	166	174	254
TOTAL		3856	8890	27543

1986 PLAN DRAINAGE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
A	4	1451	2667	7565
B	4	342	1231	4516
C	4	841	2001	5729
D	4	399	420	616
E	4	109	640	2855
F	4	74	231	773
G	4	234	675	2141
H	4	190	661	2381
J	4	49	145	470
K	4	166	174	254
TOTAL		3854	8845	27300

TABLE 7-2 INCLINE
RUNOFF VOLUMES & POLLUTANT LOADS, BY SCENARIO

EXISTING DEVELOPMENT W/CIP&BMP

LAND USE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
1	1	664	1130	2260
2	1	817	17950	96347
3	1	743	2152	6846
4	1	780	11657	60745
5	1	877	38380	212365
6	1	612	21226	116521
7	1	483	712	1329
8	1	345	1482	5930
9	1	344	443	764
10	1	289	1221	4848
11	1	121	221	457
12	1	329	439	774
13	1	142	1058	4997
TOTAL		6546	98071	514183

EXISTING DEVELOPMENT W/ CIP ONLY

LAND USE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
1	2	706	3089	9546
2	2	857	32001	112290
3	2	794	4989	17771
4	2	817	20904	74303
5	2	890	57597	227316
6	2	642	32625	130732
7	2	505	1849	5529
8	2	356	2328	10800
9	2	357	1117	3157
10	2	304	2226	9106
11	2	124	453	1866
12	2	374	1763	3504
13	2	155	2187	7501
TOTAL		6881	163128	613421

TABLE 7-2(CONT)

208 PLAN

LAND USE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
1	3	675	1284	2685
2	3	818	18273	98184
3	3	758	2632	9465
4	3	785	12644	66337
5	3	880	42291	234636
6	3	612	21371	117341
7	3	490	826	1644
8	3	376	2354	10678
9	3	363	733	1566
10	3	317	2260	10563
11	3	137	552	2149
12	3	336	523	1003
13	3	142	1058	4997
TOTAL		6689	106801	561248

1986 PLAN

LAND USE AREA	MODEL NUMBER	DRAINAGE VOLUME acre-in	NITRATE LOAD grams	SEDIMENT LOAD kgrams
1	4	674	1259	2616
2	4	819	18346	98598
3	4	758	2626	9435
4	4	785	12620	66202
5	4	878	39685	219798
6	4	613	21441	117739
7	4	490	826	1644
8	4	375	2336	10577
9	4	363	733	1566
10	4	317	2260	10563
11	4	137	552	2149
12	4	336	523	1003
13	4	142	1058	4997
TOTAL		6687	104265	546887

TABLE 7-3
SUMMARY OF SIMULATION RESULTS

SIMULATION	AREA	MODEL	VOLUME acre-in	NITRATE grams	SEDIMENT kgrams
TAHOMA	ALL	1	3812	7217	20055
TAHOMA	ALL	2	3888	14726	53200
TAHOMA	ALL	3	3856	8890	27543
TAHOMA	ALL	4	3854	8845	27300
INCLINE	ALL	1	6546	98071	514183
INCLINE	ALL	2	6881	163128	613421
INCLINE	ALL	3	6689	106801	561248
INCLINE	ALL	4	6687	104265	546867

APPENDIX F

Estimated Suspended Sediment Yield Rates
Using the State Water Resources
Control Board's Model

Tahoe Regional Planning Agency

October 12, 1988

Abstract

The State Water Resources Control Board's (SWRCB) sediment yield model was applied to two watersheds to estimate increased sediment production attributable to new development. Two development criteria were used. The first used the current development criteria, while the second used the proposed development criteria. For the first watershed, sediment yields were estimated to increase 16% using the proposed development criteria and 13% using the current development criteria. For the second watershed, sediment yield was estimated to increase only 0.04% utilizing either criteria.

Introduction

The impacts of development can be partially evaluated by comparing the production of sediment attributable to any new development. TRPA used the SWRCB's sediment model to help evaluate the potential differences between the current development criteria and the proposed development criteria. The SWRCB model is described in Appendix B, Lake Tahoe Basin Water Quality Plan (SWRCB, 1980), in Figure B-1 (attached).

Method and Material

Two watersheds were selected to be evaluated for developmental impacts. Each watershed contained both commercial and residential areas. The first watershed was an intervening area that is located in the middle of Kings Beach, California. This watershed is approximately 35 hectares in size and has the following characteristics:

Land Capability	Area (hectares)	Fraction Disturbed
5	25	.76
6	6	.50
1b	4	.25

The second watershed selected was Burke Creek, located just north of Nevada 207 in Douglas County. This watershed is approximately 1,187 hectares in size and has the following characteristics:

Land Capability	Area (hectares)	Fraction Disturbed
1a	661	.04
2	138	.21
3	57	.37
4	64	.25
5	40	.01
7	33	.15
1b	194	.14

The SWRCB's model was applied to each watershed to estimate sediment yield for the existing level of development, complete buildout using the development criteria of the 1981 208 plan, and complete buildout using the proposed development criteria of the 208 amendments. For the intervening watershed the following assumptions were made:

- lot size was estimated at 0.10 hectares (1/4 acre)
- future commercial coverage was allocated at 30% and 50% for the 1981 criteria and proposed criteria, respectively
- future residential coverage was allocated at 25% and 30% for the class 5 and class 6 parcels for both systems

For the Burke Creek watershed, the model was run using the following assumptions:

- lot size was estimated at 0.13 hectares (1/3 acre)
- the commercial areas were already built out
- future residential coverage was allocated at 20% for the class 4 lots using the 1981 criteria and 20% for the developable class 1, 2, and 4 lots using the proposed criteria
- 2/3 of the vacant class 1, 2, and 3 lots were retired using the proposed criteria

Results and Discussion

Results of the model for the two watersheds are summarized in Table 1. For the intervening watershed, sediment yields were estimated to increase from a current level of 175.5 metric tons per year to 199 metric tons per year using the 1981 criteria for an increase of 13%. Using the proposed development criteria, sediment yield was estimated to increase by 16% to 203.25 metric tons per year for an estimated difference of 3% or 4.25 metric tons per year between the two plans.

For the Burke Creek watershed, the estimated impacts were less. There were no discernible impacts with commercial development, while residential development increased sediment yields by an estimated 0.04% from 1,612.5 metric tons per year to 1,613.14 metric tons per year for both development scenarios.

Conclusions

The SWRCB's model predicts increased sediment yields utilizing either developmental scenario. The differences between the two scenarios are negligible when the inherent error in the model is taken into account.

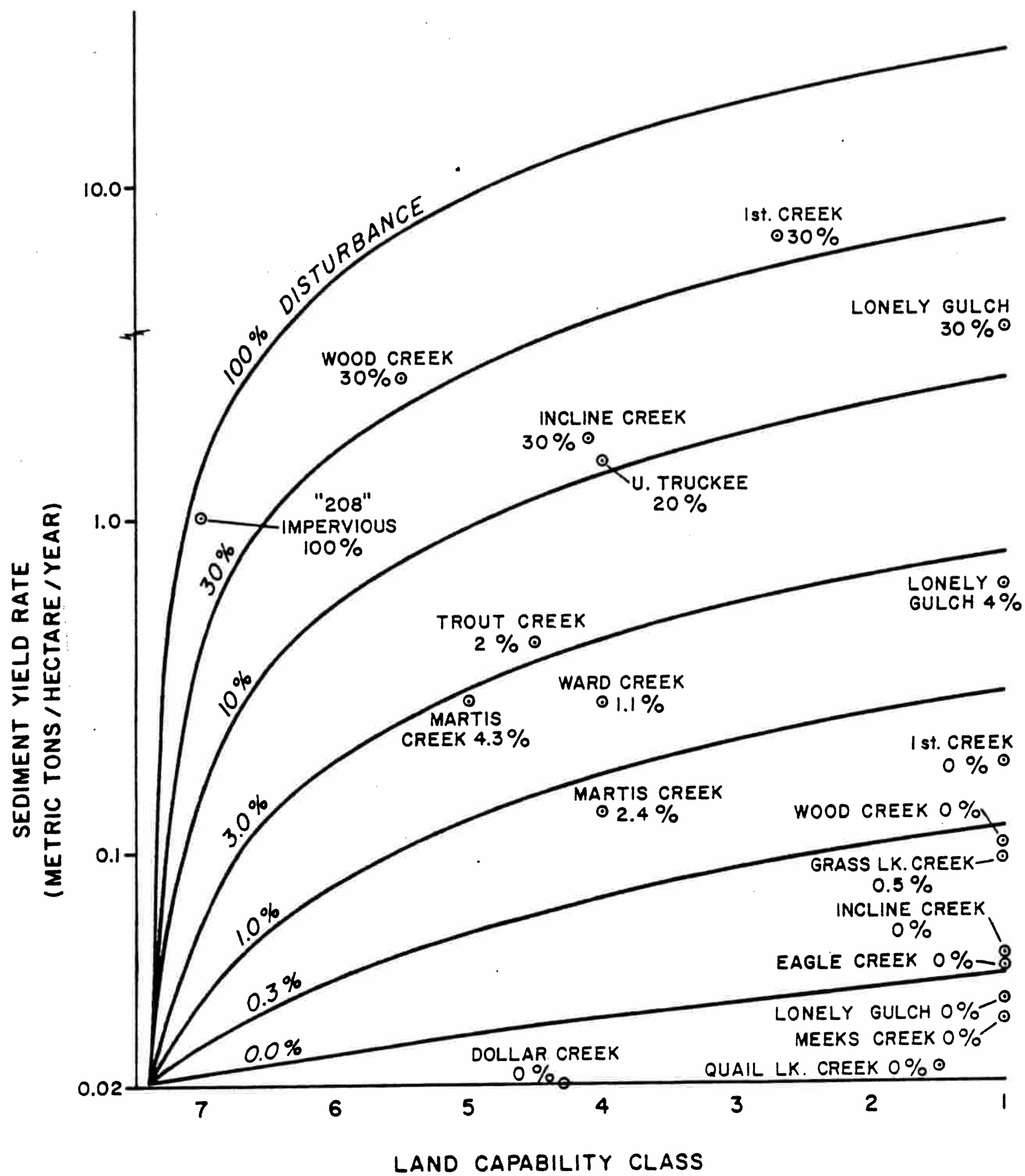
TABLE 1. Sediment Yield Estimates For Two Watersheds Using The SWRCB Model

		Yields (metric tons per year)			
Watershed	Development	1981 208 Plan Developmental Criteria	Percent Change	Proposed Developmental Criteria	Percent Change
Intervening Watershed	Commercial only	191	9%	197.5	13%
	Residential only	191	9%	191	9%
	Combined	199	13%	203.25	16%
Burke Creek	Commercial only	1,612.5	0%	1,612.5	0%
	Residential only	1,613.14	0.04%	1,613.14	0.04%
	Combined	1,613.14	0.04%	1,613.14	0.04%

For the Intervening Watershed, the model estimates a sediment yield of 175.5 metric tons per year at the current (1988) level of development.

For the Burke Creek watershed, the model estimates a sediment yield of 1,612.5 metric tons per year at the current (1988) level of development.

FIGURE B-1



Sediment Yield Rate as a Function of Percent Disturbance and Land Capability Class for the Lake Tahoe Basin

APPENDIX G

ANALYSIS OF EXISTING LAND COVERAGE:

TRPA COMMUNITY PLANNING AREAS

Tahoe Regional Planning Agency

October 12, 1988

ANALYSIS OF EXISTING LAND COVERAGE:
TRPA COMMUNITY PLANNING AREAS

I. ABSTRACT

TRPA estimated the size and existing land coverage of 23 TRPA plan areas designated as community planning areas in the Regional Plan. The community planning areas are receiving areas for land coverage transfers.

II. CONCLUSIONS

The 23 community planning areas total about 2540 acres. They have approximately 1720 acres of existing hard and soft land coverage. Hard coverage is the land coverage of structures and pavement. Soft coverage is compacted and denuded areas without structures.

III. METHODS

TRPA used the official plan area maps (1" = 400') to planimeter the areas of the 23 plan areas designated as community planning areas. Percentages of existing land coverage were estimated based on information published in the individual plan area statements (TRPA, 1987) or, where the plan area statements did not contain an estimate, based on data from TRPA's geographic data base developed in 1981-82 using the WRIS software of the USFS.

The results are shown in the attached table.

TRPA COMMUNITY PLAN AREAS
EXISTING LAND COVERAGE

	1	2	3	4
	PLAN AREA	APPROXIMATE SIZE (ACRES)	APPROXIMATE COVERAGE(%)	APPROXIMATE COVERAGE (ACRES)
CSLT	089B	179.6	85%	152.7
	091	122.2	85%	103.9
	098	160.1	50%	80.1
	110	330.6	75%	248.0
	113	73.0	70%	51.1
		865.5		635.6
Placer	001A	181.0	65%	117.7
	001B	78.1	30%	23.4
	009A	22.0	80%	17.6
	017	33.1	65%	21.5
	022	133.8	70%	93.7
	026	30.2	65%	19.6
	029	112.9	90%	101.6
	159	29.0	50%	14.5
	169	42.5	35%	14.9
		662.6		424.5
Washoe	032	49.3	90%	44.4
	045	204.9	65%	133.2
	048	218.0	40%	87.2
	054	84.0	80%	67.2
		556.2		332.0
Douglas	071	50.7	80%	40.6
	089A	122.0	85%	103.7
	076	85.4	70%	59.8
		258.1		204.0
El Dorado	125	168.6	60%	101.2
	155	28.4	75%	21.3
		197.0		122.5
	Total	2539.4		1718.6

APPENDIX H

A Comparison of Criteria for
Identification of SEZs: TRPA's 1978 Criteria
vs. TRPA's 1988 Proposed Criteria

Tahoe Regional Planning Agency

October 12, 1988

Abstract

The SEZ identification criteria of the 1981 208 plan and the proposed SEZ criteria developed for IPES were used to delineate the area of SEZs for 55 parcels. For SEZs without channels and for first and second order streams, the IPES criteria identified more area than the criteria from the 1981 plan did. For third order streams, the IPES criteria identified less area. Both systems identified the critical wet, riparian areas that remove nutrients and sediment from water, but differed in their application of protective setbacks.

Introduction

The identification, protection, and restoration of stream environment zones (SEZs) is critical in protecting Lake Tahoe's water quality due to their ability to cleanse water of nutrients and sediments. To better define these SEZs, TRPA has proposed to adopt the SEZ identification criteria developed for the Individual Parcel Evaluation System (IPES). This will be a replacement for the identification system detailed in TRPA's 1978 Handbook of Best Management Practices (BMPs), and adopted in the 1981 208 plan.

Methods and Materials

In the 1978 BMP Handbook, SEZs are identified by the presence of one or more of the following:

1. A defined stream channel with its associated setback. For first and second order streams, the setback is 25 and 50 feet, respectively, on either side of the stream's center. For third order streams, the setback is 100 feet on either side of the stream's edge.

2. One of the following soil types:

   - Loamy alluvial (Lo),
   - Elmira loamy coarse sand wet variant (Ev),
   - Celio gravelly loamy sand (Co),
   - Marsh (Mh),
   - Gravelly alluvial land (Gr), or
   - Fill land (Fd).

3. Riparian vegetation, or

4. The 100-year flood plain as mapped by the Army Corps of Engineers

The proposed IPES criteria use key indicators and secondary indicators to identify SEZs and assigns setbacks (Table 1) to protect them. The key indicators are:

1. Evidence of surface flow
2. Primary riparian vegetation
3. Near surface groundwater (within 20 inches of the surface)
4. Lakes or ponds
5. The presence of either Ev or Mh soil types

The secondary indicators are:

1. A designated flood plain
2. Groundwater between 20 and 40 inches
3. Secondary riparian vegetation, and
4. One of the following soil types:

    - Lo
    - Co
    - Gr

Fifty-five IPES field sheets were used to delineate the extent of SEZ areas using both systems. Field sheets were chosen to represent various types of SEZs. For analytical purposes, they were grouped into one of the following four categories of SEZs:

1. Channel absent, represents SEZs defined by soil type and/or the presence of riparian vegetation
2. First order streams
3. Second order streams
4. Third order streams

Results and Discussion

Results of the two methods are tabulated in Table 2. The proposed IPES criteria identify more SEZ area for the channel absent, first order, and second order categories but less for the third order category. Both systems identify the important wet, riparian areas that remove nutrients and sediments but differ in the extent of the buffer strip or setback area needed for their protection. For the channel absent category, the IPES criteria provides for a ten foot setback while the system from the 1981 208 plan provides for no setbacks. For streams, IPES establishes setbacks based upon the type of stream present and its physical characteristics. Larger setbacks are required and provided for those streams in poor condition, while streams in stable condition are assigned smaller setbacks. The system from the 1981 208 plan makes no such distinction and assigns setbacks based upon a stream's order.

Table 1 Setbacks From SEZS

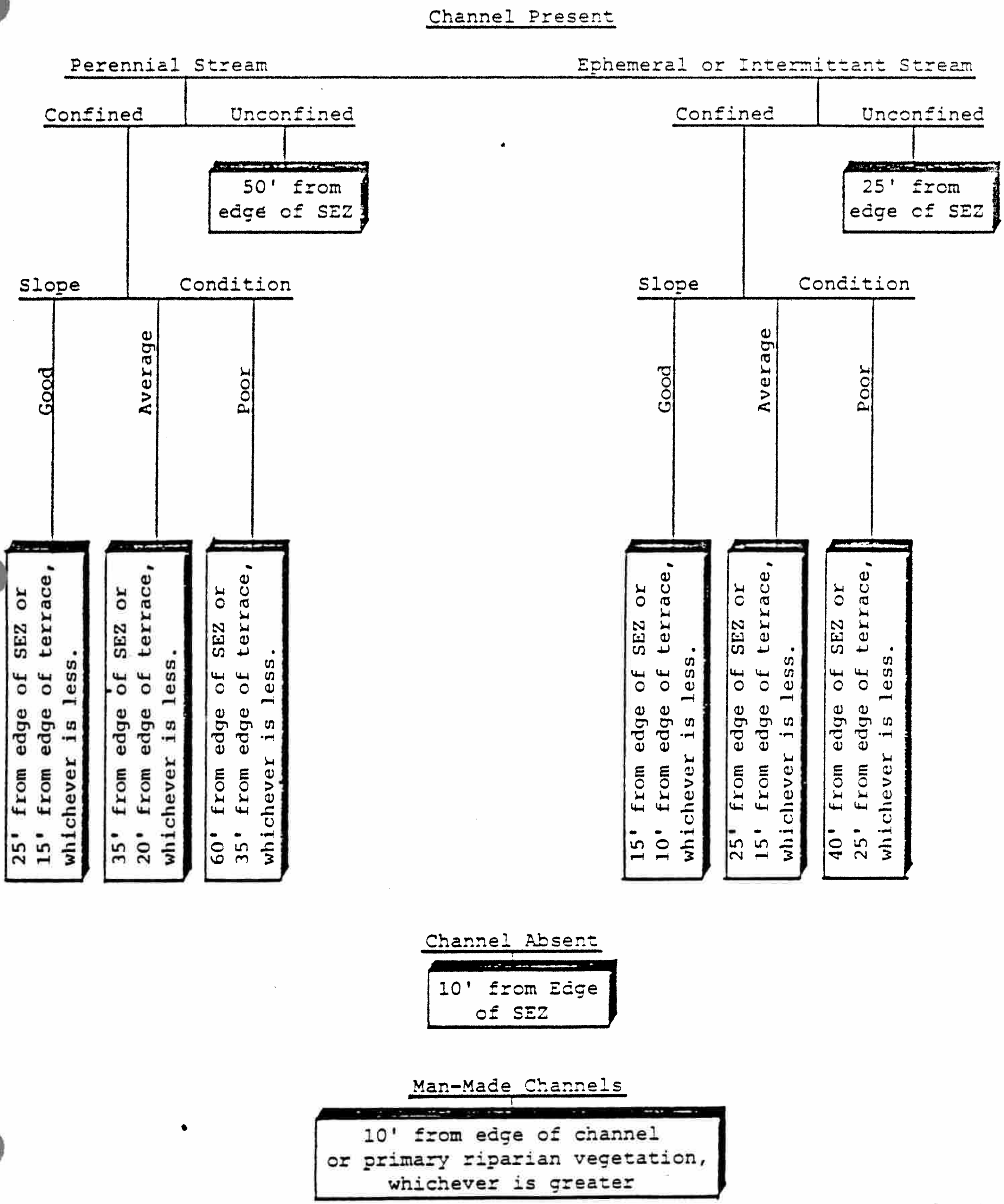


TABLE 2. SEZ Comparison Summary Table

SEZ Category	SEZ Area (square feet)			
		IPES		
	Current Criteria	SEZ	Setback	Total
No Channel	59,752	65,320	13,246	78,566
First Order	67,200	45,404	34,205	79,609
Second Order	87,131	76,147	15,043	91,190
Third Order	426,358	275,715	76,488	352,203

For third order streams, TRPAs 1978 SEZ identification criteria assigned 100 foot setbacks from the stream's edge, while the setbacks in the IPES criteria vary between 15 and 60 feet depending on slope condition. The purpose of this setback is the protection of the critical areas that remove nutrients and sediments. Additional protection of SEZs is provided by the protection of their 100 year flood plains. Although a flood plain is only a secondary indicator under the IPES criteria, the proposed amendments provide flood plains the same degree of protection as SEZs.

Conclusions

The IPES criteria for delineating SEZs have been found to identify more area for non-channel SEZs and first and second order streams. For third order streams, they identify less area than the system of the 1981 208 plan. Both systems identify the critical wet, riparian areas, with the IPES system providing protective setbacks in all instances, while the system of the 1981 208 plan provides setbacks only if a stream is present. Setbacks in the IPES criteria are site specific and are tailored to provide the protection needed. Setbacks under the system of the 1981 208 plan are assigned based upon a stream's order and may not provide the proper protection needed or provide more protection than necessary. The proposed IPES criteria adequately identify and provide for the protection of SEZs and use site specific criteria to provide more accurate delineations.

APPENDIX I

Modeling of Future Values:
Intersection Level-of-Service and
Regional Vehicle-Miles-Travelled (VMT)

Tahoe Regional Planning Agency

October 13, 1988

Note: Reprinted from Final Environmental Impact Statement: Plan Area Statements and Implementing Ordinances of the Regional Plan; Appendix 3. Tahoe Regional Planning Agency, January 10, 1987, Revised January 20, 1987

MODELING OF FUTURE VALUES:

INTERSECTION LEVEL-OF-SERVICE AND

REGIONAL VEHICLE-MILES-TRAVELLED (VMT)

Introduction

To evaluate the impacts of anticipated development and planned transportation control measures (TCMs) on the highway network of the Lake Tahoe Region, the TRPA staff applied computer models developed by the Agency since 1983. The staff modeled existing and future level-of-service (LOS) at twelve controlling intersections in the Tahoe Region, with and without application of TCMs. The staff also modeled Region-wide VMT for 1985, and for 2005 with and without TCMs. VMT-reducing impacts of TCMs were modeled separately.

Conclusions

The new development anticipated in the Goals and Policies would degrade the level-of-service (LOS) at all twelve controlling intersections, except for the intersection of Park Avenue and U.S. 50 on the South Shore, which is already at capacity. With application of planned TCMs, however, LOS improved or stayed the same at all intersections except the South Tahoe "Wye," California 28 at Dollar Hill, and the North Stateline.

The new development anticipated in the Goals and Policies would tend to increase Regional vehicles-miles-travelled (VMT) from 1.70 million (peak summer day) to 1.88 million, an increase of 10.5%. However, with the application of VMT-reducing control measures, regional VMT can be expected to decrease, over the long-term, to the threshold value of 1.53 million (peak summer day).

Methodology

Level of Service (LOS). Existing LOS calculations for control intersections and highway links in the Tahoe Basin were determined using 1985 and 1986 turning movement and traffic volume counts. This data was assembled by project consultants, the City of South Lake Tahoe, the counties, the states, and TRPA staff. Existing and future LOS calculation methodology was consistent with the Quick Response Urban Travel Techniques, and the Federal Highways Special Report 209 and 212 procedures. Future traffic volume projections were a direct output from the regional transportation model assembled by the TRPA staff for the year 2005.

US 50 at Kingsbury LOS was predicted to improve to .60% capacity as a result of an extension of the Loop road to Kingsbury Grade. In 1985, there were 987 peak hour critical movements during the summer. Based upon the model runs, it is estimated that critical movements could increase to 1,125 in the year 2005. Based upon origin and destination data, it is estimated that the Loop extension could divert up to 375 critical movements from the intersection.

extending Montreal Road to Pioneer Trail near Needle Peak, [illegible] on the North end of the Loop Road and intersecting at Pioneer Trail and US 50 and installing a free right turn lane on US 50 from Pioneer Trail to Park Avenue. In 1985, there were 1,450 peak hour critical movements at US 50 and Park. In the year 2005 it is estimated that a demand of up to 1,800 critical movements would be required at the intersection. In reality, this intersection would not be able to accommodate a number of that magnitude with the present configuration. It is estimated that with the identified control measures, that up to 656 critical movements would be diverted from the intersection. This scenario does not include the redevelopment strategy of rerouting Highway 50 traffic around the casino area via the loop roads and narrowing the existing Highway 50 from Pioneer Trail to the Stateline down to two lanes. If this measure is utilized, peak hour traffic would be reduced to 1,800 vehicles and would experience an LOS of C or better.

US 50 and Pioneer LOS was predicted to improve to .64% capacity as a result of extending Montreal Road and installing a free right turn lane on US 50 from Pioneer Trail to Park Avenue. In 1985, there were 1,131 peak hour critical movements at the intersection. It is anticipated that this could increase to 1,350 by the year 2005. It is estimated that this could be reduced by up to 518 critical movements with the identified control measures. This does not include the redevelopment scenario, which calls for a major reconfiguration of the intersection.

U.S. 50 and Al Tahoe LOS was predicted to improve to .88% capacity as a result of a reconfiguration of lanes at the intersection which will provide dedicated lanes for each turning movement from Al Tahoe onto US 50. Based upon projections, in the year 2005, up to 1,350 critical movements could be realized at the intersection. With the identified improvement, the critical movements could be reduced to 1,144.

US 50 and US 89 do not have headroom in the year 2005. However, there are additional mitigation measures which could help reduce critical movements. These are neighborhood connecting streets, a free right turn lane from Hwy 89 south onto Lake Tahoe Blvd., and transit improvements.

Tahoe City Wye and the Highway 28 corridor LOS is determined primarily by the LOS of the Highway 28 corridor through Tahoe City. In 1985, the Highway 28 corridor experienced approximately 1,115 vehicles per hour per direction. Using the Quick Response method for determining capacity through the 28 corridor, it was determined that with the existing parking situation, the capacity of the road is 1,150 vehicles per hour per direction. If one removes the parking from the highway, the capacity would be raised to 1,600 vehicles per hour per direction. The suggested mitigation measure of removing parking from the 28 corridor would reduce congestion and LOS would be .70% capacity.

Highway 28 and Mount Rose Highway LOS is at 1.0 only on the left turn movement from Mount Rose to Highway 28. The traffic projections indicate that this movement will worsen to approximately 1.19% of the capacity. A signal at this intersection would allow a free left turn and reduce the capacity of that movement to .70%.

Highway 28 at Village LOS was .69% capacity. This was determined by evaluating NDOT traffic counts which indicate average daily traffic of 10,500. The capacity of the two lane highway through Incline Village core is 15,000 vehicles per day. Based upon model runs, the year 2005 could experience average daily traffic of 11,850. The suggested mitigation measure of widening the highway to three or four lanes would increase the capacity of the highway between 17,950 and 27,000 vehicles per day.

Vehicle Miles Travelled (VMT). VMT estimates for the Region for the years 1981, 1985, and 2005 were determined using the Quick Response System travel demand gravity model adapted for the Lake Tahoe Basin. The land use scenario for the year 2005 was based on the Goals and Policies, and the addition of Harvey's tower.

The land use assumptions are as follows:

6,000 new single family units
1,600 maximum new multi-family units
400 new tourist accommodation units
850,000 ft^2 new commercial floor area, 90% in community plan areas

Cordon Stations. Cordon station (entry points into the Basin) traffic volumes were estimated based on actual observed traffic counts between 1981 and 1985. California-side traffic volumes entering the Basin have declined between 3.0% and 14.5% from 1981 to 1985. Nevada-side traffic volumes entering the Basin have increased from 3.0% to 6.5% in the same period. Therefore, the staff held traffic volumes entering the Basin from California equal to the 1985 values, and increased volumes entering the Basin from Nevada proportional to observed growth.

1985 VMT was determined by reviewing all residential securities returned since 1982 and incorporating them into the 1981 QRS gravity model for the Tahoe Basin. Also, all commercial development since 1981 has been included into the model. Attraction values at recreational areas which were inadequately represented in the 1981 model were adjusted to match existing known use. Harvey's expansion was not included.

1995 VMT was determined by incorporating 1,800 SFD as agreed to by the Consensus process. These units were allocated to TAZ's based upon the ration of new units to existing units in each TAZ between 1981 and 1985. 1,600 bonus units were included into the model as agreed upon by the Consensus group. These were intended to include low income units. These units were allocated in the same manner as the 1,800 units. 100 units were subtracted from the 64 acre tract in Tahoe City to reflect the removal of the trailer park. 607,000 square feet of commercial area was included in the model and was distributed proportionally to the plan areas identified for commercial area as described in the December 1984 allocation list. 400 new hotel/motel units were included in the model. 160 were included in the South Stateline CP, 80 in the Tahoe City CP, 60 in the Kings Beach CP, 20 in the North Stateline CP and 80 in the Incline Village CP. The addition of Harvey's new addition was also included. 2,275 work attractions were included for Harveys, 546 new rooms were included and the addition of gaming floor area was represented by boosting the recreation trips attracted to

Harveys. 6,114 overnight PAOTs were included into the model at 4 PAOTs per campground unit. 6,761 day use PAOTs were also included into the model. All PAOTs were distributed to plan areas based upon allocations the land use team derived.

2005 VMT was derived using 6,000 SFD units, 1,600 bonus units, 1,0007,040 square feet of commercial floor area, Harveys addition, and 400 hotel/motel units. These were distributed in the same manner as the 1995 scenario. PAOTs were not included.

2005A VMT was derived using the same figures as 2005 including the PAOTs which were added in the 1995 scenario.

2005AI is the same as 2005A including boosting the California cordons by 5%.

2005B VMT was derived in the same manner as 2005A including: adding 200 PAOTs for a Tahoe City visitor center and conference facility, 300 PAOTs for a Kings Beach convention center, 300 PAOTs for a golf course and cultural center in Incline Village, 600 PAOTs for an RV park on Kingsbury Grade, 300 PAOTs for Hodges convention center, 1,810 PAOTs for the LTCC expansion, 1,040 PAOTs for a campground expansion near the South Wye, and 5,000 PAOTs for a sports center in the Casino Area. 200 PAOTs were assigned to all marinas which presently have boat slips and 100 PAOTs were assigned to all marinas which presently have boat moorings.

Increased room occupancy in the south shore, Kings Beach, and Tahoe City was added to reflect increased attractivity, and economic growth in those areas as a result of the added facilities.

2005BI VMT was derived in the same manner as 2005B including boosting the California cordons by 5%.

Mitigation measures for VMT were calculated by evaluating actual trip interchanges which are a direct output from the gravity model. The trip interchange matrices are stratefied by trip purpose. Mitigation measures which were not determined by analysis of trip interchange tables relied upon existing documents such as the SRTP and the Postal Service Action Plan.

VMT Reduction Strategies. Specific VMT reduction strategies were evaluated by the TRPA staff. These specific strategies, the evaluation methodology, and the impact on VMT are as follows:

Short Range Transit Plan

The Short Range Transit Plan assumes a level of service in the five year period which will carry 3,400 people/day. If one assumes a 1.35 vehicle occupancy for those individuals diverted out of their automobiles and an average trip length of four miles, this equates to a 10,000 VMT savings. Staff assumed that as ridership builds, the VMT savings could reach a projected level of 30,000 VMT maximum.

Beach Bus Service

In the summer of 1986, the Beach Bus service from the South Shore Wye up the West Shore carried up to 65 persons/day. The average trip length was 4.63 miles and if one assumes an average vehicle occupancy of 1.35 miles, the VMT savings are approximately 230 VMT. As ridership builds and service expands, the VMT savings could range between 1,000 and 1,500 VMT.

Tahoe City Intrazonal Shuttle

In the year 2005, it is estimated that approximately 6,166 VMT will be generated in the Tahoe City core area. The VMT is primarily generated by numerous trips which never leave the Tahoe City core area. An intrazonal shuttle traversing the area with short headways could attract approximately 30% of those trips and provide a savings of 1,500 to 2,000 VMT.

Kings Beach Intrazonal Shuttle

In the year 2005, it is estimated that 15,201 VMT will be generated by vehicles with origins and destinations internal to the Kings Beach area. An intrazonal shuttle traversing the areas with short headways could attract approximately 20% of those trips and provide a savings of 2,500 to 3,500 VMT.

Extension of Bus Service into Tahoe Keys

In the year 2005, it is estimated that 20,089 VMT will be generated by vehicles originating in the Tahoe Keys destined for the casino areas exclusively. It is estimated that an extension of service to satisfy that trip interchange could provide a savings of 1,500 to 2,000 VMT.

Extension of Bus Service Into the Roundhill Neighborhood and to Nevada Beach

In the year 2005, it is estimated that 14,884 VMT will be generated by vehicles originating in the Roundhill and Nevada Beach areas destined for the casino areas exclusively. It is estimated that an extension of service to satisfy that trip interchange could provide a savings of 1,000 to 2,000 VMT.

Extension of Bus Service up Kingsbury Grade

In the year 2005, it is estimated that 15,000 VMT will be generated by vehicles originating in the Kingsbury Grade area destined for the casino area exclusively. It is estimated that an extension of service to satisfy that trip interchange could provide a savings of 1,000 to 2,000 VMT.

Extension of Bus Service to Zephyr Cove

In the year 2005, it is estimated that 18,000 VMT will be generated by vehicles origins and destinations between Zephyr Cove and the Casino area exclusively. It is estimated that an extension of service to satisfy that trip interchange could provide a savings of 1,000 to 2,000 VMT.

Extension of Bus Service to Truckee from the Tahoe City Area

It is estimated that an extension of bus service between Tahoe City and Truckee which serves the Alpine Meadows and Squaw Valley areas could have an estimated ridership of 250 persons/day in the year 2005. This could provide a savings of 1,000 to 2,000 VMT.

Extension of a Shuttle Service Between Kings Beach and North Star

It is estimated in the year 2005, that vehicles with origins and destinations between Kings Beach and North Star have a cumulative VMT of 13,792. A shuttle service which satisfies this trip interchange could provide a 2,500 to 3,000 VMT savings.

People Mover between Heavenly Valley and the Casino Area

Based upon the trip interchanges between the casino core area and the Heavenly Valley ski area during winter and summer months, it is estimated that a reduction of 20,000 to 40,000 VMT could be achieved in the year 2005.

Employer Based Employee Van Pools

It is estimated in the year 2005, that employee work trips within the South Shore destined for the casino core area will have a cumulative VMT of 100,187. If an employee van pool was initiated, it is estimated that a reduction of 20,000 to 25,000 VMT could be achieved.

Airport Master Plan

Based upon a diversion rate of 69%, and 1,200 passengers/day arriving at the Lake Tahoe Airport, a reduction of 6,000 to 9,000 VMT could be achieved. This would be dependant upon a 70 to 85% shuttle bus mode choice.

Waterborne Point to Point Service

It is estimated in the year 2005, that 52,500 VMT is generated between the Tahoe City/Incline Village urban areas and the south Stateline. The implementation of an efficient, high speed waterborne system could reduce between 15,000 and 20,000 VMT.

Waterborne Excursion Service

Currently, between 3,500 and 4,000 VMT are reduced as a result of existing waterborne excursion service. If these services are integrated with existing and proposed transit service, they are estimated to reduce 4,000 to 8,000 VMT by the year 2005.

Neighborhood Delivery Centers

Based upon the U. S. Postal Service Action Plan proposal, the Neighborhood Delivery Centers are anticipated to reduce between 45,000 and 55,000 VMT upon full implementation.

Ridership Incentives

Based upon existing ridership incentives distributed by the casinos, it is estimated that between 1,000 and 2,000 bus tickets could be distributed at a reduced fare by the casino core employers. This is estimated to be a reduction of 5,000 to 10,000 VMT.

Community Plans

It is intended that Community Plans will help to achieve the transportation goals of the Region. Based upon TRPA staff modeling, providing the recreation and work trip needs in close proximity to the residence (both resident and visitor) significantly reduces the need for multiple trips and shortens trip lengths. This is conducive to increasing walk trips and accommodates the attractiveness of shuttle service. It is estimated that 40,000 to 60,000 VMT could be reduced as a result of the community plan process.

Educational Programs

Educational programs during peak travel periods are estimated to reduce approximately 10,000 VMT.

Future Transit

Increased transit in the form of buses and rail could achieve between 35,000 and 50,000 VMT by the year 2005.

TABLE 14

REGIONAL VEHICLE MILES TRAVELED (VMT) WITHOUT CONTROL MEASURES OF THE REGIONAL PLAN

Year	VMT
1981	1,700,000
1985	1,646,000
2005	1,877,000

TABLE 15

VMT REDUCTION BY CONTROL MEASURE

Phase	Estimated VMT Reductions Low	High	Control Measure
I	1,000	1,500	Beach Bus Service
I	1,000	2,000	Bus Extension Into Truckee
I	6,000	9,000	Airport Master Plan
I	4,000	8,000	Waterborne Excursion with Shuttle
I	5,000	10,000	Education
I	5,000	10,000	Ridership Incentives
I	10,000	30,000	Short Range Transit Program
I	15,000	30,000	Increase Bike & Pedestrian Circulation
I	45,000	55,000	Neighborhood Delivery Centers*
II	1,000	2,000	Bus Extension Into Roundhill
II	1,000	2,000	Bus Extension Into Kingsbury
II	1,000	2,000	Bus Extension Into Zephyr Cove
II	1,500	2,000	Bus Extension Into Tahoe Keys
II	1,500	2,000	Tahoe City Intrazonal Shuttle
II	2,500	3,000	North Star - Kings Beach Shuttle
II	2,500	3,500	Kings Beach Intrazonal Shuttle
II	4,000	8,000	Heavenly - Stateline People Mover
II	10,000	20,000	Long Range Transit Expansion
II	15,000	20,000	Waterborne Point - Point
II	20,000	25,000	Casino Employee Van Pools
III	20,000	40,000	Home Mail Delivery
III	40,000	60,000	Community Plans with Multimodal & Parking
IV	25,000	30,000	Light Rail
I	92,000	155,500	
II	60,000	89,500	
III	60,000	100,000	
IV	25,000	30,000	
Total	237,000	375,000	

OCCUPANY RATE: 0.67

PLAN AREA	OVNT PAOT	SUMMER PAOT	VIS. PROD.	VIS. ATT.	QRS TAZ
	6,114	6,761	14,980	14,980	
089B		60	0	133	[illegible]
091		100	0	222	[illegible]
098		40	0	89	4
095	490	160	1,201	355	4
101		600	0	1,329	4
102		200	0	443	8
103		50	0	111	9
108		36	0	80	10
113		80	0	177	11
116		50	0	111	12
115		100	0	222	13
110		50	0	111	14
119		160	0	355	16
125		100	0	222	16
129	1130	190	2,769	421	18
140		80	0	177	19
146		120	0	266	20
150		160	0	355	21
153	450		1,103	0	21
151		100	0	222	21
155		50	0	111	22
162		125	0	277	22
159		50	0	111	22
152	900		2,205	0	22
169		50	0	111	23
170		20	0	44	23
163	50	280	123	620	23
174		245	0	543	25
001A		100	0	222	26
166	280		686	0	26
002		50	0	111	26
004	600		1,470	0	27
008		110	0	244	27
011		50	0	111	28
017		200	0	443	28
013	400		980	0	28
019	424	450	1,039	997	29
029		200	0	443	29
024A	200	100	490	222	29
024B		285	0	631	29
022		100	0	222	29
037		100	0	222	32
045		100	0	222	32
046		100	0	222	33
048		100	0	222	33
044		500	0	1,108	34
057	390	500	956	1,108	36
066	200	360	490	798	37
068	100		245	0	38
070B	500		1,225	0	38
076		100	0	222	39

0066

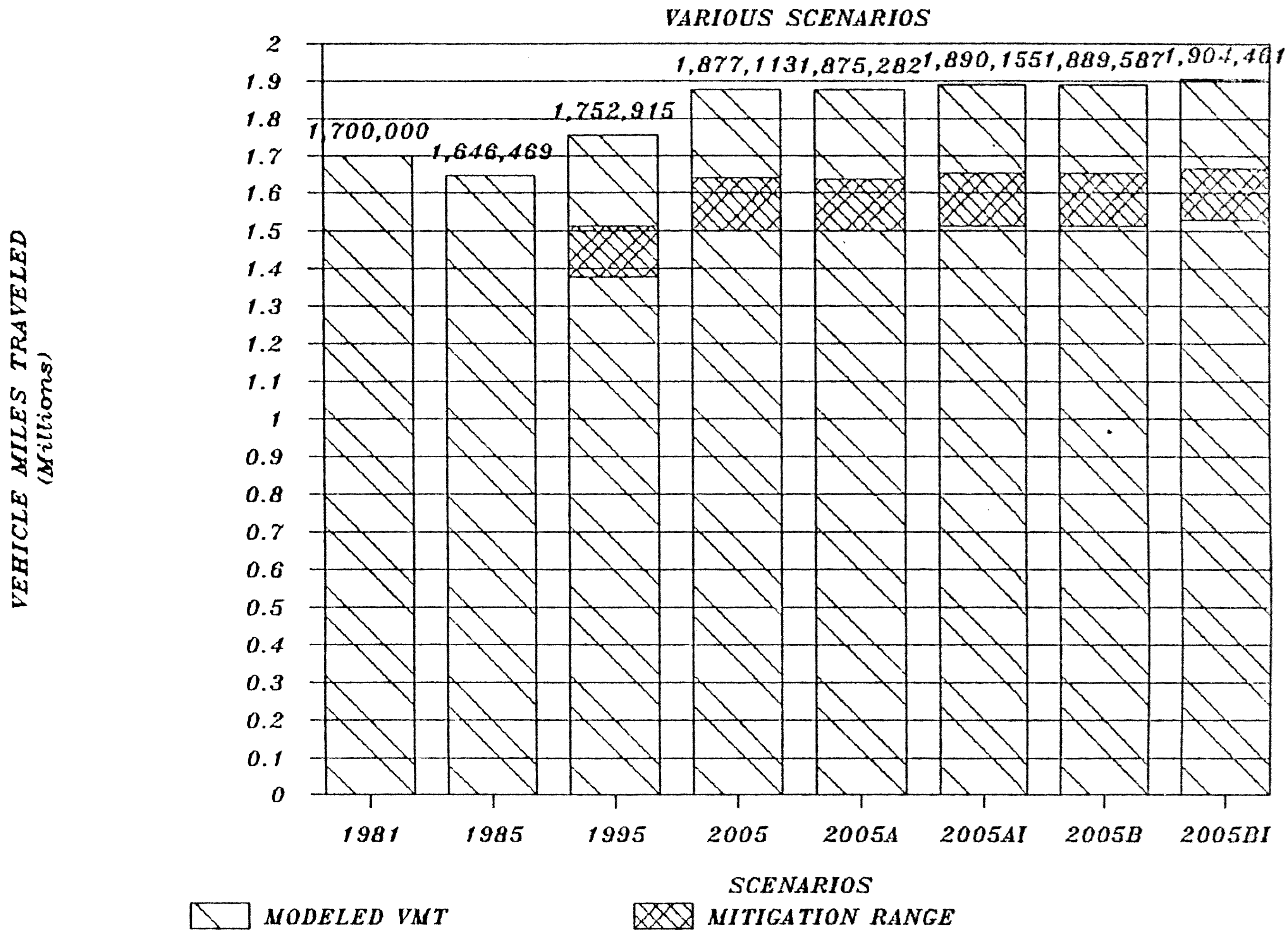
1995-GF[illegible].WR1

PAS	CP	Primary QRS-TAZ	2ndary QRS-TAZ	607,040 Initial GFA		1,299 Resident 1,299 HBW	1[illegible]097 14,097 HBNW	8,142 8,142 NHB		4,131 Visitor 4,131 HBW*	6,286 6,286 HBNW*	7,940 7,940 NHB		3[illegible] Resident 340 External	1,563 Visitor 1,563 External
001	*	26	25	23,464	-	50	545	315	-	160	243	307	-	13	60
007	?	27		3,946	-	8	92	53	-	27	41	52	-	2	10
09A	*	27		1,920	-	4	45	26	-	13	20	25	-	1	5
09B		27		13,865	-	30	322	186	-	94	144	181	-	8	36
017	*	28		1,973	-	4	46	26	-	13	20	26	-	1	5
022	*	29		15,465	-	33	359	207	-	105	160	202	-	9	40
026	*	29		11,732	-	25	272	157	-	80	121	153	-	7	30
029	*	29		23,731	-	51	551	318	-	161	246	310	-	13	61
031	*	29		395	-	1	9	5	-	3	4	5	-	0	1
032	*	30	29	7,893	-	17	183	106	-	54	82	103	-	4	20
044	*	34		3,946	-	8	92	53	-	27	41	52	-	2	10
045	*	32	33	27,730	-	59	644	372	-	189	287	363	-	16	71
048	*	33		7,893	-	17	183	106	-	54	82	103	-	4	20
050	*	34		1,973	-	4	46	26	-	13	20	26	-	1	5
054	?	34		7,893	-	17	183	106	-	54	82	103	-	4	20
058		36		395	-	1	9	5	-	3	4	5	-	0	1
063		37		395	-	1	9	5	-	3	4	5	-	0	1
067		37		747	-	2	17	10	-	5	8	10	-	0	2
071	*	38		7,893	-	17	183	106	-	54	82	103	-	4	20
076		40	39	7,893	-	17	183	106	-	54	82	103	-	4	20
085	*	2	4	395	-	1	9	5	-	3	4	5	-	0	1
088		39		1,973	-	4	46	26	-	13	20	26	-	1	5
089A	*	1		159,866	-	342	3,712	2,144	-	1,088	1,655	2,091	-	90	412
089B	*	1	2	17,598	-	38	409	236	-	120	182	230	-	10	45
091	*	3	2	27,730	-	59	644	372	-	189	287	363	-	16	71
092	*	2		395	-	1	9	5	-	3	4	5	-	0	1
098	*	4	3	27,730	-	59	644	372	-	189	287	363	-	16	71
102		9		1,173	-	3	27	16	-	8	12	15	-	1	3
103	*	8	7	23,464	-	50	545	315	-	160	243	307	-	13	60
110	*	11	10	71,779	-	154	1,667	963	-	488	743	939	-	40	185
111	*	9		1,973	-	4	46	26	-	13	20	26	-	1	5
112	?	14		395	-	1	9	5	-	3	4	5	-	0	1
113		11	15	23,997	-	51	557	322	-	163	248	314	-	13	62
116	*	12		23,997	-	51	557	322	-	163	248	314	-	13	62
125	*	13	16	21,864	-	47	508	293	-	149	226	286	-	12	56
155	*	22	21	7,893	-	17	183	106	-	54	82	103	-	4	20
159	*	22		15,785	-	34	367	212	-	107	163	206	-	9	41
169	*	23		7,893	-	17	183	106	-	54	82	103	-	4	20

