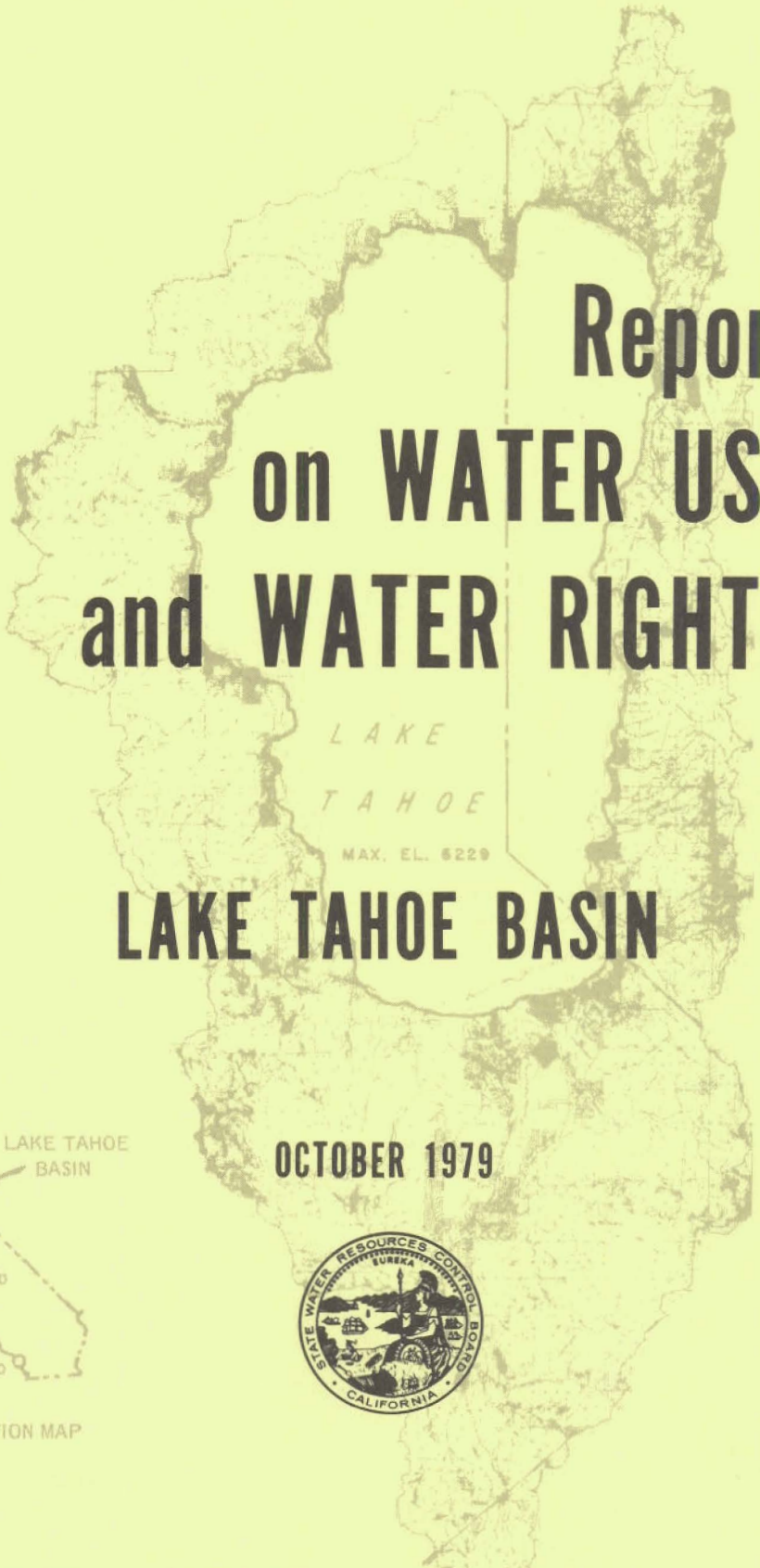
Report on WATER USE and WATER RIGHTS



LAKE TAHOE BASIN

LOCATION MAP

OCTOBER 1979

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

STATE OF CALIFORNIA

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REPORT

ON

WATER USE AND WATER RIGHTS

LAKE TAHOE BASIN

October 1979

California State Water Resources Control Board

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF FIGURES (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

SECTION I

CONCLUSIONS

AND

RECOMMENDATIONS

SECTION I

CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The State Water Resources Control Board (State Board) allocates water and administers water appropriation laws to ensure maximum beneficial use of the State's waters and protection of the public interest in development of water. Appropriative rights, based on the "first-in-time, first-in-right" principle are administered by the Division of Water Rights of the State Board through the water right permit system. In issuing water right permits the State Board considers the relative benefits to be obtained from all beneficial uses of the water. Appropriations of water are subject to such terms and conditions as the State Board in its judgment believes will best develop, conserve, and utilize in the public interest, the water sought to be appropriated. The California State Water Code authorizes the State Board to make such investigations of the water resources of the State as may be necessary for the purpose of securing information needed in connection with applications for appropriation of water. The investigation described in this Report on Water Rights and Water Use in the Lake Tahoe Basin was conducted pursuant to that authority.

The purpose of the water use investigation was to determine the present use in the Lake Tahoe Basin and to propose criteria which can be used for allocating the water supply available for use in the California portion of the Lake Tahoe Basin.

The California-Nevada Interstate Compact concerning the Water of Lake Tahoe, Truckee River, Carson River and Walker River Basins was approved by the two states in 1970 and 1971 respectively. That Compact provides the best available framework for determining the amount of water available for increased use.

There is a limited supply of water available in the Tahoe-Truckee watershed. Increased development in the Tahoe Basin will decrease the amount of water available to lower basin users. The magnitude of the problem is reflected by

the fact that it took 13 years for the two states to negotiate the Compact. Furthermore, the Compact has not yet been ratified by Congress and there has been significant litigation in the federal courts in recent years on this matter. Numerous uncertainties remain as to the availability of water in the Lake Tahoe Basin. Among these are:

- Claims of the Paiute Tribe of Indians at Pyramid Lake are unresolved. Resolution of those claims could result in a federal decree (or federal legislation) reducing the amount of water available to California. In any event there appears to be no reason to believe the California share will be increased.

- Groundwater uses are chargeable against the Compact. However, under California law such uses do not require a permit. Therefore, although the Legislature has agreed to the amount of the California allocation, it has not provided a method of ensuring that use within the State is limited to the Compact amounts.

- Conservation efforts could appreciably expand the effective supply and provide for higher levels of development than possible without conservation. There are a variety of assumptions that can be made about conservation.

Despite the foregoing limitations as to its certainty, the Interstate Water Compact reflects an expression by the California and Nevada State Legislatures as to how much water should be used in the Lake Tahoe Basin. It provides the best available basis for allocating water for use within the Lake Tahoe Basin.

The State of Nevada, through the Office of the State Engineer, has taken steps to ensure that water development on the Nevada side of the basin does not exceed the allocation specified in the Compact. The State of California has a responsibility to ensure that water use in the California side of the basin also meets the conditions of the Compact.

Since 1972, with few exceptions, the State Board has not approved any new appropriative rights or extended time for completion of use for existing permits within the Lake Tahoe Basin. The total annual face value of existing appropriative permits and licenses, pending applications, and other potential sources of water development, including riparian and groundwater diversions, greatly exceeds the allocation specified in the Interstate Water Compact.

This report presents recommendations for administering water rights in the Lake Tahoe Basin. It is recognized that local agencies face tremendous problems in guiding the types and levels of development and they do not have the legal authority to allocate the available water supply or control water quality basinwide. Therefore, the basic premise of the recommendations is that the State should provide a framework within which local agencies can make land use decisions which are consistent with California's interstate obligations.

The peak historical annual diversion of water in the California portion of the basin from all sources, including groundwater, is estimated to be 13,600 acre-feet (af). The proposed Interstate Water Compact allows a total annual diversion of 23,000 af from all sources, including groundwater. However, the presently unused portion of the Compact allocation may be needed even without approval of further developments. Within the California portion of the basin there are 17,000 vacant lots available for single family home development. Even if existing occupancy rates, number of persons per unit, and per capita water use do not increase, full development of these lots would result in water demand in excess of the allocation available for the California side of the Lake Tahoe Basin. Permanent conservation measures could provide water for most, if not all the lots. However, there would not likely be sufficient water for existing lots if water were to be claimed by new subdivision development. Even under the most optimistic assumptions, there is competition for the remaining unused apportioned water within the Tahoe Basin.

Most decisions pertaining to the level and type of development to be allowed in the Lake Tahoe Basin are made by local and regional planning agencies. As an aid to those agencies responsible for land use controls, this report recommends that the amount of water available for development and use be clearly defined through the water rights process established by State law. Furthermore, this report recommends that the State Board give clear indication to the local and

TABLE I-1

SUMMARY TABLE
WATER USE AND WATER RIGHTS SUMMARY FOR THE CALIFORNIA
PORTION OF THE LAKE TAHOE BASIN

WATER USE ZONE	PRESENT WATER USE (AFA)					REPORT ALLOCATION (AFA)	POTENTIAL DEMAND (AFA)		WATER USE RATES (gal/day)	
	Appropriative Rights	Ground Water Diversions	Other Diversions	Total Diversion For Use	Min-Max		Buildout Demand	Expansion Demand (TRPA)	Per Capita	Per Dwelling Unit
North Tahoe Zone A	1308 (11%)	92 (1%)	427 (3%)	1827 (15%)	1763-2067	2,890	2815-4815	3719-6476	159	272
West Tahoe Zone B	697 (6%)	1402 (11%)	828 (7%)	2927 (24%)	2394-3303	4,010	4466-7673	9888-16435	210	355
South Tahoe Zone C	1288 (10%)	5210 (42%)	1163 (9%)	7661 (61%)	6936-8518	12,100	12647-16966	16405-22135	147	258
TOTAL CALIFORNIA. TAHOE	3293 (27%)	6704 (54%)	2418 (19%)	12414 (100%)	11093-13888	19,000	19928-29454	30012-45046	160	277
• Sewer infiltration water exported from the Basin						600				
• Depletion associated with lake storage and flow enhancement						500				
• Potential State of California water requirements						350				
• Water Rights currently held by U.S. Forest Service						2,550				
TOTAL WATER ALLOCATION TC CALIFORNIA PORTION OF BASIN IN INTERSTATE WATER COMPACT						23,000				

regional planning agencies of the limitations of water supply. If existing lots are to receive preference in allocating that supply, no further subdivision development should be approved in the California portion of the Lake Tahoe Basin. This is a general recommendation, based upon the fact that the present law does not provide for full control of water use. A more specific set of recommendations could be developed if appropriate statutes were enacted to ensure that water use stays within the limits set by the Interstate Water Compact.

A key recommendation of this report is that, after consideration of U. S. Forest Service rights, State of California needs and other minor depletions, appropriative water right permits for the remainder of California's compact allocation be given to the three public utility districts in the California portion of this basin. These permits should be structured to take into account the Interstate Water Compact, the needs of each district, and all sources of water supply including groundwater.

Throughout the report reference is made to various "zones" into which the Lake Tahoe Basin has been divided for purposes of analyzing water use and water rights. These zones and the utility districts to which they correspond are:

- Zone A - North Tahoe (North Tahoe Public Utility District)
- Zone B - West Tahoe (Tahoe City Public Utility District)
- Zone C - South Tahoe (South Tahoe PUblic Utility District)
- Zone D - Douglas County, Nevada
- Zone E - Washoe County and Carson City, Nevada

The zones, shown in Figures III-I and IV-1, were chosen because they closely correspond to existing sewage collection and treatment systems within the Lake Tahoe Basin. In California, these zones correspond to the jurisdictional zones of the public utility districts which have filed applications for appropriative water rights to serve these areas.

B. RECOMMENDED POLICY POSITIONS FOR WATER RIGHT ADMINISTRATION

Besides determining the present water use in the Lake Tahoe Basin through detailed investigation and analysis, the report also analyzes the effect on future water use of various land use scenarios. Table I-1 is a summary of water use and water

rights in the California portion of the Lake Tahoe Basin, showing present water use, potential demand, and water use rates for the three zones. As a result of the investigation and analyses, several major policy positions are apparent:

- Guidance for both ground and surface water supplies is needed in the California portion of the Lake Tahoe Basin. All water users should be made aware of the limitations on their ability to expand water use.

- No less than 2,900 acre-feet per annum (afa), most of which is covered under rights already assigned to the Forest Service, should be held for public uses chargeable to the Interstate Water Compact, including use on Federal and State lands.

- It is prudent to assume that depletions due to export from the basin of water infiltrated into sewer lines and a portion of the water diverted to lake storage and subsequently released for streamflow enhancement would be counted against California's allocation. The annual amount of these depletions is estimated to total 1,100 acre-feet.

- In consideration of the total 23,000 annual acre-feet allocation specified in the Interstate Water Compact, U. S. Forest Service water rights, State of California water requirements, depletions associated with lake storage, and exported sewer infiltrate, no more than 19,000 acre-feet per annum (afa) remains for allocation for water use on non-Federal and non-State lands within the California portion of the Lake Tahoe Basin.

- On the basis of potential development of existing subdivided lands, distribution of the remaining 19,000 afa by zone would be:
  North Tahoe Zone A - 2,890 afa - 15%
  West Tahoe Zone B - 4,010 afa - 21%
  South Tahoe Zone C - 12,100 afa - 64%

- The State Board should issue three new permits covering these zones subject to conditions intended to ensure that the amount of water used under the permits does not result in water use in excess of the amount available for each zone. Continued development without recogni-

tion of ultimate availability of water on a zonal basis could result in aggregate use in excess of the Compact allocation. Allocation of water to the three zones will help the responsible local agencies determine the appropriate levels of development.

- The State Board should request that the Regional Planning Agencies (CTRPA and TRPA), the counties and the city within the California portion of the Lake Tahoe Basin not approve any development which would lead to an eventual level of water diversion for use in excess of the allocations specified in this report which are designed to allow water development within the limitations imposed by the Interstate Water Compact.

- In issuing waste discharge requirements for the disposal of municipal wastewater from the California portion of the Lake Tahoe Basin, the Regional Board should include conditions consistent with the allotments to the three zones to help ensure that water use in the basin will be in accord with the water right policies set forth herein.

- In view of the apparent lack of supply to meet the needs of all existing subdivided lots, a careful evaluation should be made before allocating water to those lots which are environmentally sensitive.

- If, in the future, continued groundwater development in aggregate with other diversions threatens to exceed the allocations specified in this report, the State of California should consider regulation of groundwater, as well as surface water diversions, if necessary to meet its commitment under the Compact.

- The State Board's 1972 "Policy for the Administration of Water Rights in the Lake Tahoe Basin" should be amended to reflect the findings and recommendations of this report.

- The State Board should require water companies in the California portion of the Lake Tahoe Basin who have any diversions under the Board's jurisdiction to keep complete and up-to-date records of all their water diversions and service area characteristics (number and type of services, etc.).

C. FINDINGS AND CONCLUSIONS

- Reliable and reasonably accurate diversion records are kept for less than 40% of the water diverted for use. Less than 5% of diverted water is metered to individual users.

- The average water demand in the California portion of the Lake Tahoe Basin for all municipal, domestic, and irrigation uses as of 1977 is 12,430 acre-feet/annum. This demand is based upon the 1974-77 average rate of use and the 1977 level of development. The present maximum water demand, based upon the maximum rate of use observed during the 1974-1977 period is 13,900 acre-feet/annum. The drought level of demand is 11,300 acre-feet/annum.

- The annual water demand within the California portion of the Basin has been increasing steadily over the past twenty years at a rate of approximately 450 acre-feet per year. However, a decline in total demand of about 300 acre-feet per year was observed during the 1976-77 drought years.

- Several factors influence average water use per connection, including the following:

  a. Occupancy rates.
  b. Population per residential unit.
  c. Relative proportion of single family homes, hotel/motel units, campgrounds, mobile homes, multiple family dwellings.
  d. Drought conditions.
  e. Rationing programs or increased use of water meters.
  f. Extent of lawns and landscaping techniques.
  g. Waste and unaccounted for water.

- Present occupancy rates throughout the California portion of the Lake Tahoe Basin are quite low. Occupancy rates range from a low of 48% in winter to a high of 72% in summer. The average annual occupancy rate is 56% with between 3.1 and 3.2 persons per occupied unit. Increases in occupancy rates or number of persons per unit will increase water use without additional construction of dwelling units.

- Present levels of both per capita water use and water use per dwelling unit are lower than in other urbanized areas of the State. The average per capita rate of use in the Tahoe Basin is 160 gallons/capita/day. The average annual per capita use rate in all urbanized areas of the State, not including industrial or agricultural uses, is 210 gallons/capita/day. The average annual rate of water use per dwelling unit for the four major types of residential units is approximately:

	Gal/Unit/Day
Single Family Homes	327
Multiple Family Units	189
Hotel/Motel Units	116
Mobile Homes and Campgrounds	110

  The combined annual average rate of water use per dwelling unit in the California portion of the Lake Tahoe Basin is 270 gallons/unit/day.

- The Tahoe Keys development on the south shore of Lake Tahoe has the highest rate of unit water use in the California portion of the Lake Tahoe Basin, 60% more than the average of other Lake Tahoe water users. Annual per capita use is approximately 260 gal/capita/day. The majority of the water is used for landscape irrigation during the summer. Increased levels of basinwide landscape irrigation could significantly increase dwelling unit and per capita water use rates.

- During the 1976-77 drought, unit water use rates dropped between 5% and 20% in various areas throughout the Basin. During 1977, unit water use decreased to 86% of the pre-drought rates, a saving of 14% in that year. However, the effect of the drought in stimulating long-term savings is unknown.

- The population within the California portion of the Lake Tahoe Basin has been increasing significantly over the past 20 years. The estimated 1977 population and ultimate population, not including day use, on all private lands within the California portion of the Basin is listed below. Ultimate population is that which could be supported by a 19,000 afa supply with present distribution of housing unit types, present per capita water use (160 gal/capita/day) and present seasonal population distribution.

ESTIMATED POPULATION

	1977	Ultimate
a. Peak day	94,000	159,000
b. Summer Average	82,000	138,000
c. Annual Average	64,400	100,000
d. Winter Average	54,200	84,000

- A significant amount of unaccounted for water appears to be associated with municipal and domestic diversion for use in the Lake Tahoe Basin. Unaccounted for water is normally defined as water that has been pumped but not otherwise accounted for. In the context of this report, unaccounted for water is the difference between initial water diversion and wastewater disposal, after accounting for irrigation use. Unaccounted for water may be attributable to distribution system leakage, internal household or commercial consumption, winter bleed water, or sewer system exfiltration. Nationally, distribution system losses average about 13% of total water diversion. At Lake Tahoe unaccounted for water appears to be at least 22% of diversions. Efforts directed at reducing the amount of unaccounted for water lost through leakage and wastage could be effective in reducing water demand.

- A relatively high level of water distribution system bleeding for winter freeze control is believed to occur in several Lake Tahoe water systems. These are usually small water systems originally designed for summer use only. Most of these systems are located on the west shore (Zone B), but a few are located on the North Shore (Zone A). As much as 80% of winter diversion in certain systems may be distribution system bleed water. On the whole, eleven percent (11%) of the total diversion for use in West Tahoe (Zone B) is believed to be for distribution system freeze control. In North Tahoe,(Zone A) an estimated seven percent of total diversion for use is estimated to be distribution system bleed water. Little or no bleeding, other than for individual residences, is believed to occur in South Tahoe, (Zone C).

- The Interstate Water Compact limits water diversion for use within the California portion of the Lake Tahoe Basin to 23,000 acre-feet per annum. If allowance is made for:

  a. Export of sewer infiltration (600 afa),
  b. Estimated depletion associated with lake storage and stream flow enhancement (500 afa),
  c. Developed and undeveloped U. S. Forest Service (USFS) water rights (2550 afa) and,
  d. Present and potential State of California needs for parks and recreation and erosion control (350 afa),

  Then 19,000 acre-feet per annum is available for municipal, domestic and irrigation use on private lands within the California portion of the Basin.

- The face value of appropriative permits and licenses already issued by the State Board for diversion for use is approximately 13,850 acre-feet

per annum, of which 3,300 acre-feet per annum is presently being diverted. At one time water demand under those appropriate rights is estimated to have approached 5000 acre-feet per annum. Decline from maximum historical amounts is due to decreased irrigated acreage, and reliance upon other sources, principally groundwater, for expanding municipal and domestic supplies. Use under rights not recorded with the State Board is about 9,130 acre-feet per annum.

- The legal bases of many surface water diversions within the California portion of the Lake Tahoe Basin are not clearly defined. Many of these diversions are made on the claim of either pre-1914 or riparian rights. In either case only a court decision or a watershed adjudication can establish the validity and extent of the rights. Surface water diversions with rights not clearly defined constitute over 19% (2400 afa) of the diversions for municipal, domestic and irrigation supply within the California portion of the Basin. These diversions include the following:

<u>North Tahoe, Zone A</u>

1) North Tahoe P.U.D. - Tahoe Vista/Kings Beach Area - diversion from Lake Tahoe at the Old Brockway Hotel pumphouse (possible pre-1914 right).
2) Agate Bay Water Co. - Diversion from unnamed spring for domestic use (possible riparian if rights are reserved in individual deeds).
3) North Tahoe P.U.D. - Dollar Cove System (Chinquapin) - Diversion from Lake Tahoe for domestic use within Chinquapin development and the Dollar Cove subdivision (possible partial riparian).
4) Caledonia Mutual Water Co. and several other diverters - Individual diversions from Lake Tahoe for domestic use (possible riparian).

5) Fulton Water Co. - Diversion from Lake Tahoe which has been petitioned as a point of diversion under appropriative right A-19819 (P-14336).
6) North Tahoe P.U.D.-Tahoe Marina/Lake Tahoe Estates. Diversions from Lake Tahoe for non-riparian use (unknown rights).