NEW-QFA.WR1

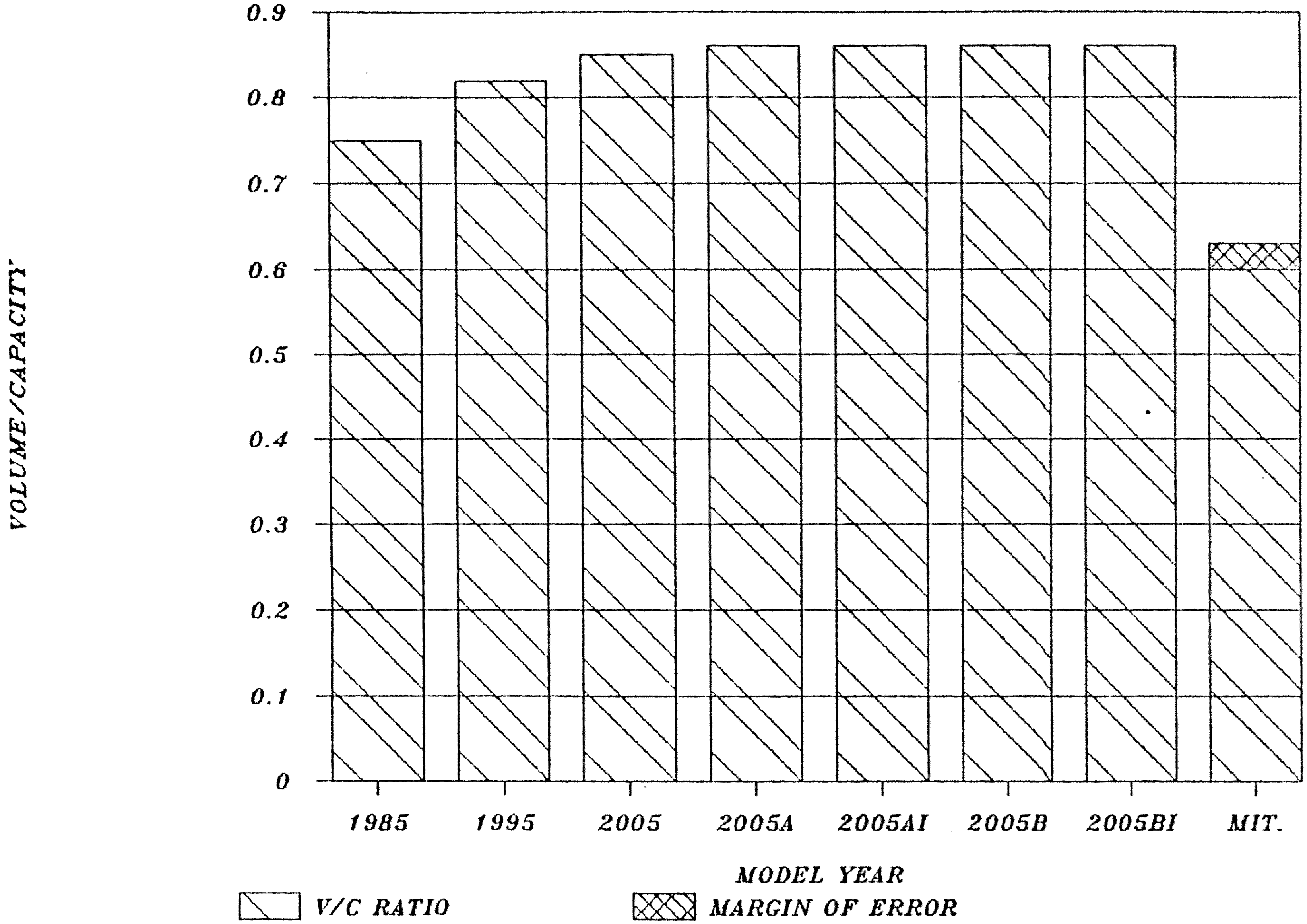
PAS	CP	Primary QRS-TAZ	2ndary QRS-TAZ	Initial GFA		Resident HBW	HBNW	NHB		Visitor HBW*	HBNW*	NHB		Resident External	Visitor External
				1,007,040		6,195	3[illegible],153	15,908		8,732	12,476	12,396		3[illegible]	1,563
						6,195	33,153	15,908		8,732	12,476	12,396		340	1,563
001	*	26	25	44,000	-	271	1,449	695	-	382	545	542	-	15	68
007	?	27		7,400	-	46	244	117	-	64	92	91	-	2	11
09A	*	27		3,600	-	22	119	57	-	31	45	44	-	1	6
09B		27		26,000	-	160	856	411	-	225	322	320	-	9	40
017	*	28		3,700	-	23	122	58	-	32	46	46	-	1	6
022	*	29		29,000	-	178	955	458	-	251	359	357	-	10	45
026	*	29		22,000	-	135	724	348	-	191	273	271	-	7	34
029	*	29		44,500	-	274	1,465	703	-	386	551	548	-	15	69
031	*	29		740	-	5	24	12	-	6	9	9	-	0	1
032	*	30	29	14,800	-	91	487	234	-	128	183	182	-	5	23
044	*	34		7,400	-	46	244	117	-	64	92	91	-	2	11
045	*	32	33	52,000	-	320	1,712	821	-	451	644	640	-	18	81
048	*	33		14,800	-	91	487	234	-	128	183	182	-	5	23
050	*	34		3,700	-	23	122	58	-	32	46	46	-	1	6
054	?	34		14,800	-	91	487	234	-	128	183	182	-	5	23
058		36		740	-	5	24	12	-	6	9	9	-	0	1
063		37		740	-	5	24	12	-	6	9	9	-	0	1
067		37		1,400	-	9	46	22	-	12	17	17	-	0	2
071	*	38		14,800	-	91	487	234	-	128	183	182	-	5	23
076		40	39	14,800	-	91	487	234	-	128	183	182	-	5	23
085	*	2	4	740	-	5	24	12	-	6	9	9	-	0	1
088		39		3,700	-	23	122	58	-	32	46	46	-	1	6
089A	*	1		168,500	-	1,037	5,547	2,662	-	1,461	2,088	2,074	-	57	262
089B	*	1	2	33,000	-	203	1,086	521	-	286	409	406	-	11	51
091	*	3	2	52,000	-	320	1,712	821	-	451	644	640	-	18	81
092	*	2		740	-	5	24	12	-	6	9	9	-	0	1
098	*	4	3	52,000	-	320	1,712	821	-	451	644	640	-	18	81
102		9		2,200	-	14	72	35	-	19	27	27	-	1	3
103	*	8	7	44,000	-	271	1,449	695	-	382	545	542	-	15	68
110	*	11	10	134,600	-	828	4,431	2,126	-	1,167	1,668	1,657	-	45	209
111	*	9		3,700	-	23	122	58	-	32	46	46	-	1	6
112	?	14		740	-	5	24	12	-	6	9	9	-	0	1
113		11	15	45,000	-	277	1,481	711	-	390	557	554	-	15	70
116	*	12		45,000	-	277	1,481	711	-	390	557	554	-	15	70
125	*	13	16	41,000	-	252	1,350	648	-	356	508	505	-	14	64
155	*	22	21	14,800	-	91	487	234	-	128	183	182	-	5	23
159	*	22		29,600	-	182	974	468	-	257	367	364	-	10	46
169	*	23		14,800	-	91	487	234	-	128	183	182	-	5	23

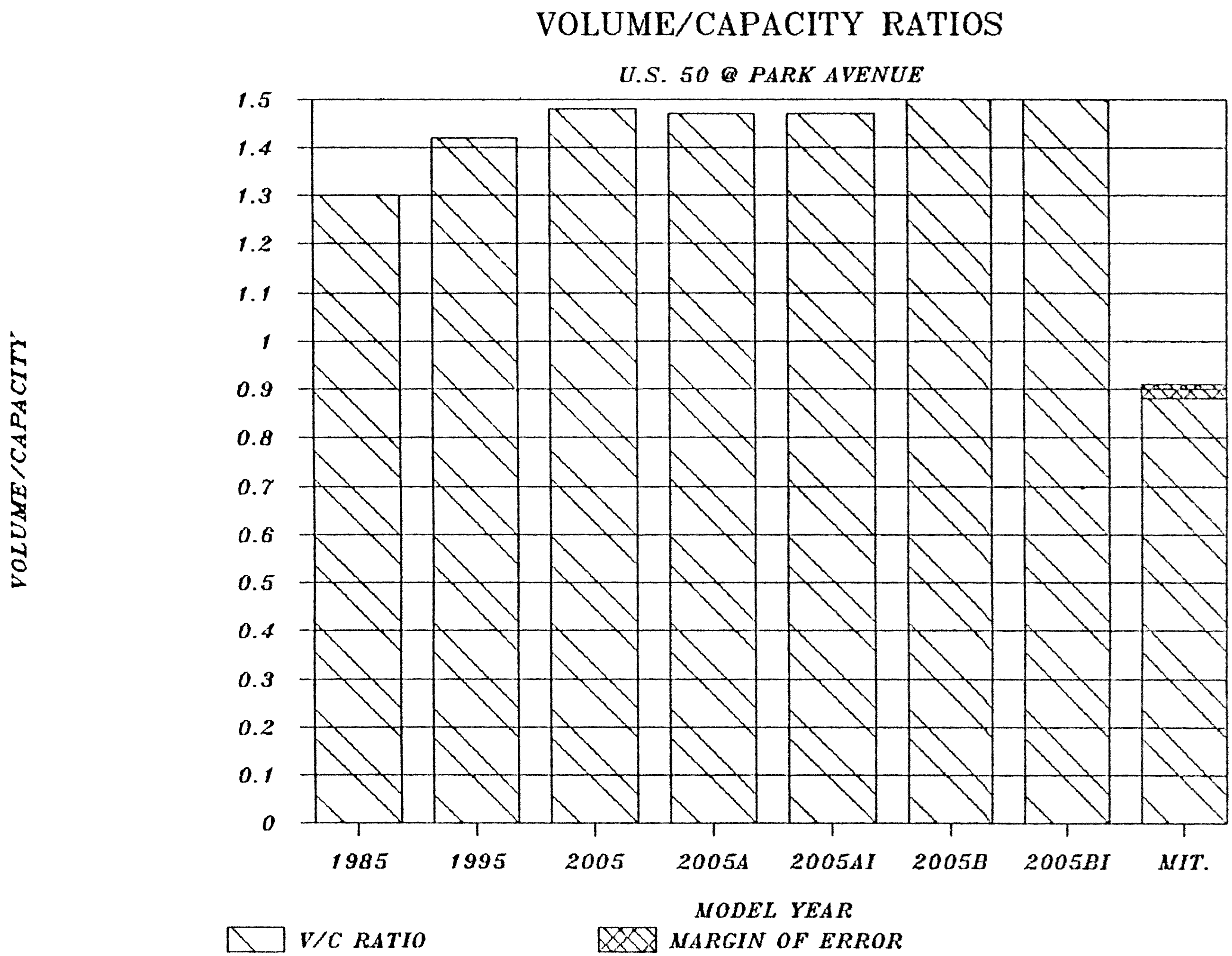
MODELED VEHICLE MILES TRAVELED



VOLUME/CAPACITY RATIOS

U.S. 50 @ KINGSBURY




VOLUME/CAPACITY RATIOS
U.S. 50 @ PARK AVENUE
VOLUME/CAPACITY
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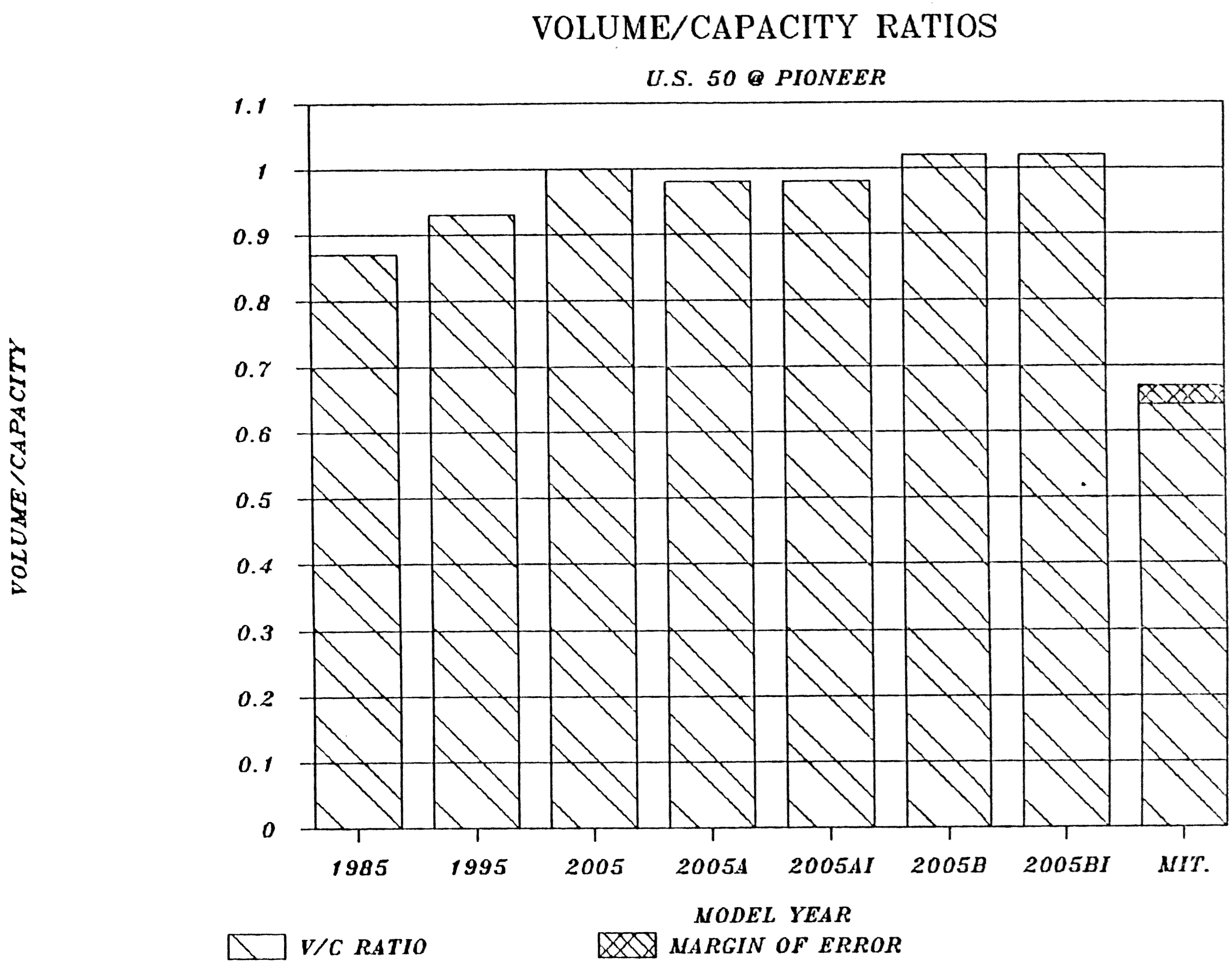
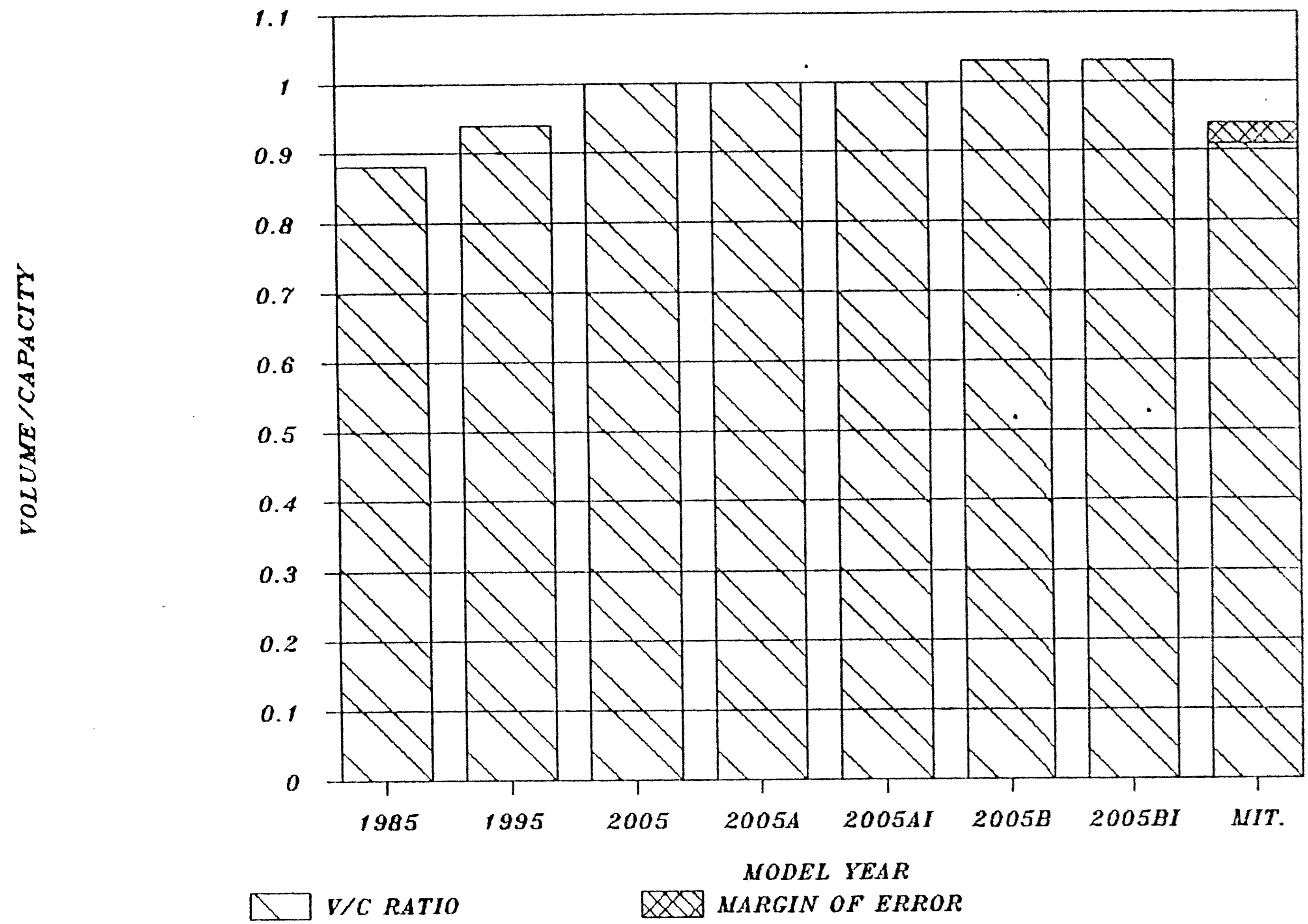
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MIT.
MODEL YEAR
V/C RATIO
MARGIN OF ERROR



VOLUME/CAPACITY RATIOS
U.S. 50 @ PIONEER
VOLUME/CAPACITY
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MIT.
MODEL YEAR
V/C RATIO
MARGIN OF ERROR

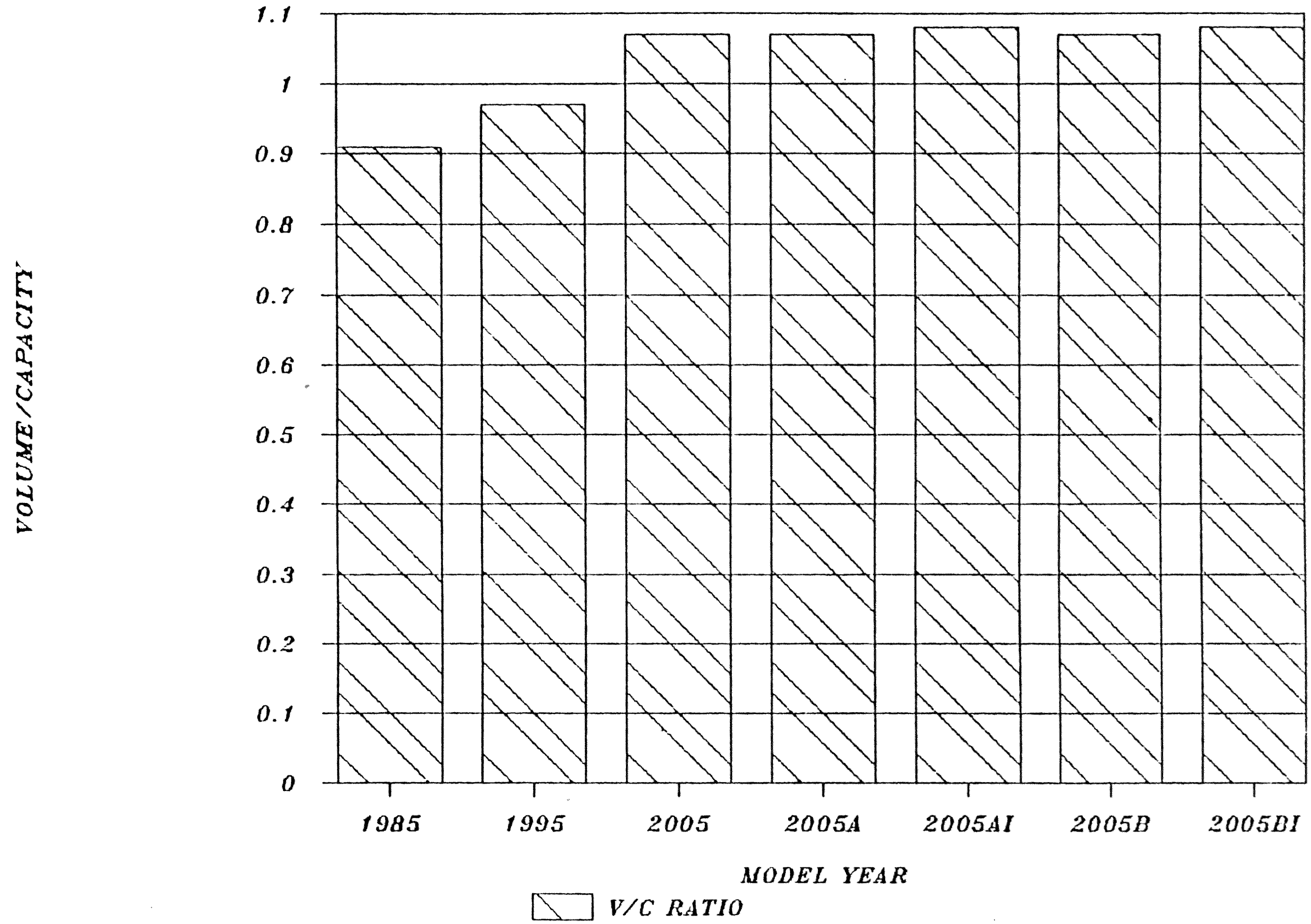
VOLUME/CAPACITY RATIOS

U.S. 50 @ AL TAHOE

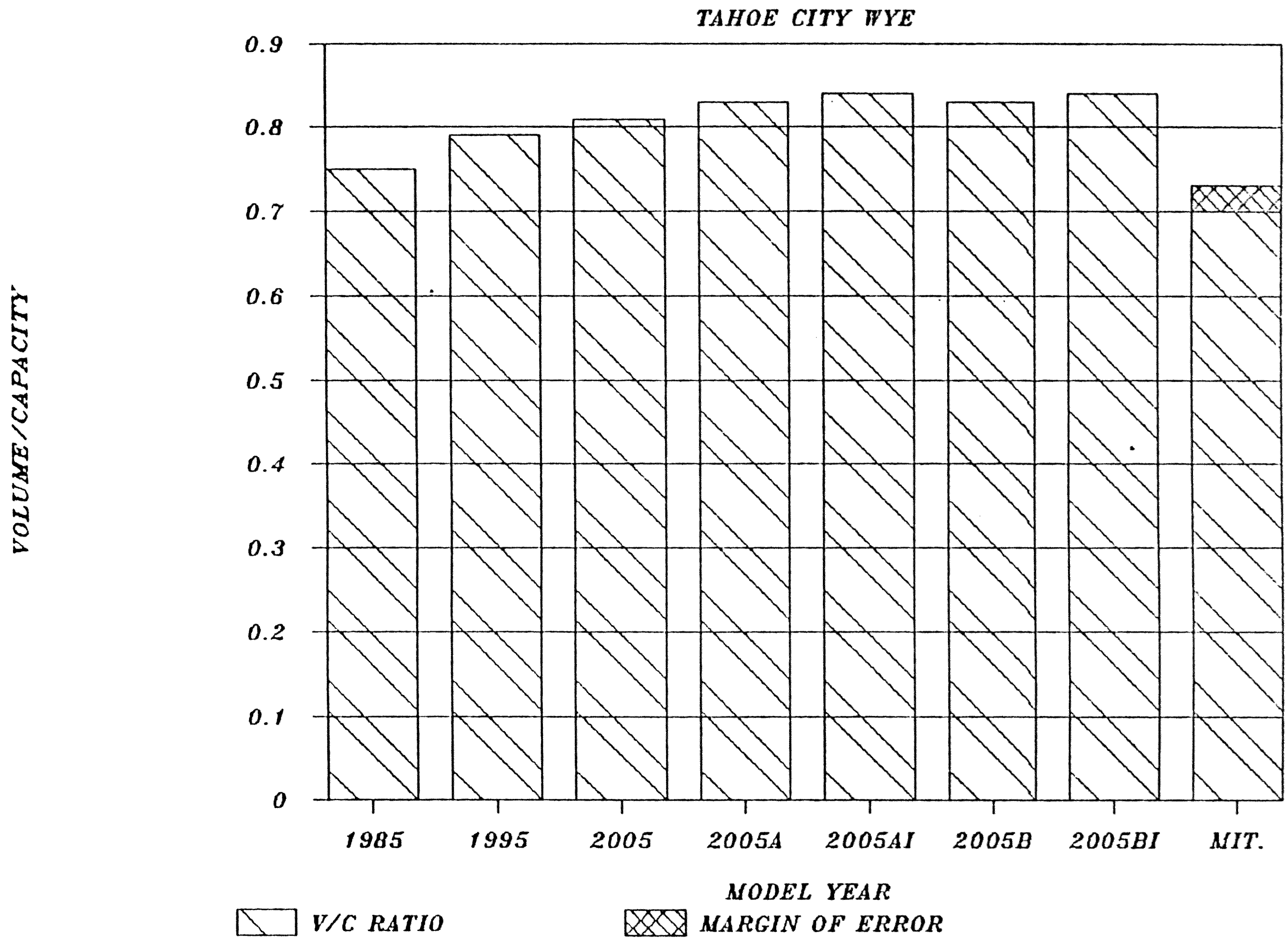


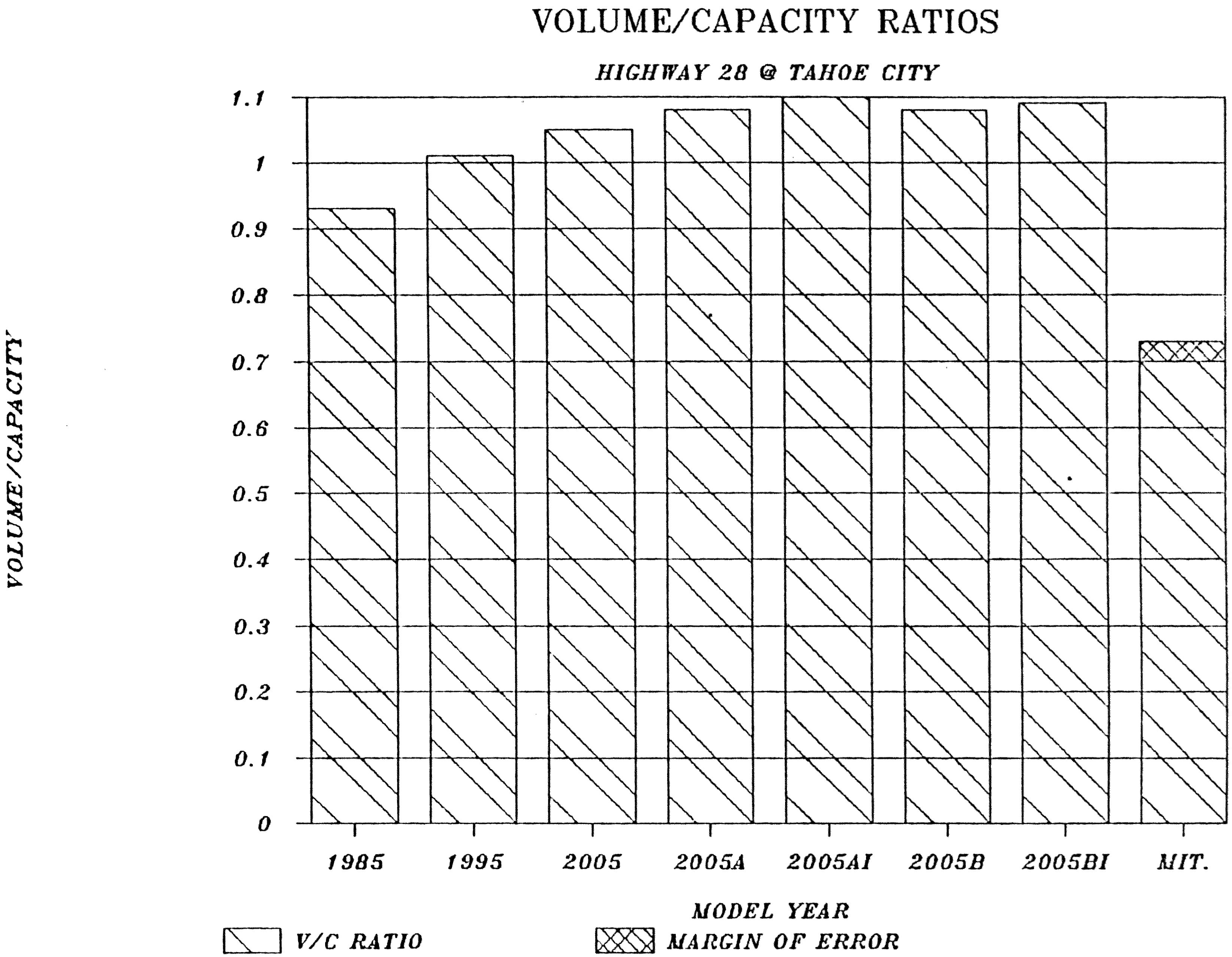
VOLUME/CAPACITY RATIOS

SOUTH TAHOE WYE



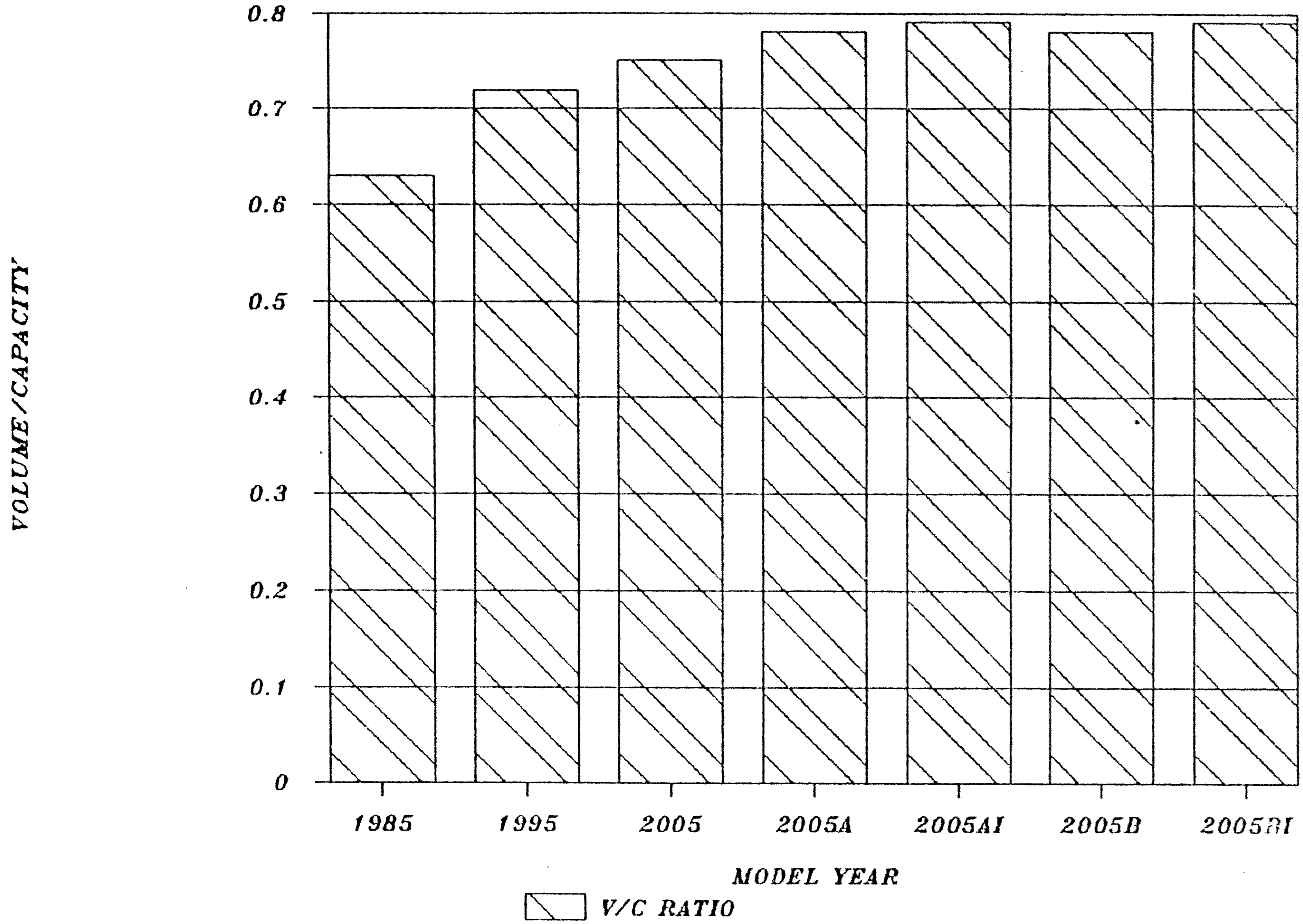
VOLUME/CAPACITY RATIOS




VOLUME/CAPACITY RATIOS
HIGHWAY 28 @ TAHOE CITY
VOLUME/CAPACITY
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MIT.
MODEL YEAR
V/C RATIO
MARGIN OF ERROR

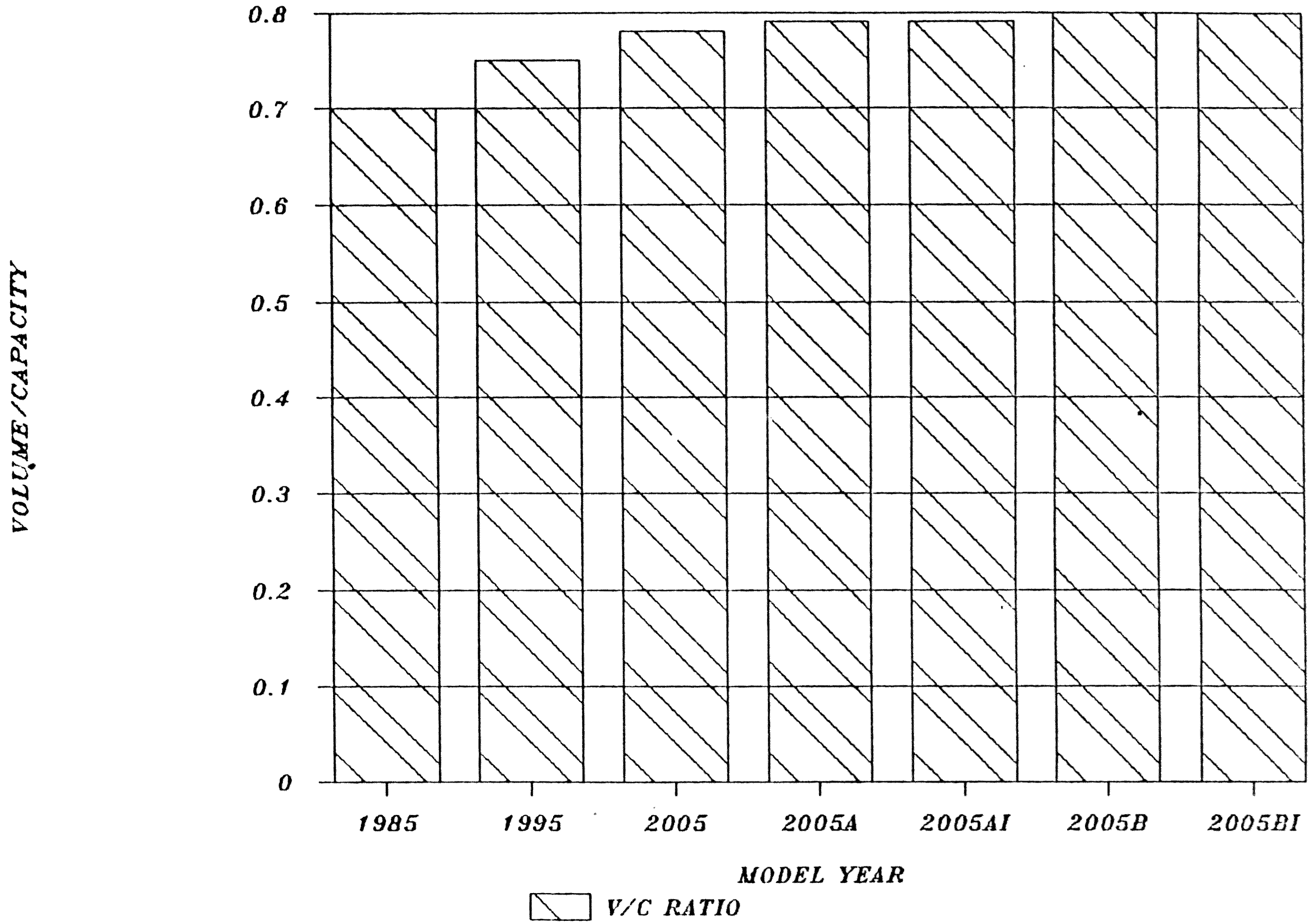
VOLUME/CAPACITY RATIOS

HIGHWAY 28 @ FABIAN



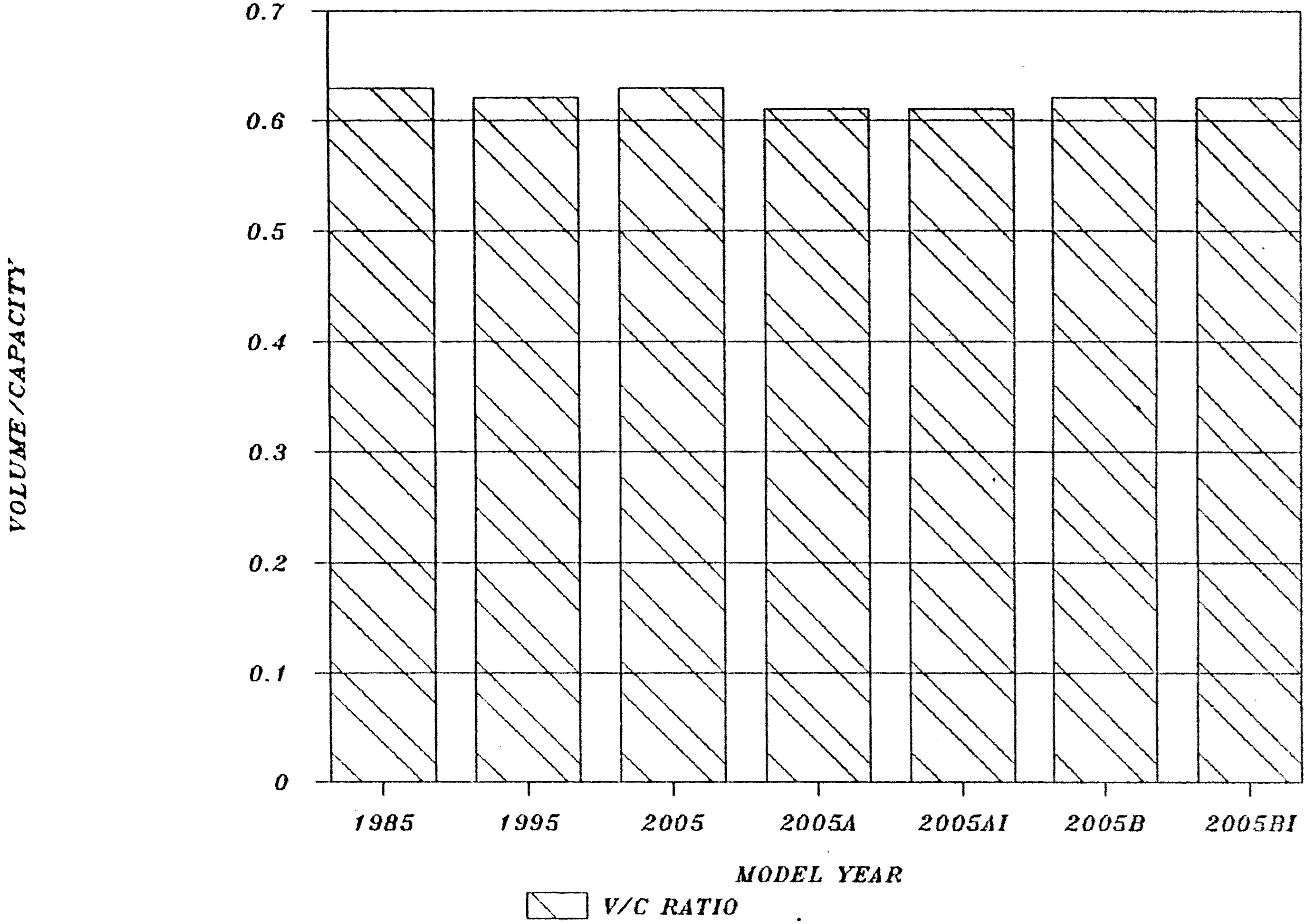
VOLUME/CAPACITY RATIOS

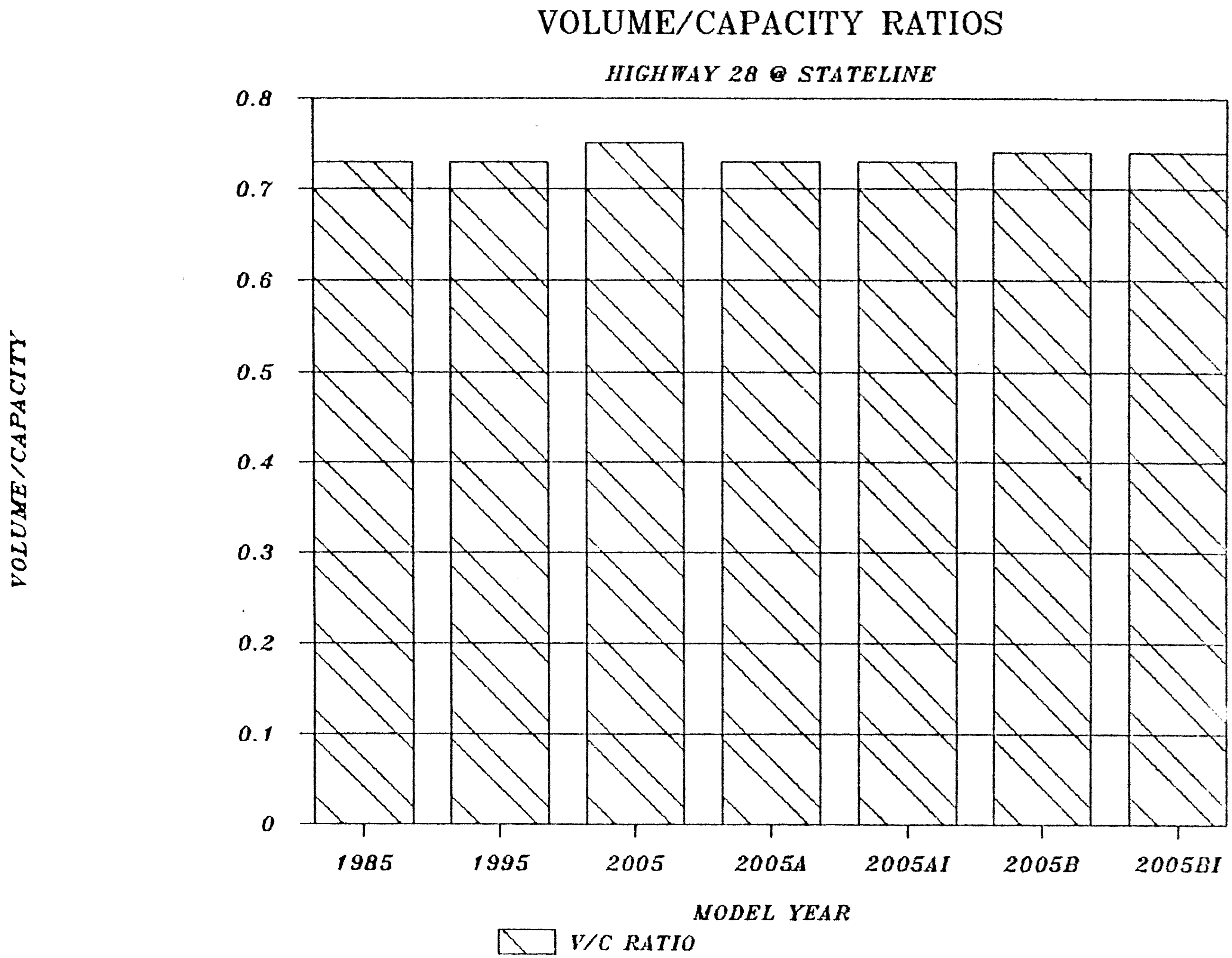
HIGHWAY 28 @ HIGHWAY 267

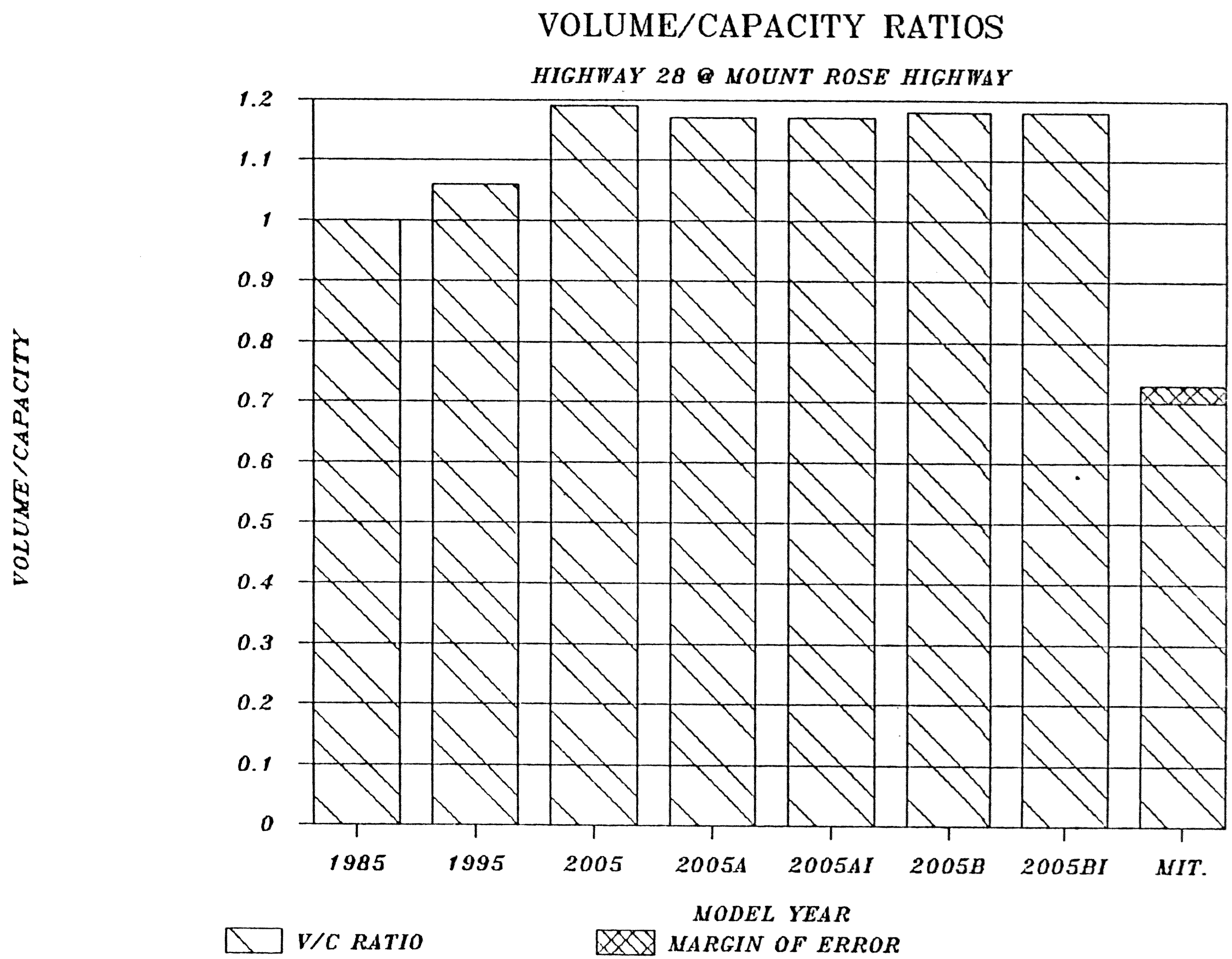


VOLUME/CAPACITY RATIOS

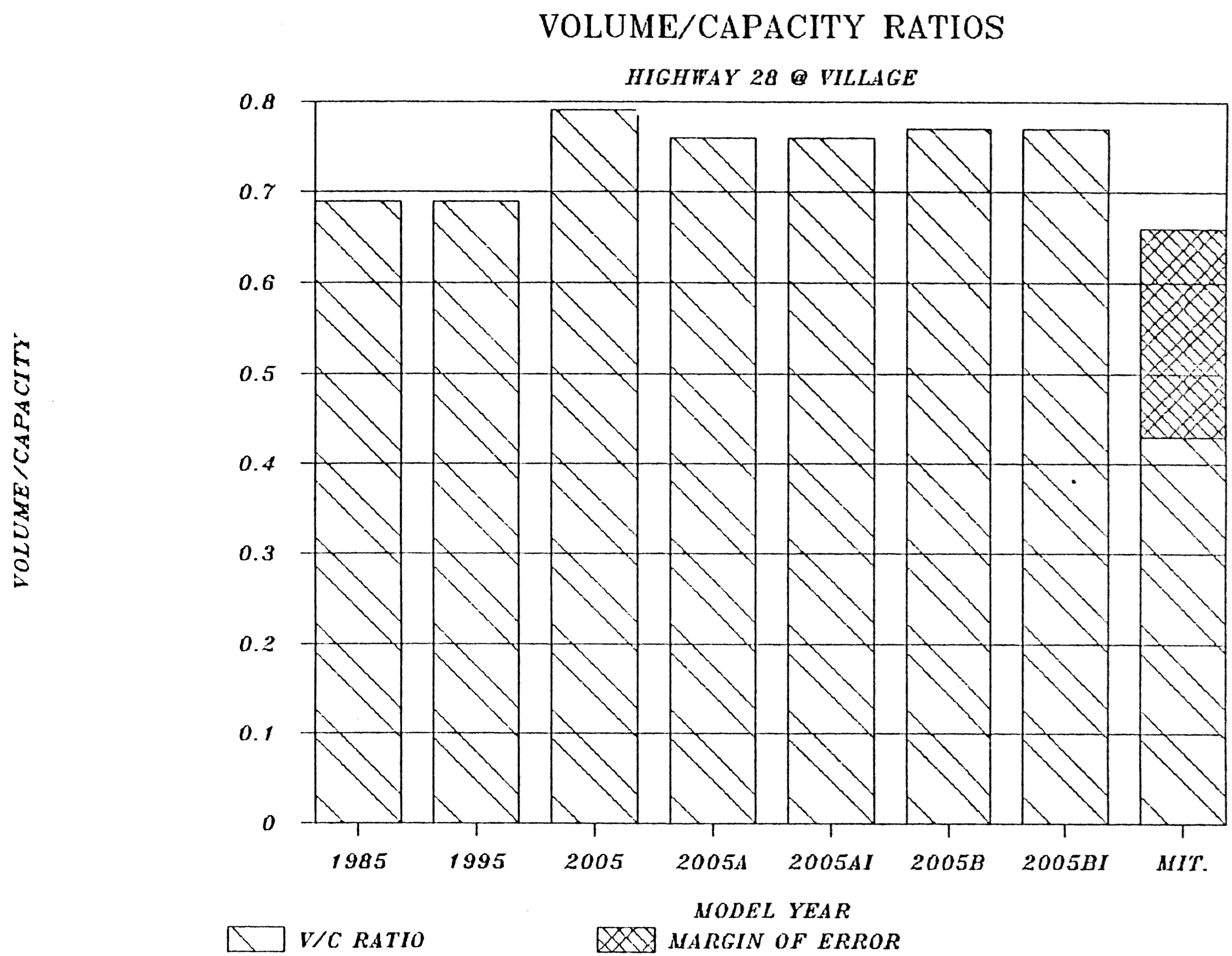
HIGHWAY 28 @ KINGS BEACH CORRIDOR




VOLUME/CAPACITY RATIOS
HIGHWAY 28 @ STATELINE
VOLUME/CAPACITY
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MODEL YEAR
V/C RATIO