West Tahoe, Zone B

1) Tahoe Pines Water Co. - Diversion from Lake Tahoe and Blackwood Creek (possible riparian if rights are reserved in individual deeds).
2) Tahoe Swiss Village Water Utility - diversion from Lake Tahoe (possible riparian if rights are reserved in individual deeds).
3) Tahoe City P. U. D. - McKinney Shores - diversion from Lake Tahoe for McKinney Shores subdivision (possible riparian).
4) Water's Edge Condominiums - Diversion from Lake Tahoe (possible riparian).
5) Meeks Bay Vista Mutual Water Co. - diversion from Lake Tahoe (possible riparian).
6) Tahoe Sierra Estates - diversion from lake Tahoe for domestic use (possible riparian if rights are reserved in individual deeds).
7) Estimated 300 individual riparian diversions for lakefront property.
8) Quail Lake Water Co.- diversion from Ellis Creek for domestic and municipal use (possible riparian or pre-1914 right),
9) Lake Forest Water Co. - diversions from Lake Tahoe for domestic use (possible pre-1914 right).
10) Skyland Mutual Water Co. - diversions from Lake Tahoe for domestic use (possible riparian).
11) Tahoe Park Water Co. - diversions from Lake Tahoe and unnamed spring for domestic use (possible pre-1914 diversion and riparian).
12) Tamarack Mutual Water Co. - Several diversions from Lake Tahoe and an unnamed spring (possible riparian diversions).
13) California State Parks - several spring and Lake Tahoe diversions for recreational and campground use (probable riparian).

14) U.S.F.S campgrounds and parks - several diversions from Lake Tahoe (possible riparian or reserved rights).
15) Tahoe City P. U. D. - Rubicon Properties - diversion from Lonely Creek Gulch in excess of original domestic needs of licensed appropriative right (no known right).

South Tahoe, Zone C

1) South Tahoe P. U. D. - diversion (portion of) from Cold Creek (probable pre-1914 right).
2) USFS - Fallen Leaf Lake Campground - diversion from Fallen Leaf Lake for campground use. (possible riparian or reserved rights).
3) USFS - several miscellaneous diversions for use by lessees (possible riparian or reserved rights).
4) Lake Tahoe Country Club - diversion from Upper Truckee River for golf course irrigation (probable riparian).
5) Cascade Properties - diversion from Cascade Lake for domestic use (possible riparian diversion if reserved in individual deeds for non-riparian parcels).
6) USFS - several miscellaneous diversions for domestic or recreational use on non-riparian lands (claimed reserved rights).

- At present no means short of a court adjudication is provided by California water rights law to allocate water to all water companies or water systems within the California portion of the basin. However, if such an allocation could be performed, several procedures could be used to arrive at an equitable distribution. One such procedure would be to distribute the total zonal water allocation to the individual water companies on the basis of existing subdivided lands. Table I-2 exemplifies such a scheme. The water allocation shown in Table I-2 uses the following criteria:

    - The projected golf course water requirements are subtracted from the total zonal allotment.

TABLE 1-2

EXAMPLE PROCEDURE OF WATER ALLOTMENT
TO INDIVIDUAL WATER COMPANIES WITHIN EACH
WATER USE ZONE

	PRIVATE DOMESTIC WATER USE ALLOTMENT UNDER FULL BUILDOUT OF EXISTING[1] SUBDIVIDED DEVELOPMENT					COMMERCIAL & PUBLIC USE ALLOTMENT[2]		TOTAL[3] WATER ALLOT-MENT	MAXI-MUM[4] HISTOR-ICAL USE
	SFU's	MFU's	M/H	MH/CG	WATER (afa)	ACRES	WATER (afa)	(afa)	(afa)
North Tahoe, Zone A									
1. North Tahoe P.U.D.									
A. Dollar Cove	59	183	0	0	54	0	0	54	89*
B. Carnelian	118	293	8	0	95	23	45	140	96
C. Tahoe Marina	269	2	0	0	89	0	0	89	59
D. Tahoe Vista, Kings Beach	2879	1222	1956	162	1419	226	441	1860	1100
2. Fulton W. C.									
A. Links	20	0	0	0	7	0	0	7	8*
B. Cedar Flat	953	42	0	0	320	0	0	320	223
3. Agate Bay	640	6	0	0	210	0	0	210	191
4. Miscellaneous	65	0	0	0	20	0	0	20	32*
Sub Total	5003	1748	1964	162	2214	249	486	2700	1797
5. Golf Courses	-	-	-	-	-	-	-	190	190
								2890	1987
West Tahoe, Zone B									
1. Tahoe City P.U.D.									
A. Tahoe City	989	1099	174	0	568	104	385	953	841
B. Dollar Point	552	0	0	0	186	0	0	186	180
C. Rubicon Prop.	600	0	0	0	203	0	0	203	158
D. Alpine Peaks	298	0	0	0	101	0	0	101	5
E. McKinney Shores	115	0	0	0	39	0	0	39	28
F. Rubicon/ Tahoe Hills	273	0	0	0	92	0	0	92	12
2. Fulton, Panorama	104	307	0	0	95	0	0	95	34
3. Lake Forest	95	18	23	0	39	19	70	109	78
4. Lakeview W. C.	7	2	0	0	3	0	0	3	6*
5. Lake Park Terrace	12	0	0	0	5	0	0	5	6*
6. Tahoe Sierra Estates	66	0	0	0	22	0	0	22	17
7. Tahoe Park W. C.	471	0	0	0	159	7	26	185	146
8. Tahoe Park Heights	25	0	0	0	8	0	0	8	6
9. Talmont/Twin Peaks	449	0	0	0	152	0	0	152	75
10. Ward Well W.C.	237	0	0	0	80	0	0	80	91*
11. Ward Creek W.C.	87	49	17	0	41	5	19	60	39
12. Timberland	206	20	0	0	73	0	0	73	87*
13. Skyland	100	0	0	0	34	0	0	34	29
14. Tahoe Pines	392	0	0	0	132	0	0	132	114
15. Tahoe Swiss Village	88	0	0	0	30	0	0	30	25
16. Madden Creek	135	32	57	0	58	26	96	154	73
17. Quail Lake	385	5	0	0	130	0	0	130	141*
18. McKinney W.D.	289	0	0	0	98	0	0	98	51
19. Tahoma Meadows	66	0	0	0	22	0	0	22	12
20. Tahoe Cedars	1676	71	100	0	590	20	74	664	321
21. Waters Edge	0	38	0	0	7	0	0	7	17*
22. Glenridge	81	0	0	0	27	0	0	27	12
23. Meeks Bay Vista	163	0	0	0	55	0	0	55	55*
24. Tamarack	17	0	0	0	6	0	0	6	8*
25. Miscellaneous	327	0	24	100	160	0	0	160	191*
Sub Total	8305	1641	395	100	3214	181	670	3884	2844
26. Golf Courses	0	0	0	0	0	0	0	126	126
Zone Total								4010	2970
South Tahoe, Zone C									
1. South Tahoe P.U.D.	8821	3394	5665	1058	4264	429	840	5104	4024
2. Lakeside MWC	89	0	2277	0	291	0	0	291	527*
3. Tahoe Keys W.C.	1300	315	0	0	480	5	10	490	600*
4. Lukins W.C.	981	250	174	58	391	62	120	511	328
5. Angora W.C.	4555	0	160	70	1548	288	564	2112	594
6. TPW&G Co.	5470	0	160	70	1803	260	509	2312	586
7. Miscellaneous	591	550	1810	221	530	0	0	530	600*
Sub Total	21807	4509	10086	1477	9307	1044	2043	11350	7259
8. Golf Courses								750	750
Zone Total								12100	8009

[1] Private Domestic Water Use Allotment is computed by subtracting maximum historical golf course irrigation, and 18% commercial and public service water use. The remainder is proportionally divided among all water users according to the estimated number of residential units at build-out. This distribution would allow water use for the various types of residential units at rates similar to the historical basin-wide averages, which are as follows:

Single Family Units (SFU's) - 327 gal/unit/day
Multiple Family Units (MFU's) - 189 gal/unit/day
Hotel/Motel Units (H/M) - 116 gal/unit/day
Mobile Homes & Camps (MH/CG) - 110 gal/unit/day

[2] Commercial and Public Service Water Use is presently about 18% of total diversion for use. This value is assumed to remain constant and is prorated to the individual water companies according to the relative acreage of presently urbanized General Commercial and Public Service land use zones established by the regional planning agencies.

[3] Total Water Allotment is the total hypothetical allocation for each water company based upon prorated private domestic and commercial/public service water use.

[4] Maximum Historical Water Use is the observed or estimated maximum annual water use within each water company. Asterisks (*) indicate those companies whose maximum historical use is known or believed to have exceeded water allotment computed by this procedure.

- o Eight-two percent of the remaining water is prorated to each water company on the basis of number and types of residential units estimated to exist at full buildout of existing subdivided lots at approximately the present basin-wide water use rates.
- o The other 18 percent of the remaining water is prorated to each water company for commercial and public service water use on the basis of the existing area of General Commercial and Public Service zones which are established by the regional land use plans and which are currently urbanized.

On the basis of this allocation procedure, a number of water systems would be currently diverting water in excess of their individual allotment. These water companies are indicated by an asterisk (*) in the last column. In these instances the individual allocations could be adjusted to reflect historical use minus any waste or unreasonable use that has occurred. This would mean that less water would be available to other systems where present water use is not as great. Alternatively, water systems with high levels of use could employ water conservation practices to reduce total water demand.

D. DETAILED RECOMMENDATIONS

- o The amount of water (1860 afa) specified in permitted applications A-11449 (P-7756) and A-22651 (P-15771) presently held by the U.S.F.S. Tahoe Basin Management Unit should be kept available for use on public lands owned by the U.S.F.S. These lands constitute 71.5% of the California portion of the Lake Tahoe Basin. The diversions authorized by the permits were originally intended for residential development on private lands. However, those lands have been acquired by the Forest Service for public use, and the water covered by the permits should be applied to that use, subject to the following conditions:

1. That use of this water be for the benefit and welfare of the general public and be consistent with management plans promulgated by the U.S.F.S. and policies of the State Board.

2. That the place of use be limited to U.S.F.S. lands within the California portion of the Lake Tahoe Basin and the channel of the Truckee River below Lake Tahoe.

3. That progress made by the U.S.F.S. in putting to use the full permitted amount of A-11449 and A-22651 be periodically reviewed by the State Board. Appropriate amendments should be made to the permits upon petition by U.S.F.S. or the Board's own motion.

4. If at any time in the future it becomes apparent that the remainder of the water supply available under the Compact for other competing uses is insufficient and the U.S.F.S. cannot show specific plans for full utilization of water covered by the two permits, then the State Board shall consider reducing the permitted amount, so that water not used by the U.S.F.S. will be available for use by others.