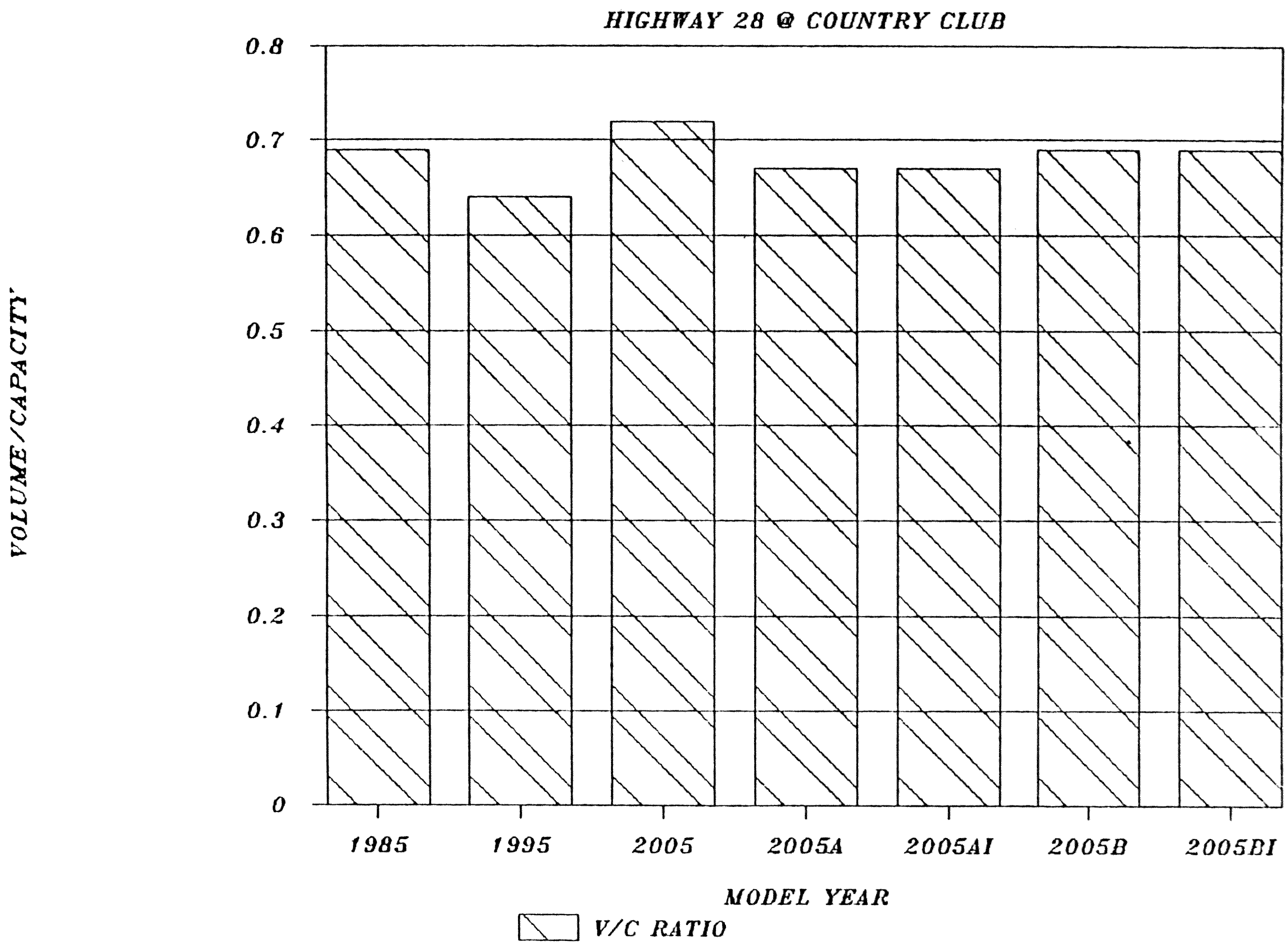


VOLUME/CAPACITY RATIOS
HIGHWAY 28 @ MOUNT ROSE HIGHWAY
VOLUME/CAPACITY
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MIT.
MODEL YEAR
V/C RATIO
MARGIN OF ERROR



VOLUME/CAPACITY RATIOS
HIGHWAY 28 @ VILLAGE
VOLUME/CAPACITY
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1995
2005
2005A
2005AI
2005B
2005BI
MIT.
MODEL YEAR
V/C RATIO
MARGIN OF ERROR

VOLUME/CAPACITY RATIOS



APPENDIX J

Upwind Emissions of Oxides of Nitrogen

Tahoe Regional Planning

October 12, 1988

Abstract

Emissions of oxides of nitrogen (NOx) upwind of Lake Tahoe in 2005 will be 73 to 87 percent of 1983 emissions. This conclusion is based on expected reductions in individual vehicle on-road NOx emissions to 40 percent of current levels offset by a 30% increase in population within 250 kilometers west and south of the Region.

Conclusions

Emissions of oxides of nitrogen upwind of Lake Tahoe in 2005 will be 73 to 87 percent of 1983 emissions. To make this estimate, a four step process was used.

Isolate Contributing Air Basins: For the purposes of this analysis, a distance of 250 kilometers was used to delimit contributing air basins. Next, contributing air basins were further limited to those west to south of Lake Tahoe. Using this process, 31 areas within 5 air basins were selected.

Determine Base Data: The most recent published emission data is for 1983 (California Air Resources Board, 1986). Therefore, 1983 base populations for the 31 areas were also determined (California Department of Finance, 1984).

Forecast Vehicle Emission Improvement: Using data developed for TRPA (Sierra Research, 1987), and assuming that downwind vehicles would operate in an environment of 60 to 80 degrees Fahrenheit and at all speeds to 55 mph, typical 2005 NOx emissions for individual on-road motor vehicles may be 40.3 percent of 1983 emissions.

Estimate Change in Population and Emission: For the 31 areas, population may grow from approximately 8,358,670 persons in 1983 to 10,848,183 persons by 2005 (California Department of Finance, 1983 and 1984). On-road emissions of NOx may decrease from 569.2 tons/day to 307.7 tons/day. Other emissions of NOx could remain at 414.1 tons/day, assuming individual districts succeed in holding the line; other emission of NOx could increase to as much as 548.3 tons/day if individual districts allow these emissions to increase with population. Therefore, the total emissions of NOx may decrease from 983.3 tons/day (1983) to 721.8 to 856.0 tons/day (2005).

Basin Number	Basin Description	On-road NOX (Tons/Day) CY 1983	Other NOX (Tons/Day) CY 1983	Total NOX (Tons/Day) CY 1983	Whole * County Population 7/1/1983	Whole * County Population 7/1/2005	2005 over 1983	On-road NOX (Tons/Day) CY 2005	Other NOX (Tons/Day) CY 2005	Total NOX (Tons/Day) CY 2005	2005 over 1983
									414.1	721.8	73.41%
		569.2	414.1	983.3	8,358,670	10,848,183	129.78%	307.7	548.3	856.0	87.05%
6	Lake	2.9	1.3	4.2	42,950	92,800	216.07%	2.5	2.8	5.3	127.00%
11	Amador	2.1	1.9	4.0	21,325	38,400	180.07%	1.5	3.4	4.9	123.63%
12	Calaveras	2.1	0.7	2.8	24,400	54,300	222.54%	1.9	1.6	3.4	122.90%
13	Por. ElDoCo	6.2	2.5	8.7	89,506	178,725	199.68%	5.0	5.0	10.0	114.73%
14	Mariposa	1.1	0.4	1.5	12,400	22,000	177.42%	0.8	0.7	1.5	99.75%
15	Nevada	6.8	2.9	9.7	62,450	136,500	218.57%	6.0	6.3	12.3	127.10%
16	Por. Placer	2.7	1.1	3.8	120,589	243,858	202.22%	2.2	2.2	4.4	116.44%
19	Tuolumne	3.2	2.2	5.4	37,425	63,100	168.60%	2.2	3.7	5.9	108.96%
36	Colusa	5.1	2.7	7.8	14,075	17,500	124.33%	2.6	3.4	5.9	75.80%
38	Por. Placer	12.0	6	18.0				9.8	12.1	21.9	121.74%
39	Sacramento	60.0	17	77.0	849,300	1,269,500	149.48%	36.1	25.4	61.6	79.94%
41	Por. Solano	7.2	2.8	10.0	260,400	429,600	164.98%	4.8	4.6	9.4	94.06%
42	Sutter	4.5	4.3	8.8	56,300	73,600	130.73%	2.4	5.6	8.0	90.82%
44	Yolo	12.0	6	18.0	118,850	167,500	140.93%	6.8	8.5	15.3	84.84%
45	Yuba	3.7	3	6.7	51,850	63,000	121.50%	1.8	3.6	5.5	81.45%
48	Alameda	71.0	27	98.0	1,160,250	1,301,700	112.19%	32.1	30.3	62.4	63.67%
49	Contra Costa	38.0	142	180.0	689,200	871,900	126.51%	19.4	179.6	199.0	110.56%
50	Marin	14.0	3	17.0	224,700	240,200	106.90%	6.0	3.2	9.2	54.34%
51	Napa	5.0	1.9	6.9	101,400	121,900	120.22%	2.4	2.3	4.7	68.21%
52	San Francisco	25.0	20	45.0	702,600	661,600	94.16%	9.5	18.8	28.3	62.93%
53	San Mateo	40.0	15	55.0	599,950	628,400	104.74%	16.9	15.7	32.6	59.26%
54	Santa Clara	87.0	33	120.0	1,354,700	1,642,400	121.24%	42.5	40.0	82.5	68.76%
55	Por. Solano	15.0	15	30.0				10.0	24.7	34.7	115.73%
56	Por. Sonoma	16.0	3	19.0	320,400	472,900	147.60%	9.5	4.4	13.9	73.39%
58	Fresno	46.0	51	97.0	551,250	735,600	133.44%	24.7	68.1	92.8	95.66%
61	Madera	9.6	5.4	15.0	71,350	126,400	177.15%	6.9	9.6	16.4	109.47%
62	Merced	18.0	10	28.0	147,550	210,600	142.73%	10.4	14.3	24.6	87.95%
63	San Joaquin	33.0	19	52.0	384,700	551,000	143.23%	19.0	27.2	46.3	88.96%
64	Stanislaus	20.0	14	34.0	288,800	433,200	150.00%	12.1	21.0	33.1	97.32%

APPENDIX K

Development of the Individual Parcel Evaluation System

Tahoe Regional Planning Agency

October 12, 1988

October 5, 1988

DEVELOPMENT OF THE INDIVIDUAL PARCEL EVALUATION SYSTEM

Introduction

The Individual Parcel Evaluation System (IPES) was adopted by the Tahoe Regional Planning Agency (TRPA) in May, 1987. The initial direction to develop IPES came from the Regional Plan adopted in 1984, which called for the implementation of a numerical system to establish the suitability of vacant residential parcels for development. This concept was advanced further through the Consensus Building Workshop which begun in August of 1985. One of the initial agreements reached by the participants of the Workshop was that a new system be developed for evaluating the relative suitability of vacant residential parcels for development and that such a system should replace the Bailey System.

In October of 1985 TRPA assembled a technical committee to assist staff in developing the new system. The members of the technical committee are identified in Volume 1, Attachment 3, of the 208 Plan. The Consensus Building Workshop established specific objectives that were to be achieved by the committee and staff in developing IPES. The charge was to develop a system which (1) is credible and understandable by the public, (2) is as accurate, objective, and scientific as possible, (3) is compatible with other systems applicable to other lands, (4) includes a transfer-of-development program, (5) includes incentives for remedial erosion control, and (6) includes an objective and technically-based appeal process.

General Development Process

Between October of 1985 and May of 1986 staff and the technical committee met numerous times in all-day workshops. Periodically during this time period status reports were given at Consensus Building Workshops and Governing Board meetings. As a result of these reports, specific direction was received and general concerns identified from both groups. This information was considered by the technical committee and staff and in many instances was the bases for revisions to the system. Throughout the process considerable time was spent reviewing available scientific and technical information on the subject of land suitability, both in a general sense and specific to the Lake Tahoe Region. This coordinated effort culminated in the presentation of a draft system to the Governing Board in May of 1986 (see Attachment A). The system presented in that report was the bases for the language setting forth IPES in the Goals and Policies.

In June of 1986 the technical committee and staff conducted a field test of IPES, which resulted in approximately 60 parcels being evaluated. Based on extensive analysis of the results of that test the technical committee recommended that some minor refinements be made to the system and that an additional element be included to account for the distance a parcel is from Lake Tahoe. This revised system was the one adopted by TRPA in 1987.

Development of IPES Elements

The following paragraphs provide a brief description of how the eight major elements of IPES were developed.

Relative Erosion Hazard: The committee agreed with the general premise of the "Bailey" system, which is that the relative erosion hazard of an area, in combination with runoff potential, is the most important characteristic in establishing suitability for development. However, instead of relying on broad soil classifications to distinguish these characteristics, the committee identified three factors that they felt were collectively a better indicator of relative erosion hazard; (1) the degree to which the soil particles are susceptible to being detached and transported by rain or flowing water; (2) the gradient, length, and shape of slope; and, (3) a comparative measure of the total raindrop energy delivered to the site. With respect to measurements for these indicators and their relative importance in determining the potential for erosion, the K, LS, and R factors developed by the Soil Conservation Service (SCS) and their application in the Universal Soil Loss Equation were agreed to be the best methods available for estimating relative erosion hazard. The LS formula developed by G. R. Foster and W. H. Wischmeier, which is set forth in Section A(1)(c) of the Technical Appendices, was determined to be the best method for estimating the effects of slope on erosion potential. This equation is sensitive to the shape of the slope being either convex, concave, or complex.

Runoff Potential: In conjunction with relative erosion hazard, the committee agreed that the potential for overland flow was a critical factor in estimating the potential for, and severity of, surface erosion. Erosion resulting from overland flow depends primarily on two factors; (1) the ease with which surface horizons of the soil become saturated; and, (2) the extent to which overland flow is impeded due to the presence of ground cover vegetation and forest litter. A good indicator of a soil's susceptibility to become saturated is the hydrologic-soil group in which the soil has been classified by SCS. The committee agreed that for this element a simple table could be developed relating the four hydrologic-soil groups to categories denoting amounts of vegetative cover. The point values in the table were distributed in accordance with runoff curve numbers developed by SCS for woodlands.

Access Difficulty: Since IPES was to determine the relative suitability of parcels located for the most part in existing subdivisions, the committee felt that it was important to consider the relationship of the subdivision streets to the potential building site and how that relationship might effect that amount of land disturbance necessary to comply with applicable off-street parking requirements. The committee agreed that due to the necessity to excavate, upsloping parcels should receive a substantially lower score than downsloping parcels with similar slope characteristics. For upsloping parcels the committee identified three factors that were felt to provide a good comparison of the amount of excavation required; (1) the height of the cut slope; (2) the extent to which soil properties make excavation more difficult; and, (3) the gradient of the terrain above the cut slope. For downsloping parcels Factor (2) is not applied to downsloping parcels and the point values decrease much more gradually to account for required land disturbance being much less on downsloping parcels.

To account for situations where some identifiable grading had been done in the past to provide access to a building site, a subelement was developed that assigned points from a table based on the extent of additional land disturbance required to bring the existing access up to applicable standards.

A separate scoring system was developed for situations where access must cross an SEZ. Special columns were included in each access table to account for impacts on water quality and a separate subelement was included to account for impacts resulting from the loss of riparian vegetation and associated wildlife habitat.

Stream Environment Zones: New procedures for identifying SEZs were developed as part of IPES to improve primarily on two aspects of the procedures set forth in the 208 Plan. New procedures were developed for establishing setbacks to SEZs and for accurately identifying areas influenced by near surface groundwater, such as seeped and variable source areas. Under the new procedure the presence of groundwater within 20 inches of the surface denotes the presence of an SEZ. The presence of groundwater within 20 to 40 inches of the surface in combination with two other hydrologic related characteristics being present, such as certain species of riparian vegetation and a designated flood plain, also denotes the presence of an SEZ. Under the new procedure setbacks to SEZs are not considered to be part of the SEZ. Setbacks range from 10 to 60 feet and are based on the degree to which the stream is confined in a channel, the type of stream, being either ephemeral, intermittent or perennial, and the extent to which the embankment adjacent to the stream shows evidence of active and pronounced erosion. The stream classification system developed by Dave Rosgen was used to determine the degree of confinement and stream type.

Based on field application of the new procedure for identifying SEZs, the area of SEZ present on each parcel was mapped. The committee agreed that the score should be reduced for parcels where utility connections had to be constructed through an SEZ. A table was developed assigning points based on the elements of the SEZ that would have to be disturbed. For example, more points were deducted if utilities had to cross the actual stream channel than if disturbance was limited to only the area within the setback.

Condition of Watershed: The committee recognized that some watersheds in the Region produce greater amounts of sediment and nutrient than others. To account for the likelihood that further development in such watersheds will accelerate the degradation of water quality, the committee established three criteria to estimate a watershed's relative health; (1) a comparison of existing land coverage with allowed land coverage to identify watersheds with a high degree of disturbance and, therefore, higher concentrations of nutrients and sediments in surface runoff; (2) an identification of watersheds that based on present and past monitoring data are known to be high producers of sediments and nutrients; and, (3) a determination of the efficiency of a watershed to move eroded material from their source based upon a complex array of hydrologic conditions, including drainage area, watershed slopes, drainage density and relief ratio. These three criteria were used by the technical committee to rank the 64 watersheds from best to worst.

Ability to Revegetate: The committee also recognized that during the construction of a single family residence vegetation is removed and soil disturbed beyond the limits of the buildings and accessory improvements. Without effective revegetation, excessive soil and nutrient loss can occur in these areas. Therefore, the degree of difficulty encountered in attempting to revegetate these disturbed areas can effect the probability that revegetation will be successful and, therefore, both the short-term and long-term potential for erosion.

Two factors were identified by the committee which they felt are of significant importance in estimating the difficulty to revegetate disturbed areas; the inherent limitations of the soil and climatic conditions.

The best information available on soil characteristics that effect the potential for revegetation is the classification by SCS of soil types into vegetative groups. SCS vegetative groups identify soils that have similar limitations on plant selection.

To account for the effects of climatic conditions on the potential to revegetate, the committee considered three elements that in combination significantly reduce the likelihood that efforts to revegetate will be successful; steep terrain, aspects ranging from magnetic west to magnetic southwest, and elevation of 7,000 feet or greater.

Need For Water Quality Improvements In Vicinity Of Parcel: The impervious surface resulting from the construction of a new single family residence and associated improvements increases the potential for storm water runoff. As a mitigation measure, TRPA requires collection and infiltration facilities designed to discharge the runoff generated from a 2 year, 6 hour storm below the ground surface. In the event a larger storm occurs, the excess flows will be discharged into the drainage system in the vicinity of the parcel. The committee, therefore, agreed to establish the general level of water quality improvements in the urban areas of the Region as a relative indicator of the off-site impacts that may result.

Using the TRPA 208 Capital Improvements Program maps as a guideline, the technical committee and TRPA staff performed extensive field evaluations to categorize the urban portions of the Region into areas needing similar levels of water quality improvements. Areas were categorized with respect to the need for improvements such as rock-lined ditches, curb and gutter, storm drain pipes, retaining walls, paved streets, and sediment basins.

Proximity To Lake Tahoe: This element was included in IPES based on the committee agreeing that the extent to which storm water runoff discharged from a parcel passes through SEZs and other areas where suspended sediments are allowed to settle prior to being discharged into Lake Tahoe, is to some degree a function of the distance a parcel is from the lake. Sediments discharged from parcels located immediately adjacent to the lake and in close proximity to the seasonal watertable have a much greater potential of reaching the lake than do sediments discharged from parcels located four miles from the lake. Due to the general nature of this concept, broad areas were established on maps at a scale of 2" = 1 mile and points assigned based on the areas distance in miles from Lake Tahoe.

Adjustments For Scores Received Under IPES Elements

The committee agreed that the eight elements of IPES did not account for impacts resulting from the development of single family residences in two situations.

Small Parcels: Additional impacts result when parcels are developed in subdivisions containing relatively small lots due to there being higher concentrations of land coverage and, therefore, less undeveloped space in which to install mitigation measures, such as infiltration facilities, sediment basins, slope stabilization, and revegetation. To account for these addition impacts the committee agreed that the scores for parcels containing less than 10,000 sq. ft. should be reduced. The committee agreed that a formula that disproportionately increase the reduction in score as parcel became relatively smaller.

Parcels Containing Small Areas Outside An SEZ: The committee recognized that when a single family residence is constructed on a parcel that has a very small area outside of, and immediately adjacent to, an SEZ, additional impacts on the SEZ are likely to occur. Therefore, the committee agreed that in addition to the size factor for small parcels, scores for parcels with less than 5,000 sq. ft. outside an SEZ should be reduced in proportion to the area's size compared to 5,000 sq. ft.

Additional Mitigation

To encourage remedial erosion control work in the Region, the committee agreed that a parcel's score could be increased by a limited amount if the property owner constructed off-site water quality improvements that would not otherwise be required as part of project approval. The improvements must be approved by TPRA, actually constructed prior to completion of the new single family residence, and consistent with the TRPA Capital Improvements Program maps. The increase in score was limited to 10% of the numerical value establishing the "top rank" parcels to maintain the integrity of IPES.

Weighting Of Elements

In determining the number of points to be assigned to each element, and therefore, their relative significance, the committee recognized three basic objectives;

1. Accurately estimating the relative suitability for development of vacant residential parcels.

2. Not departing significantly from the Bailey System.

3. Being consistent with the TRPA Environmental Thresholds, which require development to comply with the Bailey System.

Consistent with these objectives, the first two elements, Relative Erosion Hazard and Runoff Potential, were given the greatest relative significance in IPES. In combination, these two elements account for 57 percent of the total maximum points. The committee assigned Access Difficulty the next highest point value in order to differentiate the wide range of impacts that can result from the construction of improvements required to satisfy applicable parking standards and to recognize the significance of the impacts that can result from large excavation activities and permanent disturbance in SEZs. Stream Environment Zones were given the next highest point value due to the extreme sensitivity of these areas and their critical importance in protecting water quality. The remainder of the elements were given substantially fewer point values because the committee generally agreed that the potential impacts relating to these elements were less significant in comparison to the impacts relating to the other elements. The committee considers these remaining elements as a "fine tuning" mechanism, designed to establish minor distinctions between parcels that otherwise may have similar scores under the other elements.

Area Of Parcel To Be Evaluated

The committee realized that it would be impracticable to attempt to apply the IPES criteria to the entire area of every vacant residential parcel. In addition, the committee agreed that in most cases land disturbance resulting from the construct of a single family residence is limited to an area of approximately 1/3 acre. Data also indicated that approximately 85% of the vacant residential parcels are 1/3 acre or less in size. In recognition of these factors, the committee decided that the entire area of parcels of 1/3 acre or less would be evaluated and for parcels greater than 1/3 acre, the best 1/3 acre having reasonable access to a public right-of-way would be evaluated.

Procedure For Establishing "Top Rank" Parcels

In considering options for determining the numerical value establishing the "top rank" parcels the committee's primary goal was to have the number of parcels with scores above the line approximately equal to the number of parcels classified as land capability levels 4, 5, 6, and 7. To achieve this goal a two step process was developed. First, a numerical value is established so that the number of parcels with scores above the value equals the number of parcels shown on the TRPA land capability maps as being in capability levels 4, 5, 6, or 7. Then a zone is created between the numerical values that are 10% greater than and 10% less than numerical value established above. Second, the actual line is established at the numerical average of the average IPES score received by parcels found to be in land capability level 4 and the average IPES score received by parcels found to be in land capability level 3. If necessary, the location of the line is then adjusted to assure that the initial numerical value is consistent with the Bailey System. If the line falls above the zone it is adjusted to coincide with the upper limits of the zone. If the line falls below the zone it is adjusted to coincide with the lower limits of the zone.

Allowable Base Land Coverage

In developing a method for establishing allowable land coverage based on IPES, the committee again sought to utilize a procedure that was consistent with the Bailey System while avoiding some of the problems inherent in that system. To achieve these objectives the committee set the following goals; (1) the total amount of gross land coverage allowed under IPES should approximate the total amount of gross land coverage allowed under the Bailey System; (2) the maximum allowable coverage should be 30% and the minimum allowable should be 1%; (3) the procedure should eliminate the large increments in allowable percentages of land coverage currently set forth in the Bailey System; and, (4) the allowable land coverage for a parcel should relate to the parcel's overall suitability with respect to both the line identifying the "top rank" parcels and the Bailey System.

The committee initially agreed on a procedure for developing a formula for determining allowable percentages of land coverage based on the assumption that the distributions of scores within each capability classes would be somewhat normal and statistically distinguishable. However, after most of the parcel had received a score it was discovered that with respect to some capability classes the distributions of scores were bi-modal or skewed and that the central tendency scores for parcels found to be in capability classes 4 and 5 were statistically indistinguishable. The procedure that was initially agreed on is set forth in Subsection 37.11.A of the March 23, 1988 edition of the TRPA Code.

In October of 1988, after consultation with a group of statisticians from the University of Nevada, Reno, the committee agreed on a revised procedure for establishing allowable land coverage under IPES:

1. Based on the soil series and average slope determined in the field by the IPES teams, all parcels are identified as to which of the seven Bailey capability classes each parcel would have been classified.

2. The combined scores for Relative Erosion Hazard and Runoff Potential representing the central tendency scores within each capability class is determined using valid statistical methods, including mean, mode, and median values and establishing confidence intervals.

3. The central tendency scores are then plotted in graph form against percentages of allowable land coverage ranging from 1% to 30%. The central tendency scores and confidence intervals for capability classes 1a, 1c, and 2 are plotted at 1%, for capability class 3 at 5%, for capability classes 4 and 5 at 22.5%, and for capability classes 6 and 7 at 30%. Capability classes 1b and SEZ were excluded from the group plotted at 1% because statistically classes 1b and SEZ represent a totally different population from the other classes in this group. This

difference is due to the fact that the IPES score for parcels found in the field to be entirely within classes 1b or SEZ is not based on relative erosion hazard and runoff potential, as are the scores for all other parcels. Parcels located entirel within classes 1b or SEZ automatically receive a score of zero in recognition of the extreme sensitivity of these areas and their importance in protecting water quality. Classes 4 and 5 were combined and plotted at 22.5% because the central tendency scores for relative erosion hazard and runoff potential for these classes are statistically indistinguishable.

4. A line is then drawn passing through the confidence intervals plotted on the graph and adjusted within the confidence intervals so that the total amount of gross land coverage allowed under IPES approximates the total amount of gross land coverage allowed under the Bailey System. The formula for determining allowable coverage under IPES is developed from this line.

<u>Appeal Process</u>

The committee developed two distinct processes for having a parcel's score reviewed by TRPA for possible change.

1. If the IPES team was unaware of information when the parcel was evaluated that could change the score, such as access easements or lot consolidations, the owner can provide such information and ask that the parcel be reevaluated.

2. If the owner feels that the IPES criteria was applied incorrectly an appeal may be filed with TRPA. Parcels on which an appeal is filed will be reevaluated by an IPES team other than the one having done the initial evaluation. The second evaluation will be the bases for the final score, unless the owner requests that the appeal be heard by the Governing Board. The Governing Board may change the IPES score if the board finds that the IPES criteria were applied incorrectly and then only to the extent resulting from correct application of the criteria.

APPENDIX L

DATA FROM THE IPES DATA BASE REGARDING FREQUENCY DISTRIBUTIONS OF IPES SCORES, IDENTIFICATION OF SEZs, AND AVERAGE IPES SCORES

Tahoe Regional Planning Agency

October 12, 1988

DATA FROM THE IPES DATA BASE REGARDING
FREQUENCY DISTRIBUTIONS OF IPES SCORES,
IDENTIFICATION OF SEZs, AND
AVERAGE IPES SCORES

I. ABSTRACT

TRPA used data from the Individual Parcel Evaluation System (IPES) data base, collected in the 1987 field season, to draw preliminary conclusions on frequency distributions of IPES scores, identification of SEZs within IPES, and average IPES scores. Two data sets were used: (1) a data set including data on 10,139 parcels assigned IPES scores during 1987 and 1988 and (2) a data set including data on 6,237 parcels assigned IPES scores during 1987 and 1988 for which the IPES field teams also identified the Bailey land capability classification.

II. CONCLUSIONS

Frequency distributions of IPES scores of parcels in both data sets appear in the attached figures and tables. For the parcels in question, IPES identifies an area of SEZs plus setbacks slightly larger than the criteria of the 1981 208 plan would have. Average IPES scores of parcels which could become eligible to pursue building permits under implementation of IPES are estimated to be equal to or higher than average IPES scores on parcels which would be eligible to pursue building permits under the 1981 208 plan in all counties except Douglas County, NV.

III. METHODS

Based on the work of the IPES field teams during 1987, TRPA assigned IPES scores to 10,139 parcels in 1988, and notified the owners of those parcels of their scores. On 6,237 of those parcels, IPES field teams were able to assign the soils found on the parcel to a Bailey land capability classification, based on presence or absence of SEZ, soil series, and average slope. On the balance of the parcels, IPES field teams did not assign a Bailey land capability classification because: (1) the soil profile did not identify the soil as belonging to a soil series previously mapped in the Tahoe Region by the USDA, Soil Conservation Service, or (2) the soil series and slope combination had not been previously mapped in the Tahoe Region by the USDA, Soil Conservation Service. Parcels with unclassified soils nevertheless received IPES scores based on the inherent properties of the soils found and the other IPES rating factors.

In addition to calculating total IPES scores, TRPA assigned an "IPES coverage score" to each parcel. The IPES coverage score is the sum of the scores received under two rating criteria: relative erosion hazard and runoff potential. The IPES coverage score is used to calculate the base allowed coverage for a given parcel, pursuant to Chapter 37 of the TRPA Code of Ordinances, and is based on the same rating factors as the Bailey Report (1974).

Frequency plots of total IPES scores and IPES coverage scores were then prepared for soils with mapped land capability (sample size = 10,139) and found land capability (sample size = 6,237). The frequency plots are attached.

The procedure for calculating the numerical level in the IPES ratings of the line dividing the top rank from the balance of the parcels is set forth in Chapter 37 of the TRPA Code of Ordinances. The IPES line cannot be set until all the IPES ratings have been completed, and must be set by the TRPA Governing Board. Nevertheless, information was desired on the approximate percentages of parcels which might fall above and below the initial IPES line. A tentative calculation of the level of the line was made, and the following distribution of parcels (rounded to the nearest five percent) was determined:

	Based on Mapped Capability (sample = 10,139)			Based on Found Capability (sample = 6,237)		
	1-3/SEZ	4-7	Total	1-3/SEZ	4-7	Total
above	15%	45%	60%	5%	55%	60%
below	20%	20%	40%	25%	15%	40%
total	35%	65%	100%	30%	70%	100%

Information was also desired on the number of parcels identified as SEZ, and the mapped land capability of those parcels. This information is in the attached pie chart, and indicates that some parcels mapped as belonging to every land capability district were determined to be SEZs. 32 percent of the parcels identified as SEZs had been mapped in land capability district 5.

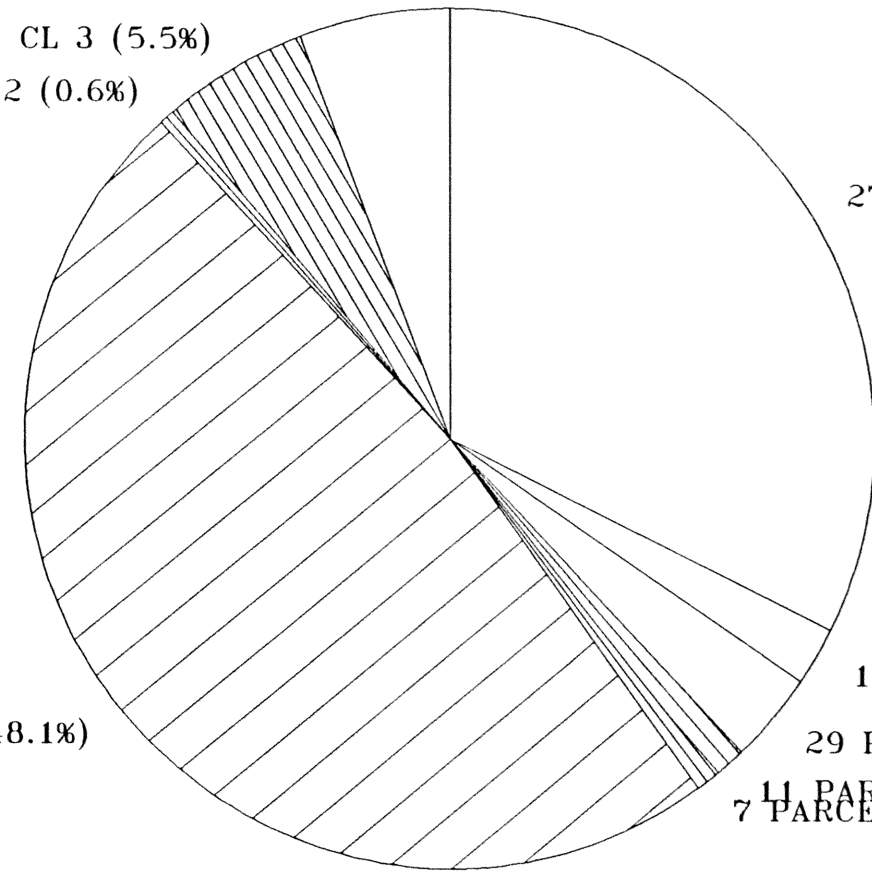
Based on the data set of 10,139 parcels with IPES scores, IPES field teams found 1865 parcels with some evidence of SEZs. The total acreage of those parcels is about 3000 acres. Applying the proposed SEZ identification criteria from Chapter 37 of the TRPA Code of Ordinances resulted in 360 acres of SEZ and 52 acres of setback area, totalling 14 percent of the total acreage of 1865 parcels. Applying the criteria from the 1981 208 plan results in 380 acres of SEZ, which includes the buffer zone, or 13 percent of the total acreage.

To estimate the average IPES scores of parcels which could become eligible to pursue building permits under IPES, TRPA calculated the average IPES scores, by county, of parcels above the tentative line plus a number of parcels below the line equal to 20% (California) and

33% (Nevada) of the parcels in that county mapped in land capability districts 1, 2, 3 and SEZ, pursuant to the provisions of Chapter 37 of the TRPA Code of Ordinances. All calculations were corrected by extrapolation to represent a total IPES inventory of 13,000 parcels. TRPA assumed that the parcels below the line which would eventually become eligible were the highest-rated parcels below the line. The results of these calculations appear in Table 27, Volume I, of the 208 plan.

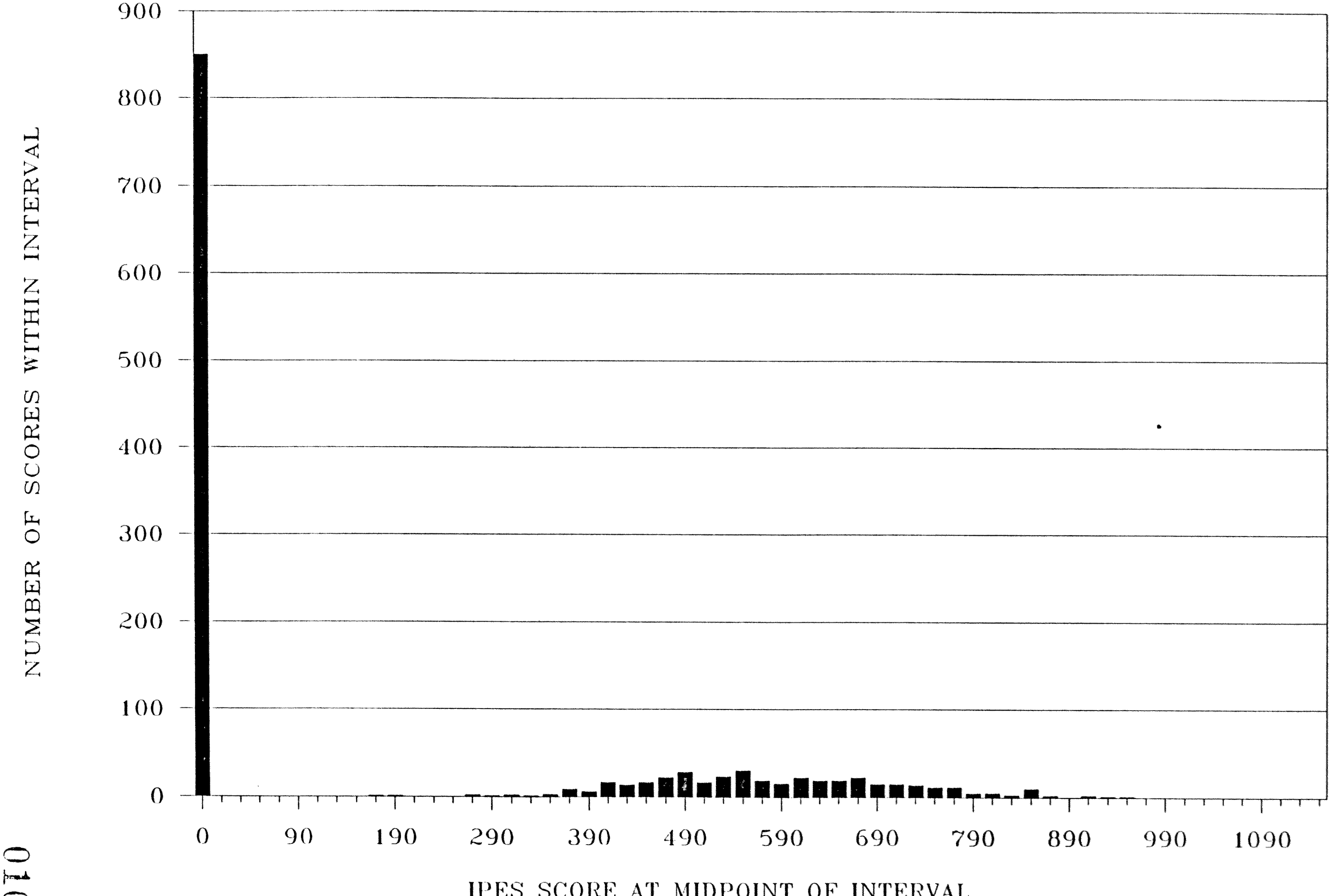
851 100% SEZ PARCELS BY CLASS MAPPED

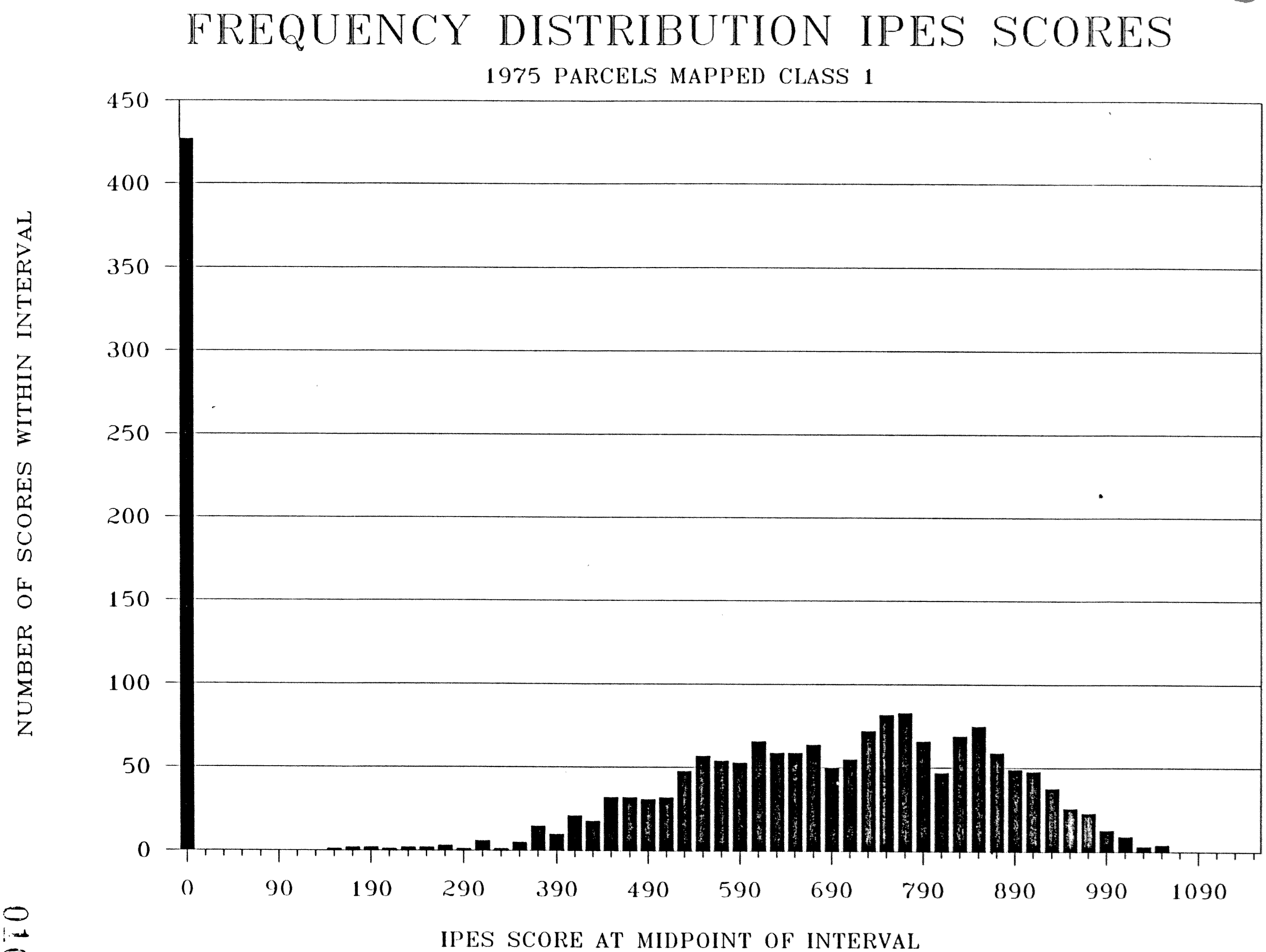
SHADED CLASS 1–3, UNSHADED CLASS 4–7



FREQUENCY DISTRIBUTION IPES SCORES

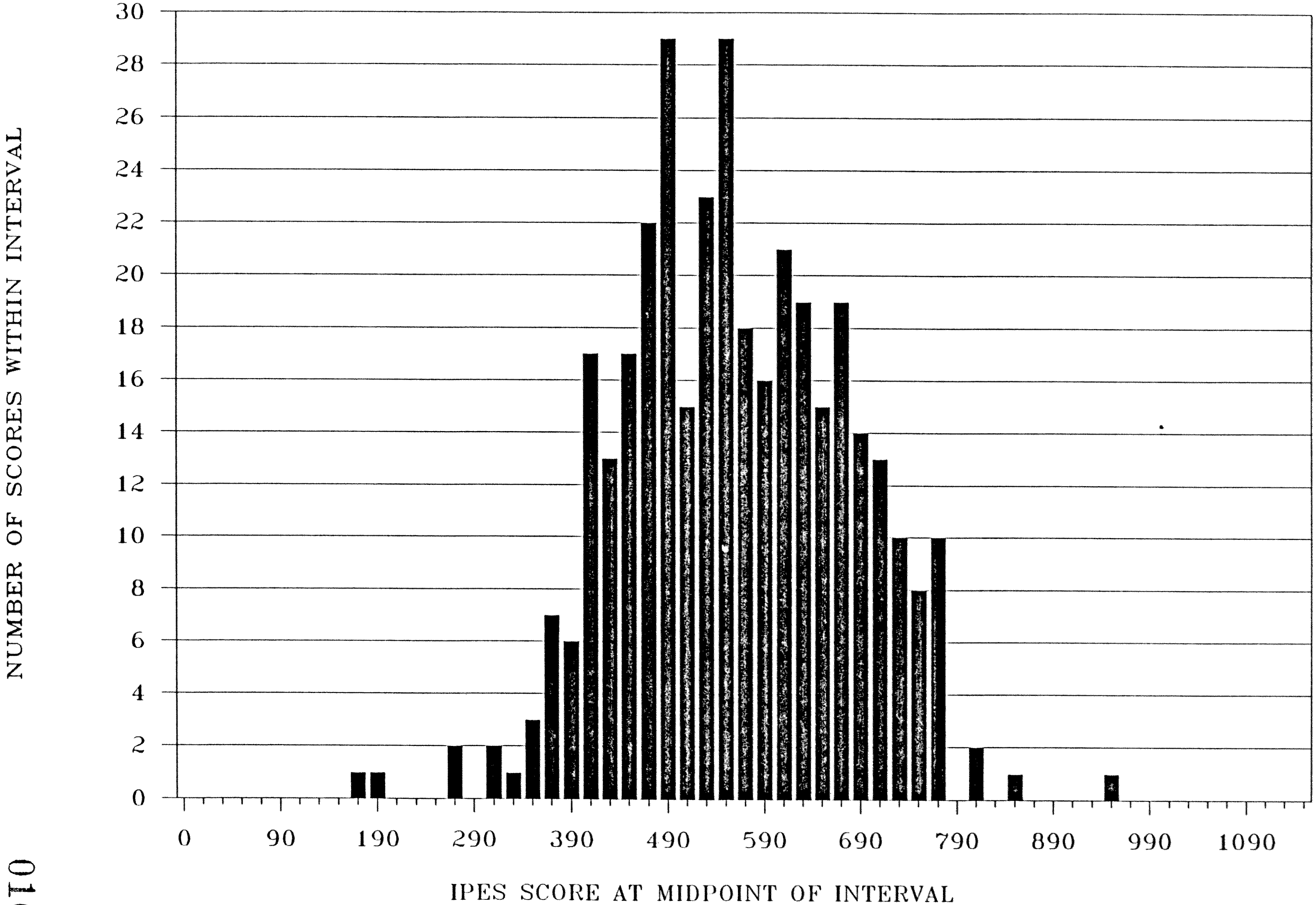
1265 PARCELS FOUND CLASS 1

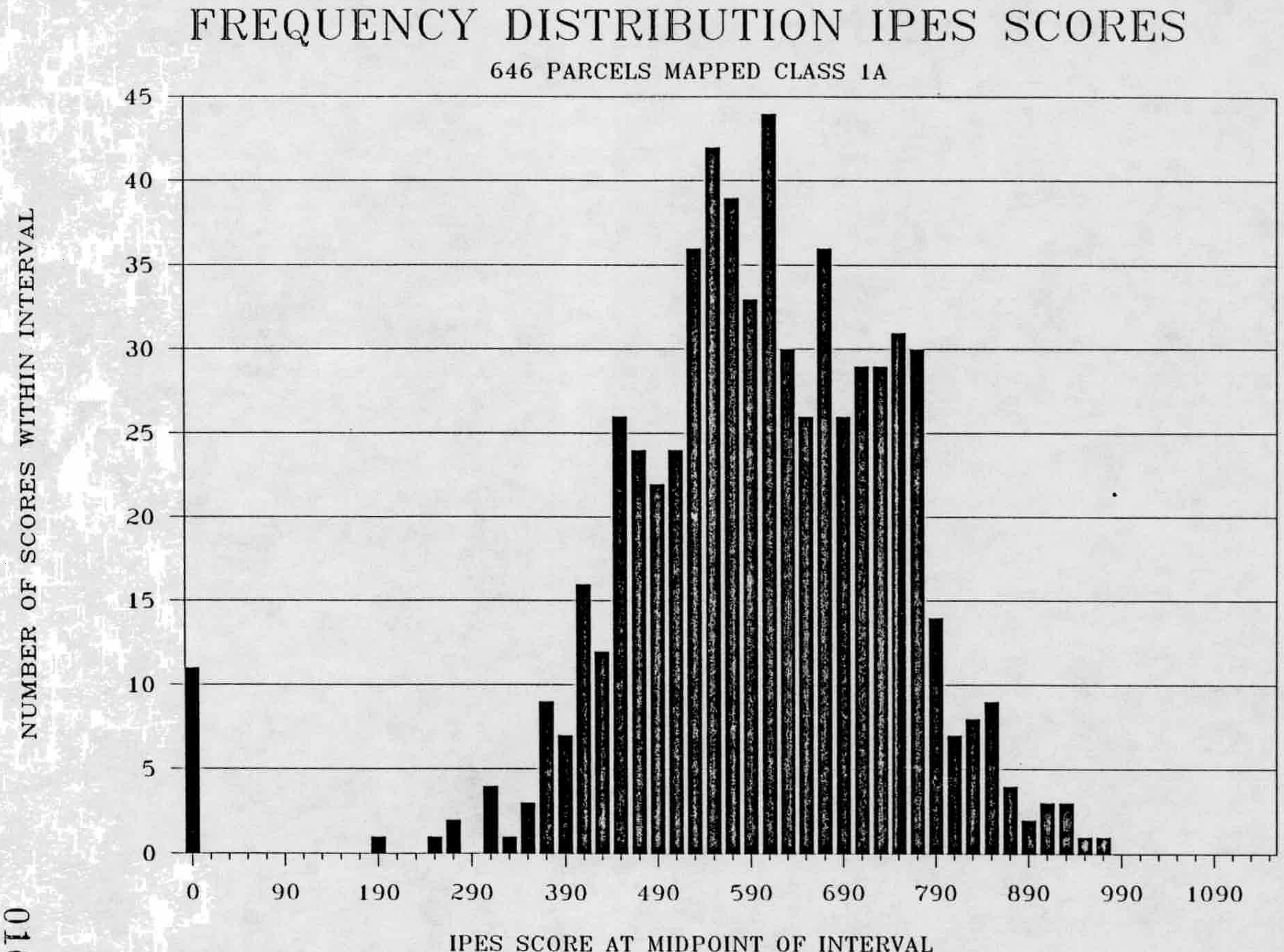



FREQUENCY DISTRIBUTION IPES SCORES
1975 PARCELS MAPPED CLASS 1
NUMBER OF SCORES WITHIN INTERVAL
450
400
350
300
250
200
150
100
50
0
0
90
190
290
390
490
590
690
790
890
990
1090
IPES SCORE AT MIDPOINT OF INTERVAL

FREQUENCY DISTRIBUTION IPES SCORES

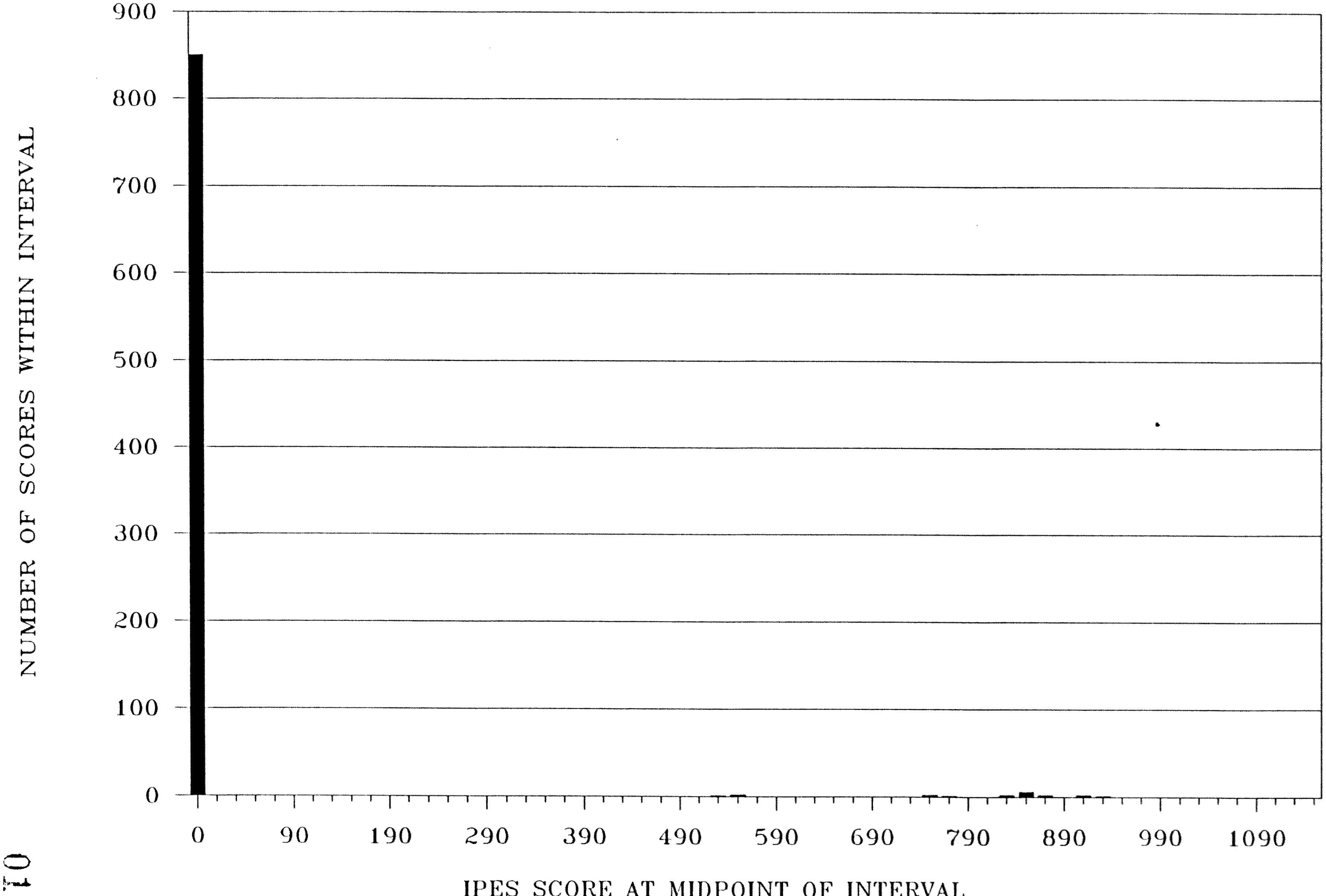
355 PARCELS FOUND CLASS 1A

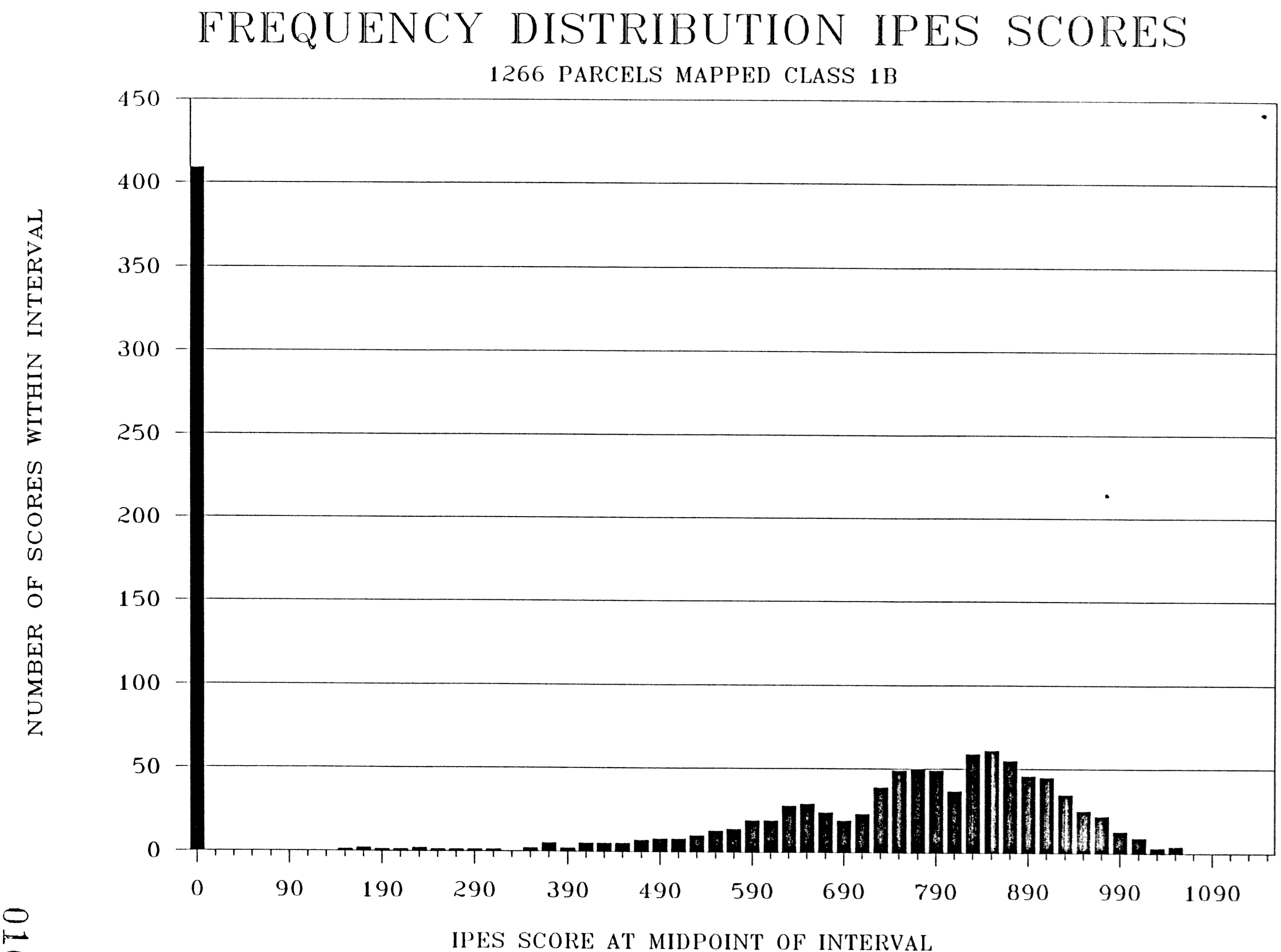



FREQUENCY DISTRIBUTION IPES SCORES
646 PARCELS MAPPED CLASS 1A
NUMBER OF SCORES WITHIN INTERVAL
45
40
35
30
25
20
15
10
5
0
0
90
190
290
390
490
590
690
790
890
990
1090
IPES SCORE AT MIDPOINT OF INTERVAL

FREQUENCY DISTRIBUTION IPES SCORES

870 PARCELS FOUND CLASS 1B

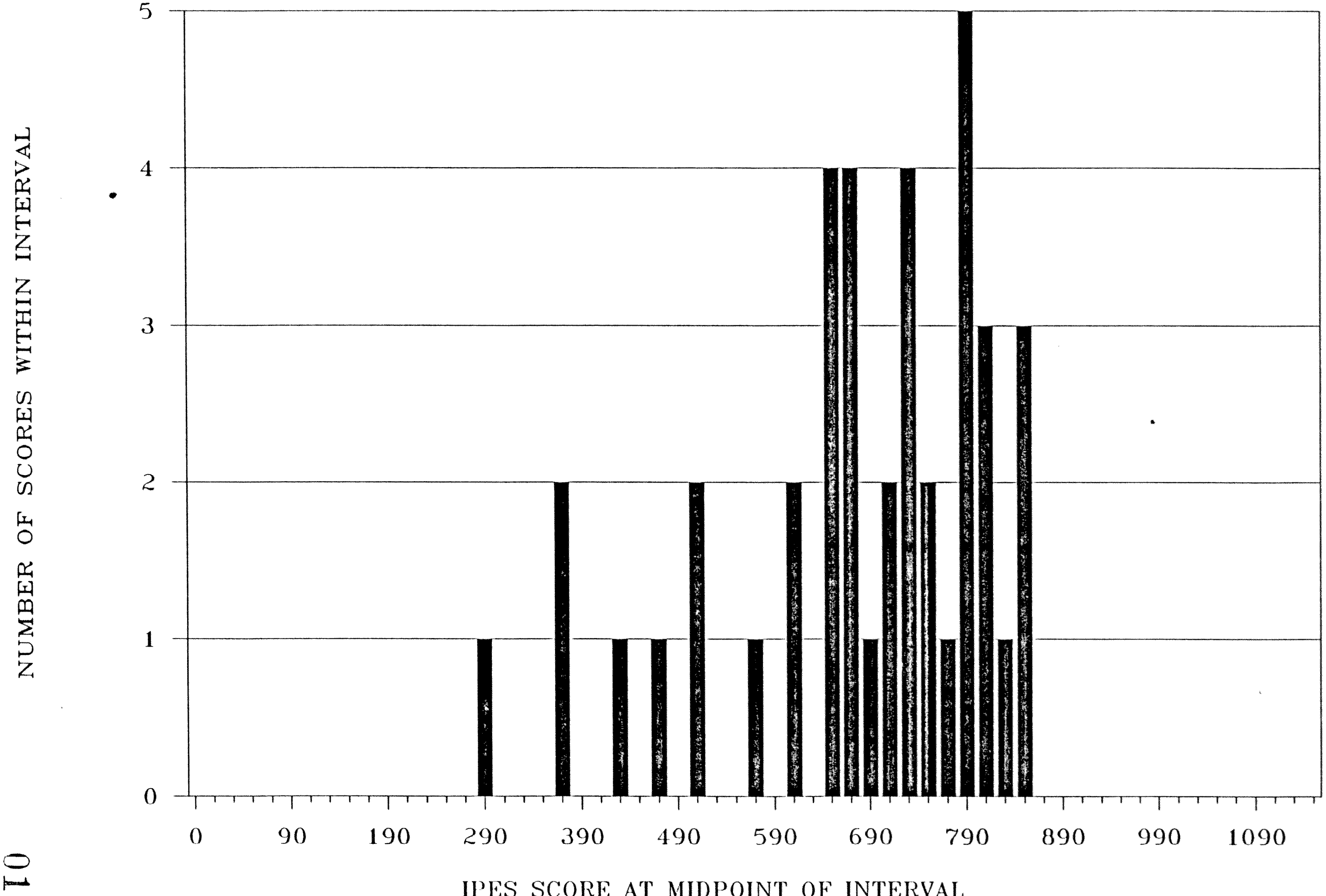




FREQUENCY DISTRIBUTION IPES SCORES
1266 PARCELS MAPPED CLASS 1B
NUMBER OF SCORES WITHIN INTERVAL
450
400
350
300
250
200
150
100
50
0
0
90
190
290
390
490
590
690
790
890
990
1090
IPES SCORE AT MIDPOINT OF INTERVAL

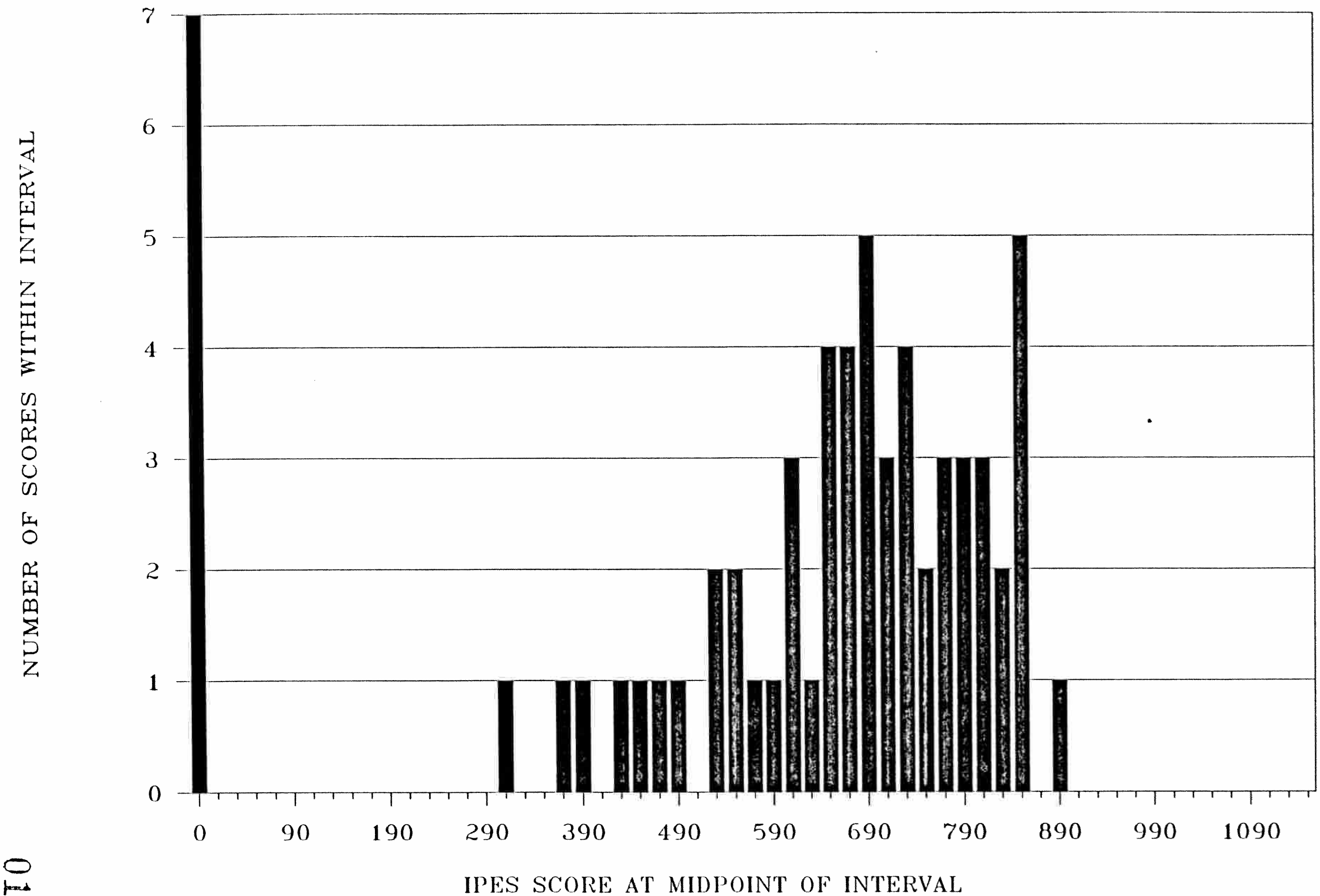
FREQUENCY DISTRIBUTION IPES SCORES

40 PARCELS FOUND CLASS 1C



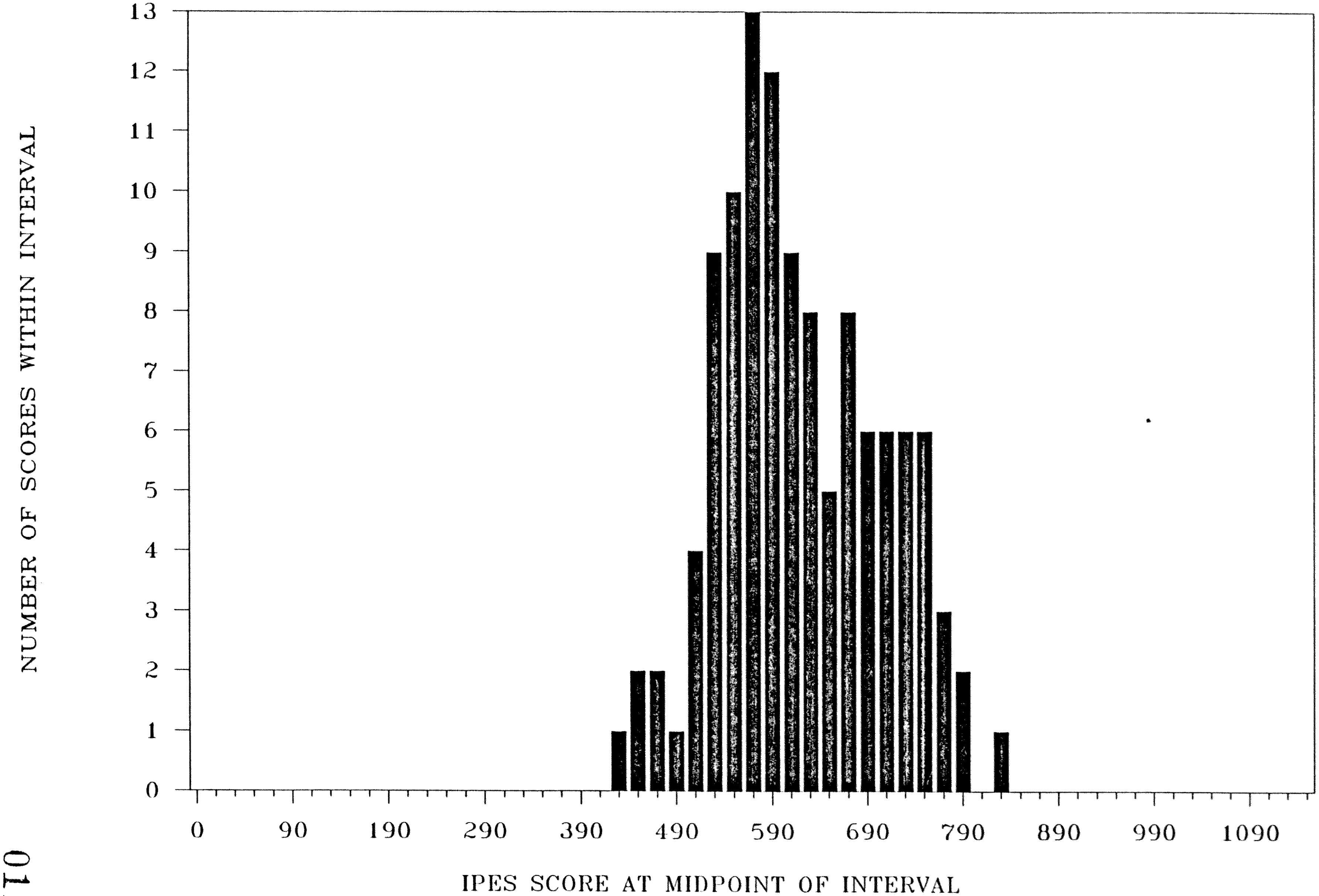
FREQUENCY DISTRIBUTION IPES SCORES

63 PARCELS MAPPED CLASS 1C



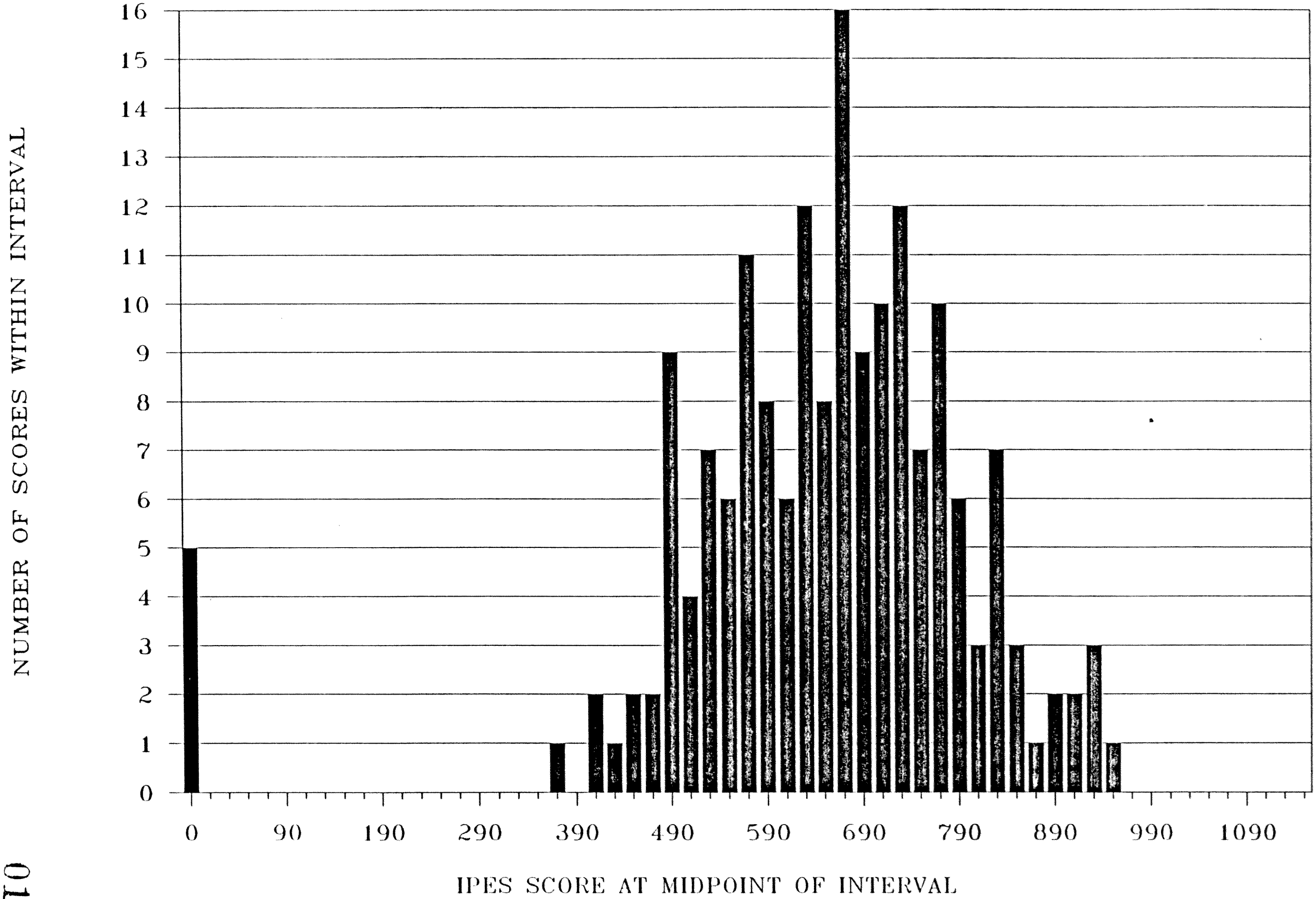
FREQUENCY DISTRIBUTION IPES SCORES

114 PARCELS FOUND CLASS 2



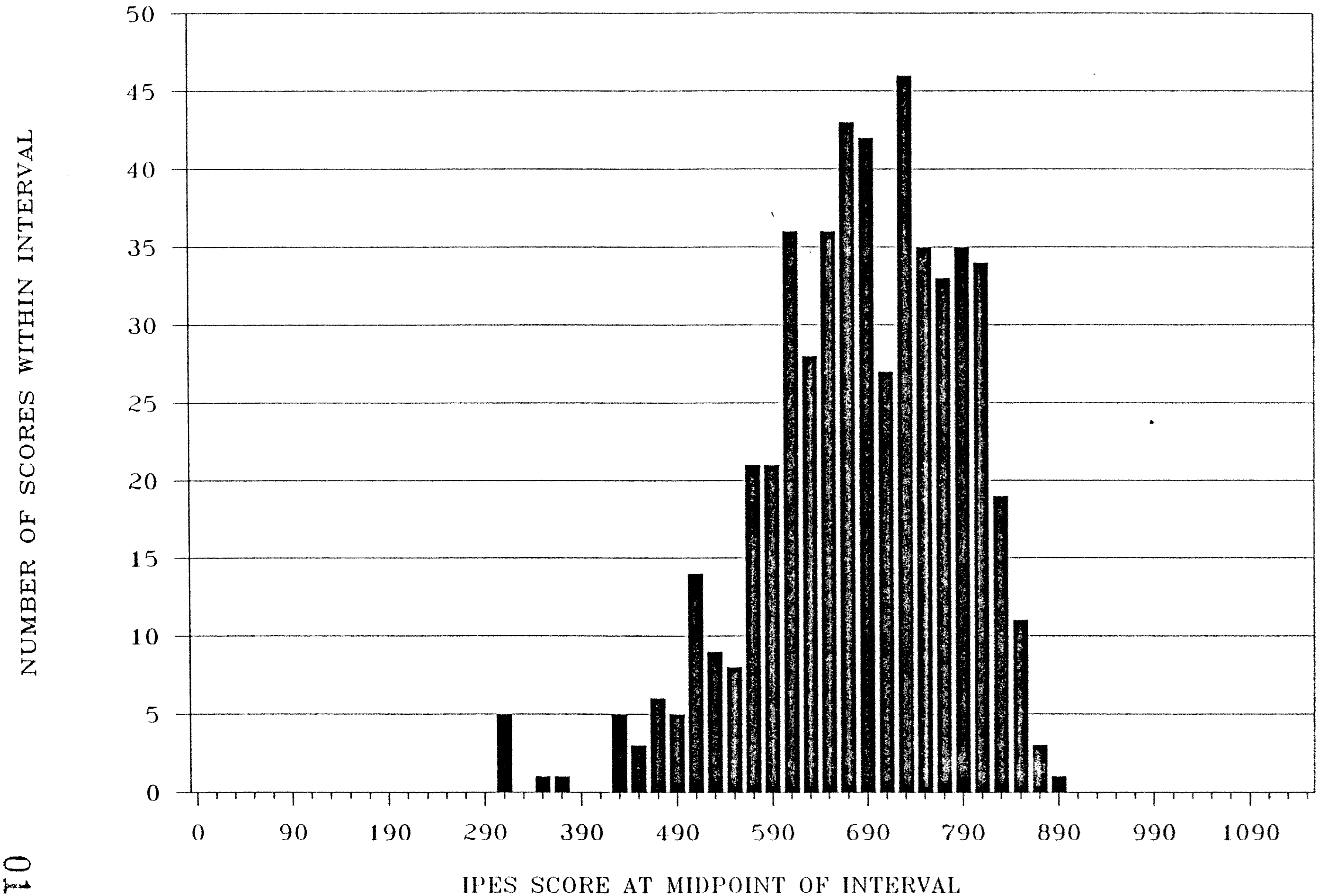
FREQUENCY DISTRIBUTION IPES SCORES

176 PARCELS MAPPED CLASS 2



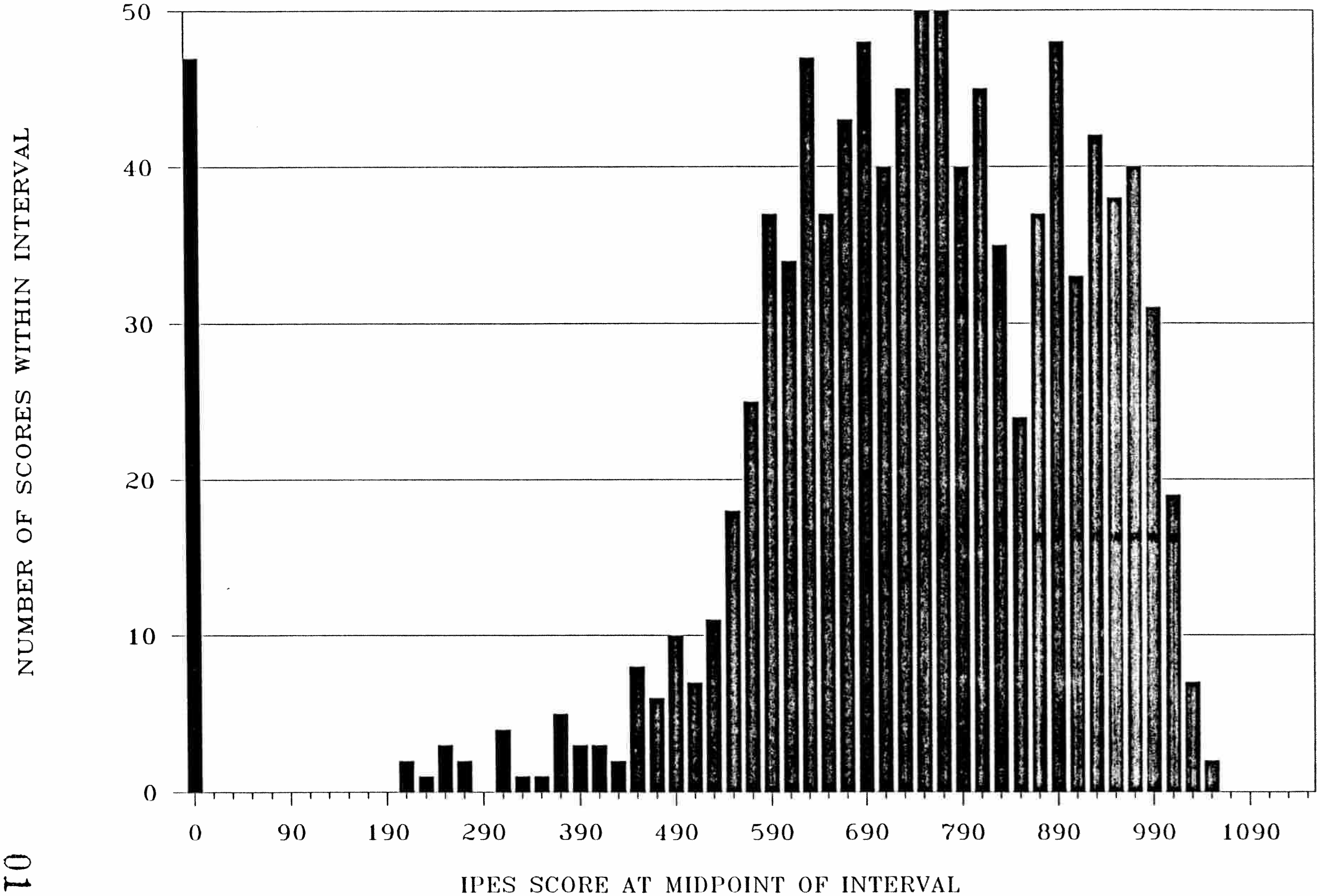
FREQUENCY DISTRIBUTION IPES SCORES

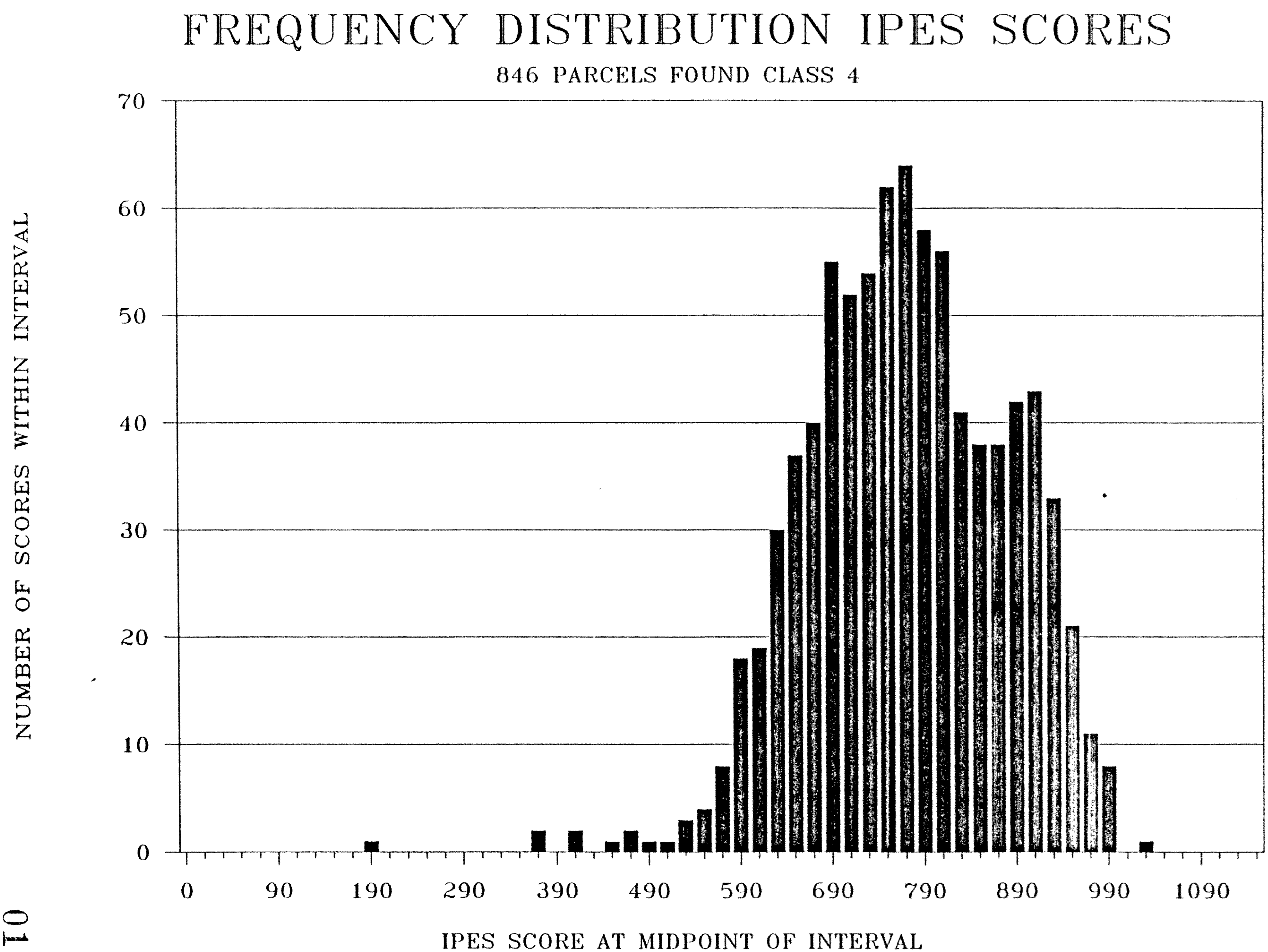
528 PARCELS FOUND CLASS 3



FREQUENCY DISTRIBUTION IPES SCORES

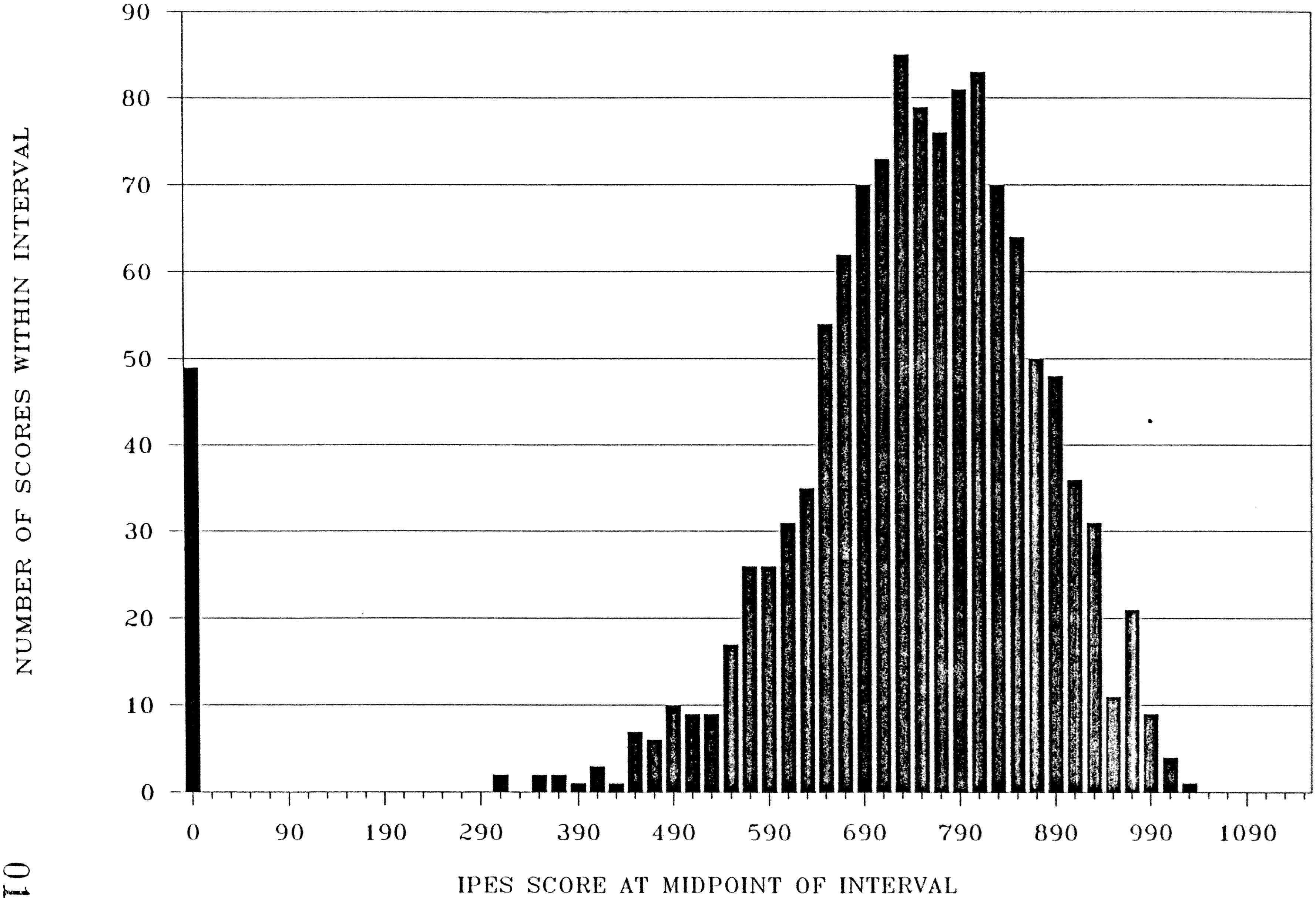
1031 PARCELS MAPPED CLASS 3




FREQUENCY DISTRIBUTION IPES SCORES
846 PARCELS FOUND CLASS 4
NUMBER OF SCORES WITHIN INTERVAL
70
60
50
40
30
20
10
0
0
90
190
290
390
490
590
690
790
890
990
1090
IPES SCORE AT MIDPOINT OF INTERVAL