5. That total water diversion for municipal, domestic, campground and irrigation use on federal lands within the California portion of the Lake Tahoe Basin under all water rights, and any water used for streamflow enhancement and fishery maintenance released from Lake Tahoe to the Truckee River in excess of any other existing rights, be limited to 2,550 acre-feet per annum.

o The State Board should consider partial approval of water right Applications A-23393, A-23479 and A-24257 (held by the South Tahoe, Tahoe City and North Tahoe P.U.D.'s) in the amounts of 12,100, 4,010, and 2,890 acre-feet per annum, respectively. The State Board should consider placing the following conditions on the permits:

1. The quantity of water diverted for use should include water used on private, county, or city owned lands within each of the respective zones.

2. Water diverted for use on state or federally owned public lands should not be chargeable against the quantity allowed under the permits, but should be charged against rights held by either the State of California or the United States Government.

3. Water diverted under these appropriative rights, together with water diverted from all other natural sources, including groundwater, for use on non-state and non-federal lands, within each zone, should not exceed the annual limitations specified above.

4. The gross place of use specified in the approved permits should be non-overlapping, but taken together should cover the entire California portion of the Lake Tahoe Basin.

5. All other pending applications should be denied, unless the appropriate Public Utility District certifies that it is unable and/or unwilling to supply the proposed project. In such case, the individual application should be evaluated on its merits. The amount covered by any permit issued pursuant to the application should be charged against the total amount allotted to the respective Public Utility Districts zonal allocation. Applications by State agencies or the U.S. Forest Service should be charged against the amount allocated for public uses.

o The following conditions should be included as restrictions on all permits and applications which come before the State Board for review.

1. Total monthly and annual acre-feet limitations should be imposed.

2. Monthly and annual limitations should be based upon projected requirements within the permitted place of use, insofar as they are consistent with land use controls and with the overall limitation imposed by the Compact.

3. Water diverted from all sources, including other appropriative rights, riparian diversions, and groundwater extractions for use within the place of use together with that diverted under the permit should not exceed a specifically determined amount established by the State Board. This specified amount should be sufficient for the needs of the place of use in proportion to the needs of the entire basin.

4. Notice should be given to each permittee as to the total zonal allocation for the zone in which the permitted diversion and use occur. Furthermore, provision should be made in each permit that if total water diversion for the respective zone exceeds the zonal allocation due to increased diversions from non-permitted sources, such as groundwater, the permitted diversion may be reduced at some later date.

5. Installation and maintenance of water meters or other measuring devices satisfactory to the State Board should be required on all sources including groundwater. Each permittee should provide monthly records of such measurements in annual progress reports.

o The State Board should consider the following actions pertaining to individual statutory appropriative permits and licenses within the Lake Tahoe Basin.

North Tahoe, Zone A

1) North Tahoe Public Utility District (NTPUD) - Tahoe Vista/Kings Beach Service Area.

On November 8, 1967, the Oakwood Investment Co. deeded most of its water system to the NTPUD. The water system for the Brockway Golf Course and the water right, A-17139, to service this course were specifically excluded by the deed. As such, the portion of A-17139 to irrigate the golf course was never transferred to NTPUD. This appropriation, A-17139 (P-13525), should be divided and each party should be made aware of its rights and responsibilities.

2) NTPUD - Carnelian System.

The only permitted appropriation in the service area is A-1379 (P-679) on Watson Creek for 0.67 cfs with an annual face value of 482 afa. Siltation problems in the diversion basin and other public health considerations have required the Permittee to abandon this point of diversion. Thus, the appropriative right should be cancelled or the points of diversion changed. During 1977 the Carnelian Woods well provided more than 91% of the water for the service area. Some water maybe provided by an unpermitted lake diversion to the service area. Pending Applications 23727 and 24257 would cover this diversion and place of use.

3) NTPUD - Dollar Cove System.

Application A-753 (L-107) historically served the Dollar Estate with a limited diversion of 2200 gpd with a face value of 0.90 afa. Water available under the right is insufficient in quantity and quality to warrant its continued use by the NTPUD. It has not been used for several years. This appropriative right should be cancelled or the points of diversion amended.

Present water demand is satisfied by unpermitted lake diversions. Pending Applications 23475 and 24257 would cover this diversions and place of use. (This report recommends approval of Application 24257.)

4) Fulton Water Co. - Cedar Flat Service Area.

A-18248 and A-19510 have two identical points of diversion. Decision D-1152 limited these diversions to a sum of 314 afa and 50.5 af/mo. An additional point of diversion has been obtained with the acquisition of the Cedar Flat Mutual Water Co. A petition to add this point of diversion was filed on July 8, 1971. During 1974-77 this unpermitted diversion supplied some 42% of the total diversion within this service area. State approval of the petitioned additional point of diversion is recommended.

1) Tahoe City Public Utility District (TCPUD).

A petition has been filed to consolidate the places of use and points of diversion for various TCPUD water systems. Interties presently exist between the Dollar Hill and Tahoe City water systems and the Rubicon Palisades/Tahoe Hills and Rubicon Properties water systems. Approval of the petition is recommended with the stipulation that intertied connections and all points of diversion be metered.

Furthermore, any consolidation of water rights, points of diversion, and place of use within the existing Tahoe City PUD water systems should recognize limitations on water use within each system as correlated with other diversions within West Tahoe, Zone B. This report recommends allocation of 4,010 afa for use on all private lands within West Tahoe, Zone B. If this allocation were used by the various systems within the zone in proportion to the total zone water dependent development, the various TCPUD water systems would be entitled to the following approximate amounts:

	afa
o Tahoe City system	953
o Dollar Point system	186
o Rubicon Properties system	203
o Alpine Peaks system	101
o Mckinney Shores system	39
o Rubicon Palisades/Tahoe Hills	92
o Other systems	2,436
	4,010

2) TCPUD - Rubicon Properties Water System.

A-2626 (L-383) was originally licensed for power generation and domestic use during the summer only. Domestic use was for one large lakeshore house and cottages. The vast majority of the appropriation was for power generation,a non-consumptive use. This beneficial use has been abandoned for many years. The entire right is used for domestic

supply to a 600 parcel subdivision. This use depletes the entire flow of Lonely Gulch Creek in portions of most years. The original license should be amended to show an allowable domestic diversion for use of 1.9 acre-feet per year which is estimated to correspond to the original domestic use.

South Tahoe, Zone C

1) Lakeside Mutual Water Co.

Water is provided to this service area by a permitted lake diversion, A-22640 (P-15421) and some minor well diversions. The permit should be reduced from the present value of 1,070 afa. The amended amount should be that which has been placed to beneficial use (without waste) or an amount (291 afa) based on the relative percentage of total zone water dependent development in the service area, whichever is more. This action is appropriate since further intense development under regional land use plans is not possible. The amended permit should limit the diversion under the permit and all other diversions for use from all natural sources, including groundwater, to the allocated amount. Requirements for metering all sources should also be imposed.

2) Tahoe Paradise Water and Gas Company (TPW&G) - Angora Water Company and Tahoe Keys Water Company.

TPW&G has filed several applications for appropriations directly from the Upper Truckee River or its tributaries (A-18030, A-18031, A-18038, A-18039, A-19629). These were permitted with diversion restrictions such that they were never developed. TPW&G has filed change petitions to (a) cover an extended place of use including the Angora Water Company service area and the Tahoe Keys service area, and (b) allow for direct diversion from Lake Tahoe of the amount originally applied for. No action has taken place on the permits or the petitions in several years. All three service areas obtain 95% of their water supply from wells. Although TPW&G and Angora water system are interconnected for emergency situations, the Tahoe Keys water system is not. The Angora Water Company also holds pending

Application A-23502 which applies for the same water for the same use as described in the TPW&G change petition. Approval of the petitioned changes and/or approval of pending Application A-23502 should include conditions limiting total diversion for use. This limitation should recognize all sources of water, including groundwater. If the limitation were based on a proportional allocation of water to all water service areas in South Tahoe, Zone C, consistent with the total zonal allocation, the systems would be entitled to the following approximate amounts:

	Annual (afa)	Max. Month (af)	Peak Diversion (cfs)
TPW&G	2,312	330	6.3
Angora	2,112	302	5.8
Tahoe Keys	490	70	1.4
Total	4,914	702	13.5

It is probable that surface supplies will never be heavily relied upon since groundwater development has progressed to such a large extent.

The present average level of water use within Tahoe Keys is about 560 afa. This is greater than the proposed allocation specified above. At present the following options are available for further water development for Tahoe Keys:

a) Water development and use remains at or below present levels by means of intense water conservation measures, reduction of irrigated landscape area, and/or limitations on further development.

b) Water development and use continues to increase above the 490 afa amount. This would result in less water being ultimately available to other water users within the basin in order to stay within allocations specified in the Interstate Water Compact.

o Many water companies in the California portion of the Lake Tahoe Basin do not keep adequate records of their water diversions for consumptive use, nor have they indicated intention to do so in the immediate future. A concerted effort should be considered by the State Board to require all

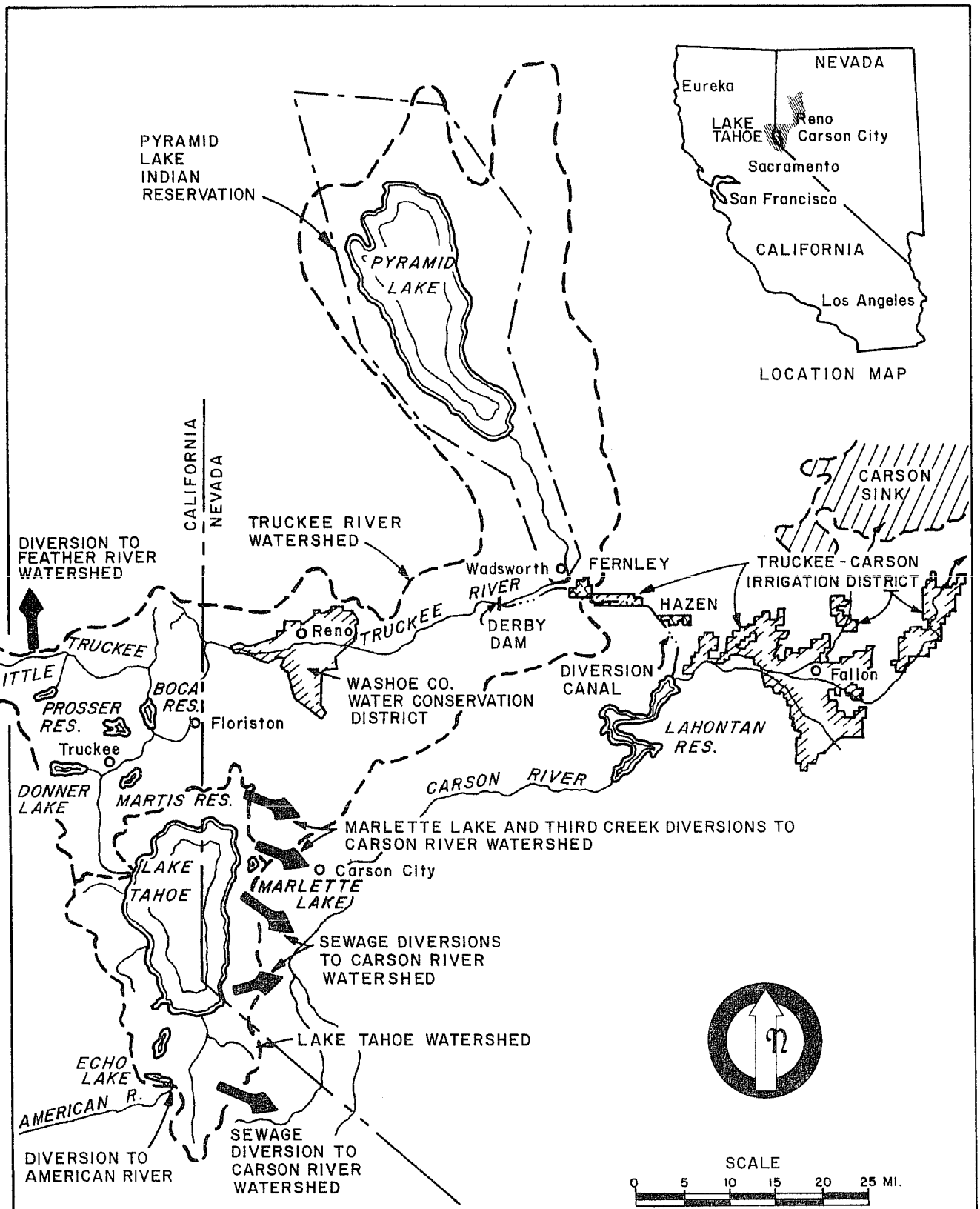
companies to keep complete and up-to-date records of water diversion for use and service area characteristics (number and type of services, etc.). The major water systems which need to institute better data collection and recordation procedures are:

1. Lukins Brother Water Co. (Zone C)
2. Tahoe Paradise Golf Course. (Zone C)
3. Brockway Golf Course (Zone A)
4. Tahoe City Golf Course (Zone B)
5. Lakeview Water Co. (Zone B)
6. Lake Park Terrace Water Co. (Zone B)
7. Tahoe Park Water Co. (Zone B)
8. Tahoe Park Heights (Zone B)
9. Talmont Estates Water Co. (Zone B)
10. Ward Creek Water Co. (Zone B)
11. Ward Well Water Co. (Zone B)
12. Tahoe Pines Water Co. (Zone B)
13. Tahoe Swiss Villiage Water Utility (Zone B)
14. Madden Creek Water Co. (Zone B)
15. Quail Lake Water Co. (Zone B)
16. McKinney Creek Water District (Zone B)
17. Tahoma Meadows Water Co. (Zone B)
18. Tahoe Cedars Water Co. (Zone B)
19. Water's Edge Condominiums (Zone B)
20. Meeks Bay Vista Mutual Water Co. (Zone B)
21. Tamarack Mutual Water Co. (Zone B)
22. Glenridge Park Water Co. (Zone B)
23. Skyland Water Co. (Zone B)
24. Timberland Water Co. (Zone B)
25. Lake Forest Water Co. (Zone B)
26. Tahoe Sierra Estates Water Co. (Zone B)

SECTION II

WATER RIGHTS PERSPECTIVE

FIGURE II-1



LAKE TAHOE – TRUCKEE RIVER WATERSHED

SECTION II

WATER RIGHTS PERSPECTIVE

A. GEOGRAPHICAL AND HISTORICAL SETTING

The Lake Tahoe Basin forms the headwaters of the Lake Tahoe-Truckee River watershed pictured in Figure II-1. Roughly two-thirds of the Lake Tahoe Basin is situated within California, while one-third lies within Nevada. Lake Tahoe lies within a graben fault bounded on the west by the main range of the Sierra Nevada and on the east by the Carson Range, a smaller branch of the Sierra Nevada range. The prime physical features of the Basin are summarized in Table II-1.

TABLE II-1
PHYSICAL CHARACTERISTICS
OF THE LAKE TAHOE BASIN

Total Surface Area of Basin	500 square miles
Land Surface Area	310 square miles
Lake Surface Area	190 square miles
Lake Elevation	6,223 to 6,229.1 feet
Maximum Elevation of Surrounding Mountains	10,881 feet
Length of Lake	22 miles
Width of Lake	12 miles
Length of Shoreline	71 miles
Maximum Depth of Water	1,645 feet
Average Lake Depth	1,027 feet
Storage Volume above outlet sill (top 6.1 feet)	720,000 acre-feet
Total Volume	126,000,000 acre-feet

Annual precipitation within the Lake Tahoe Basin ranges from 80 inches near the crest of the Sierra Nevada in California, to 20 inches on the east shoreline area in Nevada. Most of the annual precipitation comes as snow during the winter months. Summers are characteristically sunny and dry.

The top 6.1 feet of Lake Tahoe is regulated by the U. S. Bureau of Reclamation for flow maintenance and use for irrigation within Nevada. Water released from Lake Tahoe is diverted from the Truckee River at Derby Dam near Fernley, Nevada. This diversion, as well as others, has been the subject of litigation for many years by various parties.

Since 1901, when reliable records were first kept, the Lake Tahoe outflow has varied widely, ranging from 4,700 to 657,000 acre-feet per year. This wide range is due not only to climatic conditions but also to variation in the manner of operating Lake Tahoe as a reservoir. Over the past 76 years the average annual outflow has been 179,400 af. During the 1977 drought year, total outflow was reduced to 81,000 af, with a 300,000 af loss in storage capacity. At the present time, existing watershed export, existing in-basin depletion, potential depletion under currently unused export rights total 20,000 acre-feet per year. During an average year this constitutes about 11% of the total Lake Tahoe outflow to the Truckee River. During the 1977 drought year existing and potential basin exports and in-basin depletion constituted 20% of the total Lake Tahoe outflow. At potential levels of future development within Lake Tahoe Basin, the net depletion may total about 30,000 afa or more. This depletion is 15% of the total average annual outflow and 30% of the 1977 drought year outflow of the Lake Tahoe Basin.

Prior to World War II, development of the Lake Tahoe Basin was quite limited due to its relative remoteness. The population was extremely seasonal with almost no year-round residents. After World War II, a building boom started at Lake Tahoe and has continued to this day. At present Lake Tahoe has become an urbanized recreational resort community with extensive skiing, gambling, water sport facilities, and many second home developments.

A much more detailed discussion of the geographical characteristic and historical setting is available in the report "The Lake Tahoe Basin, California, Nevada" by J. R. Crippen and B. R. Pavelka, U. S. Geological Survey Paper No. 1972, prepared in cooperation with the California Department of Water Resources.

B. HISTORICAL WATER RIGHTS PERSPECTIVE

Water rights of the Lake Tahoe Basin and Truckee River watershed have been the subject of disagreement and litigation for over a century. In 1955, the states of California and Nevada formed the Joint California-Nevada Interstate Compact Commission (Interstate Water Commission) to allocate the water of various streams which cross the joint boundary of the two states. In 1968 the Interstate Water Commission adopted the "California-Nevada Interstate Compact Concerning Water of Lake Tahoe, Truckee River, Carson River and Walker River Basins" (Interstate Water Compact) after 13 years of extensive debate and negotiation. Although the Interstate Water Compact was ratified with minor revision in 1970 and 1971 by the states of California and Nevada, respectively, it is still pending ratification by the United States Congress as provided in the U. S. Constitution. The water rights of the Paiute Indian Tribe of Pyramid Lake are the subject of continuing dispute. At the present time the interstate allocations of water specified in the Compact provide the best available basis for determing water availability in the Lake Tahoe portion of the Truckee River watershed.

As it pertains to water development and use within the Lake Tahoe Basin, the Interstate Water Compact states, in part:

> "...the total annual gross diversions for use within the Lake Tahoe Basin from all natural sources including ground water and under all water rights in said basin shall not exceed 34,000 acre-feet annually, of which 23,000 acre-feet annually is allocated to the State of California for use within said basin, and 11,000 acre-feet annually is allocated to the State of Nevada for use within said basin. After use of the water allocated herein, neither export of the water from the Lake Tahoe Basin nor the reuse thereof prior to its return to the lake is prohibited...." (emphasis added)

In addition to this language, draft versions of the compact recognized the desirability of basing the limitations on net depletion. In 1966, Col. A. M. Barton, Chairman of the Interstate Water Commission, testified at a House subcommittee hearing as follows:

"...23,000 acre-feet is for use in the California portion of the basin and 11,000 acre-feet in the Nevada portion. This allocation is a "gross diversion" allocation which means that the total amount of water which is diverted for use is charged against the total amount made available to the basin. The compact also provides that if the permanent commission ever determines that it is technically possible to measure the total amount of water which is removed from the water supply of the Lake Tahoe Basin through use, then it can substitute this method as the means of measuring the allocation to the Lake Tahoe Basin. This method, called the 'net depletion' basis of measurement would give credit to the basin for the water which would be salvaged from natural losses such as use by native vegetation, evaporation and other natural causes because of the removal of trees and other natural cover and the substitution of buildings and paved areas, and would charge only for the net amount of water which was actually used up by man's activities. Under this concept the Lake Tahoe Basin would be permitted to deplete the water supply of the basin by an additional 7,500 acre-feet over the depletion which existed in 1956...."

"...The compact provides that when it is necessary to protect the health of the people and to protect the quality of these waters the commission shall permit the export of wastewater from the Basin. The only time it can deny such export is when it finds that the exported waters would create a health or other hazard in the disposal area, or when the export would reduce the amount of water available downstream below that which would be available if all of the water allocated to the Lake Tahoe Basin was being used and no export was occurring. The commission can still authorize export of waste waters under the latter condition by requiring that the exporter take appropriate steps to prevent such reduction...."

The net depletion concept, however, was deleted because of the likelihood of having to include sewage export (currently 6500 afa) and the uncertainty of ever being able to determine net depletion precisely. Actually the 23,000 acre-feet and 11,000 acre-feet gross diversion breakdown is much easier to record and enforce due to the ability to record accurately amounts at the point of diversion, and the lack of a need for empirical manipulations to translate "gross diversion" into "net depletion".

Although the section of the Interstate Water Compact dealing with Lake Tahoe states "all natural sources...and all water rights" (Article V), Article XIV on nonconsumptive use states:

> "Each state may use water for nonconsumptive purposes, including but not limited to flood control, recreation, fishery and wildlife maintenance and enhancement, and hydroelectric power generation, provided that such uses result in no discernible reduction in the water allocated to the other state."

Thus, it is unclear whether numerous appropriative water rights held by the U. S. Forest Service in California for lake storage and stream flow enhancement should be charged all or in part against the Interstate Water Compact allocation. Although not specifically a diversion for consumptive use, a certain albeit small portion (estimated in this report to be 10%) of this appropriated water is, in fact, depleted.