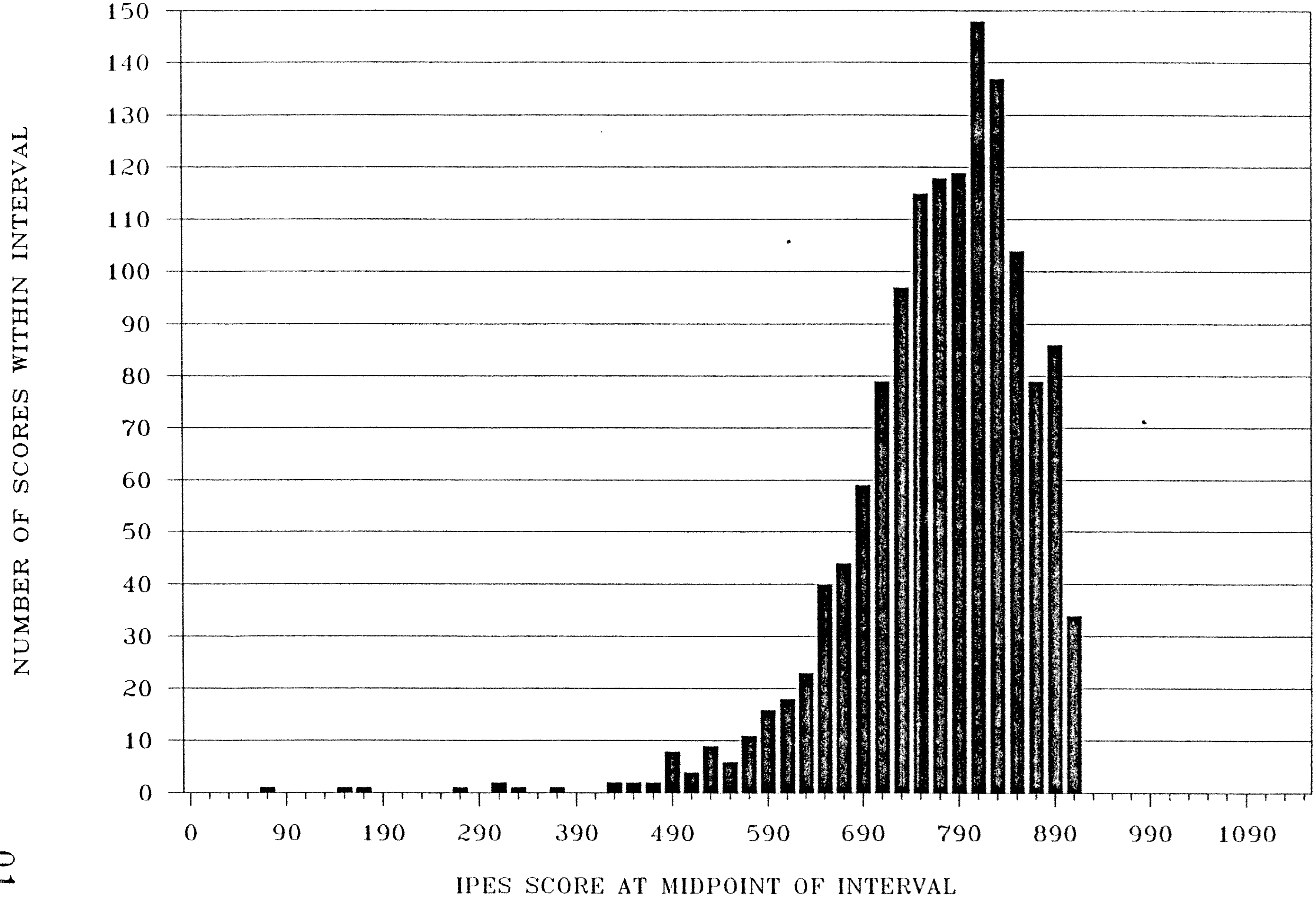
FREQUENCY DISTRIBUTION IPES SCORES

1244 PARCELS MAPPED CLASS 4



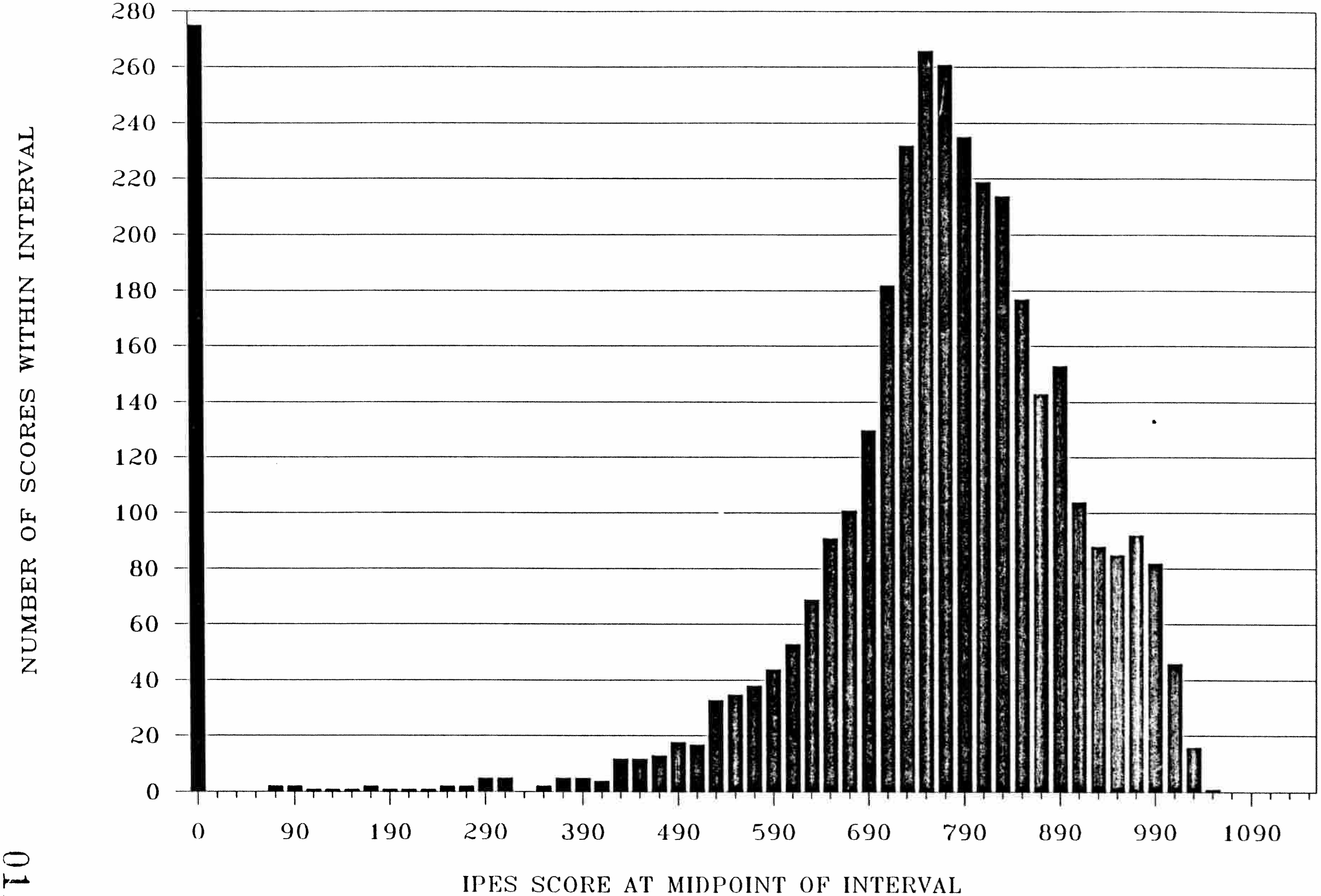
FREQUENCY DISTRIBUTION IPES SCORES

1368 PARCELS FOUND CLASS 5



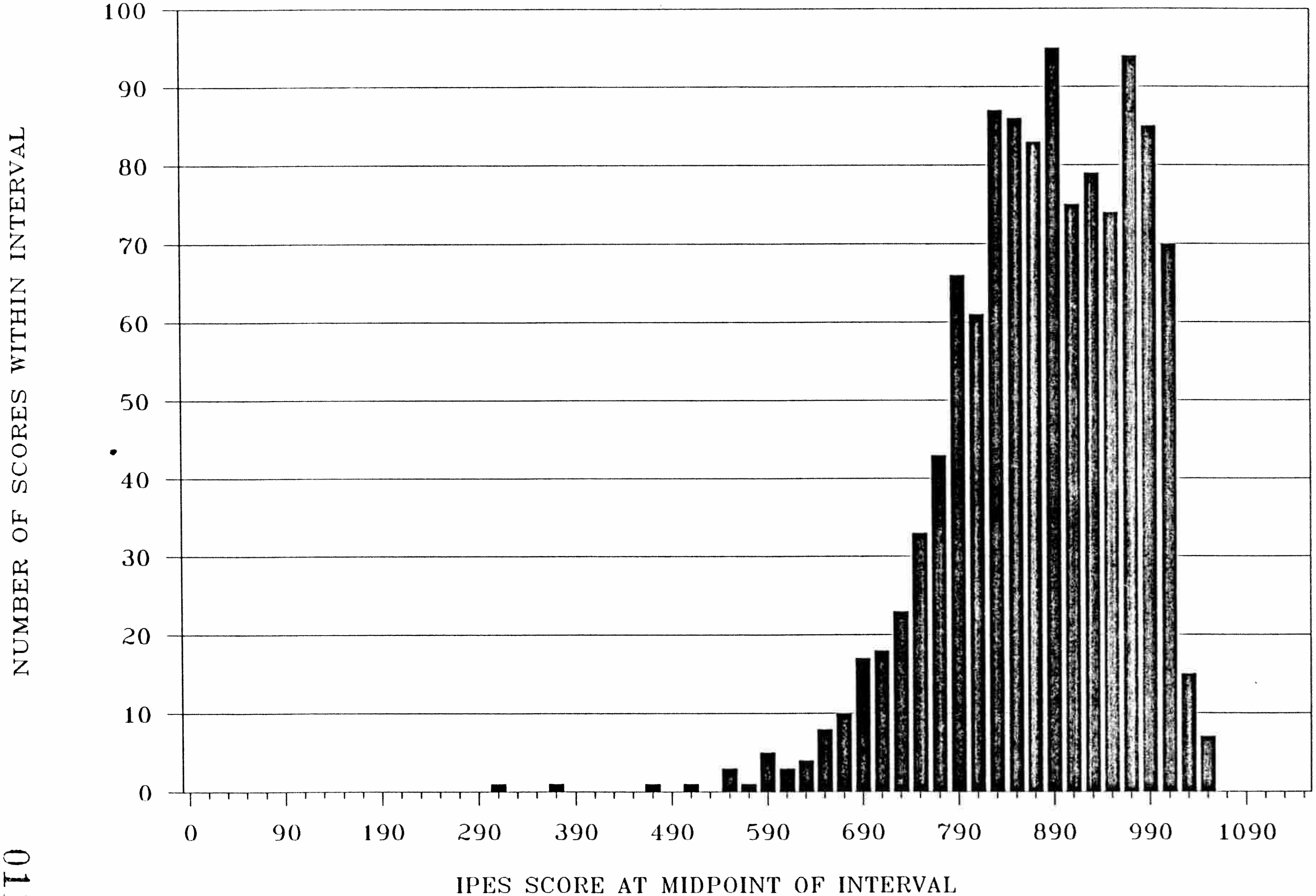
FREQUENCY DISTRIBUTION IPES SCORES

3579 PARCELS MAPPED CLASS 5



FREQUENCY DISTRIBUTION IPES SCORES

1149 PARCELS FOUND CLASS 6



FREQUENCY DISTRIBUTION IPES SCORES

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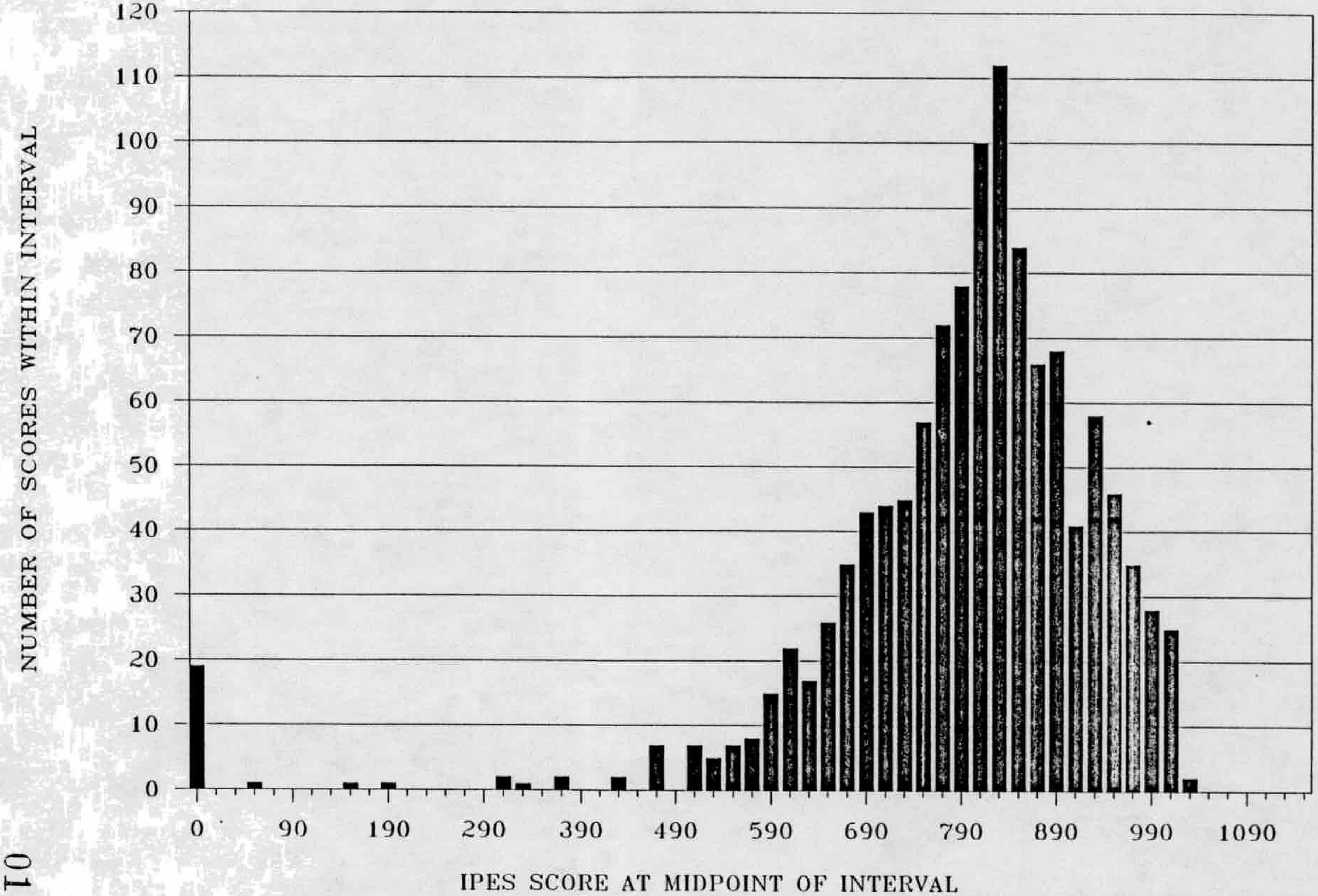
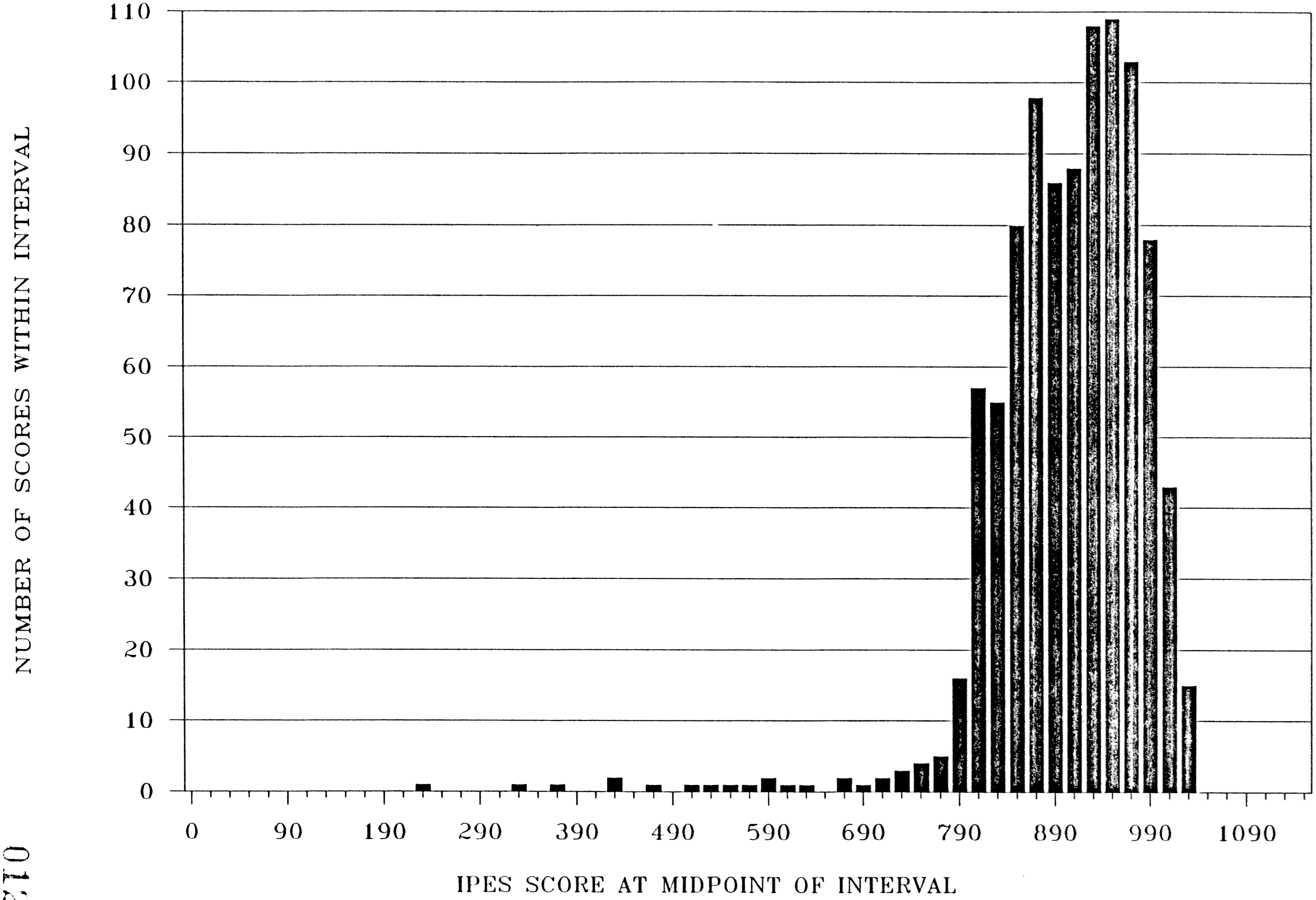


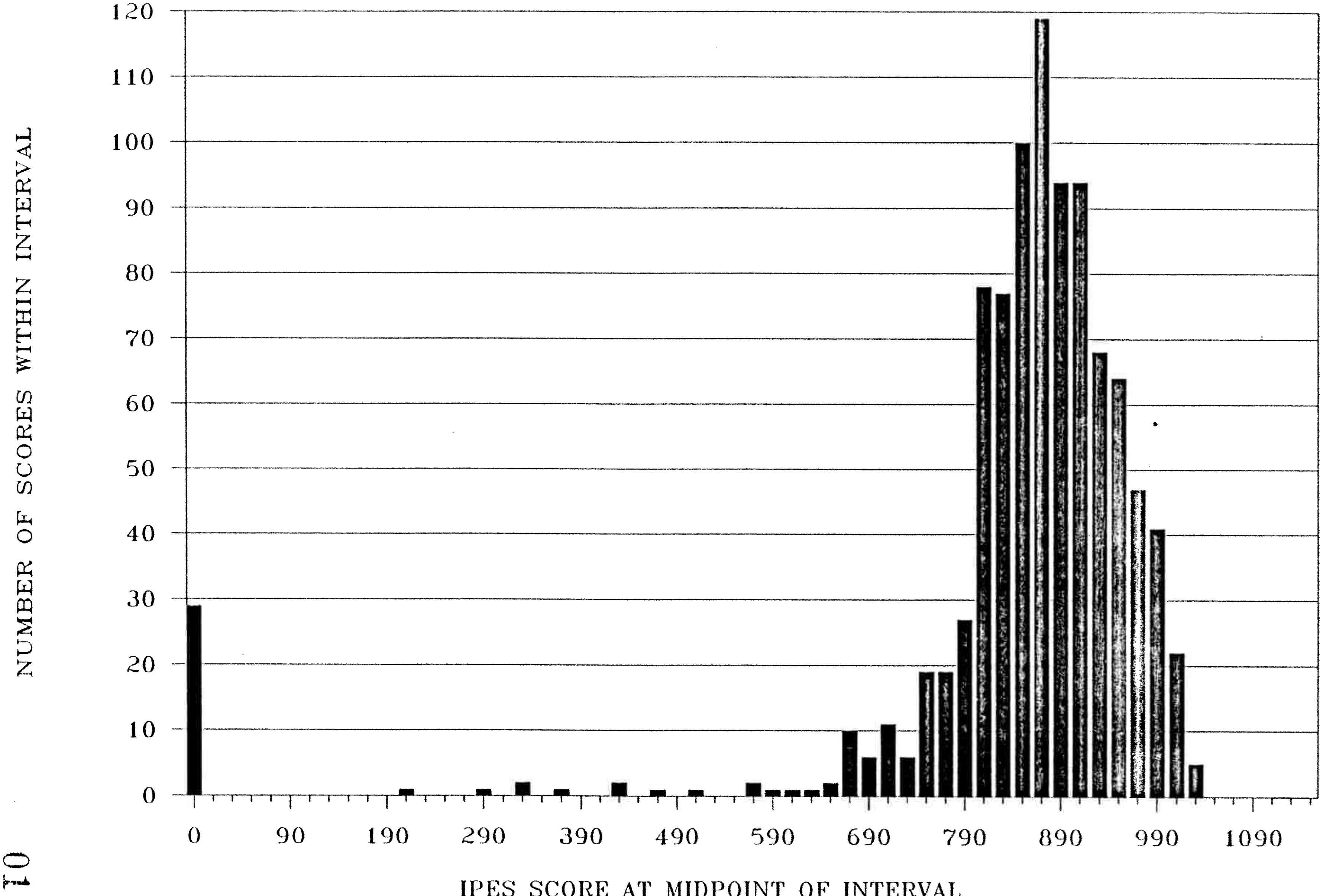
FREQUENCY DISTRIBUTION IPES SCORES

967 PARCELS FOUND CLASS 7



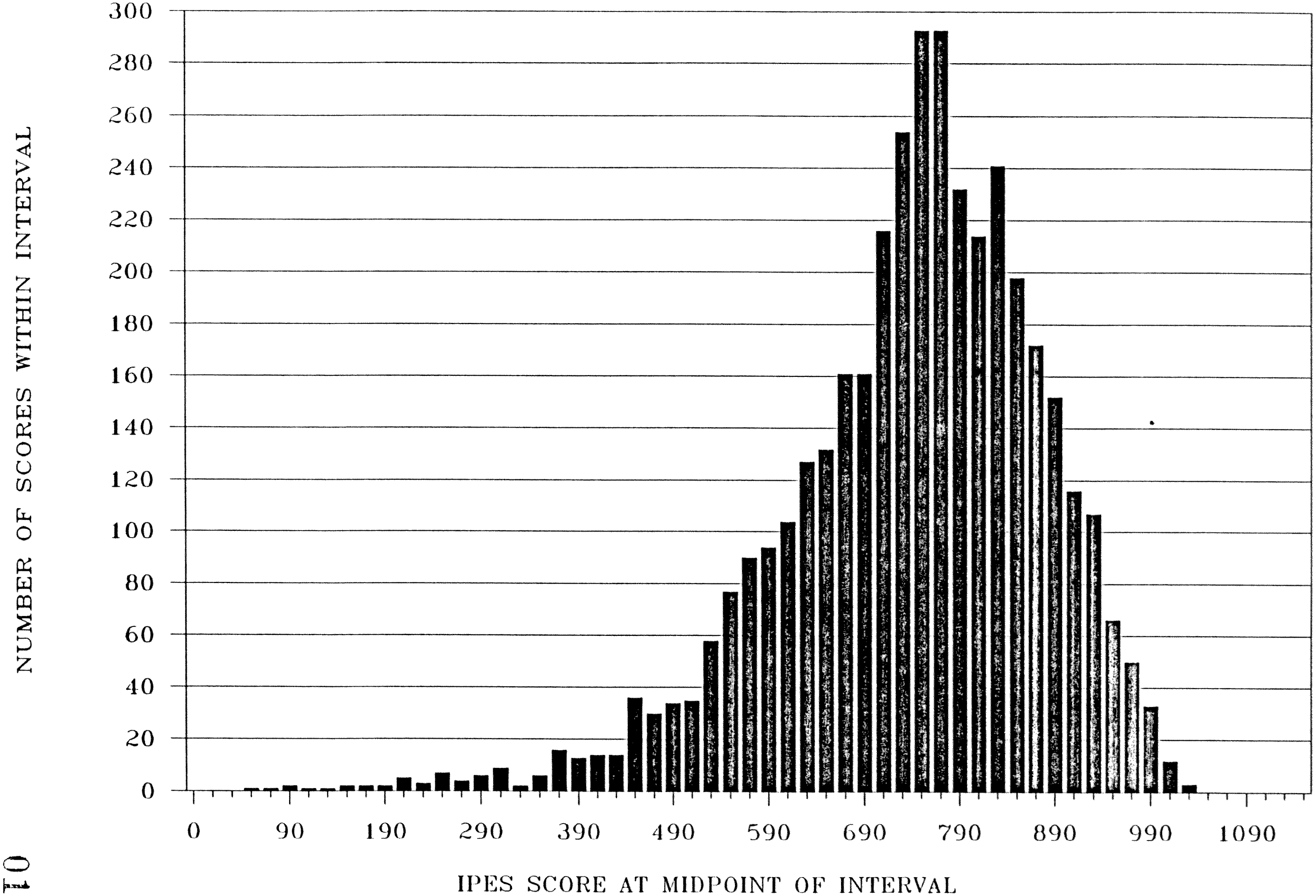
FREQUENCY DISTRIBUTION IPES SCORES

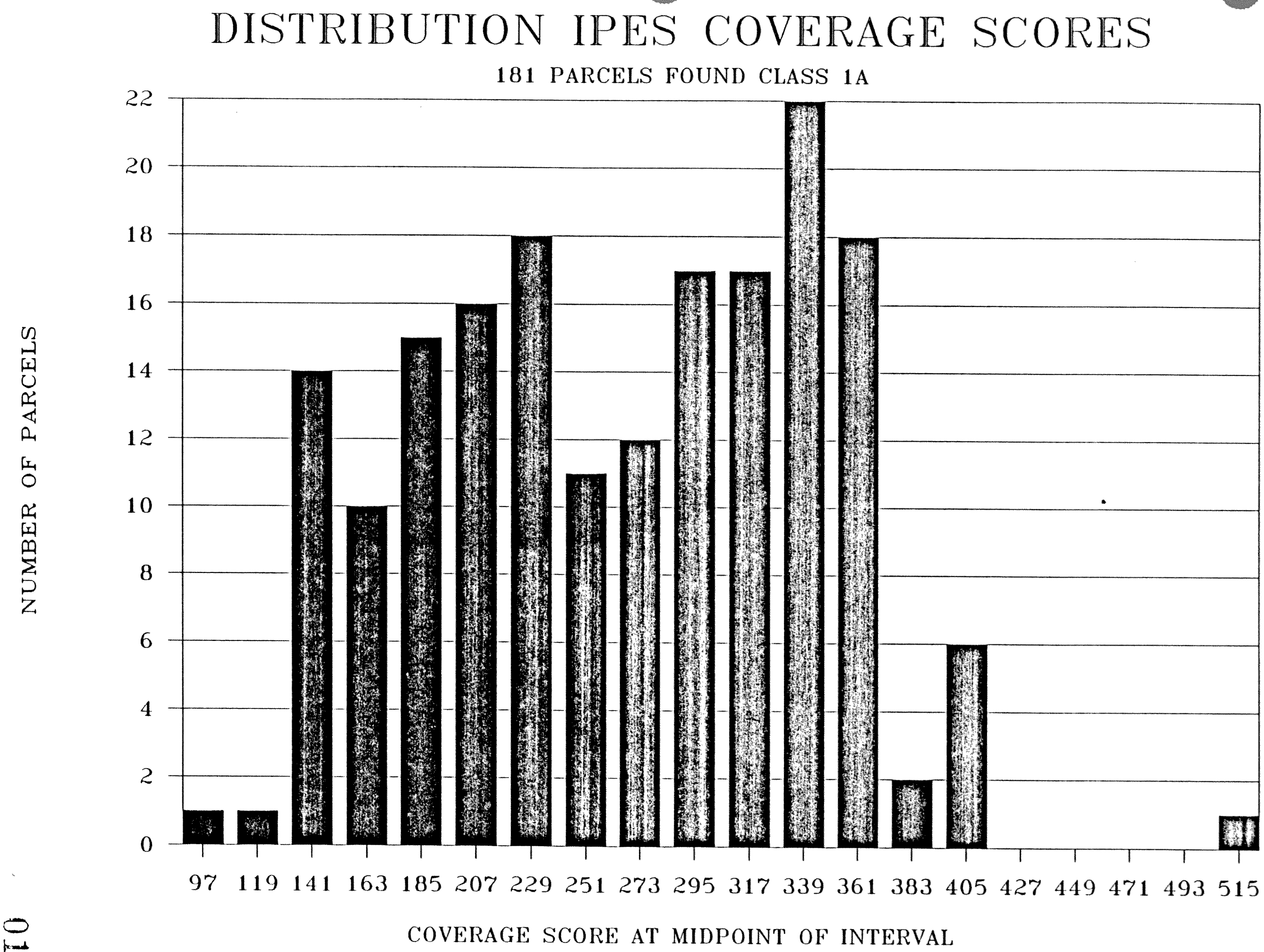
952 PARCELS MAPPED CLASS 7



FREQUENCY DISTRIBUTION IPES SCORES

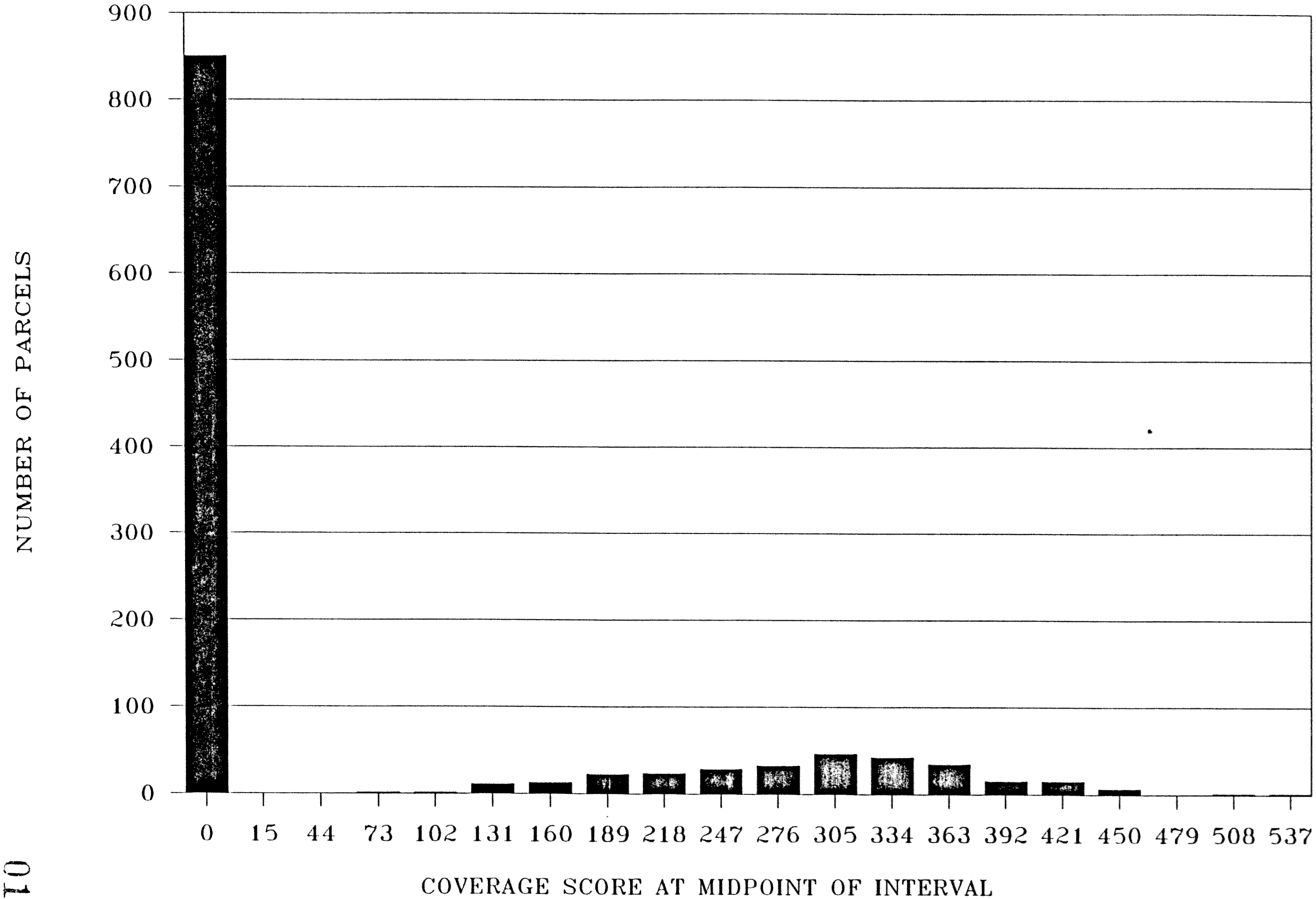
3902 PARCELS FOUND UNCLASSIFIED




DISTRIBUTION IPES COVERAGE SCORES
181 PARCELS FOUND CLASS 1A
NUMBER OF PARCELS
0
2
4
6
8
10
12
14
16
18
20
22
97 119 141 163 185 207 229 251 273 295 317 339 361 383 405 427 449 471 493 515
COVERAGE SCORE AT MIDPOINT OF INTERVAL

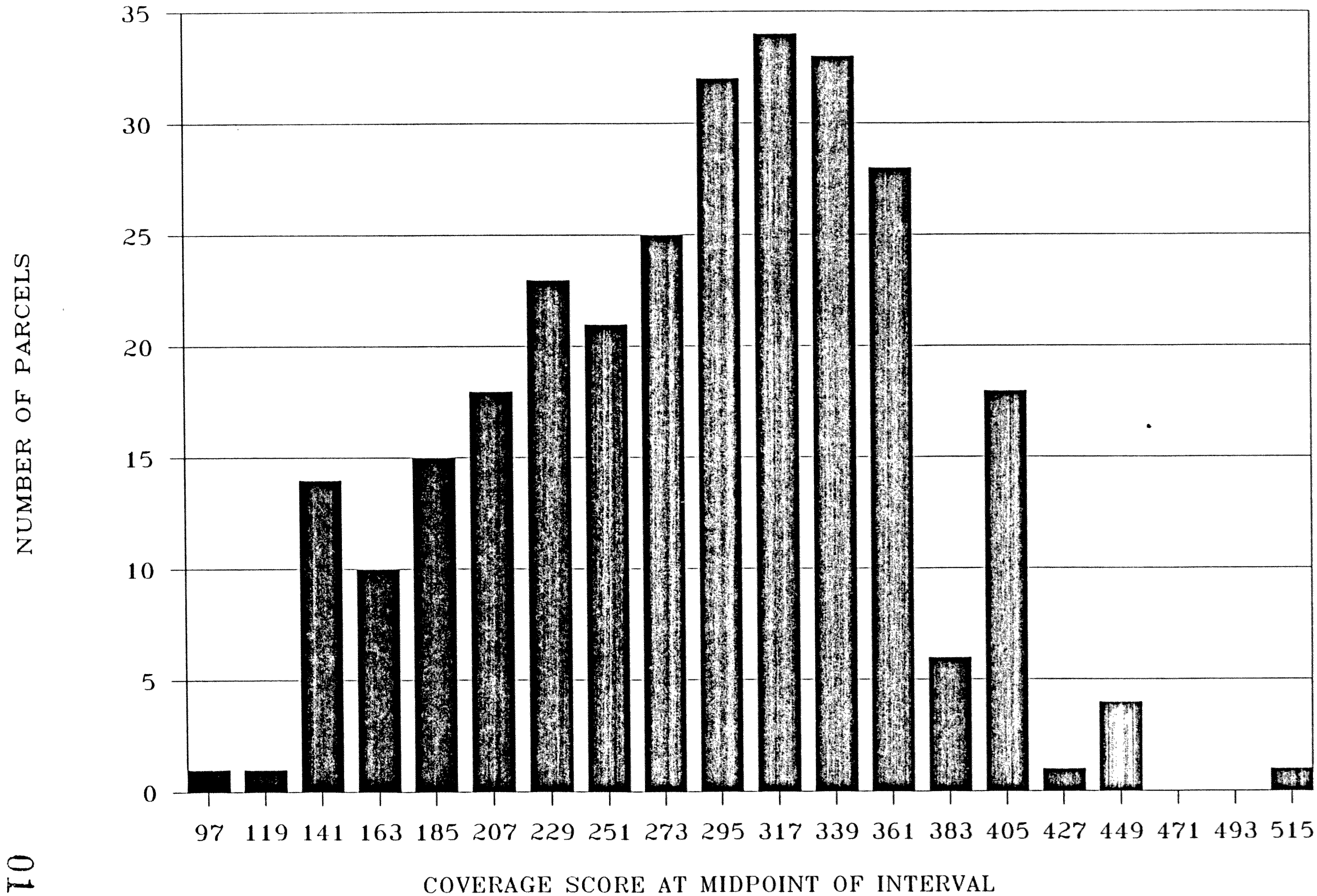
DISTRIBUTION IPES COVERAGE SCORES

1150 CLASS 1A-1B-1C-2 PARCELS



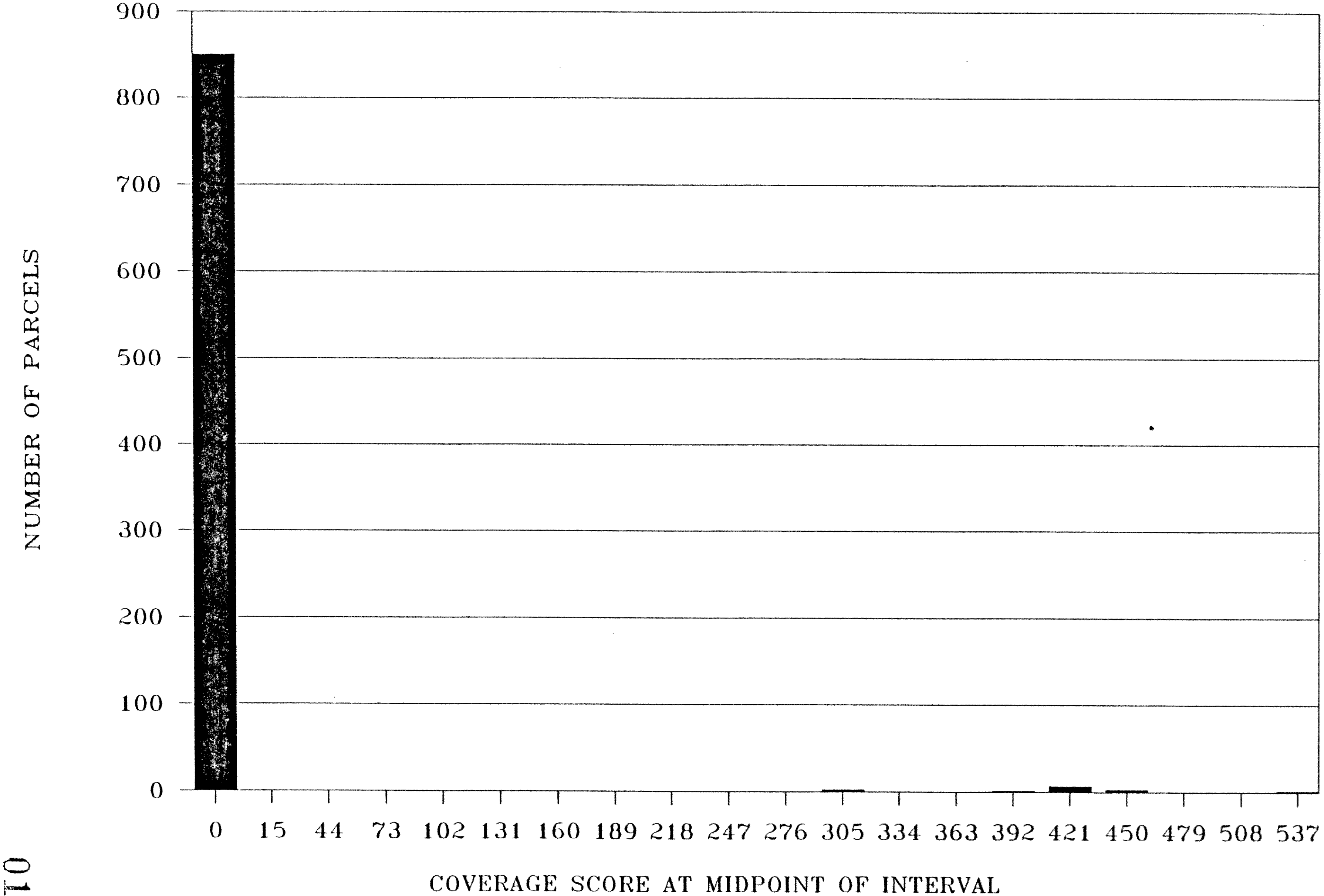
DISTRIBUTION IPES COVERAGE SCORES

285 CLASS 1A-1C-2 PARCELS



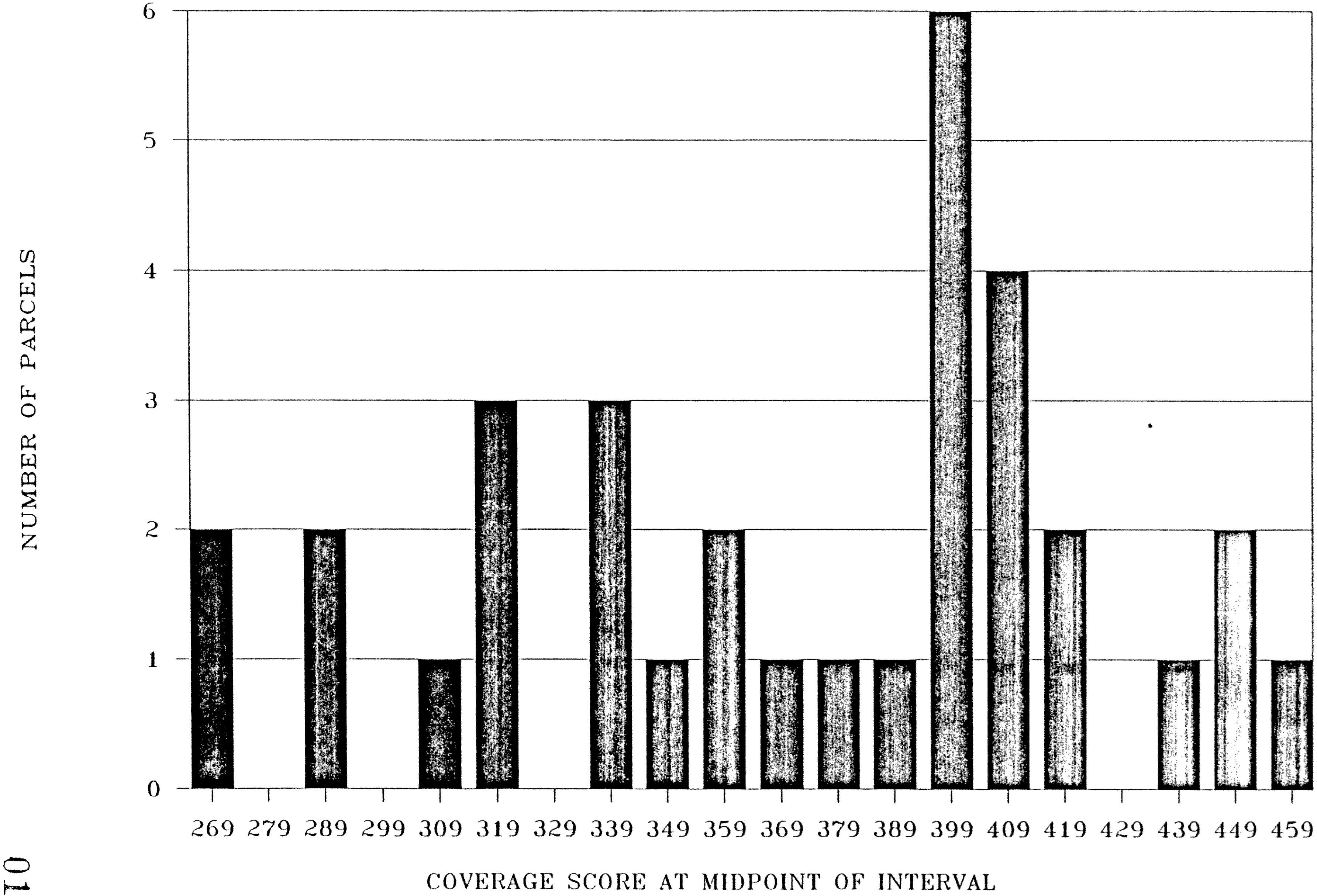
DISTRIBUTION IPES COVERAGE SCORES

865 PARCELS FOUND CLASS 1B



DISTRIBUTION IPES COVERAGE SCORES

33 PARCELS FOUND CLASS 1C



DISTRIBUTION IPES COVERAGE SCORES

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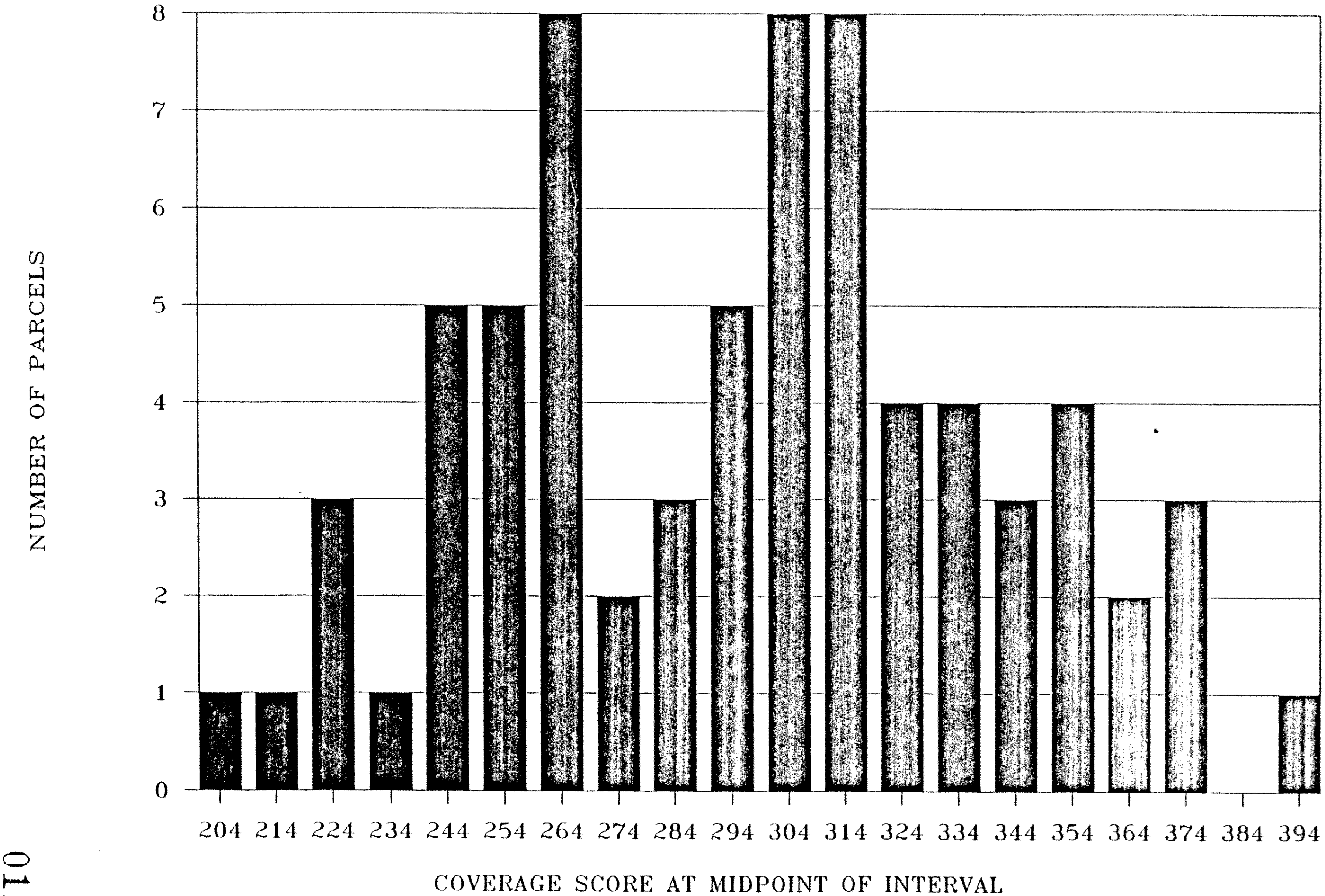
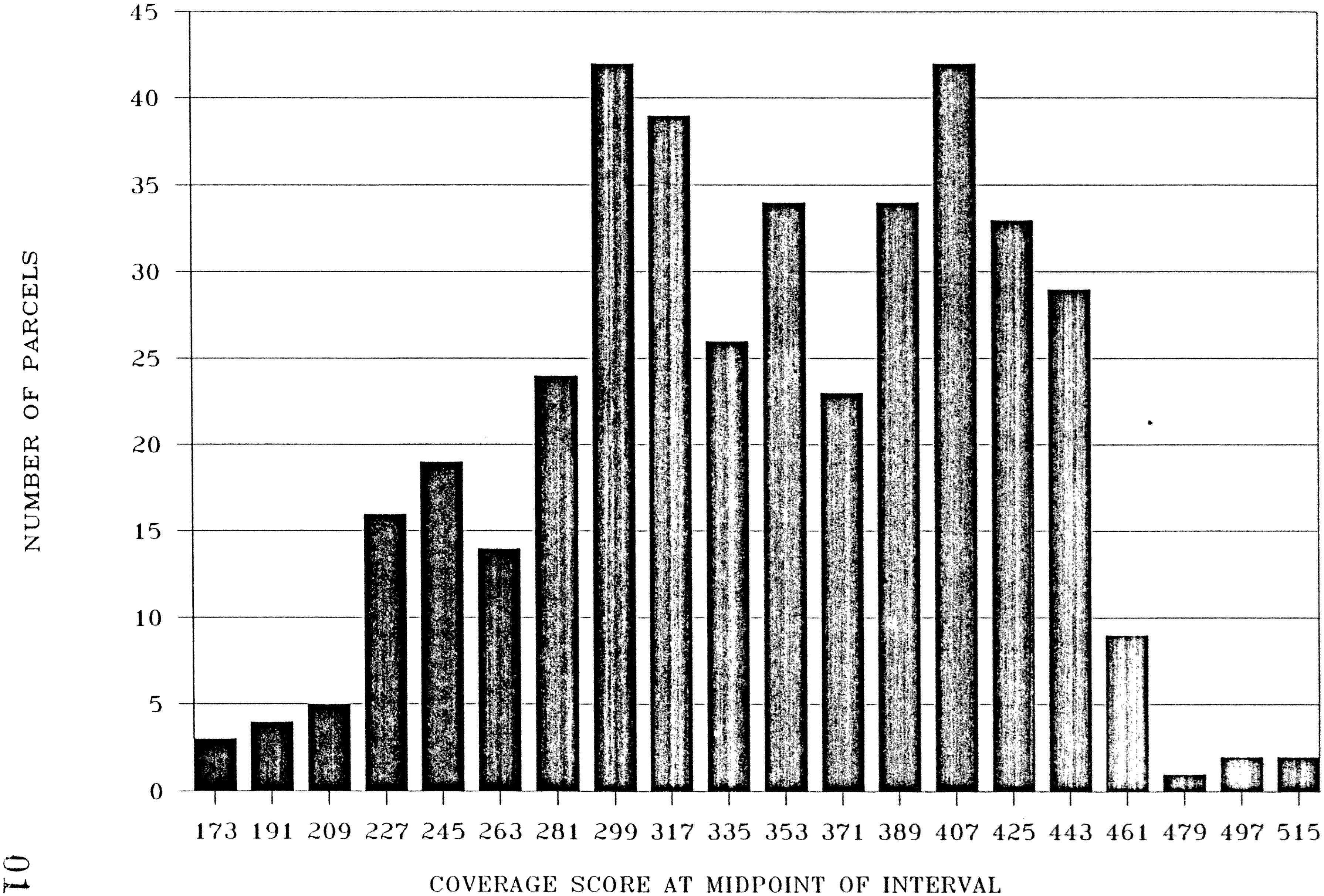


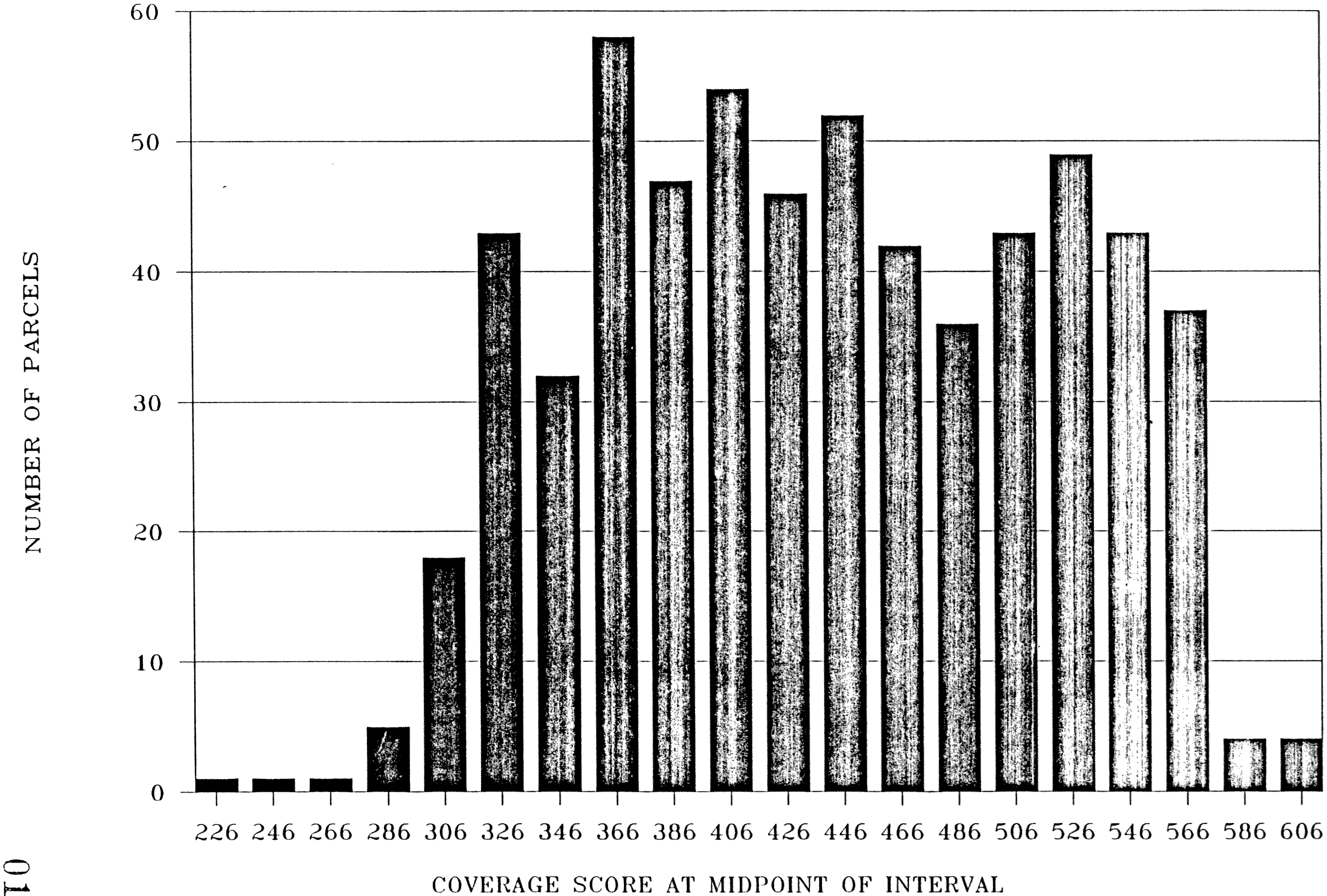
DISTRIBUTION IPES COVERAGE SCORES

401 PARCELS FOUND CLASS 3



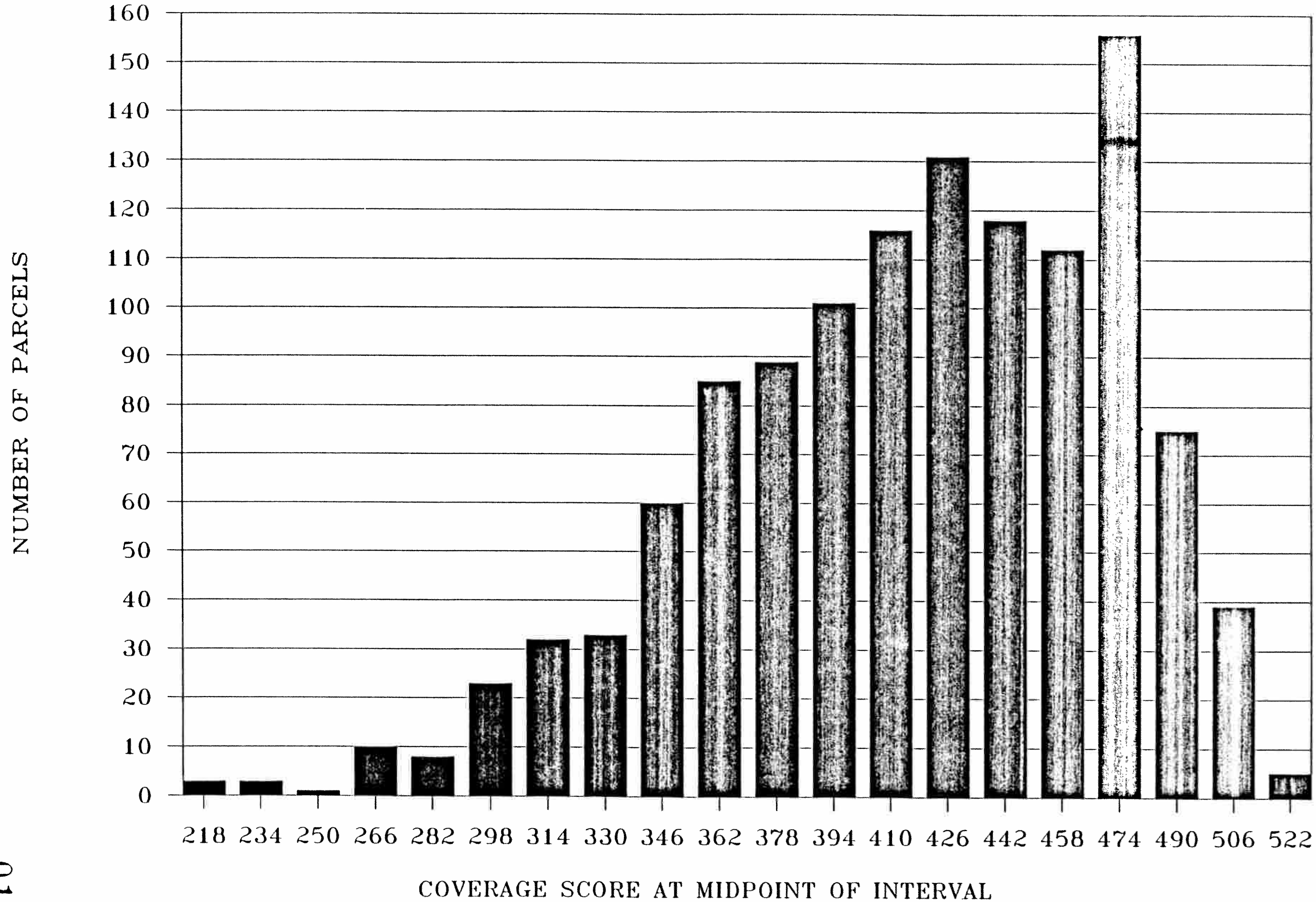
DISTRIBUTION IPES COVERAGE SCORES

616 PARCELS FOUND CLASS 4



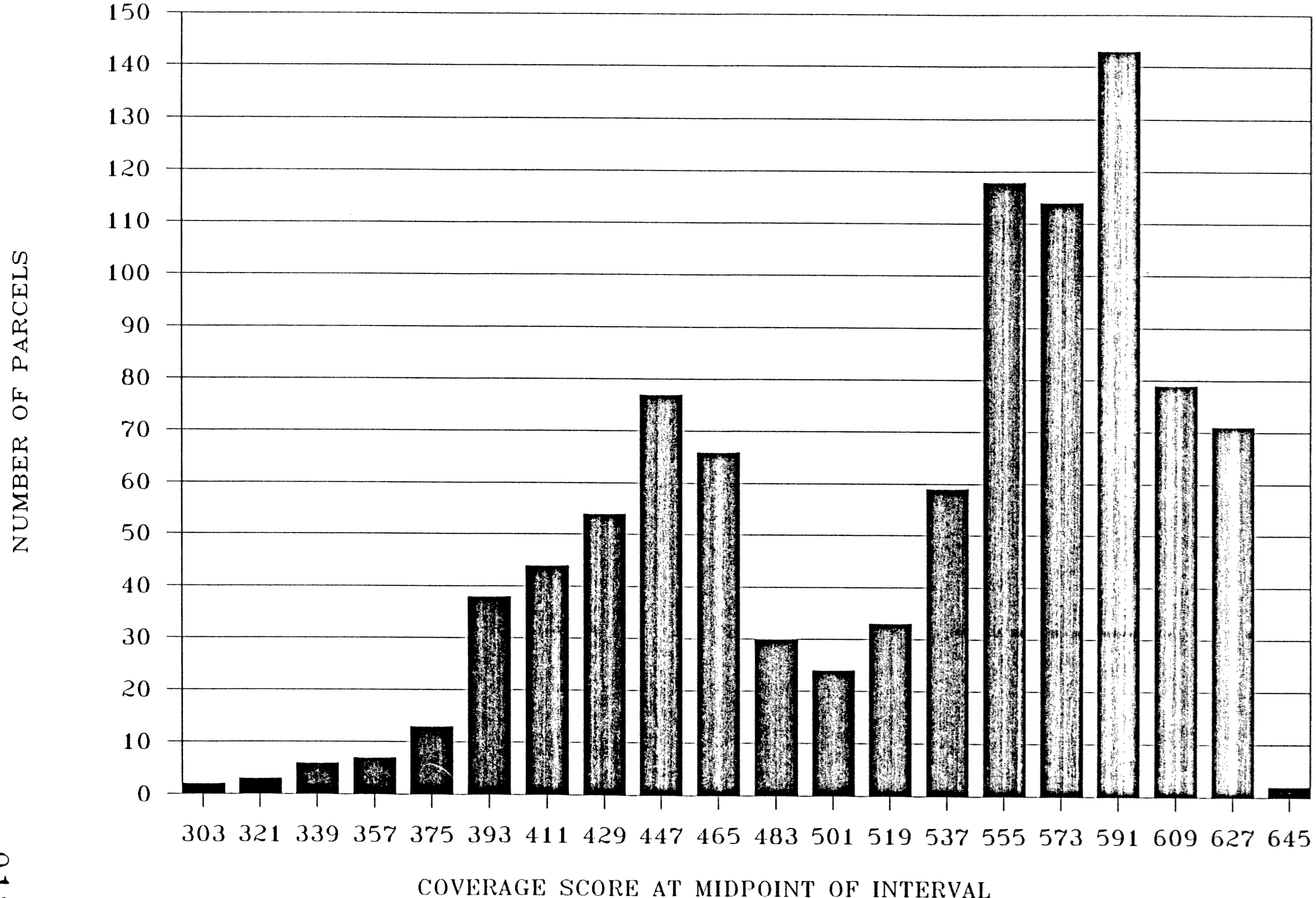
DISTRIBUTION IPES COVERAGE SCORES

1200 PARCELS FOUND CLASS 5



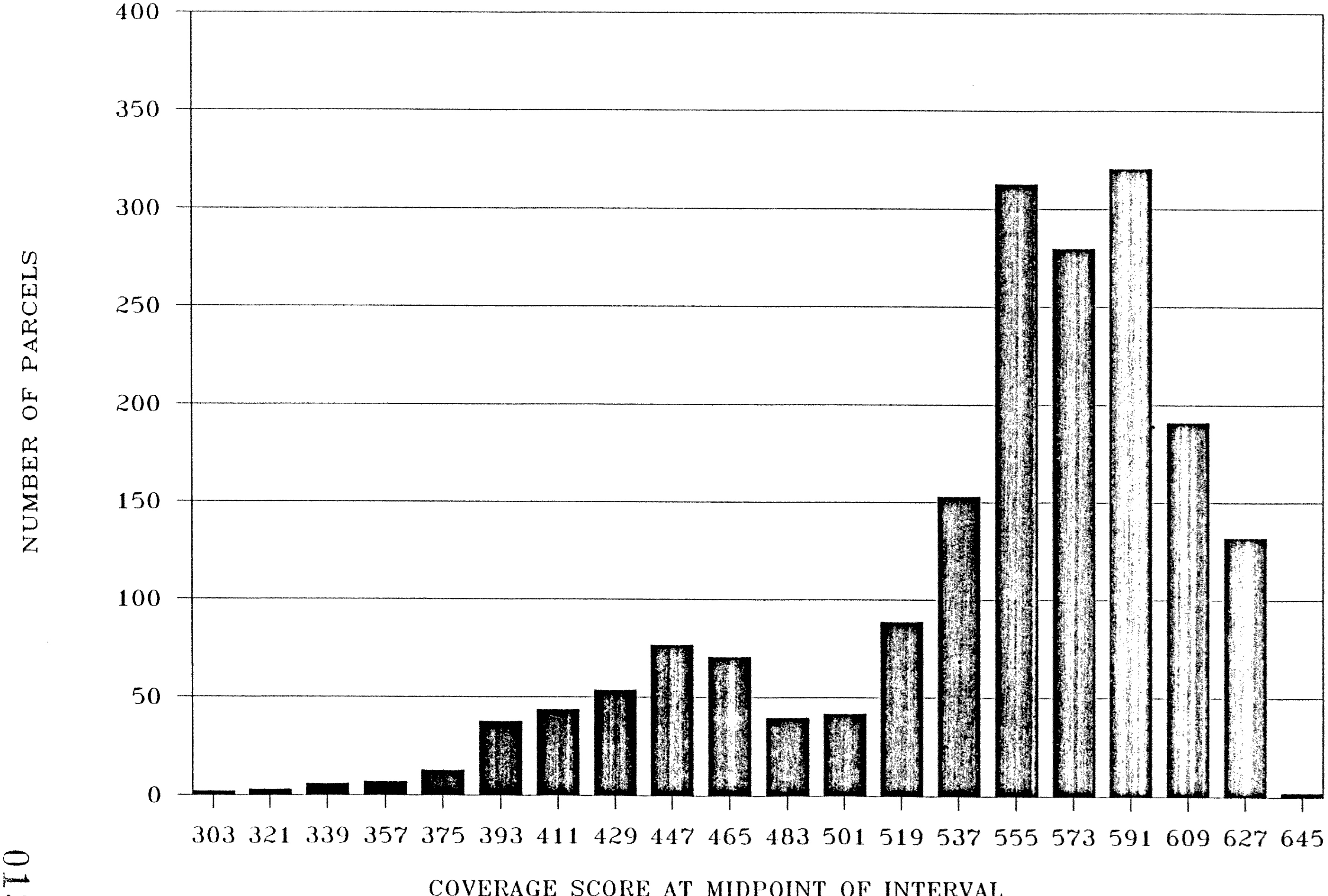
DISTRIBUTION IPES COVERAGE SCORES

983 PARCELS FOUND CLASS 6



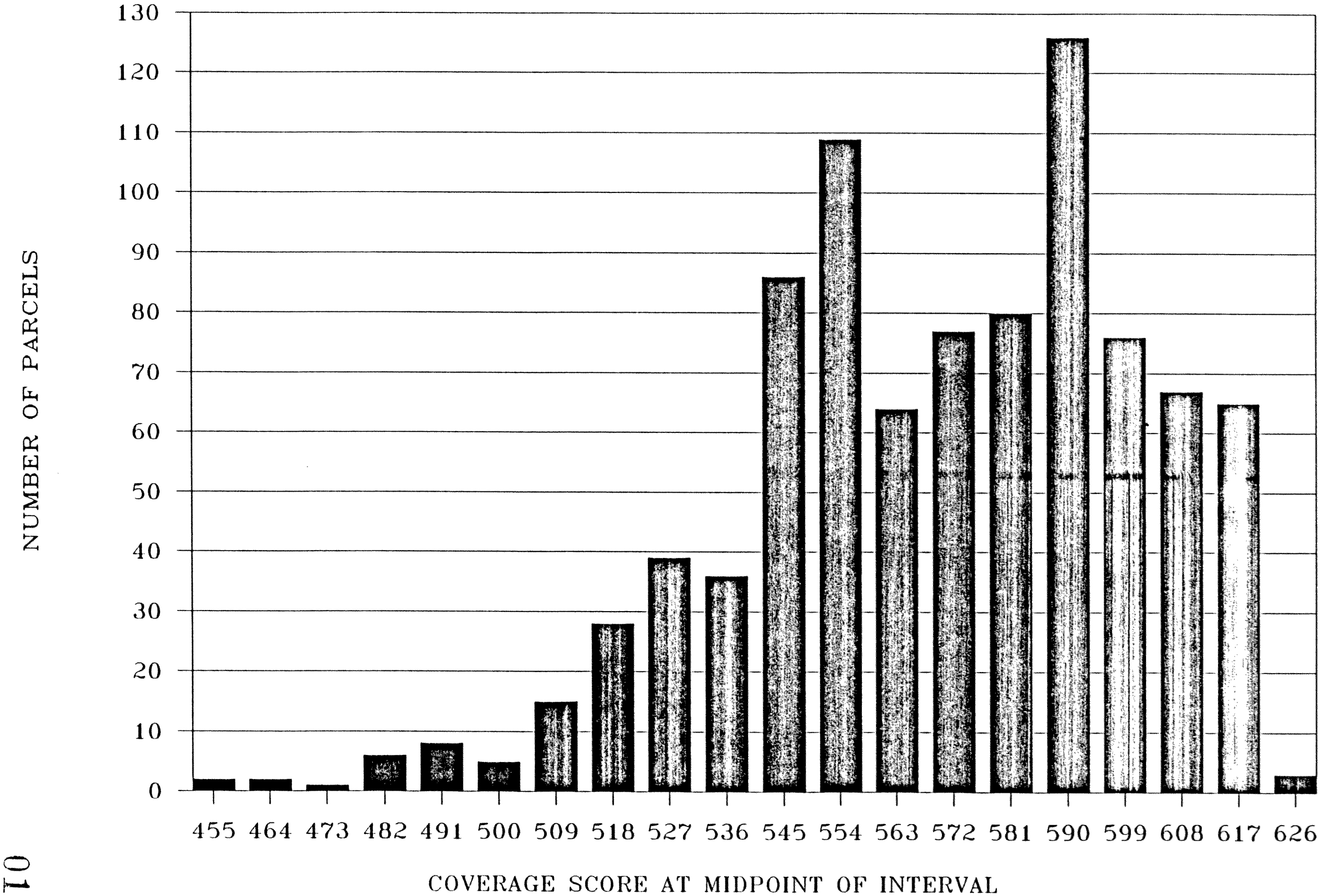
DISTRIBUTION IPES COVERAGE SCORES

1878 PARCELS FOUND CLASS 6-7



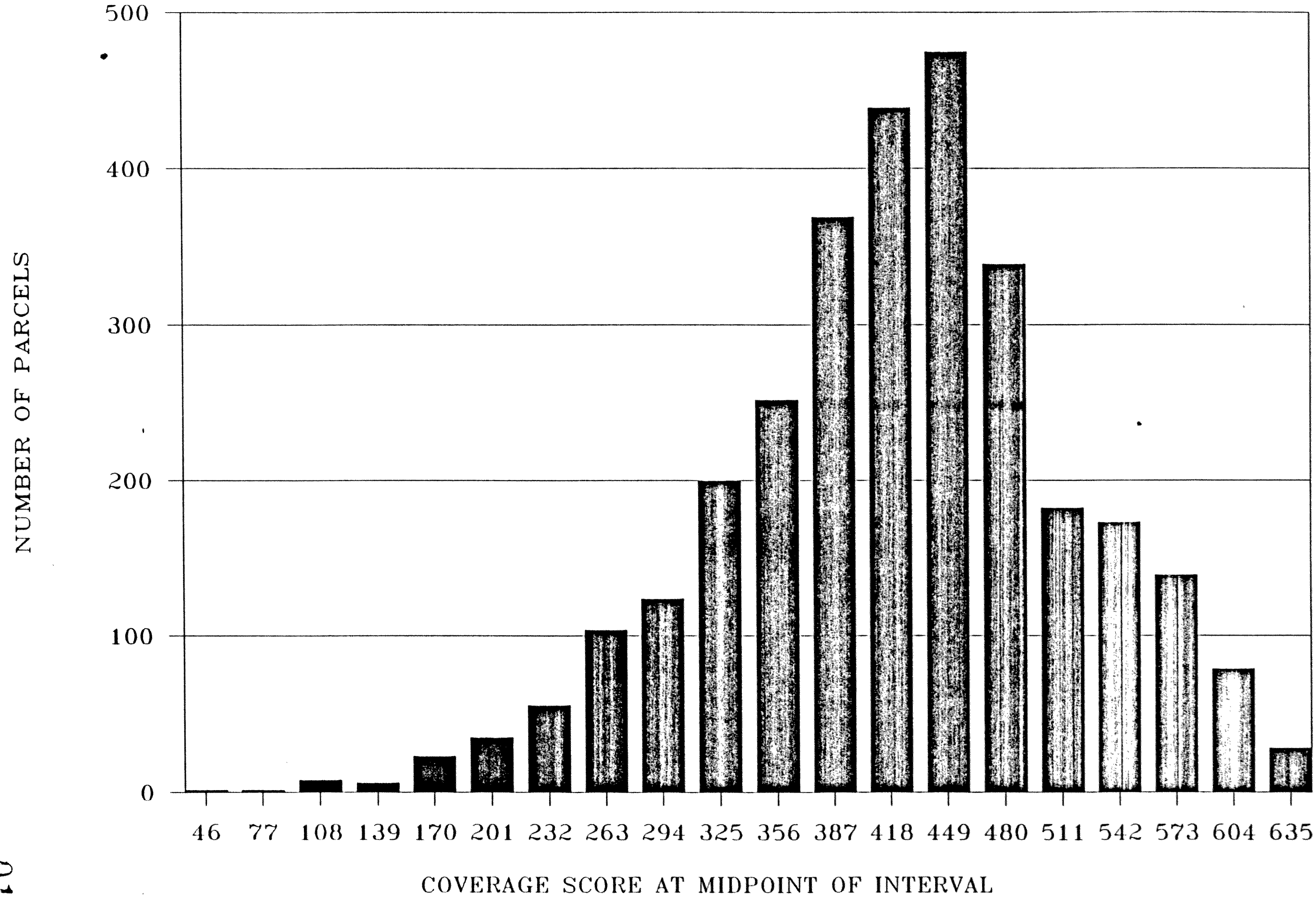
DISTRIBUTION IPES COVERAGE SCORES

895 PARCELS FOUND CLASS 7



DISTRIBUTION IPES COVERAGE SCORES

3033 UNCLASSIFIED PARCELS



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APPENDIX M

Water Quality Monitoring Work Program

Tahoe Regional Planning Agency

October 12, 1988

WQ-1. Water Quality - Littoral Zone Turbidity

Objective

The objective of this work element is to monitor turbidity in the littoral zone of Lake Tahoe. Eight sites have been selected to include littoral stretches adjacent to recreational beaches and mouths of major tributaries.

Product

Data collected will be compiled into an annual TRPA report.

Responsibility

Field - TRPA
Financial - TRPA

WQ-2. Water Quality - Pelagic Zone Clarity and Algal Primary Productivity

Objective

The objective of this work element is to monitor water clarity and algal primary productivity in the pelagic zone of Lake Tahoe.

Product

Data collected will be compiled in the annual report of the Tahoe Research Group.

Responsibility

Field work - TRG
Financial support - SWRCB, USGS-Sacramento, TRG

WQ-3. Water Quality - Tributary Water Quality

Objective

The objective of this work element is to monitor in-stream water quality to assess compliance with water quality standards and to track nutrient and sediment delivery to Lake Tahoe.

Product

Data collected will be compiled in the annual reports of the Tahoe Research Group and the USGS (Carson City).

Responsibility

Field - TRG and USGS
Financial - SWRCB, USGS-Sacramento, USGS-Carson City, TRPA, TRG

WQ-4. Water Quality - IPES Tributary Monitoring

Objective

The objective of this work element is to monitor tributary water quality to assess the impacts of development under the IPES system.

Product

Data will be compiled in an annual TRPA report.

Responsibility

Field - contractors (to be determined)
Financial - TRPA, local government

WQ-5. Water Quality - Surface Runoff

Objective

The objective of this work element is to periodically sample storm and snowmelt runoff to assess compliance with regional runoff quality guidelines.

Product

Data will be compiled into periodic reports by the regulatory agencies.

Responsibility

Field - self-monitoring by permittees
Financial - self-monitoring by permittees

WQ-6. Water Quality - Groundwater Quality

Objective

The objective of this work element is to assess the impacts of groundwater on nutrient loading to Lake Tahoe.

Product

Data will be compiled in annual reports of the USGS (Carson City).

Responsibility

Field - USGS-Carson City
Financial - TRPA, USGS-Carson City

WQ-7. Water Quality - Other Lakes

Objective

The objective of this work element is a preliminary assessment of compliance with state standards for water bodies other than Lake Tahoe.

Product

Data will be compiled in a TRPA annual report.

Responsibility

Field - TRPA
Financial - TRPA

AQ-1. Air Quality - Atmospheric Deposition

Objective

The objective of this work element is to collect data on atmospheric deposition of nutrients. This data will be used to help develop a nutrient loading model for Lake Tahoe.

Product

Annual TRPA reports will be prepared to present the data.

Responsibility

Field - CARB, NDEP, TRPA, and TRG
Financial - CARB, NDEP, TRPA, and TRG

AQ-2. Air Quality - Vehicle Miles Traveled (VMT)

Objective

The objective of this work element is to calculate peak summer day VMT based on monitored traffic volumes on the roadways in the Tahoe Region.

Product

The VMT estimate will be included in annual TRPA reports.

Responsibility

Field - TRPA
Financial - TRPA

SC-1. Soil Conservation - Land Coverage and Disturbance

Objective

The objective of this work element is to develop a data base system to track a representative sample of parcels in the Tahoe Region to determine the degree of coverage and disturbance and of implementation of BMPs.

Product

The results of the tracking system will be included in annual TRPA reports.

Responsibility

Field - TRPA
Financial - TRPA

SC-2. Soil Conservation - Stream Environment Zone (SEZ) Restoration

Objective

The objective of this element is to track the restoration of disturbed SEZs.

Result

The results of the tracking system will be included in annual TRPA reports.

Responsibility

Field - TRPA
Financial - TRPA,

APPENDIX N

Selected Water Quality Data
For The Tahoe Region

Tahoe Regional Planning Agency

October 12, 1988

The following water quality data is from the Water Quality Management Plan for the Lake Tahoe Region, Volume I, Section I (TRPA, 1988).

'ABLE 8. Tahoe Research Group Stream Monitoring Stations: Mean Annual Loading Values

Parameter	Tributary	1973	1974	1975	1976	1977	1978	Water Year 1979	1980	1981	1982	1983	1984	1985	1986
Suspended Sediment metric tons/year	Trout									181	2652	3290	1917	494	
	Upper Truckee									992	7288	4422	6522	1859	6277
	Blackwood			2184	31	5			7005	217	9979	2456	1294	354	6305
	Ward	914	2119	1043	8	2			2032	90	8940	1603	655	117	1815
	General									28	1303	243	165	46	579
	Third								1159	52	1258	602	288	183	
	Snow									3	77	154	23	16	
Nitrate Kg/Year as N	Trout					309	460		940	512	1043	1199	896	800	
	Upper Truckee					411	2020			984	4279	4801	2750	1897	2913
	Blackwood			1756	828	284	1652		1090	509	1773	1588	1018	952	1098
	Ward	538	561	680	300	68	342		290	124	605	665	350	316	249
	General									38	231	235	156	112	124
	Third									38	247	299	182	146	
	Snow									3	54	91	17	12	
Total P Kg/Year as P	Trout								433	155	3052	4258	2073	874	
	Upper Truckee								894	1064	5032	6442	4735	1724	5088
	Blackwood								752	318	3372	2952	1037	371	2664
	Ward			2358					474	308	2298	1342	964	285	1109
	General									86	708	603	276	132	371
	Third								425		1146	807	364	163	
	Snow										118	393	74	34	
Biologically Available Iron Kg/Year as Fe	Trout								6840	2528	37,019	90,698	22,733	7629	
	Upper Truckee								10,710	11,629	108,595	96,464	49,780	21,512	67,199
	Blackwood								4512	1848	45,105	32,347	9,362	2398	37,038
	Ward								1732	1053	37,997	17,097	4,329	1123	9609
	General									434	2,499	3153	1,354	756	4398
	Third								10,822		19,645	11,755	5,842	2671	
	Snow										446	3546	737	542	

TABLE 9. Tahoe Research Group Stream Monitoring Stations: Mean Annual Concentration Values

Parameter	Tributary	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
								Water Year							
Suspended Sediment mg/l	Trout								48	5	44	43	34	20	
	Upper Truckee								49	24	42	24	48	31	55
	Blackwood			67	2	2			85	14	152	38	26	15	125
	Ward	41	63	42	1	1			16	9	171	30	18	8	55
	General									4	42	8	8	4	25
	Third								135	13	105	48	28	27	
	Snow									11	18	20	10	20	
Nitrate ug N/l	Trout					72	22		14	15	18	16	16	32	
	Upper Truckee					26	23		12	24	25	26	20	32	25
	Blackwood			54	60	36	46		17	32	27	24	21	41	22
	Ward	24	17	27	29	14	14		5	12	12	13	10	20	8
	General									6	8	8	7	11	5
	Third								10	10	21	24	18	22	
	Snow									9	13	12	8	16	
Total P ug P/l	Trout								25	30	51	56	37	35	
	Upper Truckee								21	40	29	36	35	29	44
	Blackwood								31	32	51	45	21	16	53
	Ward			95					27	36	44	26	27	18	34
	General									19	23	20	13	13	16
	Third								74	36	96	64	35	24	
	Snow									39	28	51	32	41	
Biologically Available Iron ug Fe/l	Trout								387	426	619	1192	405	308	
	Upper Truckee								246	449	622	530	366	359	584
	Blackwood								187	173	688	493	189	102	734
	Ward								103	119	728	324	119	71	292
	General									97	80	103	63	74	192
	Third								1944	706	1646	936	564	395	
	Snow									342	107	464	320	667	

TABLE 10. U.S. Forest Service Stream Monitoring Stations: Mean Parameter Concentration Values

Parameter	Tributary	Water Year 1980	1981	1982	1983	1984	1985	1986	1987
	Wildwood Keller					40	4	12	1
	Heavenly Valley								
	Above	22	12	27	7	12	4	23	4
	Below	47	139	54	173	96	65	83	103
	Saxon	12	4	18	23	15	6	16	
	Snow							14	19
Suspended	Griff						11	10	
Sediment	South Zephyr						13		
mg/l	Burke			4	6	14	14		
	Marlette	15	5	14	28	9	5	18	10
	Big Meadow	9	5	5	10	4	3	9	4
	Grass Lake	24	6	12	18	6	3	10	4
	Meeks	3	6	2	1	1	4	2	4
	Trout			19	60	10	5	24	7
	Blackwood	7	5	5	2	13	3	3	5
	Wildwood/Keller					8	3	3	3
	Heavenly Valley								
	Above	7	12	6	5	11	29	10	48
	Below	40	36	45	86	119	159	173	164
	Saxon	8	8	4	6	7	16	5	
	Snow							11	7
	Griff						16	7	
Nitrate/Nitrite	South Zephyr						5		
ug N/l	Burke			1	3	3	5		
	Marlette	63	67	70	57	52	87	98	90
	Big Meadow	6	6	3	13	12	19	7	14
	Grass Lake	22	24	8	15	12	24	9	20
	Meeks	16	28	10	17	16	17	10	13
	Trout			5	9	8	15	8	10
	Blackwood	14	40	18	23	34	51	14	25

TABLE 10. U.S. Forest Service Stream Monitoring Stations: Mean Parameter Concentration Values (continued)

Parameter	Tributary	Water Year 1980	1981	1982	1983	1984	1985	1986	1987
	Wildwood/Keller					195	23	38	22
	Heavenly Valley								
	Above	41	24	24	21	22	20	24	32
	Below	50	47	42	92	60	178	72	78
	Saxon	29	15	17	21	14	14	17	
	Snow							20	35
Total	Griff						18	13	
Phosphorus	South Zephyr						48		
ug P/l	Burke			8	11	20	17		
	Marlette	27	20	17	34	17	16	19	20
	Big Meadow	20	10	9	12	9	11	13	18
	Grass Lake	30	14	11	15	14	10	13	18
	Meeks	11	4	5	4	4	4	5	9
	Trout			16	20	14	14	19	17
	Blackwood	44	7	13	5	8	5	5	15

Table 13. Nitrogen and Phosphorus Loading Estimates For Seven Sites in the Tahoe Region.

Site	PPM			Kg/Km^2		
	NO_3-N	Organic N	Extractable P	NO_3-N	Organic N	Total P
Luther Pass	.03	.12	.003	34	139	4
Meyers	.02	.12	.003	9	78	2
Kingsbury Grade	.05	.16	.008	20	69	3
Spooner	.07	.15	.003	19	72	1
General Creek	.03	.16	.003	14	50	2
Brockway	.03	.20	.006	42	305	8
Incline Village	.06	.10	.003	28	90	2

(Brown and Skau, 1975)

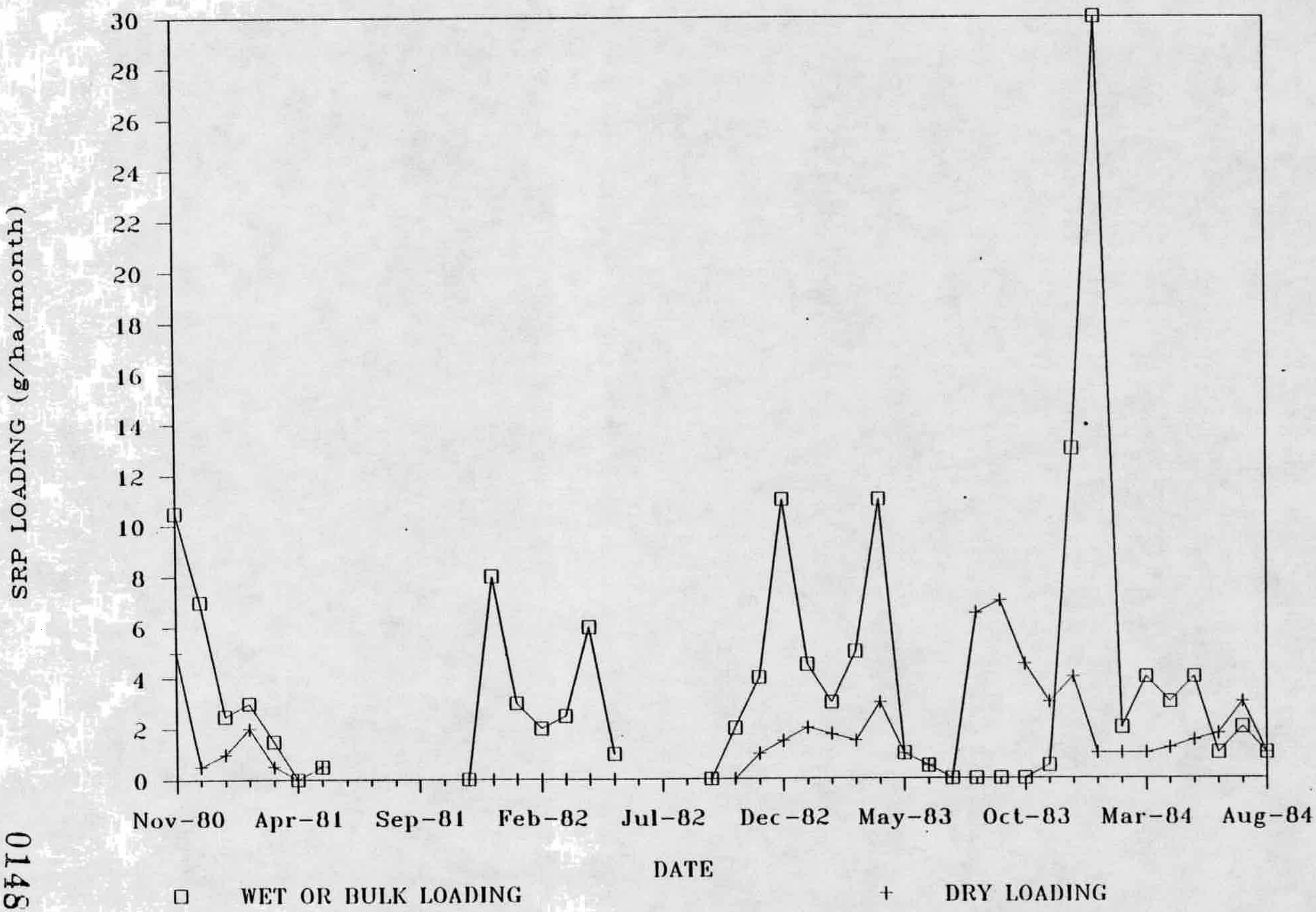

Figure 10. Atmospheric Phosphorus Loading, 1980-1984

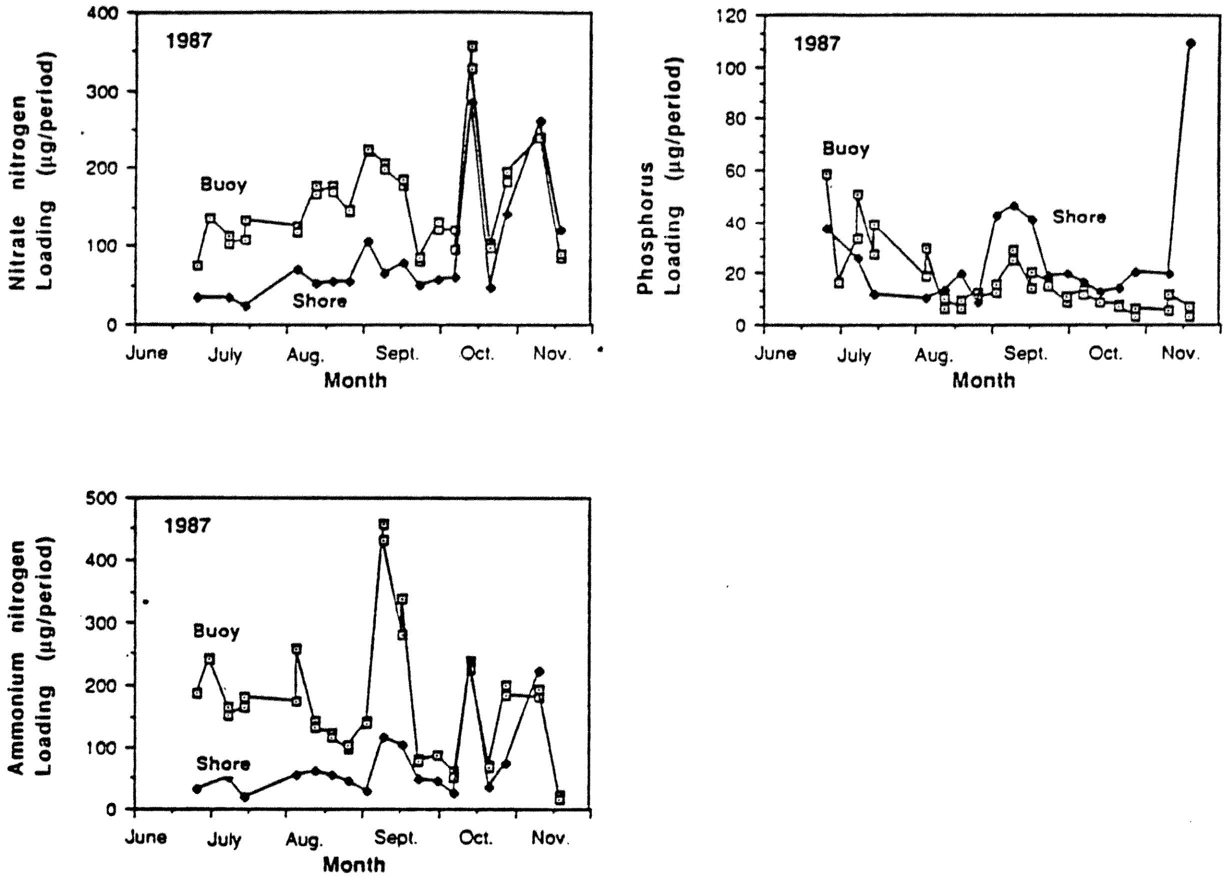

Figure 9. Dry Atmospheric Loading Estimates for Nitrogen and Phosphorus

The following water quality data is from the Study Report for the Establishment of Environmental Threshold Carrying Capacities (TRPA, 1982).

Table 4-21. Suspended Solids and Nutrient Loads[a]

Parameter	Tributary	1973	1974	1975	1976	1977	1978	1980	1981
Suspended solids, tonnes/year	Upper Truckee								181
	Trout								992
	Blackwood			2184	828	5		7005	217
	Ward	914	2119	1043	300	2		2032	90
	General								28
Nitrate, kg/year	Upper Truckee					411	2020		984
	Trout					309	460	940	512
	Blackwood			1756	31	284	1652	1090	509
	Ward	538	561	680	8	68	342	290	124
	General								38
Total P, kg/year	Upper Truckee							894	1064
	Trout							433	155
	Blackwood							752	318
	Ward			2358				474	308
	General								86
Dissolved ortho P, kg/year	Upper Truckee							287	254
	Trout							342	154
	Blackwood							161	57
	Ward			251				174	67
	General								35
Biologically available iron, kg/year	Upper Truckee							10,710	11,629
	Trout							6,840	2,528
	Blackwood							4,512	1,848
	Ward							1,734	1,053
	General								434
Dissolved iron, kg/year	Upper Truckee							337	261
	Trout							342	100
	Blackwood							304	64
	Ward							95	32
	General								45

[a]Goldman et al. (1982)

Table 4-22. Mean Values for Tributary Water Quality

Tributary	Suspended solids		Nitrate		Dissolved ortho P		Total P		Dissolved iron		Biologically available iron	
	Mean of monthly means, mg/l	Number of months	Mean of monthly means, ug/l	Number of months	Mean of monthly means, ug/l	Number of months	Mean of monthly means, ug/l	Number of months	Mean of monthly means, ug/l	Number of months	Mean of monthly means, ug/l	Number of months
Upper Truckee	18.3	17	32	27	7	17	30	5	5	17	329	5
Trout	18.9	19	31	34	8	24	23	5	6	24	498	5
Blackwood	29.2	57	21	65	4	24	21	6	5	24	120	6
Ward	19.5	81	11	89	7	24	29	6	3	24	98	6
General	1.2	12	6	12	12	12	19	3	5	12	[illegible]	[illegible]

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Table 4-23. Comparison of Total Nitrogen Data to California Standards

Tributary	California standard, annual average, mg/l	Range of concentrations, mg/l	50 Percentile	Number of samples
First	--	0.17 - 1.4	0.61	12
Glenbrook	--	0.25 - 2.1	0.70	9
Taylor	0.17	0.04 - 0.63	--	2
Upper Truckee	0.19	0.08 - 0.16	--	2
Burton[a]	0.16	0.011 - 0.30	0.10	9
Edgewood[a]	--	0.038 - 0.85	0.15	24
General[a]	0.15	0.016 - 1.4	0.13	37
Griff[a]	0.19	0.05 - 1.1	0.40	15
Lonely Gulch[a]	0.19	0.05 - 2.3	0.15	9
Madden[a]	0.18	0.02 - 0.14	0.09	8
McKinney[a]	0.19	0.05 - 0.90	0.22	15
Mill[a]	--	0.15 - 1.5	0.40	8
Slaughterhouse[a]	--	0.45 - 1.9	0.80	15
Taylor[a]	0.17	0.04 - 1.1	0.40	16
Trout[a]	0.19	0.10 - 2.8	0.18	24
Unnamed[a]	--	0.05 - 1.3	0.10	4
Upper Truckee[a]	0.19	0.04 - 0.90	0.15	42
Ward[a]	0.15	0.05 - 1.0	0.25	15

[a]Total Kjeldahl nitrogen

Table 4-24. Comparison of Dissolved Inorganic Nitrogen Data to Nevada Standard

Tributary	Nevada standard, mg/l	Range of concentrations, mg/l	50 Percentile	Number of samples
First[a]	0.025	0.010 - 0.28	0.10	12
Glenbrook[a]	0.025	0.03 - 0.40	0.10	9
Incline[a]	0.025	0.03 - 1.36	0.16	17
Taylor[a]	--	0.02 - 0.04	0.03	6
Third[a]	0.025	0.02 - 1.15	0.09	20
Edgewood[b]	0.025	0.04 - 0.14	0.07	8

[a]Dissolved nitrate plus nitrite plus ammonia.
[b]Dissolved nitrate plus nitrite.