In addition to establishing limitations on water diversion for use within the Lake Tahoe Basin, the Interstate Water Compact, upon Congressional ratification, establishes an eleven member permanent "California-Nevada Compact Commission" (Commission) to enforce the provisions of the Compact. The powers given to the Commission would include the power to:

- Adopt rules, regulations and procedures necessary to administer provisions of the Interstate Water Compact
- Employ staff personnel
- Make findings
- Install, or require to be installed, measuring devices on all diversion works

- o Obtain a right of access to all properties for purposes of administering the compact

- o Subpoena witnesses

In 1969, Congressional ratification was given to the "Tahoe Regional Planning Compact" which established the Tahoe Regional Planning Agency (TRPA) a bi-state land use planning agency. Although the Planning Compact gives the TRPA moderate powers to determine the extent and type of land use within the Lake Tahoe Basin, part (d), Section 2 of Article VIII of the Planning Compact states:

> "No provision of this Compact shall have any effect upon the allocations or distribution of interstate waters or upon any appropriative water right"

Thus, none of the considerations pertaining to the Interstate Water Compact were embodied in the Tahoe Regional Planning Compact.

C. CALIFORNIA WATER RIGHTS

Numerous categories of water rights exist within the California portion of the Lake Tahoe Basin. Briefly described they are as follows:

1. Pre 1914 Appropriative Rights. These are appropriative rights established prior to the passage of the Water Commission act in 1914. These rights are ill defined and require a court adjudication for absolute determination.

2. Section 12 filings. These are appropriative rights which were initiated at the time the Water Commission Act was being considered but before it was effective. These rights were issued a certificate defining the amount of diversion and place of use.

3. Statutory Appropriative Rights. Following the procedures established in the Water Code since 1914, the State Board (and its predecessors) have issued permits and licenses for the appropriation of water for beneficial use.

4. Riparian diversions. These are legal diversions for reasonable use on lands adjacent or riparian to a surface water body. Nonriparian subdivided parcels of an original large riparian tract may retain riparian rights if such rights are reserved in the deed.

5. Overlying and Correlative Rights. Groundwater rights are not codified but are subject to judicial interpretation. Generally speaking, an overlying landowner may use as much groundwater as is reasonable if such use does not harm other rights. Groundwater rights are usually determined only through individual court action or a watershed adjudication.

In the California portion of the Lake Tahoe Basin, the amount of water presently being diverted under each of these categories is approximately as follows:

	afa	% of total
1. Pre 1914 Appropriations	775	6.3
2. Section 12 Filings	170	1.4
3. Statutory Appropriative Rights		
a. Permits	2470	20.0
b. Licenses	660	5.3
4. Riparian Diversions	920	7.4
5. Groundwater Diversions	6700	54.2
6. Undefined rights	675	5.5

Groundwater is the largest category (54%) and 90% of increases in water diversion for use is by means of further groundwater development. Surface water diversion on file with the State Board (including Section 12 filings) account for 27% of total water diversion for use. Another 19% of total

diverted water is provided by means of surface water diversion which are not clearly defined, including riparian diversions and pre-1914 appropriative rights.

The State Board and its predecessors have made numerous decisions over the years which have had impacts on water development and use. Specific water right decisions which have been made as result of protested water right applications are briefly described as follows:

Decision 48 (1925) - Approval of a permit for an application to divert water from Star Lake on Cold Creek in South Tahoe for power generation purposes. This right has subsequently been cancelled.

Decision 73 (1925) - Rejection and cancellation of an application for diversion from Ellis Creek for the "improvement of the scenic beauty of Quail Lake and the propagation of fish".

Decision 104 (1926) - Revocation of a permit issued on an application to divert water from Rush Lake Creek tributary to McKinney Creek for irrigation and domestic use.

Decision 227 (1929) - Application approved and permit granted for the appropriation of water from an unnamed spring tributary to Ward Creek to serve the Tahoe Park subdivision. This permit was subsequently cancelled. Furthermore, Application 12-5859 filed under Section 12 of the Water Commission Act and presently held by Ward Creek Water Company was issued a certificate of diligence for 0.42 cfs with the provision that complete use be made by January 1, 1939.

Decision 1056 (1962) - This decision involved numerous water rights throughout the California portion of the Lake Tahoe Basin. These are:

a. Application 17139 held by Oakwood Investment Co. approved with seasonal and annual limitations with the provision that use be completed by 1965.

b. Applications 17149 and 17235 held by the North Tahoe P.U.D. were approved with annual limitations. In addition, under maximum annual and monthly amounts, these rights and any rights acquired by the NTPUD from Oakwood Investment Company were limited with the provision that complete use be made by 1970.

c. Applications 18021, 18030, 18031, 18038, and 18039 were approved for diversion from the Upper Truckee River (and its tributaries) by Meyers Water Company, now Tahoe Paradise Water and Gas Company. Maximum annual and monthly limitations were imposed with seasonal restrictions for fishery protection on flow depletion of the Upper Truckee River. These rights have never been developed, although petitions to change the point of diversion to Lake Tahoe have been filed.

d. Application 18248 was approved for diversion from Lake Tahoe by Fulton Water Company. Maximum annual and monthly limitations were imposed with the added stipulation that water be completely put to use by 1970.

e. Application 18282 was approved for diversion from Lake Tahoe by Tahoe Tavern Heights Water Company. Maximum annual and monthly limitations were imposed with the added stipulation that water be completely put to use by 1970.

Decision 1152 (1963) - This decision also involved numerous water rights throughout the California portion of the Lake Tahoe Basin. These are:

a. Application 19111 which was approved for diversion from Lake Tahoe and is presently held by Tahoe City P.U.D. for domestic service to the Dollar Hill area. Maximum annual and monthly limitations were imposed with the added stipulation that water be completely put to use by 1970.

b. Application 19510 which was approved for diversion from Lake Tahoe by Fulton Water Company. Maximum annual and monthly limitations were imposed with the added stipulation that water be completely put to

use by 1970. In addition, petitions were approved to provide for the same diversion points and place of use in both Applications 18248 and 19510. Total maximum annual and monthly diversion limitations were placed on both rights as a whole.

c. Application 19629 now held by Tahoe Paradise Water and Gas Company, for which a petition amending the place of use was approved. Application 19629 itself was approved for diversion from Coyote Creek tributary to the Upper Truckee River. In addition to maximum annual and monthly limitations imposed upon A-19629, total maximum annual and monthly limitations were imposed upon all rights held by Tahoe Paradise Water and Gas Company.

d. Application 19819 which was approved for diversion from Lake Tahoe by Agate Bay Water Co. Maximum annual and monthly limitations were imposed with the added stipulation that water be completely put to use by 1970.

e. Application 19845 which was approved for diversion from Lake Tahoe by Tahoe City P.U.D. to service the Tahoe City area. Maximum annual and monthly limitations were imposed with the stipulation that water be put to use by 1970.

f. Application 20137 which was approved for diversion from Lake Tahoe by West Tahoe Water Company (Beryl Smith and Robert Williams). Maximum annual and monthly limitations were imposed with the stipulation that water be put to use by 1970. To date, this right has never been developed.

Decision 1200 (1964) - Approval was given to Application 19965 for diversion from the Truckee River by Tahoe Paradise, Inc., for purposes of maintaining a recreational reservoir. Storage and diversion limitations were imposed with the provision that minimum seasonal flows be maintained in the Truckee River for fishery protection. This use was recognized as being subordinate to any potential future domestic or municipal needs.

Decision 1207 (1964) - This decision involved the following two applications:

a. Application 20487 which was approved for diversion from Madden Creek by Madden Creek Water Company. Maximum annual and monthly limitations were imposed with the added stipulation that water be put to use by 1970.

b. Application 21398, now held by Tahoe City P.U.D., which was approved for diversion from Lake Tahoe to serve the Dollar Hill area. Maximum annual and monthly limitations on both A-19111 and A-21398 were imposed as a whole, with the stipulation that water be put to use by 1970.

Decision 1262 (1966) - Application 22112, held by E. B. Marr (Tahoe Cedars Water Company) was approved, in part, for diversion from Lake Tahoe. Maximum annual and monthly limitations were imposed, with the stipulation that water be put to use by 1970.

In addition to the protested rights approved pursuant to a water rights hearing and subsequent decision by the State Board, numerous other unprotested appropriative rights have been approved by the State Board or its predecessors since 1914. Currently a total of 136 appropriative filings are still actively on file with the State Board.

In 1969 the State Board directed its staff to conduct a study of water use and water rights within the California portion of the Lake Tahoe Basin. At that time, the total face value of all permitted, and licensed appropriative rights and pending applications amounted to more than twice the limitations imposed by the Interstate Water Compact. The 1969 report indicated, however, that total diversion for use in the California portion of the Basin was about 9,600 acre-feet/annum (afa), with 6,300 afa being diverted under appropriative rights on file with the Board, while the remaining 3,300 afa was obtained through other diversions (both surface and groundwater) not on file with the

State Board. The 1969 study further found that the average annual per capita use was 125 gallons/capita/day. Since 1969, no new appropriative permits have been issued by the State Board for appropriative diversions and use within the California portion of the Lake Tahoe Basin.

In 1972, the State Board adopted a "Policy for the Administration of Water Rights in the Lake Tahoe Basin". Briefly stated, this policy provided as follows:

1. Issuance of new water right permits shall be limited so that their aggregate face value, in combination with existing permits and licenses and use under other rights including ground water, shall not exceed 23,000 acre-feet per annum.

2. The initial time allowed to complete construction work and full beneficial use of water under a permit shall not exceed eight years.

3. Extensions of time to complete construction and use of water under a permit shall not exceed three years.

4. The quantity of water allowed for domestic purposes shall be limited, ordinarily, to 540 gallons per day per dwelling during the month of maximum use.

5. Land use densities in the place of use, as authorized by local ordinances, or as may be modified by the final order of the Tahoe Regional Planning Agency, shall be used in determining the extent of water requirements.

6. Existing permits, as they come up for extension of time, will be reviewed to assure that the water allocation does not exceed the provisions of paragraphs 4 and 5.

7. Existing licenses will be reviewed periodically with a view to a reduction of the licensed amount if it appears that the use of water has substantially declined since the issuance of license.

8. The Board will maintain close liaison with the Planning Agency (TRPA) and counties so as to be advised of all land zoning affecting the place of use of the permittees and licensees within the Basin.

Since 1972, modifications to this policy have been considered but never acted upon. In addition, legislation has been sought to give the State Board increased jurisdiction over groundwater and recordation of groundwater diversions. Such legislation has never been enacted.

In 1976, notice was given to all water users in the Lake Tahoe and Truckee River Basin that the United States Supreme Court Decision in U.S. v. Cappaert, which reaffirmed the reservation principle, cast doubt on the further availability of water for diversion in the Lake Tahoe Basin. This uncertainty was due to claims made by the Paiute Indian Tribe for sufficient water to maintain Pyramid Lake, part of a federal Indian reservation. The notice indicated that:

> "....the State Board will either (1) license the uses under these existing permits based on the amount of water which has been applied to beneficial use, or (2) if petitions for extension of time are filed, hold hearings on the petitions".
>
> "At hearings held on petitions for extension of time, the State Board will consider the public interest in increased use of water in the Lake Tahoe and Truckee Basins. In determining the public interest, the State Board will consider evidence on the uses proposed to be made of an increase in water supply. The State Board will also consider evidence of the environmental impact of such proposed uses...."

Table II-2 indicates those appropriative water right permits which are in need of extensions of time within the Lake Tahoe Basin.

In December 1977, the State Board authorized its staff to conduct another study of water use and water rights within the Lake Tahoe Basin. This report is the result of those efforts.

TABLE II-2

CALIFORNIA WATER RIGHT
PERMITS FOR WHICH EXTENSIONS OF TIME ARE PENDING BEFORE
THE STATE BOARD WITHIN THE LAKE TAHOE BASIN

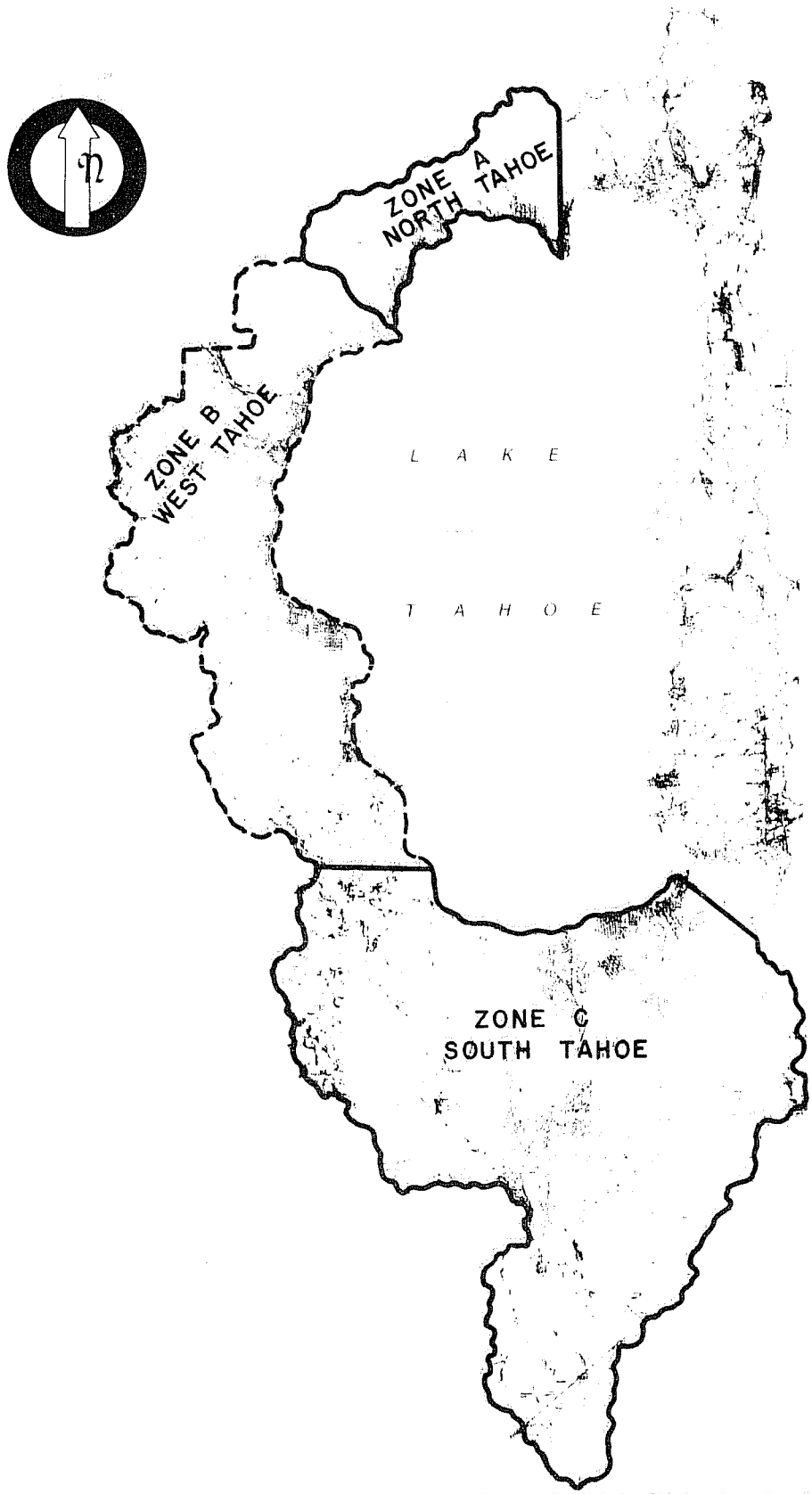
Permit	Application	Permittee
679*	1379	North Tahoe Public Utility District
12049*	18414	North Tahoe Public Utility District
13525*	17139	North Tahoe Public Utility District
15582*	17149	North Tahoe Public Utility District
15581*	17235	North Tahoe Public Utility District
6642	11183	Beryl S. Smith
12497	19072	Beryl S. Smith
7756	11449	U. S. Forest Service - Tahoe Basin Management Unit
10067	11993	South Tahoe Public Utility District
9232	14921	Lake Forest Water Company
14931	21719	Lake Forest Water Company
13527	18030	Tahoe Paradise Water and Gas Company
13528	18031	Tahoe Paradise Water and Gas Company
13529	18038	Tahoe Paradise Water and Gas Company
13530	18039	Tahoe Paradise Water and Gas Company
14335	19629	Tahoe Paradise Water and Gas Company
14330	18248	Fulton Water Company, Inc.
14332	19510	Fulton Water Company, Inc.
14331	19509	Fulton Water Company, Inc.
13531	18283	Tahoe City Public Utility District
14334	19111	Tahoe City Public Utility District
14337	19845	Tahoe City Public Utility District
14746	21398	Tahoe City Public Utility District
14572	21465	Tahoe City Public Utility District
14938	18934	Helen T. Alrich
14336	19819	Agate Bay Water Company
14675	19965	Tahoe Paradise Resort
14718	20487	Earl B. Marr
15296	22173	Earl B. and Ethel B. Marr
15241	22640	Lakeside Park Association
15771	22651	U. S. Forest Service - Tahoe Basin Management Unit

*Limited extensions were given to those permits on April 19, 1979, until December 31, 1980.

SECTION III

WATER USE IN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

FIGURE III-1



CALIFORNIA WATER USE ZONES

SECTION III

WATER USE IN THE CALIFORNIA OF THE LAKE TAHOE BASIN

A. INTRODUCTION

For purposes of analyzing water use, in this report the California portion of the Lake Tahoe Basin was divided into three zones pictured in Figure III-1. These zones basically correspond to the sewage service areas of the basin as follows:

North Tahoe, Zone A - North Tahoe P.U.D.
West Tahoe, Zone B - Tahoe City P.U.D.
South Tahoe, Zone C - South Tahoe P.U.D.

The basin was divided into these three zones to allow comparison between the quantity of water diverted for use and the quantity of water appearing as sewage flow. Furthermore, the water companies or use areas within each zone appeared to have similar service area characteristics, service area interconnections, and regional intra-dependence. For example, while the majority of commercial water use in a particular zone might be concentrated in the service area of only one water company or use area, the remainder of the zone tends to rely for its commercial services on customers of that particular water company rather than visiting businesses in other zones. In this manner, each zone may be treated as a hypothetically independent region. Total water diverted for use within each zone, when divided by the number of households or total population, will accurately represent the overall average unit or per capita water demand within that zone. Thus, the unit water use values determined on this basis reflect the water use characteristics of each zone. The only major deviation occurs at the north and south stateline areas where unit water use in Nevada may appear higher due to use by temporary visitors from the California portion of the Basin.

Further discussion of water use in the California portion of the basin is broken down as follows:

- o Diversions for Municipal and Domestic Use - The discussion is organized on a zonal basis giving consideration to present and potential land use and population, present and potential water diversion for use, and present and potential unit water use values. These diversions are considered to be diversions for consumptive use as required for the maintenance of residential and visitor households including associated commercial water use. Water use for landscape irrigation associated with residential and commercial development is also included. This category accounts for the majority of significant diversions for consumptive water use. Detailed analysis of the individual water use areas in each zone are included in the separately bound Appendices A, B and C.

- o Diversions for Irrigation or Agricultural Use - These water uses, also considered diversions for consumptive use, includes two categories: 1) golf course irrigation, and 2) water use for pasture or for irrigation of school playgrounds.

- o Diversions for Lake Storage and Stream Flow Enhancement - These diversions include reservior storage for stream flow and fishery maintenance and other diversions for recreational uses. Most water uses in this category are diversions by the U. S. Forest Service.

- o Interstate and Interbasin Diversions - In most cases these diversions are a direct depletion of flow to the Lake Tahoe Basin.

- o Water Rights Considerations - Water development potential in view of current development trends is discussed in detail including a breakdown of sources of water supply and applicable water rights.

B. DIVERSIONS FOR MUNICIPAL AND DOMESTIC USE

Water Use Areas

Each of the three zones includes many water use areas. In most cases these areas correspond to the service areas of individual water companies which

operate within each zone. Complete detailed analyses of the various water use areas appear in the separately bound appendices to this report. The discussion presented here is a summary of the individual system analyses. The municipal and domestic water systems or water use areas appearing in each zone are listed in Tables III-1, III-2, III-3. For each area the present average rate of annual water demand and the maximum historical annual water demand is listed. Along with these tables appear Figures III-2, III-3, and III-4 which indicate the relative locations of each of the water use areas within each zone. More detailed figures and maps appear in the Appendices.

In Table III-1 through III-3, the letters UVA (unit value analysis) identify those water use areas where no reliable information exists on the amount of water diverted for use. In these instances, water diversion estimates were made on the basis of land use characteristics within the systems and the application of unit water use (i.e., water use per dwelling or development unit) known for adjacent or similar water systems. This approach was used extensively only for West Tahoe, Zone B. This zone includes numerous small systems which do not maintain any substantial records of water use, and for which water use could not be estimated from electric meter records due to diversion and distribution system peculiarities. Unit value analyses were also performed for miscellaneous domestic systems in Zone A and C and for Lukins Brothers Water Company in Zone C.

All municipal and domestic water use areas in Zones A and B are sewered. However, in South Tahoe, Zone C, several non-sewered domestic water systems are operating. These systems are generally indentified in Table III-3 and Figure III-4.