Table 4-25. Comparison of Total Phosphorus Data to California Standards

Tributary	California standard, annual average, mg/l	Range of concentrations, mg/l	50 Percentile	Number of samples
Burton	0.015	0.019 - 0.081	0.030	10
Edgewood	--	0.020 - 0.080	0.040	24
First	--	0.030 - 0.90	0.090	12
Glenbrook	--	0.060 - 0.54	0.20	9
Griff	0.010	0.010 - 0.090	0.010	15
Incline	--	0.005 - 0.83	0.050	41
Lonely Gulch	0.015	0.010 - 0.030	0.010	9
Madden	0.015	0.010 - 0.024	0.013	9
Marlette	--	0.002 - 0.038	0.023	20
McKinney	0.015	0.010 - 0.030	0.010	13
Meeks	0.010	0 - 0.066	0.009	24
Slaughterhouse	--	0.020 - 0.14	0.040	15
Taylor	0.010	0.010 - 0.040	0.010	2
Third	--	0.010 - 0.65	0.080	35
Cascade[a]	0.005	0.001 - 0.006	0.003	17
Eagle[a]	0.010	0.001 - 0.005	0.003	12
Second[a]	--	0.005 - 0.258	0.047	10
Secret Harbor[a]	--	0.002 - 0.015	0.010	8
Tallac[a]	0.015	0.003 - 0.008	0.004	8
Watson[a]	0.015	0.001 - 0.020	0.008	17
Zephyr[a]	--	0.005 - 0.010	0.007	6

[a] Total hydrolyzable phosphorus

Table 4-26. Comparison of Dissolved Orthophosphorus Data to Nevada Standards

Tributary	Nevada standard, mg/l	Range of concentrations, mg/l	50 Percentile	Number of samples
Burton	--	0.007 - 0.045	0.021	10
Edgewood	0.007	0.010 - 0.050	0.015	23
First	0.007	0.010 - 0.120	0.018	22
Glenbrook	0.007	0 - 0.10	0.010	9
Griff	--	0.005 - 0.050	0.009	14
Incline	0.007	0.005 - 0.350	0.021	44
Lonely Gulch	--	0.005 - 0.010	0.004	9
Madden	--	0.005 - 0.010	0.009	9
Marlette	0.007	0.002 - 0.020	0.009	19
Meeks	--	0.001 - 0.036	0.005	24
Mill	0.007	0.015 - 0.035	0.020	8
Slaughterhouse	0.007	0.010 - 0.031	0.015	15
Third	0.007	0.005 - 0.250	0.010	33
Unnamed	0.007	0.005 - 0.010	0.005	4

Table 4-27. Comparison of Total Iron Data to California Standards.

Tributary	California standard, annual average, mg/l	Range of concentrations, mg/l	50 Percentile	Number of samples
Burton	0.03	0.005 - 0.176	0.034	9
Cascade	0.01	0.004 - 0.038	0.013	7
Eagle	0.03	0.015 - 0.022	--	2
First	--	0.35 - 12.0	2.0	11
Glenbrook	--	0.009 - 0.192	0.09	9
Incline	--	0.027 - 0.382	0.107	12
Madden	0.015	0.012 - 0.044	0.020	4
McKinney	0.03	0.009 - 0.251	0.040	9
Meeks	0.07	0.016 - 0.121	0.025	7
Polaris	--	0.013 - 0.177	0.027	9
Second	--	0.011 - 0.366	0.152	9
Tallac	0.03	0.012 - 0.038	--	2
Taylor	0.02	0.001 - 0.050	0.016	12
Third	--	0.022 - 2.75	0.216	20
Watson	0.04	0.011 - 0.064	0.034	9
Zephyr	--	0.008 - 0.184	0.022	6

Table 4-30. Mean Values for Surface Runoff Quality

Surface runoff category	Suspended sediment[a,b]		Nitrate[c]		Dissolved ortho P[c]		Dissolved iron[c]	
	Mean	Sample No.	Mean	Sample No.	Mean	Sample No.	Mean	Sample No.
Urban runoff	427 (6,510)	231 (107)	126	191	729	100	1,070	57
Ski area runoff	238	475	30	22	10	42	–	–
Runoff/tributary	96 (1,100)	166 (148)	86	109	176	84	350	36
Natural runoff	104	38	68	35	57	25	207	4
Tributary/natural	13 (611)	188 (352)	10	80	11	142	200	6

[a]Mean values are in mg/l.

[b]Numbers in ( ) are total sediment concentration (including both suspended sediment and bed load) from the USGS/NDWR sampling program.

[c]Mean values are in ug/l.

Table 4-31. Frequency Distribution of Surface Runoff Quality Data[a]

Parameter	Surface runoff category: Urban runoff	Ski area runoff	Runoff tributary	Natural runoff	Tributary natural
Suspended sediment					
Minimum	3	0	0	2	0
10 percent	26	5	2.7	3	1
50 percent	130	37	34	22	6
90 percent	650	175	25	470	29
Maximum	25,100	18,273	1,150	577	152
Total sediment data from USGS/NDWR monitoring program					
Minimum	0		3		1
10 percent	8		30		4
50 percent	1,645		297		40
90 percent	20,000		3,200		728
Maximum	60,000		27,500		32,400
Nitrate					
Minimum	0	0	0	0	0
10 percent	0	5	0	0	0
50 percent	19	31	6	1	6
90 percent	380	53	21	230	19
Maximum	3,100	66	1,200	760	55
Dissolved phosphorus					
Minimum	1	4	1	1	1
10 percent	1	6	1	1	5
50 percent	90	9	7	5	9
90 percent	2,200	15	300	240	19
Maximum	11,000	32	3,500	350	46
Dissolved iron					
Minimum	1		1	1	1
10 percent	4		2	2	1
50 percent	65		12	8	10
90 percent	2,330		730	350	500
Maximum	16,000		3,230	2,330	890

[a]Suspended and total sediment data are in mg/l; all other data are in ug/l.

Table 4-33. Water Quality of Other Lakes in the Tahoe Basin.

Lake	Agency	Station number	Period of record	Secchi depth, m		Nutrient concentration, mg/l: Nitrate		Dissolved P		Total nitrogen		Total dissolved Iron	
				Mean	No. of samples	Mean	No. of samples	Mean	No. of samples	Mean	No. of samples	Mean	No. of samples
Fallen Leaf													
	EPA	060802	03/24/75 - 11/05/75	7.41	3	——	24	0.005	16	0.048	16	——	—
		060801	03/18/75 - 11/04/75	13.72	3	——	—	0.004	23	0.036	23	——	—
		060805	03/24/75 - 11/05/75	13.72	3	——	—	0.006	22	0.034	22	——	—
	USGS	3852....501	06/04/74 - 05/21/75	——	-	0.007	63	0.001	63	0.012	63	18.86	35
		3853....5001	06/04/74 - 06/25/75	——	-	0.006	74	0.002	74	0.012	74	20.31	20
	EPA	060804	03/24/75 - 11/05/75	13.61	3	——	—	0.006	22	0.033	22	——	—
		060803	03/27/75 - 11/05/75	11.89	2	——	—	0.007	14	0.011	14	——	—
Lilly													
	USGS	3852....801	07/11/75 - 10/22/76	4.92	3	0.004	11	0.0009	11	0.093	11	——	—
Gilmore													
	USGS	3853....401	07/10/75 - 10/13/76	14.38	4	0.004	24	0.0008	24	0.010	24	——	—

Table 6-6. Comparison of Measured Sediment Yields from Tahoe Basin Watersheds and Subwatersheds

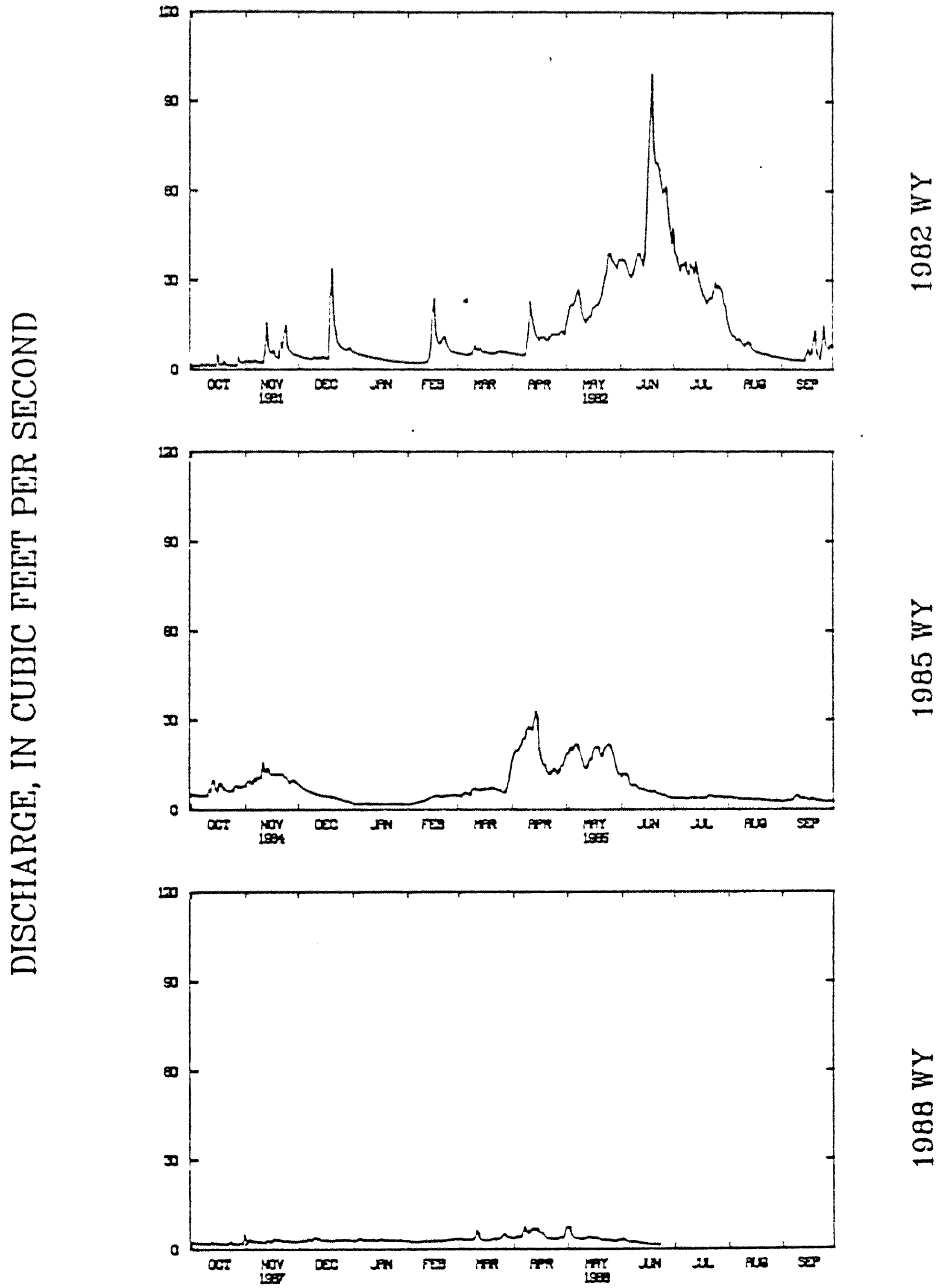
Source	Watershed name	Drainage area, hectares	Water year	Sediment yield,[a,b] kg/ha/yr	Disturbance type
Glancy, 1981	Second Creek	63	1970-73	14,040 (6.3)	Developed
Glancy, 1976	First Creek	47	1970-73	7,412 (3.3)	Developed
Glancy, 1976	Third Creek	378	1970-73	7,171 (3.2)	Developed
White and Franks, 1978	Lonely Gulch Creek	38	1973	3,660 (1.6)	Developed
Glancy, 1976	Wood Creek	121	1970-73	3,306 (1.5)	Developed
Glancy, 1976	Incline Creek	434	1970-73	2,682 (1.2)	Developed
Goldman et al., 1982	Blackwood Creek	2,896	1975-77 1980-81	705[c] (0.3)	Developed
Glancy, 1976	Third Creek	1,234	1970-73	600 (0.30)	Undeveloped
White and Franks, 1978	Lonely Gulch Creek	275	1973	536 (0.2)	Developed
Goldman et al., 1982	Ward Creek	2,523	1973-77 1980-81	370[c] (0.2)	Developed
Kroll, 1976	Grass Lake Creek	580	1972-74	310 (0.1)	Undeveloped
Glancy, 1976	First Creek	264	1970-73	200 (.08)	Undeveloped
Kroll, 1976	Eagle Creek	400	1972-74	170 (.08)	Undeveloped
Glancy, 1976	Wood Creek	404	1972-74	160 (.07)	Undeveloped
Glancy, 1976	Incline Creek	405	1970-73	110 (.05)	Undeveloped
Kroll, 1976	Meeks Creek	1,240	1972-74	60 (.03)	Undeveloped
Kroll, 1976	Quail Creek	110	1972-74	60 (.03)	Undeveloped
Kroll, 1976	Dollar Creek	100	1972-74	50 (.02)	Undeveloped
White and Franks, 1978	Lonely Gulch Creek	237	1973	34 (.02)	Undeveloped
Goldman et al., 1982	General Creek	1,958	1981	14[c] (.01)	Undeveloped

[a]All Glancy data include bedload. Other sources include just suspended sediment.
[b]Numbers in ( ) are in tons/acre/year.
[c]1976, 1977, and 1981 were very low precipitation years and have greatly affected these data.

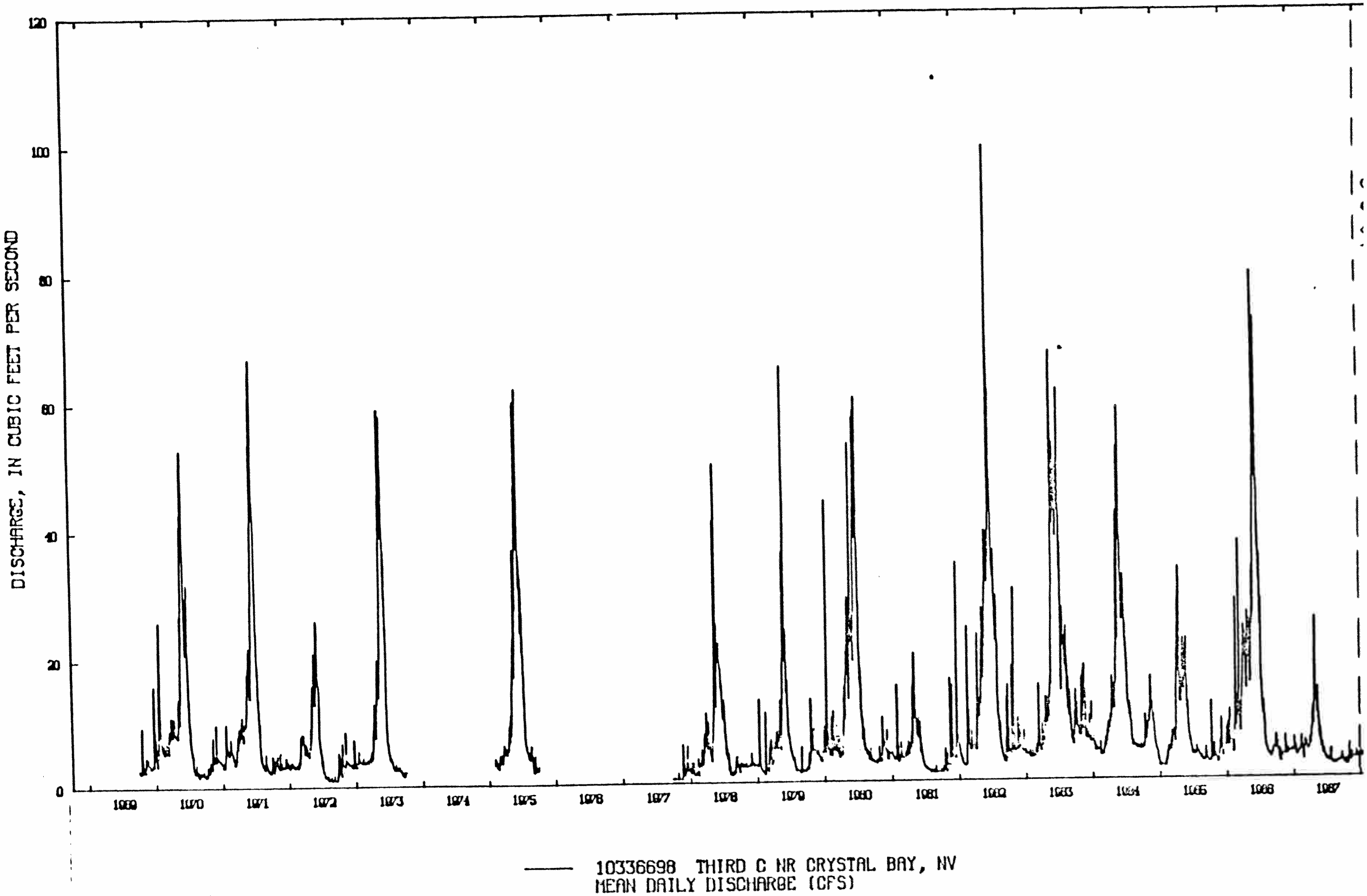
Table 5-7. Comparison of Drainage Areas and Estimated Runoff Volumes

Tributary name	USGS watershed number	Drainage area: Acres	Drainage area: Percent of basin	Mean daily flow[a], cfs	Mean annual runoff volume[b], ac-ft	Percent of total annual basin runoff volume
Blackwood	104	6,234	3.1	35.2	25,484	8.4
Eagle	80A	4,262	2.1	22.4	16,217	5.4
General	94A	4,834	2.4	15.4	11,149	3.7
Incline	34A	4,326	2.2	7.0	5,068	1.7
Madden	102	1,325	0	5.9	4,271	1.4
Meeks	90A	5,222	2.6	16.8	12,163	4.0
Quail	98	608	0.3	2.0	1,448	0.5
Taylor	75A	11,738	5.8	41.5	30,045	9.9
Third	33A	3,878	1.9	7.2	5,213	1.7
Trout at South Lake Tahoe	72A	26,221	13.1	36.9	26,714	8.8
U. Truckee at South Lake Tahoe	73A	36,250	18.1	85.2	61,682	20.4
Ward	106A	6,234	3.1	25.5	18,461	6.1
Total of 12 Tributaries		111,132	55.4		217,915	72.0
Total basin		200,672	100.0		302,500[c]	100.0

The following water quality data was collected and reported by the U.S. Geological Survey. The data collection period was from November 17, 1987 to July 14, 1988, except where otherwise noted.

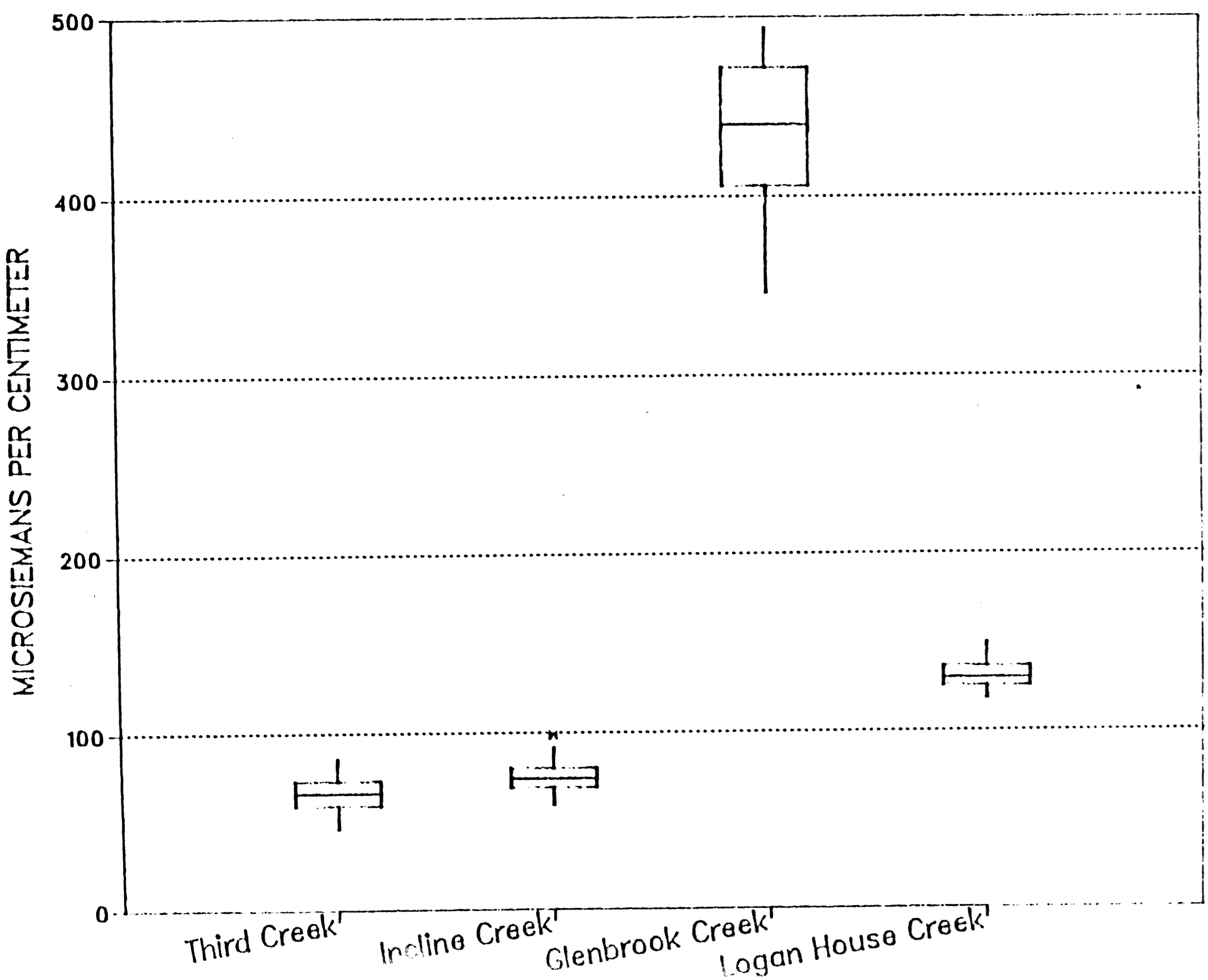


THIRD CREEK, NEAR CRYSTAL BAY, NEVADA



DISCHARGE, IN CUBIC FEET PER SECOND
0
20
40
60
80
100
120
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
10336698 THIRD C NR CRYSTAL BAY, NV
MEAN DAILY DISCHARGE (CFS)

Specific Conductance



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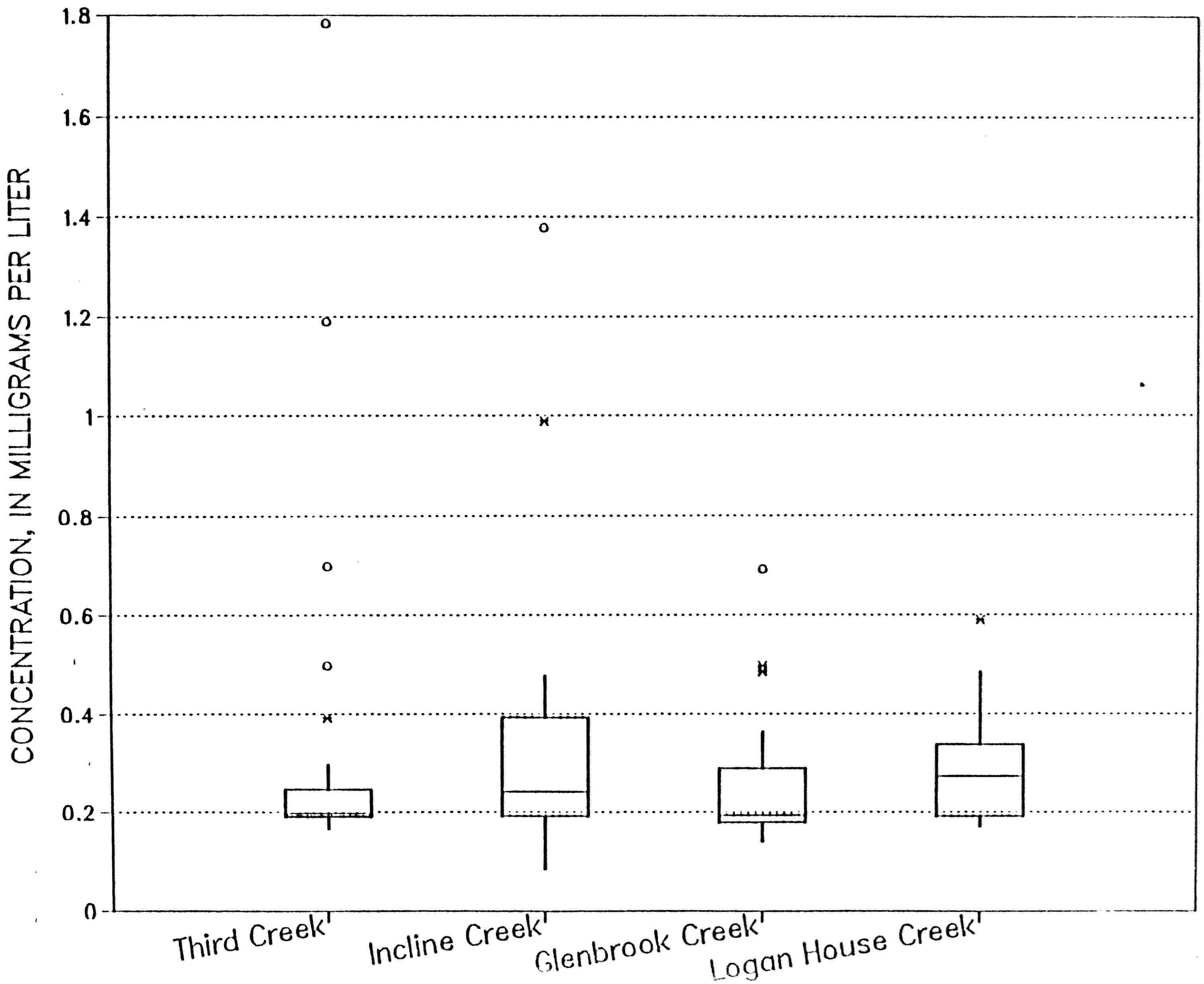
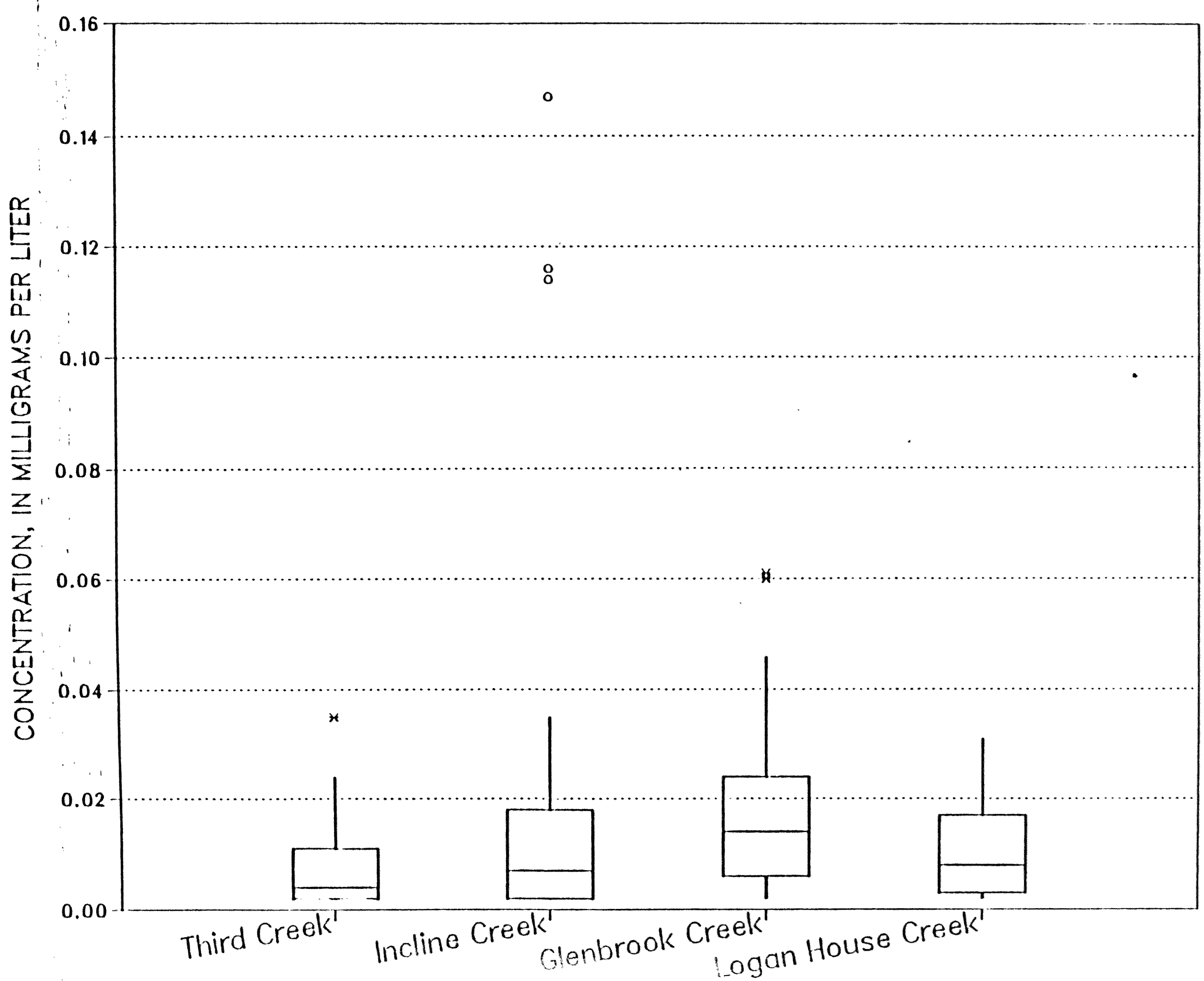
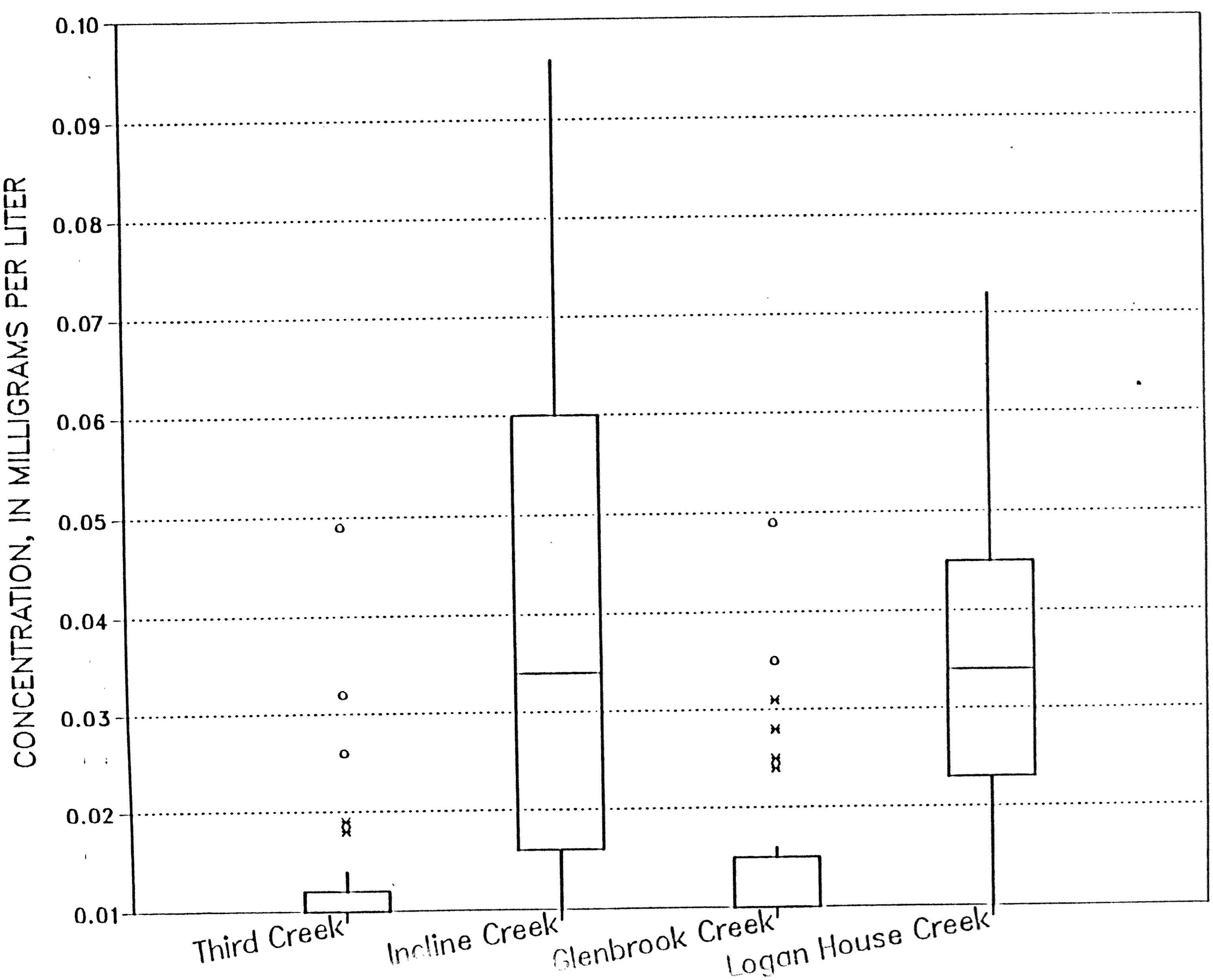


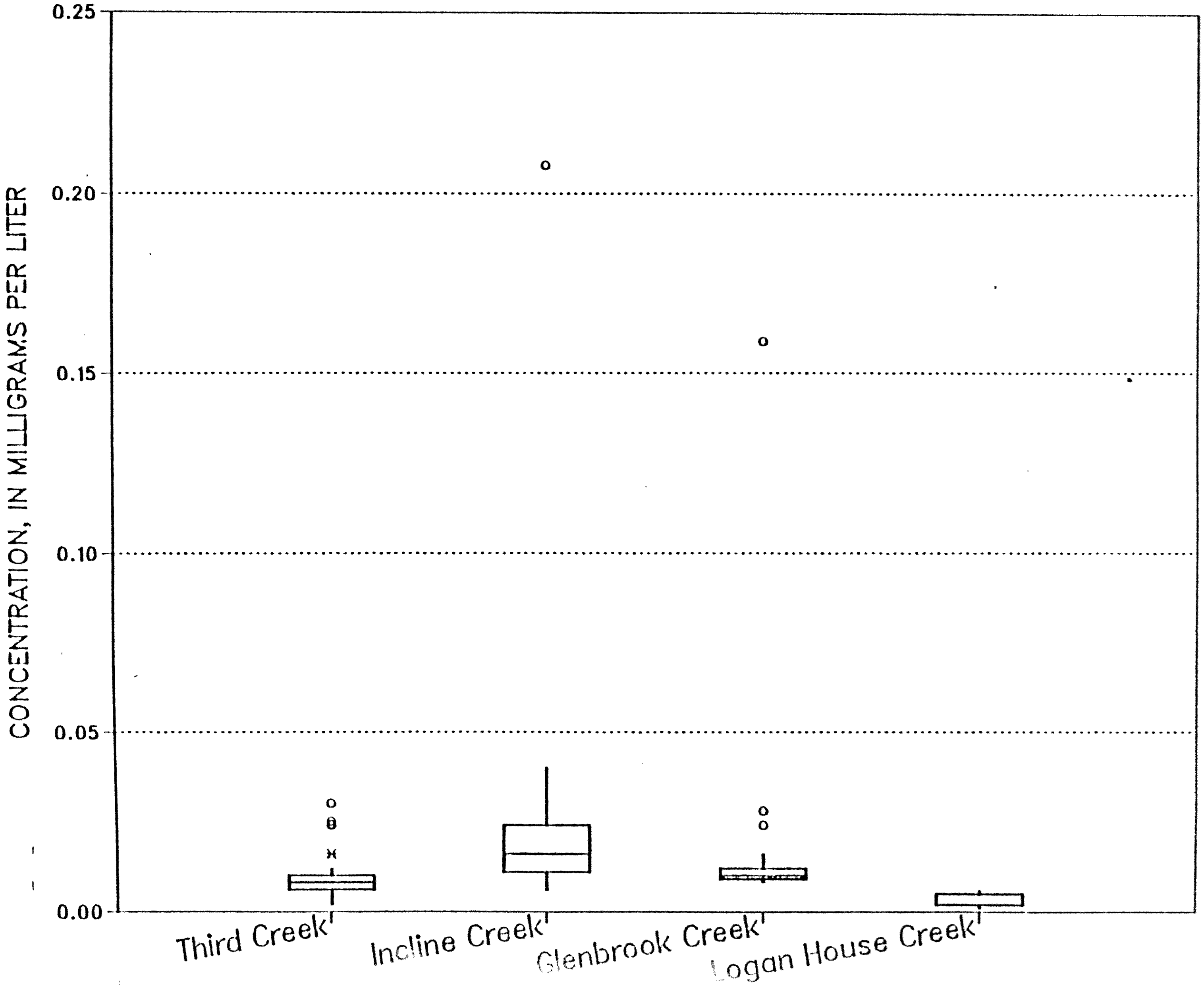
Dissolved Ammonia Nitrogen as N



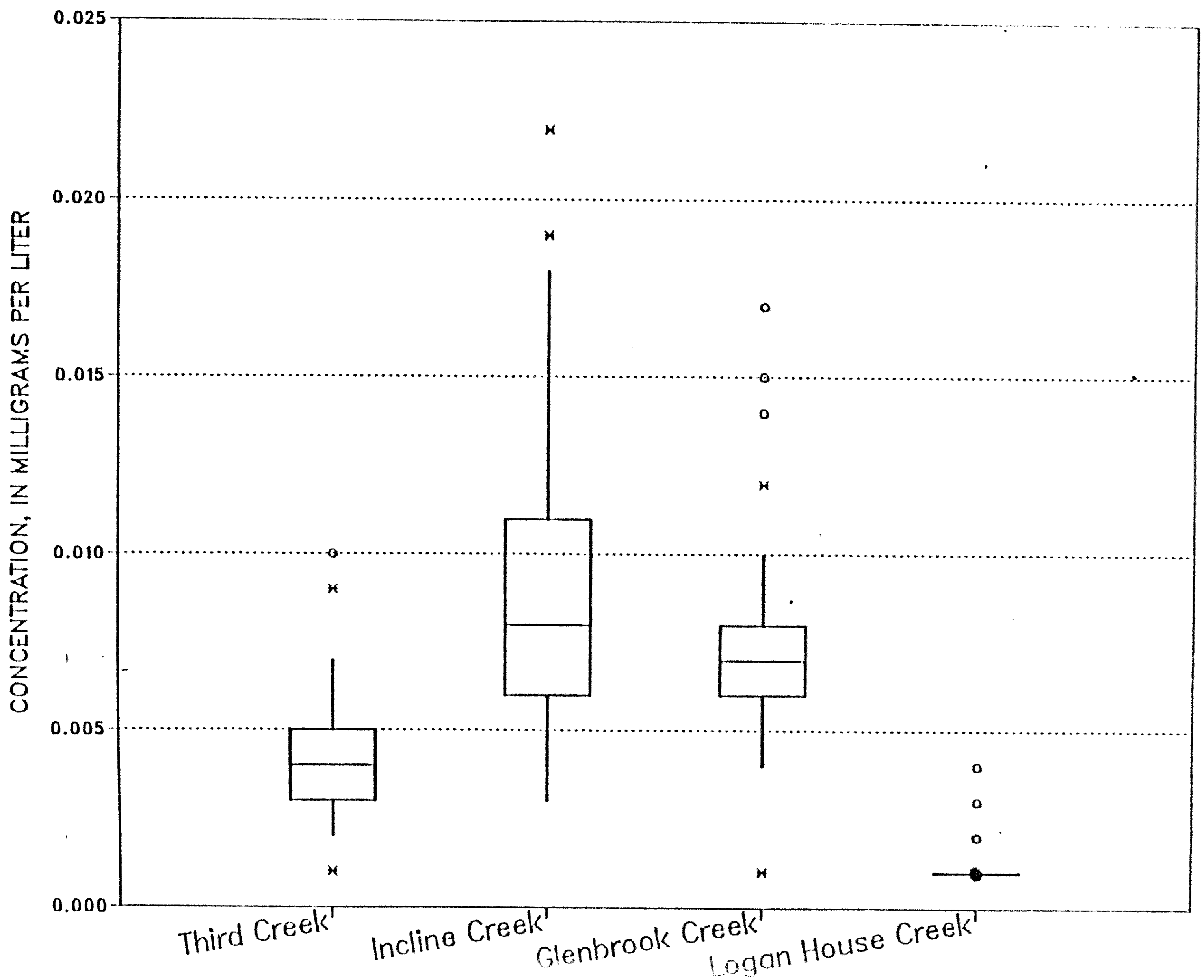
Dissolved Nitrite plus Nitrate as N



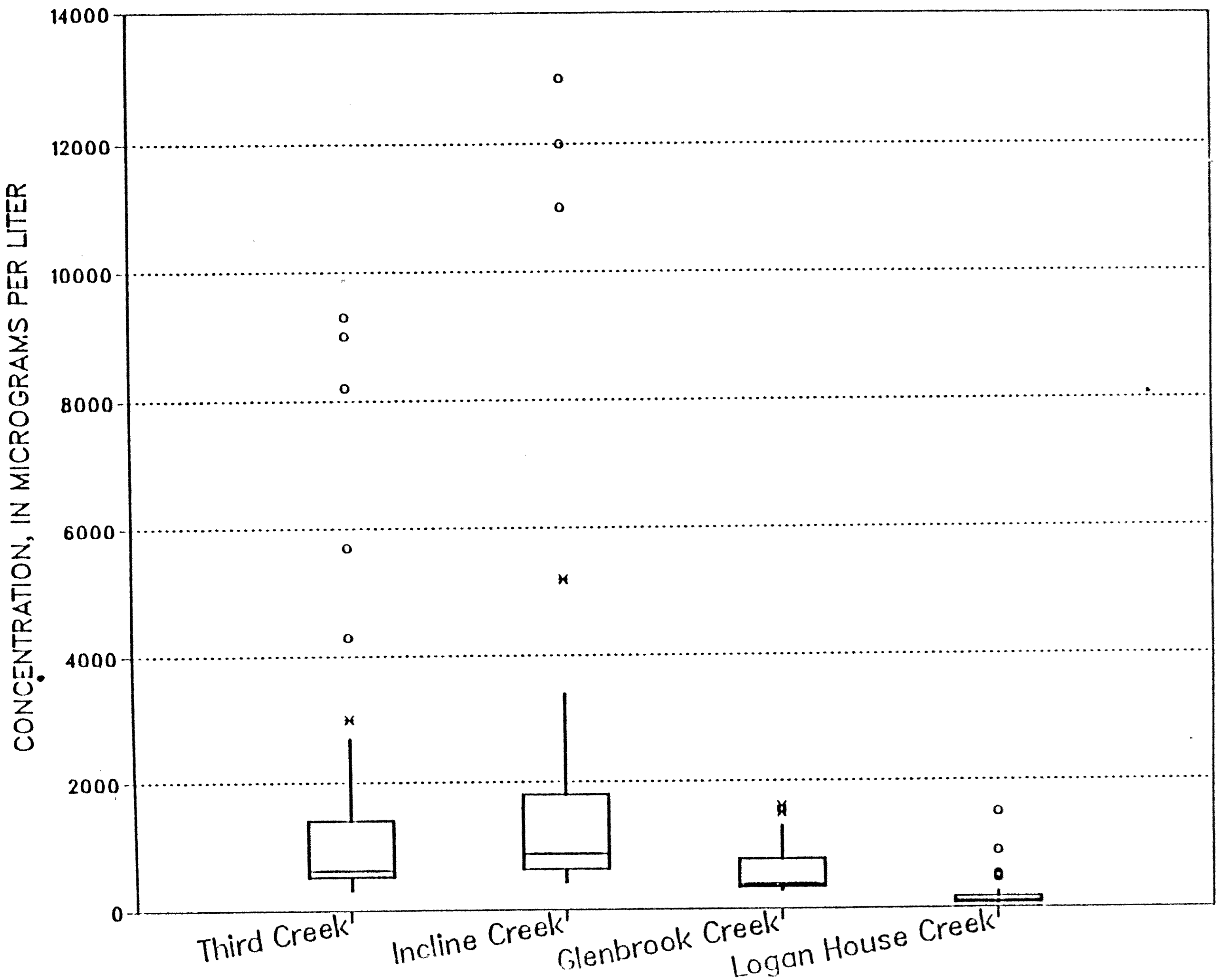
Total Phosphorus as P



Dissolved Orthophosphorus as P



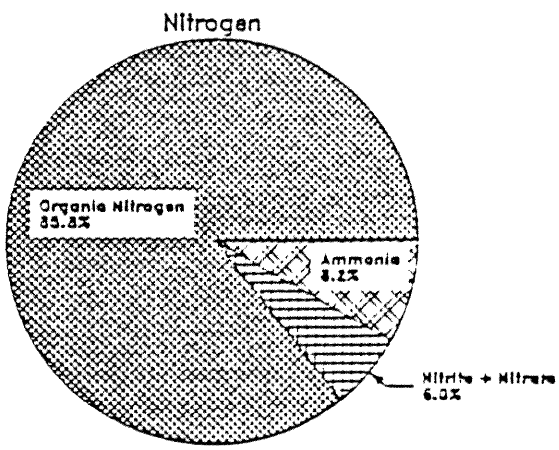
Total Iron

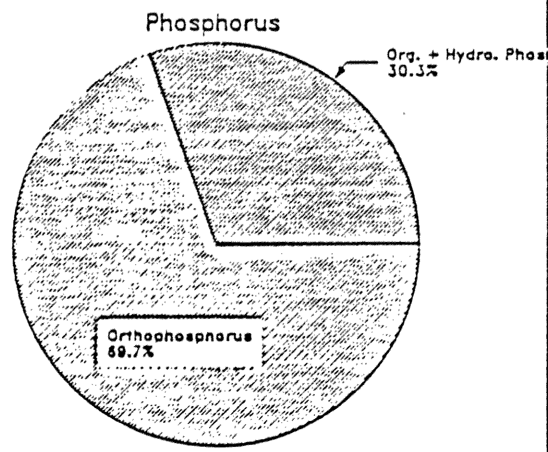


14000
12000
10000
8000
6000
4000
2000
0
CONCENTRATION, IN MICROGRAMS PER LITER
Third Creek
Incline Creek
Glenbrook Creek
Logan House Creek

GLENBROOK CREEK AT GLENBROOK, NEVADA

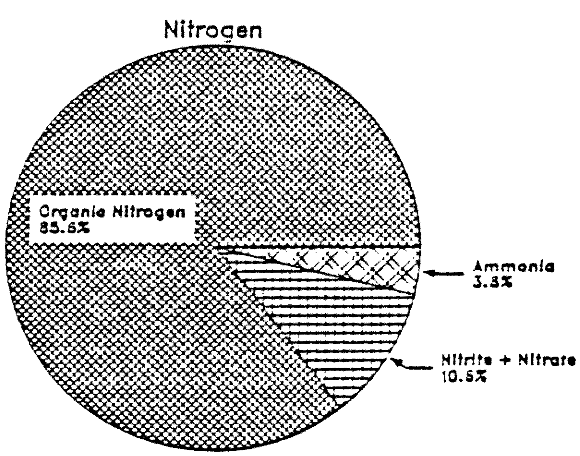
Percentages of Nitrogen and Phosphorus

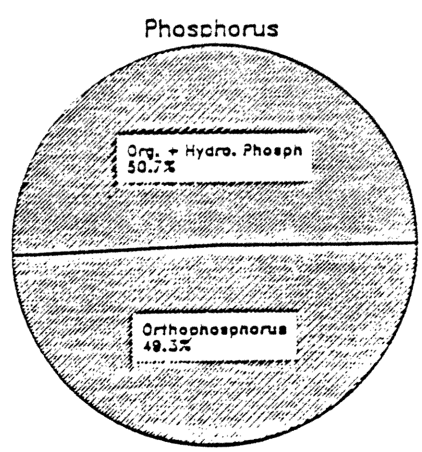




LOGAN HOUSE CREEK NR GLENBROOK NEVADA

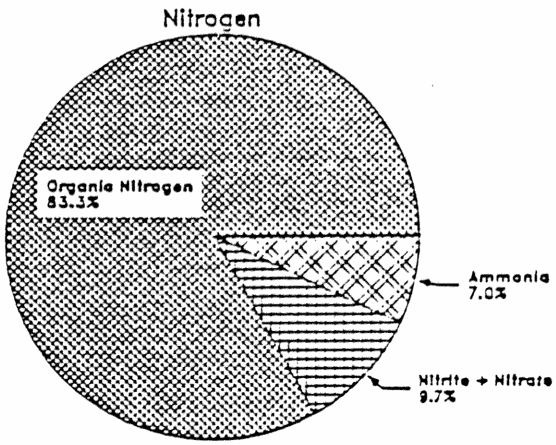
Percentages of Nitrogen and Phosphorus

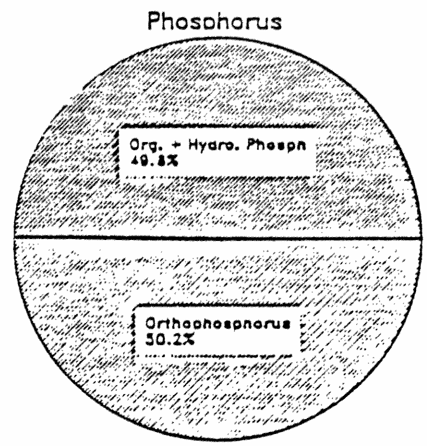




INCLINE CREEK NEAR CRYSTAL BAY, NEVADA

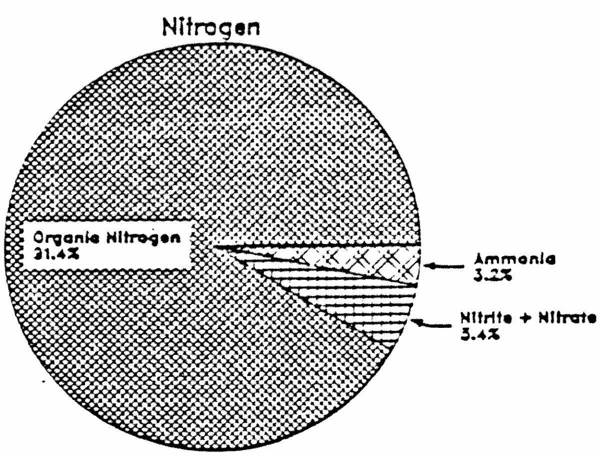
Percentages of Nitrogen and Phosphorus

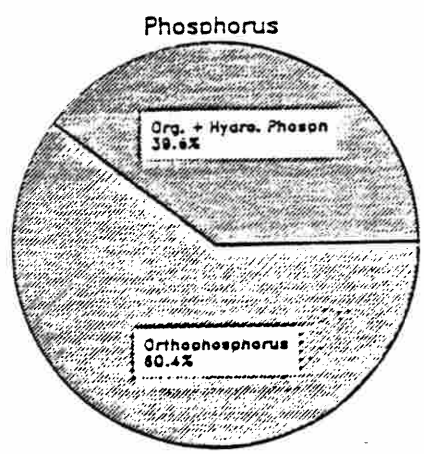


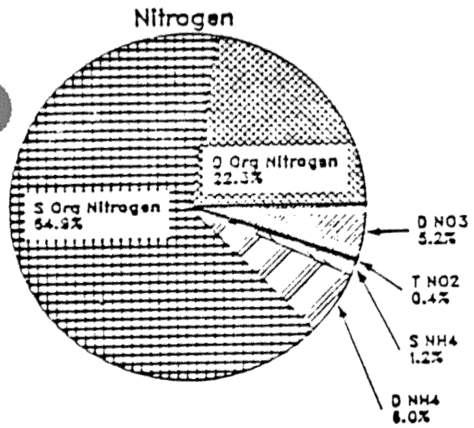


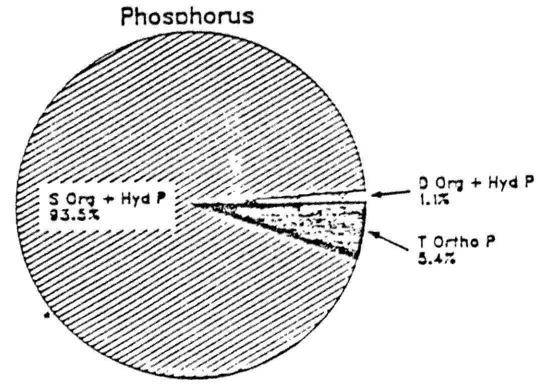
THIRD CREEK NEAR CRYSTAL BAY, NEVADA

Percentages of Nitrogen and Phosphorus

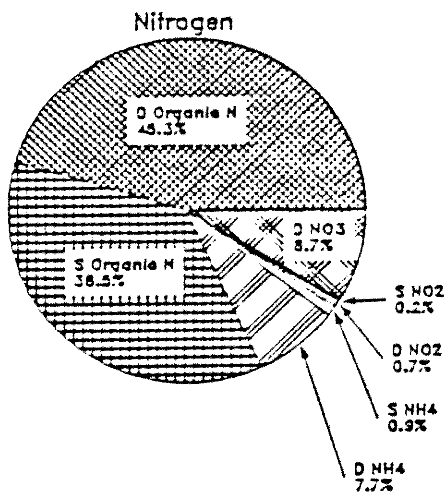


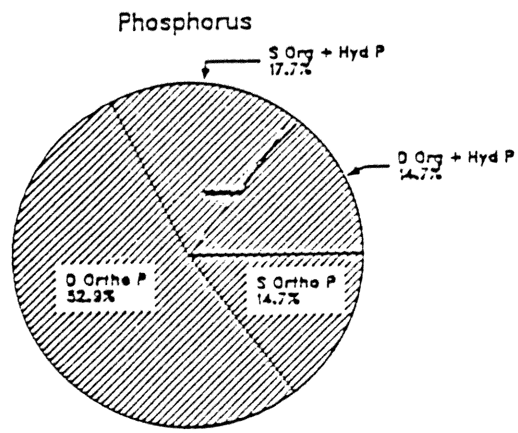






Percentages of Nitrogen and Phosphorus





PRELIMINARY DATA FROM LAKE TAHOE TRIBUTARY MONITORING PROGRAM

NEVADA STATIONS

July 1988

EXPLANATION OF TABLE HEADINGS

NUMBER-- Sample number (sequential at a given site).

DATE-- year-month-day.

TIME-- 24-hour clock.

SPEC COND-- Specific Conductance at 25 deg C.

TOTAL KJD N--Kjeldahl N, whole-water sample.

EST ORG N-- Organic N estimated as total Kjeldahl N minus dissolved ammonia N(may overestimate by the magnitude of any unmeasured suspended ammonia N).

DIS NH4 N-- Ammonia N, filtered sample.

DIS NO2NO3 N-- Nitrite N + Nitrate N, direct determination, filtered sample.

EST TOT N-- Total N estimated by total Kjeldahl N plus dissolved Nitrite + nitrate N.

TOT P-- Total (organic + hydrolyzable) P, whole-water sample.

DIS O-P-- Ortho phosphorus, filtered sample.

"CALC" columns-- percent of total N or P for indicated species.

"ESTIMATED" columns-- Computed loads for indicated species, in pounds per day.

TOTAL IRON-- Recoverable ("biologically available") iron, whole-water sample.

NUMBER	DATE	TIME	FLOW (CFS)	COND (us/CM)	KJD N (MG/L)	ORG N (MG/L)	NH4 N (MG/L)	NO2NO3 N (MG/L)	TOT N (MG/L)	P (MG/L)	O-P (MG/L)
1	19871117	1500	6.3	99	0.4	0.386	0.014	<0.010	<0.410	0.208	0.018
2	19871202	1250	2.3	84	0.3	<0.298	<0.002	0.016	0.316	0.006	0.004
3	19871206	1615	4.4	84	0.4	0.395	0.005	0.039	0.439	0.023	0.011
4	19871211	1235	3.0	76	<0.2	<0.173	0.027	0.037	<0.237	0.016	0.012
5	19871217	1403	2.5	74	0.5	0.478	0.022	0.050	0.550	0.009	0.011
6	19871224	1459	3.2	73	<0.2	<0.190	0.010	0.037	<0.237	0.011	0.003
7	19871230	1513	2.9	80	<0.2	<0.165	0.035	0.060	<0.260	0.011	0.015
8	19880106	1428	3.5	86	0.2	0.084	0.116	0.079	0.279	0.030	0.022
9	19880122	1505	3.5	77	0.4	0.286	0.114	<0.010	<0.410	0.039	0.019
10	19880127	1359	3.0	86	0.3	0.153	0.147	0.079	0.379	0.040	0.016
11	19880210	1442	3.8	89	*	*	0.010	0.060	*	0.022	0.011
12	19880210	1705	4.0	92	*	*	0.011	0.075	*	0.021	0.011
13	19880224	1745	4.2	80	*	*	0.022	0.069	*	0.024	0.012
14	19880311	1325	6.6	73	0.4	0.391	0.009	0.070	0.470	0.008	0.007
15	19880318	1650	5.0	70	<0.2	<0.198	<0.002	0.034	<0.234	0.009	0.004
16	19880325	1235	3.7	69	*	*	<0.002	0.033	*	0.024	0.005
17	19880330	1140	3.3	74	*	*	<0.002	0.036	*	0.016	0.008
18	19880330	1405	4.3	66	*	*	0.018	0.034	*	0.015	0.007
19	19880330	1725	3.3	69	*	*	<0.002	0.030	*	0.016	0.007
20	19880403	930	3.1	72	*	*	0.017	0.021	*	<0.018	0.008
21	19880403	1726	2.6	75	*	*	<0.002	0.026	*	0.017	0.008
22	19880403	1828	3.3	74	*	*	0.003	0.041	*	0.031	0.009
23	19880406	1105	3.1	68	<0.2	<0.198	<0.002	0.013	<0.213	0.011	0.005
24	19880406	1700	3.8	62	0.4	<0.398	<0.002	0.010	0.410	0.036	0.008
25	19880406	1930	4.7	59	0.4	<0.398	<0.002	0.023	0.423	0.030	0.006
26	19880406	2255	4.0	60	0.3	<0.298	<0.002	0.038	0.338	0.015	0.006
27	19880413	1235	3.1	61	<0.2	<0.195	0.005	<0.010	<0.210	0.022	0.009
28	19880413	1850	5.6	80	1.0	0.989	0.011	0.088	1.088	0.029	0.012
29	19880413	1956	6.3	78	1.4	1.378	0.022	0.096	1.496	0.019	0.010
30	19880422	1132	3.1	68	<0.2	<0.194	0.006	0.016	<0.216	0.013	0.006
31	19880429	1210	3.2	66	<0.2	<0.197	0.003	<0.010	<0.210	0.010	0.004
32	19880504	1150	3.5	68	<0.2	<0.198	0.002	<0.010	<0.210	0.010	0.006
33	19880511	1046	3.1	69	0.2	*	*	*	*	*	*
34	19880519	1016	2.4	72	0.3	<0.298	<0.002	0.020	0.320	0.009	0.003
35	19880526	1115	2.4	68	<0.2	<0.185	0.015	0.012	<0.212	0.013	0.007
36	19880610	1045	2.2	69	*	*	*	*	*	*	*
37	19880616	1240	1.7	74	*	*	*	*	*	*	*
38	19880623	735	1.9	78	*	*	*	*	*	*	*
39	19880623	1325	1.9	80	*	*	*	*	*	*	*
40	19880623	1915	1.4	77	*	*	*	*	*	*	*
41	19880630	930	1.7	78	*	*	*	*	*	*	*
42	19880714	1330	1.2	78	*	*	*	*	*	*	*

BER	T KJD PERCENT CALC	EST ORG N PERCENT CALC	D NH4 PERCENT CALC	NO2 NO3 PERCENT CALC	O P PERCENT CALC	TOTAL KJD LOAD lb/DAY	TOTAL ORG N LOAD lb/DAY	DIS NH4 LOAD lb/DAY	DIS NO2 NO3 LOAD lb/DAY	TOTAL N LOAD lb/DAY	TOTAL P LOAD lb/DAY	DIS O P LOAD lb/DAY
1	98	94	3	2	9	13.608	13.132	0.476	0.340	13.948	7.076	0.4[illegible]
2	95	94	1	5	67	3.726	3.701	0.025	0.199	3.925	0.075	0.03[illegible]
3	91	90	1	9	48	9.504	9.385	0.119	0.927	10.431	0.546	0.2[illegible]
4	84	73	11	16	75	3.240	2.803	0.437	0.599	3.839	0.259	0.194
5	91	87	4	9	122	6.750	6.453	0.297	0.675	7.425	0.121	0.148
6	84	80	4	16	27	3.456	3.283	0.173	0.639	4.095	0.190	0.052
7	77	63	13	23	136	3.132	2.584	0.548	0.940	4.072	0.172	0.235
8	72	30	42	28	73	3.780	1.588	2.192	1.493	5.273	0.567	0.416
9	98	70	28	2	49	7.560	5.405	2.155	0.189	7.749	0.737	0.359
0	79	40	39	21	40	4.860	2.479	2.381	1.280	6.140	0.648	0.259
1	*	*	*	*	50	*	*	0.205	1.231	*	0.451	0.226
2	*	*	*	*	52	*	*	0.238	1.620	*	0.454	0.238
3	*	*	*	*	50	*	*	0.499	1.565	*	0.544	0.272
4	85	83	2	15	88	14.256	13.935	0.321	2.495	16.751	0.285	0.249
5	85	85	1	15	44	5.400	5.346	0.054	0.918	6.318	0.243	0.108
6	*	*	*	*	21	*	*	0.040	0.659	*	0.480	0.100
7	*	*	*	*	50	*	*	0.036	0.642	*	0.285	0.143
8	*	*	*	*	47	*	*	0.418	0.789	*	0.348	0.163
9	*	*	*	*	44	*	*	0.036	0.535	*	0.285	0.125
0	*	*	*	*	44	*	*	0.285	0.352	*	0.301	0.134
1	*	*	*	*	47	*	*	0.028	0.365	*	0.239	0.112
2	*	*	*	*	29	*	*	0.053	0.731	*	0.552	0.160
3	94	93	1	6	45	3.348	3.315	0.033	0.218	3.566	0.184	0.084
4	98	97	0	2	22	8.208	8.167	0.041	0.205	8.413	0.739	0.164
5	95	94	0	5	20	10.152	10.101	0.051	0.584	10.736	0.761	0.152
6	89	88	1	11	40	6.480	6.437	0.043	0.821	7.301	0.324	0.130
7	95	93	2	5	41	3.348	3.264	0.084	0.167	3.515	0.368	0.151
8	92	91	1	8	41	30.240	29.907	0.333	2.661	32.901	0.877	0.363
9	94	92	1	6	53	47.628	46.880	0.748	3.266	50.894	0.646	0.340
0	93	90	3	7	46	3.348	3.248	0.100	0.268	3.616	0.218	0.100
1	95	94	1	5	40	3.456	3.404	0.052	0.173	3.629	0.173	0.069
2	95	94	1	5	60	3.780	3.742	0.038	0.189	3.969	0.189	0.113
3	*	*	*	*	*	3.348	*	*	*	*	*	*
4	94	93	1	6	33	3.888	3.862	0.026	0.259	4.147	0.117	0.039
5	94	87	7	6	54	2.592	2.398	0.194	0.156	2.748	0.168	0.091
6	*	*	*	*	*	*	*	*	*	*	*	*
7	*	*	*	*	*	*	*	*	*	*	*	*
8	*	*	*	*	*	*	*	*	*	*	*	*
9	*	*	*	*	*	*	*	*	*	*	*	*
0	*	*	*	*	*	*	*	*	*	*	*	*
1	*	*	*	*	*	*	*	*	*	*	*	*
2	*	*	*	*	*	*	*	*	*	*	*	*

NUMBER	IRON (UG/L)	LOAD lb/DAY
1	1700	57.834
2	420	5.216
3	3000	71.280
4	480	7.776
5	530	7.155
6	550	9.504
7	480	7.517
8	480	9.072
9	530	10.017
10	520	8.424
11	640	13.133
12	1000	21.600
13	1100	24.948
14	3400	121.176
15	1800	48.600
16	900	17.982
17	700	12.474
18	1200	27.864
19	770	13.721
20	830	13.894
21	910	12.776
22	1100	19.602
23	750	12.555
24	5200	106.704
25	5200	131.976
26	2600	56.160
27	13000	217.620
28	11000	332.640
29	12000	408.240
30	790	13.225
31	750	12.960
32	630	11.907
33	640	10.714
34	*	*
35	920	11.923
36	*	*
37	*	*
38	*	*
39	*	*
40	*	*
41	*	*
42	*	*

NUMBER	DATE	TIME	FLOW (CFS)	COND (us/CM)	KJD N (MG/L)	ORG N (MG/L)	NH4 N (MG/L)	NO2NO3 N (MG/L)	TOT N (MG/L)	P (MG/L)	O-P (MG/L)
1	19871117	1635	5.5	84	1.2	1.190	0.010	<0.010	<1.210	0.030	0.004
2	19871202	1430	3.4	75	<0.2	<0.198	<0.002	<0.010	<0.210	0.005	0.004
3	19871206	1835	4.4	81	0.3	<0.298	<0.002	<0.010	<0.310	0.010	0.006
4	19871211	1512	4.3	66	<0.2	<0.186	0.014	<0.010	<0.210	0.010	0.009
5	19871217	1541	3.6	67	<0.2	<0.176	0.024	<0.010	<0.210	0.006	0.010
6	19871224	1732	*	73	<0.2	<0.198	<0.002	0.011	<0.211	0.006	0.002
7	19871230	1248	3.3	70	<0.2	<0.165	0.035	0.019	<0.219	0.005	0.005
8	19880122	1327	3.4	86	<0.2	<0.192	0.008	0.049	<0.249	0.009	0.005
9	19880128	1345	3.0	77	0.2	0.183	0.017	0.010	0.210	0.007	0.003
10	19880210	1250	4.1	79	*	*	0.019	0.010	*	0.008	0.005
11	19880224	1520	3.5	73	*	*	0.018	0.026	*	0.012	0.006
12	19880311	1141	9.2	75	0.4	0.392	0.008	0.018	0.418	0.006	0.004
13	19880318	1520	3.6	68	<0.2	<0.198	<0.002	<0.010	<0.210	0.008	0.004
14	19880325	950	4.2	66	*	*	<0.002	<0.010	*	0.016	0.002
15	19880330	1250	4.8	63	*	*	<0.002	<0.010	*	0.009	0.006
16	19880330	1605	4.3	63	*	*	0.004	<0.010	*	0.008	0.004
17	19880403	1040	4.6	60	*	*	0.008	<0.010	*	0.008	0.004
18	19880403	1615	4.6	62	*	*	<0.002	<0.010	*	0.009	0.005
19	19880406	1000	5.0	58	<0.2	<0.198	<0.002	<0.010	<0.210	0.005	0.002
20	19880406	1225	4.8	58	<0.2	<0.198	<0.002	<0.010	<0.210	0.006	0.002
21	19880406	1425	4.6	59	<0.2	<0.198	<0.002	<0.010	<0.210	0.007	0.006
22	19880406	1815	8.3	56	0.7	<0.698	<0.002	<0.010	<0.710	0.011	0.004
23	19880406	2045	9.2	62	0.5	<0.498	<0.002	<0.010	<0.510	0.012	0.004
24	19880407	50	9.8	59	0.3	0.296	0.004	<0.010	<0.310	0.010	0.003
25	19880413	1320	8.3	46	<0.2	<0.190	0.010	<0.010	<0.210	0.005	0.003
26	19880413	1520	5.7	56	0.2	0.193	0.007	0.019	0.219	0.025	0.004
27	19880413	1607	5.7	60	<0.2	<0.188	0.012	0.014	<0.214	0.024	0.006
28	19880413	2005	7.1	66	1.8	1.784	0.016	0.032	1.832	<0.002	0.005
29	19880413	2255	6.6	52	0.2	0.194	0.006	0.014	0.214	0.008	0.007
30	19880422	1029	3.3	65	<0.2	<0.198	0.002	<0.010	<0.210	0.007	0.003
31	19880429	1000	4.1	58	<0.2	<0.198	<0.002	<0.010	<0.210	0.006	0.005
32	19880504	1039	3.8	58	0.2	0.194	0.006	<0.010	<0.210	0.009	0.005
33	19880511	944	4.0	57	0.2	0.198	0.002	0.019	0.219	0.007	<0.001
34	19880519	912	3.5	64	*	*	<0.002	<0.010	*	0.007	0.004
35	19880526	930	2.9	64	<0.2	<0.185	0.015	<0.010	<0.210	0.009	0.005
36	19880610	1200	2.5	66	*	*	*	*	*	*	*
37	19880616	1400	2.1	70	*	*	*	*	*	*	*
38	19880623	950	2.5	73	*	*	*	*	*	*	*
39	19880623	1530	2.2	72	*	*	*	*	*	*	*
40	19880623	2135	2.2	74	*	*	*	*	*	*	*
41	19880630	1055	2.1	75	*	*	*	*	*	*	*
42	19880714	1525	1.7	78	*	*	*	*	*	*	*

MBER	T KJD PERCENT CALC	EST ORG N PERCENT CALC	D NH4 PERCENT CALC	NO2 NO3 PERCENT CALC	O P PERCENT CALC	TOTAL KJD LOAD lb/DAY	TOTAL ORG N LOAD lb/DAY	DIS NH4 LOAD lb/DAY	DIS NO2 NO3 LOAD lb/DAY	TOTAL N LOAD lb/DAY	TOTAL P LOAD lb/DAY	DIS O P LOAD lb/DAY
1	99	98	1	1	13	35.640	35.343	0.297	0.297	35.937	0.391	[illegible]
2	95	94	1	5	80	3.672	3.635	0.037	0.184	3.856	0.092	[illegible]
3	97	96	1	3	60	7.128	7.080	0.048	0.238	7.366	0.238	0.143
4	95	89	7	5	90	4.644	4.319	0.325	0.232	4.876	0.232	0.209
5	95	84	11	5	167	3.888	3.421	0.467	0.194	4.082	0.117	0.194
6	95	94	1	5	33	*	*	*	*	*	*	*
7	91	75	16	9	100	3.564	2.940	0.624	0.339	3.903	0.089	0.089
8	80	77	3	20	56	3.672	3.525	0.147	0.900	4.572	0.165	0.092
9	95	87	8	5	43	3.240	2.965	0.275	0.162	3.402	0.113	0.049
10	*	*	*	*	63	*	*	0.421	0.221	*	0.177	0.111
11	*	*	*	*	50	*	*	0.340	0.491	*	0.227	0.113
12	96	94	2	4	67	19.872	19.475	0.397	0.894	20.766	0.298	0.199
13	95	94	1	5	50	3.888	3.849	0.039	0.194	4.082	0.156	0.078
14	*	*	*	*	13	*	*	0.045	0.227	*	0.363	0.045
15	*	*	*	*	67	*	*	0.052	0.259	*	0.233	0.156
16	*	*	*	*	50	*	*	0.093	0.232	*	0.186	0.093
17	*	*	*	*	50	*	*	0.199	0.248	*	0.199	0.099
18	*	*	*	*	56	*	*	0.050	0.248	*	0.224	0.124
19	95	94	1	5	40	5.400	5.346	0.054	0.270	5.670	0.135	0.054
20	95	94	1	5	33	5.184	5.132	0.052	0.259	5.443	0.156	0.052
21	95	94	1	5	86	4.968	4.918	0.050	0.248	5.216	0.174	0.149
22	99	98	0	1	36	31.374	31.284	0.090	0.448	31.822	0.493	0.179
23	98	98	0	2	33	24.840	24.741	0.099	0.497	25.337	0.596	0.199
24	97	95	1	3	30	15.876	15.664	0.212	0.529	16.405	0.529	0.159
25	95	90	5	5	60	8.964	8.516	0.448	0.448	9.412	0.224	0.134
26	91	88	3	9	16	6.156	5.941	0.215	0.585	6.741	0.769	0.123
27	93	88	6	7	25	6.156	5.787	0.369	0.431	6.587	0.739	0.185
28	98	97	1	2	250	69.012	68.399	0.613	1.227	70.239	0.077	0.192
29	93	91	3	7	88	7.128	6.914	0.214	0.499	7.627	0.285	0.249
30	95	94	1	5	43	3.564	3.528	0.036	0.178	3.742	0.125	0.053
31	95	94	1	5	83	4.428	4.384	0.044	0.221	4.649	0.133	0.11[illegible]
32	95	92	3	5	56	4.104	3.981	0.123	0.205	4.309	0.185	0.103
33	91	90	1	9	14	4.320	4.277	0.043	0.410	4.730	0.151	0.022
34	*	*	*	*	57	*	*	0.038	0.189	*	0.132	0.076
35	95	88	7	5	56	3.132	2.897	0.235	0.157	3.289	0.141	0.07[illegible]
36	*	*	*	*	*	*	*	*	*	*	*	*
37	*	*	*	*	*	*	*	*	*	*	*	*
38	*	*	*	*	*	*	*	*	*	*	*	*
39	*	*	*	*	*	*	*	*	*	*	*	*
40	*	*	*	*	*	*	*	*	*	*	*	*
41	*	*	*	*	*	*	*	*	*	*	*	*
42	*	*	*	*	*	*	*	*	*	*	*	*

NUMBER	TOTAL IRON (UG/L)	IRON LOAD lb/DAY
1	1200	35.640
2	410	7.528
3	1500	35.640
4	560	13.003
5	390	7.582
6	320	*
7	310	5.524
8	850	15.606
9	480	7.776
10	640	14.170
11	640	12.096
12	2700	134.136
13	600	11.664
14	1200	27.216
15	780	20.218
16	650	15.093
17	510	12.668
18	590	14.656
19	600	16.200
20	580	15.034
21	600	14.904
22	9300	416.826
23	9000	447.120
24	4300	227.556
25	1400	62.748
26	5700	175.446
27	3000	92.340
28	8200	314.388
29	1400	49.896
30	380	6.772
31	520	11.513
32	520	10.670
33	520	11.232
34	*	*
35	500	7.830
36	*	*
37	*	*
38	*	*
39	*	*
40	*	*
41	*	*
42	*	*

NUMBER	DATE	TIME	FLOW (CFS)	COND (us/CM)	KJD N (MG/L)	ORG N (MG/L)	NH4 N (MG/L)	NO2NO3 N (MG/L)	TOT N (MG/L)	P (MG/L)	O-P (MG/L)
1	19871117	1115	1.50	444	0.3	0.275	0.025	<0.010	<0.310	0.028	0.017
2	19871202	1036	0.40	443	0.2	0.184	0.016	0.011	0.211	0.010	0.007
3	19871206	1510	1.10	452	0.2	0.177	0.023	<0.010	<0.210	0.009	0.007
4	19871217	1219	0.60	446	0.2	0.155	0.045	0.028	0.228	0.010	0.008
5	19871224	1235	0.80	474	0.4	0.365	0.035	0.028	0.428	0.012	0.005
6	19871231	1301	0.75	441	<0.2	<0.139	0.061	0.035	<0.235	0.008	0.007
7	19880106	935	1.10	472	<0.2	<0.140	0.060	0.049	<0.249	0.014	0.009
8	19880122	917	1.10	494	*	*	0.033	0.015	*	0.009	0.007
9	19880129	1615	0.80	479	0.3	0.273	0.027	0.025	0.325	0.009	0.005
10	19880210	937	0.83	493	*	*	0.010	0.031	*	0.009	0.008
11	19880224	950	0.76	468	*	*	0.021	0.024	*	0.011	0.007
12	19880311	831	0.57	484	<0.2	<0.186	0.014	0.016	<0.216	0.008	0.008
13	19880318	1227	0.80	442	0.5	0.498	0.002	0.011	0.511	0.009	0.006
14	19880325	1515	1.00	421	*	*	<0.002	<0.010	*	0.016	0.004
15	19880330	1126	0.82	420	*	*	0.004	0.013	*	0.011	0.008
16	19880330	1438	1.00	420	*	*	0.003	<0.010	*	0.013	0.008
17	19880330	1830	1.00	406	*	*	<0.002	<0.010	*	0.008	0.014
18	19880406	954	1.10	390	0.7	0.692	0.008	<0.010	0.710	0.008	0.006
19	19880406	1454	1.10	388	0.3	0.292	0.008	<0.010	<0.310	0.008	0.007
20	19880406	1739	1.20	394	0.2	0.194	0.006	<0.010	<0.210	0.009	0.007
21	19880406	1847	1.20	398	<0.2	<0.194	0.006	<0.010	<0.210	0.009	0.006
22	19880406	2015	1.20	378	*	*	0.004	<0.010	*	0.012	0.007
23	19880406	2252	1.20	380	0.2	0.194	0.006	<0.010	<0.210	0.159	0.007
24	19880413	1053	1.40	346	<0.2	<0.194	0.006	<0.010	<0.210	0.012	0.006
25	19880414	1800	2.30	444	0.3	0.288	0.012	0.015	0.315	0.024	0.015
26	19880422	1505	1.20	417	<0.2	<0.196	0.004	<0.010	<0.210	0.010	0.006
27	19880429	1620	0.92	396	<0.2	<0.179	0.021	<0.010	<0.210	0.010	0.010
28	19880504	1310	0.74	406	<0.2	<0.179	0.021	<0.010	<0.210	0.010	0.008
29	19880511	1217	0.82	418	0.5	0.485	0.015	0.014	0.514	0.010	0.001
30	19880519	1134	0.74	426	0.5	0.486	0.014	0.015	0.515	0.013	0.010
31	19880526	1355	0.55	440	0.2	0.154	0.046	<0.010	<0.210	0.015	0.012
32	19880603	1255	0.57	426	*	*	*	*	*	*	*
33	19880609	1100	0.60	432	*	*	*	*	*	*	*
34	19880615	1225	0.51	455	*	*	*	*	*	*	*
35	19880623	805	0.45	478	*	*	*	*	*	*	*
36	19880623	1335	0.42	474	*	*	*	*	*	*	*
37	19880623	1923	0.37	475	*	*	*	*	*	*	*
38	19880630	1505	0.40	484	*	*	*	*	*	*	*

BER	T KJD PERCENT CALC	EST ORG N PERCENT CALC	D NH4 PERCENT CALC	NO2 NO3 PERCENT CALC	O P PERCENT CALC	ESTIMATED TOTAL KJD LOAD lb/DAY	TOTAL ORG N LOAD lb/DAY	DIS NH4 LOAD lb/DAY	DIS NO2 NO3 LOAD lb/DAY	TOTAL N LOAD lb/DAY	TOTAL P LOAD lb/DAY	DIS O P LOAD lb/DAY
	97	89	8	3	61	2.430	2.227	0.202	0.081	2.511	0.227	0.1[illegible]
	95	87	8	5	70	0.432	0.397	0.035	0.024	0.456	0.022	0.0[illegible]
	95	84	11	5	78	1.188	1.051	0.137	0.059	1.247	0.053	0.042
	88	68	20	12	80	0.648	0.502	0.146	0.091	0.739	0.032	0.026
	93	85	8	7	42	1.728	1.577	0.151	0.121	1.849	0.052	0.022
	85	59	26	15	88	0.810	0.563	0.247	0.142	0.952	0.032	0.028
	80	56	24	20	64	1.188	0.832	0.356	0.291	1.479	0.083	0.053
3	*	*	*	*	78	*	*	0.196	0.089	*	0.053	0.042
	92	84	8	8	56	1.296	1.179	0.117	0.108	1.404	0.039	0.022
	*	*	*	*	89	*	*	0.045	0.139	*	0.040	0.036
1	*	*	*	*	64	*	*	0.086	0.098	*	0.045	0.029
2	93	86	6	7	100	0.616	0.573	0.043	0.049	0.665	0.025	0.025
3	98	97	0	2	67	2.160	2.151	0.009	0.048	2.208	0.039	0.026
4	*	*	*	*	25	*	*	0.011	0.054	*	0.086	0.022
5	*	*	*	*	73	*	*	0.018	0.058	*	0.049	0.035
6	*	*	*	*	62	*	*	0.016	0.054	*	0.070	0.045
7	*	*	*	*	175	*	*	0.011	0.054	*	0.043	0.076
3	99	97	1	1	75	4.158	4.110	0.048	0.059	4.217	0.048	0.036
9	97	94	3	3	88	1.782	1.734	0.048	0.059	1.841	0.048	0.042
0	95	92	3	5	78	1.296	1.257	0.039	0.065	1.361	0.058	0.045
1	95	92	3	5	67	1.296	1.257	0.039	0.065	1.361	0.058	0.039
2	*	*	*	*	58	*	*	0.026	0.065	*	0.078	0.045
3	95	92	3	5	4	1.296	1.257	0.039	0.065	1.361	1.030	0.045
4	95	92	3	5	50	1.512	1.467	0.045	0.076	1.588	0.091	0.045
5	95	91	4	5	63	3.726	3.577	0.149	0.186	3.912	0.298	0.186
6	95	93	2	5	60	1.296	1.270	0.026	0.065	1.361	0.065	0.039
7	95	85	10	5	100	0.994	0.889	0.104	0.050	1.043	0.050	0.030
3	95	85	10	5	80	0.799	0.715	0.084	0.040	0.839	0.040	0.032
9	97	94	3	3	10	2.214	2.148	0.066	0.062	2.276	0.044	0.004
0	97	94	3	3	77	1.998	1.942	0.056	0.060	2.058	0.052	0.040
1	95	73	22	5	80	0.594	0.457	0.137	0.030	0.624	0.045	0.036
2	*	*	*	*	*	*	*	*	*	*	*	*
3	*	*	*	*	*	*	*	*	*	*	*	*
4	*	*	*	*	*	*	*	*	*	*	*	*
5	*	*	*	*	*	*	*	*	*	*	*	*
6	*	*	*	*	*	*	*	*	*	*	*	*
7	*	*	*	*	*	*	*	*	*	*	*	*
8	*	*	*	*	*	*	*	*	*	*	*	*

NUMBER	TOTAL IRON (UG/L)	IRON LOAD lb/DAY
1	650	5.265
2	400	0.864
3	1600	9.504
4	390	1.264
5	830	3.586
6	350	1.417
7	370	2.198
8	390	2.317
9	330	1.426
10	360	1.614
11	310	1.272
12	450	1.385
13	330	1.426
14	350	1.890
15	340	1.506
16	340	1.836
17	330	1.782
18	740	4.396
19	720	4.277
20	1300	8.424
21	1100	7.128
22	1300	8.424
23	770	4.990
24	340	2.570
25	1500	18.630
26	320	2.074
27	600	2.981
28	1000	3.996
29	420	1.860
30	*	*
31	280	0.832
32	*	*
33	*	*
34	*	*
35	*	*
36	*	*
37	*	*
38	*	*

NUMBER	DATE	TIME	FLOW (CFS)	COND (us/CM)	KJD N (MG/L)	ORG N (MG/L)	NH4 N (MG/L)	NO2NO3 N (MG/L)	TOT N (MG/L)	P (MG/L)	O-P (MG/L)
1	19871117	925	0.50	128	0.6	0.590	0.010	<0.010	<0.610	<0.005	<0.001
2	19871202	850	0.30	130	0.4	<0.398	<0.002	0.018	0.418	<0.005	<0.001
3	19871206	1610	0.40	124	0.3	0.298	0.002	0.025	0.325	0.005	<0.001
4	19871217	1049	0.20	130	0.3	0.269	0.031	0.035	0.335	<0.005	0.003
5	19871224	1015	0.20	133	0.2	0.192	0.008	0.023	0.223	<0.005	<0.001
6	19880104	1033	0.30	135	<0.2	<0.170	0.030	0.038	<0.238	0.004	0.001
7	19880122	1115	0.21	136	*	*	<0.002	0.021	*	<0.005	<0.001
8	19880129	1235	0.30	128	0.3	0.294	0.006	0.028	0.328	0.001	<0.002
9	19880210	1058	0.25	134	*	*	0.007	0.036	*	0.003	<0.002
10	19880224	1225	0.30	136	*	*	0.028	0.034	*	0.002	0.002
11	19880311	950	0.57	132	0.2	0.189	0.011	0.033	0.233	<0.002	<0.001
12	19880318	1330	0.40	128	0.3	<0.298	<0.002	0.031	0.331	0.002	<0.001
13	19880325	1800	0.65	128	*	*	<0.002	0.046	*	0.004	<0.001
14	19880330	1316	0.41	128	*	*	0.021	0.044	*	<0.002	<0.001
15	19880330	1652	0.51	124	*	*	0.018	0.047	*	<0.002	<0.001
16	19880330	1957	0.46	124	*	*	0.002	0.049	*	<0.002	0.001
17	19880406	1202	0.51	124	<0.2	<0.184	0.016	0.049	<0.249	<0.002	0.001
18	19880406	1611	0.70	120	0.3	0.279	0.021	0.059	0.359	0.002	<0.001
19	19880406	1639	0.77	121	0.5	0.486	0.014	0.064	0.564	0.004	<0.001
20	19880406	2138	0.63	121	0.3	0.287	0.013	0.072	0.372	0.002	<0.001
21	19880413	1229	0.46	127	0.2	0.184	0.016	0.044	0.244	0.005	0.004
22	19880414	1645	0.70	118	0.4	0.378	0.022	0.038	0.438	<0.002	0.001
23	19880422	1336	0.36	124	<0.2	<0.196	0.004	0.024	<0.224	<0.002	<0.001
24	19880429	1415	0.38	136	<0.2	<0.195	0.005	0.017	<0.217	0.002	<0.001
25	19880504	1444	0.28	129	<0.2	<0.193	0.007	0.015	<0.215	<0.002	<0.001
26	19880511	1332	0.28	132	0.4	0.395	0.005	0.026	0.426	0.003	<0.001
27	19880519	1320	0.21	138	0.6	*	*	*	*	*	*
28	19880526	1615	0.20	140	<0.2	<0.197	0.003	<0.010	<0.210	0.006	0.001
29	19880603	1000	0.21	137	*	*	*	*	*	*	*
30	19880609	855	0.25	137	*	*	*	*	*	*	*
31	19880615	956	0.16	145	*	*	*	*	*	*	*
32	19880623	1045	0.11	148	*	*	*	*	*	*	*
33	19880623	1555	0.11	150	*	*	*	*	*	*	*
34	19880623	2108	0.09	149	*	*	*	*	*	*	*
35	19880630	1315	0.09	146	*	*	*	*	*	*	*

MSE	T KJD PERCENT CALC	EST ORG N PERCENT CALC	D NH4 PERCENT CALC	NO2 NO3 PERCENT CALC	O P PERCENT CALC	ESTIMATED TOTAL KJD LOAD lb/DAY	TOTAL ORG N LOAD lb/DAY	DIS NH4 LOAD lb/DAY	DIS NO2 NO3 LOAD lb/DAY	TOTAL N LOAD lb/DAY	TOTAL P LOAD lb/DAY	DIS O P LOAD lb/DAY
1	98	97	2	2	20	1.620	1.593	0.027	0.027	1.647	0.013	0.003
2	96	95	0	4	20	0.648	0.645	0.003	0.029	0.677	0.008	0.002
3	92	92	1	8	20	0.648	0.644	0.004	0.054	0.702	0.011	0.002
4	90	80	9	10	60	0.324	0.291	0.033	0.038	0.362	0.005	0.003
5	90	86	4	10	20	0.216	0.207	0.009	0.025	0.241	0.005	0.001
6	84	71	13	16	25	0.324	0.275	0.049	0.062	0.386	0.006	0.002
7	*	*	*	*	20	*	*	0.002	0.024	*	0.006	0.001
8	91	90	2	9	200	0.486	0.476	0.010	0.045	0.531	0.002	0.003
9	*	*	*	*	67	*	*	0.009	0.049	*	0.004	0.003
10	*	*	*	*	100	*	*	0.045	0.055	*	0.003	0.003
11	86	81	5	14	50	0.616	0.582	0.034	0.102	0.717	0.006	0.003
12	91	90	1	9	50	0.648	0.644	0.004	0.067	0.715	0.004	0.002
13	*	*	*	*	25	*	*	0.007	0.161	*	0.014	0.004
14	*	*	*	*	50	*	*	0.046	0.097	*	0.004	0.002
15	*	*	*	*	50	*	*	0.050	0.129	*	0.006	0.003
16	*	*	*	*	50	*	*	0.005	0.122	*	0.005	0.002
17	80	74	6	20	50	0.551	0.507	0.044	0.135	0.686	0.006	0.003
18	84	78	6	16	50	1.134	1.055	0.079	0.223	1.357	0.008	0.004
19	89	86	2	11	25	2.079	2.021	0.058	0.266	2.345	0.017	0.004
20	81	77	3	19	50	1.021	0.976	0.044	0.245	1.266	0.007	0.003
21	82	75	7	18	80	0.497	0.457	0.040	0.109	0.606	0.012	0.010
22	91	86	5	9	50	1.512	1.429	0.083	0.144	1.656	0.008	0.004
23	89	83	2	11	50	0.389	0.381	0.008	0.047	0.435	0.004	0.002
24	92	90	2	8	50	0.410	0.400	0.010	0.035	0.445	0.004	0.002
25	93	90	3	7	50	0.302	0.292	0.011	0.023	0.325	0.003	0.002
26	94	93	1	6	33	0.605	0.597	0.008	0.039	0.644	0.005	0.002
27	*	*	*	*	*	0.680	*	*	*	*	*	*
28	95	94	1	5	17	0.216	0.213	0.003	0.011	0.227	0.006	0.00[illegible]
29	*	*	*	*	*	*	*	*	*	*	*	*
30	*	*	*	*	*	*	*	*	*	*	*	*
31	*	*	*	*	*	*	*	*	*	*	*	*
32	*	*	*	*	*	*	*	*	*	*	*	*
33	*	*	*	*	*	*	*	*	*	*	*	*
34	*	*	*	*	*	*	*	*	*	*	*	*
35	*	*	*	*	*	*	*	*	*	*	*	[illegible]

NUMBER	TOTAL IRON (UG/L)	TOTAL IRON LOAD lb/DAY
1	80	0.216
2	80	0.130
3	260	0.562
4	90	0.097
5	90	0.097
6	80	0.130
7	80	0.091
8	80	0.130
9	100	0.135
10	70	0.113
11	130	0.400
12	90	0.194
13	890	3.124
14	100	0.221
15	90	0.248
16	60	0.149
17	140	0.386
18	510	1.928
19	470	1.954
20	210	0.714
21	1500	3.726
22	530	2.003
23	80	0.156
24	100	0.205
25	100	0.151
26	110	0.166
27	*	*
28	140	0.151
29	*	*
30	*	*
31	*	*
32	*	*
33	*	*
34	*	*
35	*	*

APPENDIX O

List of Supplemental Compliance Measures
and Contingency Measures which
TRPA Has Identified as of November, 1988

Tahoe Regional Planning Agency

November 30, 1988

SUPPLEMENTAL COMPLIANCE MEASURES
AND CONTINGENCY MEASURES:

Water Quality and Soil Conservation

A. URBAN RUNOFF AND EROSION

(01) Restrictions on rate and/or amount of additional development: This is a contingency measure, not presently enacted by the TRPA. Such restrictions could include restrictions on additional development in all categories or certain categories, including residential, commercial, recreational, and public service. Restrictions could be applied Region-wide, by jurisdiction, by watershed, or by other appropriate sub-unit. Restrictions could be placed on public service uses not currently covered by allocations by establishing allocation limits, setting priorities, or prohibiting certain uses in the Region.

(02) Improved BMP implementation/enforcement program: This is a contingency measure not presently enacted by the TRPA. An improved program could include subsidized BMP applications from grants, annual budgets, or fees; or mandatory compliance with BMPs upon sale of property.

(03) Additional restrictions on fertilizer use: This is a contingency measure not presently enacted by TRPA. Additional restrictions on fertilizer use could include bans on fertilizer applications in some situations, such as golf courses in SEZs, or requirements to use only certain types of fertilizers, such as slow-release fertilizers in some applications.

(04) More stringent coverage transfer requirements: This is a contingency measure not presently enacted by TRPA. More stringent requirements could include: elimination of transfers of potential coverage; elimination of transfers of soft coverage; increased coverage transfer ratios; or restriction on TRPA's ability to substitute transfers of soft or potential coverage for hard coverage in commercial transfers.

(05) More stringent SEZ encroachment rules: This is a contingency measure not presently enacted by TRPA. More stringent SEZ encroachment rules could include reducing or eliminating the exceptions to the prohibitions on SEZ encroachment.

(06) Controls on outdoor water use: This is a contingency measure not presently enacted by TRPA. In conjunction with more stringent fertilizer controls, this compliance measure would help reduce nutrient loading to ground and surface waters via fertilizer application.

(07) Increased funding for CIP for erosion and runoff control: Increased funding could come from grants, annual budgets, bonding, or fees. This measure is consistent with the CIP, Volume IV of the 208 plan.

(08) Artificial wetlands/runoff treatment program: This compliance measure would include a more active program to identify major points of discharge of surface runoff and provide treatment through the installation and maintenance of artificial wetlands. The program should involve pilot projects prior to full-scale implementation. The program is consistent with the 208 plan.

(09) Transfer of development from SEZs: This is a contingency measure not presently enacted by TRPA. Removal of existing structures from SEZs could be accomplished by establishment of a specific transfer program, with incentives.

(10) Improved excess coverage mitigation program: This is a contingency measure not presently enacted by TRPA. An improved program could include adjustment of fees--up or down--to optimize revenues from excess coverage mitigation.

(11) Modifications to list of exempt activities: This is a contingency measure not presently enacted by TRPA. Activities presently exempt from requirements for TRPA permits but which are found to have adverse impacts may be removed from the list of exempt or qualified exempt activities.

(12) Modifications to IPES: This is a contingency measure not presently enacted by TRPA. The Goals and Policies contemplate adjustments in IPES based on results of a special component of the TRPA monitoring program to evaluate IPES. Modifications to IPES could include further restrictions or safeguards on movement of the IPES line.

B. AIRBORNE NUTRIENTS

(13) Increased idling restrictions: This is a contingency measure not presently enacted by TRPA. Increased restrictions could include restrictions on diesel engines or all engines, in certain locations or in all locations within the Region.

(14) Control of upwind pollutants: Future compliance measures implemented by upwind jurisdictions will have a beneficial effect on transport of nitrogen compounds to the Tahoe Region. The 208 plan contains a strategy for encouraging controls on upwind NOx emissions.

(15) Additional controls on combustion heaters: This is a contingency measure not presently enacted by TRPA. This compliance measure could include requirements to install certified combustion heaters upon sale of a home, or sooner.

C. WASTE MANAGEMENT

(16) Improved exfiltration control program: This is a contingency measure not presently enacted by TRPA. An improved program could include monitoring and reporting requirements and compliance schedules for correction of problems.

(17) Improved infiltration control program: This is a contingency measure not presently enacted by TRPA. An improved program could include monitoring and reporting requirements and compliance schedules for correction of problems.

(18) Water conservation/flow reduction program: This is a contingency measure not presently enacted by TRPA. Such a program could include a problem assessment, strategy development, improvement program, and implementation program.

D. NATURAL AREA MANAGEMENT

(19) Additional land use controls: This is a contingency measure not presently enacted by TRPA. It could include amendments to the Plan Area Statements to restrict areas in which certain uses are allowed or special uses.

(20) Improved BMP implementation/enforcement program: See supplemental compliance measure (02), above.

(21) Restrictions on rate and/or amount of additional development: See supplemental compliance measure (01), above.

E. LAKE TAHOE AND THE SHOREZONE

(22) Improved BMP implementation/enforcement program: See supplemental compliance measure (02), above.