Land Use, Residential Occupancy, and Population

A summary of existing and projected future residential land use within the California portion of the Lake Tahoe Basin is presented in Table III-4 and shown graphically in Figure III-5. The California portion of the Lake Tahoe Basin has seen approximately a 14% increase in total residential dwelling

TABLE III-1

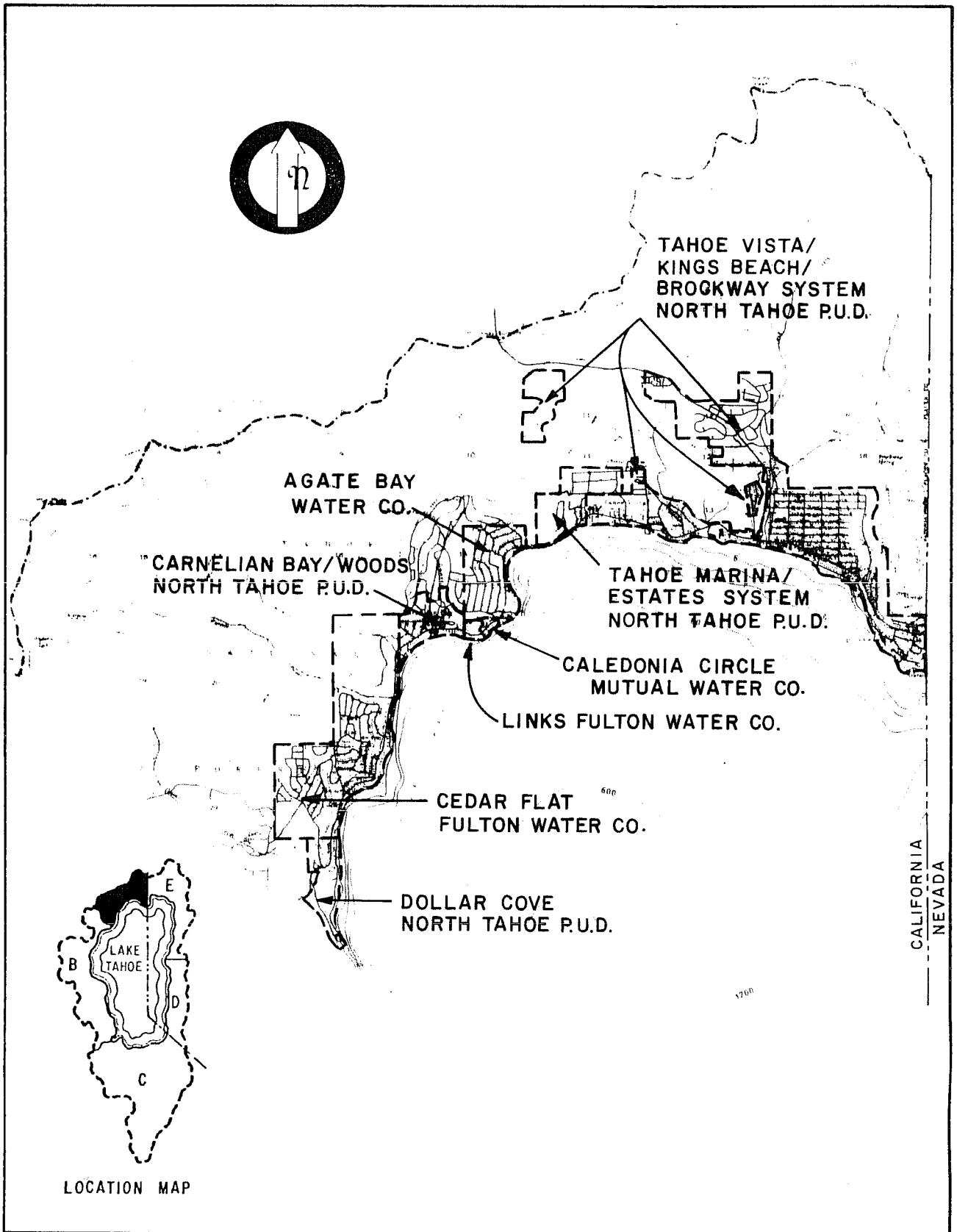
NORTH TAHOE, ZONE A MUNICIPAL AND DOMESTIC WATER USE AREAS

WATER USE AREAS	TOTAL WATER USE (AFA) Present Average	Maximum Historical	(Year)
A. Municipal and Large Domestic Water Systems			
1. Fulton Water Company:			
.Links System	5.4	7.5	(76)
.Cedar Flat System	238.8	223.1	(75)
2. Agate Bay Water Company	200.4	191.1	(76)
3. North Tahoe P.U.D.			
.Dollar Cove System	85.0	88.7	(77)
.Carnelian System	91.6	95.6	(77)
.Tahoe Marina/Estates	55.4	59.3	(76)
.Tahoe Vista, Kings Beach Brockway System	997.1	1100.0	(77)
B. Miscellaneous Domestic Water Systems			
.Caledonia Circle and other Private Diverters (UVA)	21.4	32.1	(76)
Total	1676	1797	

units in the three-year period from 1974 to 1977. Full development (100%) of existing subdivided residential property will result in a 58% increase over 1977 levels of development while ultimate development under either the CTRPA or TRPA general plan will result in increases of 76% and 104%, respectively. Commercial and other non-residential water users are not included in this analysis for three prime reasons.

1) Separating commercial and non-residential water use from residential water use proved impossible due to lack of detailed metering records within nearly all the water systems.

FIGURE III-2



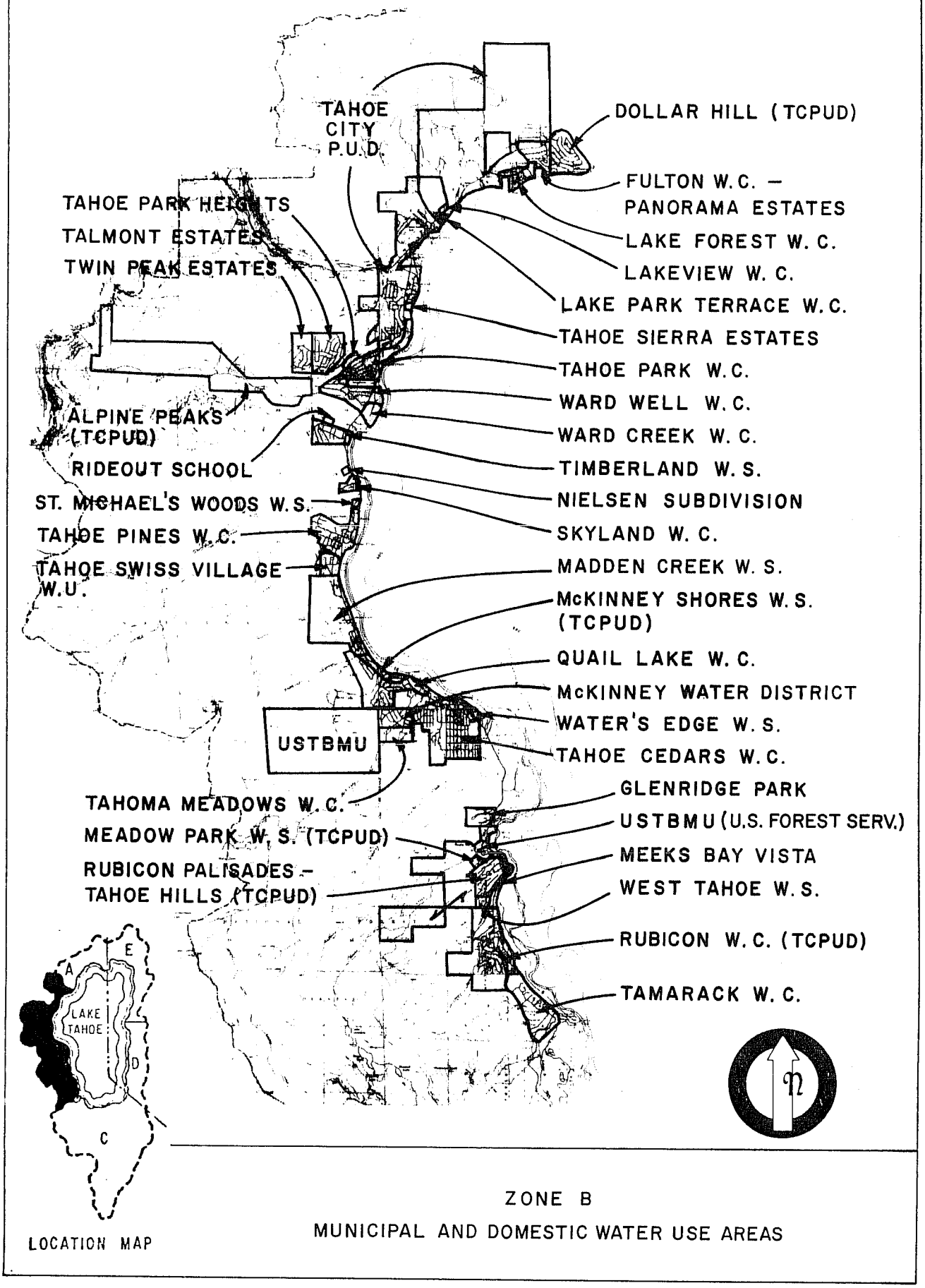
ZONE A

MUNICIPAL AND DOMESTIC WATER USE AREAS

TABLE III-2
ZONE B MUNICIPAL AND DOMESTIC WATER USE AREAS

WATER USE AREAS	TOTAL WATER USE (AFA) Present Average	Maximum Historical
A) Municipal or Domestic Systems with Diversion Data		
1) Tahoe City P.U.D.		
A. Dollar Point	191	180
B. Tahoe City	850	841
C. Rubicon Properties	135	158
2) Fulton Water Company-Panorama	38.6	34.0
3) Lake Forest	73.8	78
4) Tahoe Sierra Estates	16.2	17.3
5) Timberland	62.9	87.3
6) Skyland	23.4	28.9
7) Glenridge	11.8	11.6
B) Municpal or Domestic Systems without Diversion Data (UVA)		
1) Tahoe City P.U.D.		
A. Alpine Peaks (UVA)	6.1	5.2
B. McKinney Shores (UVA)	24.6	28.2
C. Rubicon Palisades/Tahoe Hills (UVA)	11.5	11.6
2) Lakeview Water Company (UVA)	5.4	6.3
3) Lake Park Terrace (UVA)	4.9	5.8
4) Tahoe Park (UVA)	123.4	145.5
5) Tahoe Park Heights (UVA)	4.9	5.8
6) Talmont Estates (UVA)	72.1	74.6
7) Ward Creek (UVA)	37.2	38.7
8) Ward Well (UVA)	82.3	90.7
9) Tahoe Pines (UVA)	93.9	103.5
10) Tahoe Swiss Village (UVA)	25.5	25.2
11) Madden Creek	63.9	73.4
12) Quail Lake (UVA)	128.6	140.6
13) McKinney Water District (UVA)	65.1	50.6
14) Tahoma Meadows (UVA)	10.7	11.6
15) Tahoe Cedars (UVA)	328.8	320.5
16) Waters Edge Condominums (UVA)	14.4	16.9
17) Meeks Bay Vista (UVA)	45.1	55.0
18) Tamarack (UVA)	7.0	7.8
C) Miscellaneous and Private W.S.		
1) Private Diversions (300) (UVA)	123.4	145.5
2) St. Michaels Woods(UVA)	1.23	1.46
3) Nielsen Subdivision (UVA)	3.70	4.37
4) Douglas Dale Lodge (UVA)	4.94	5.83
5) Patterson Well (UVA)	1.23	1.46
6) West Tahoe W.S.	6.5	6.5
7) Meadow Park W.S. (UVA)	4.94	5.83
8) Tahoe City Mobile Home (UVA)	12.3	12.3
9) Rideout School (UVA)	7.4	7.4
D) State Parks	29.9	29.9
E) U.S. Forest Service Parks & Lawns	47.7	47.7
Total	2801	2922

FIGURE III - 3



ZONE B

MUNICIPAL AND DOMESTIC WATER USE AREAS

LOCATION MAP

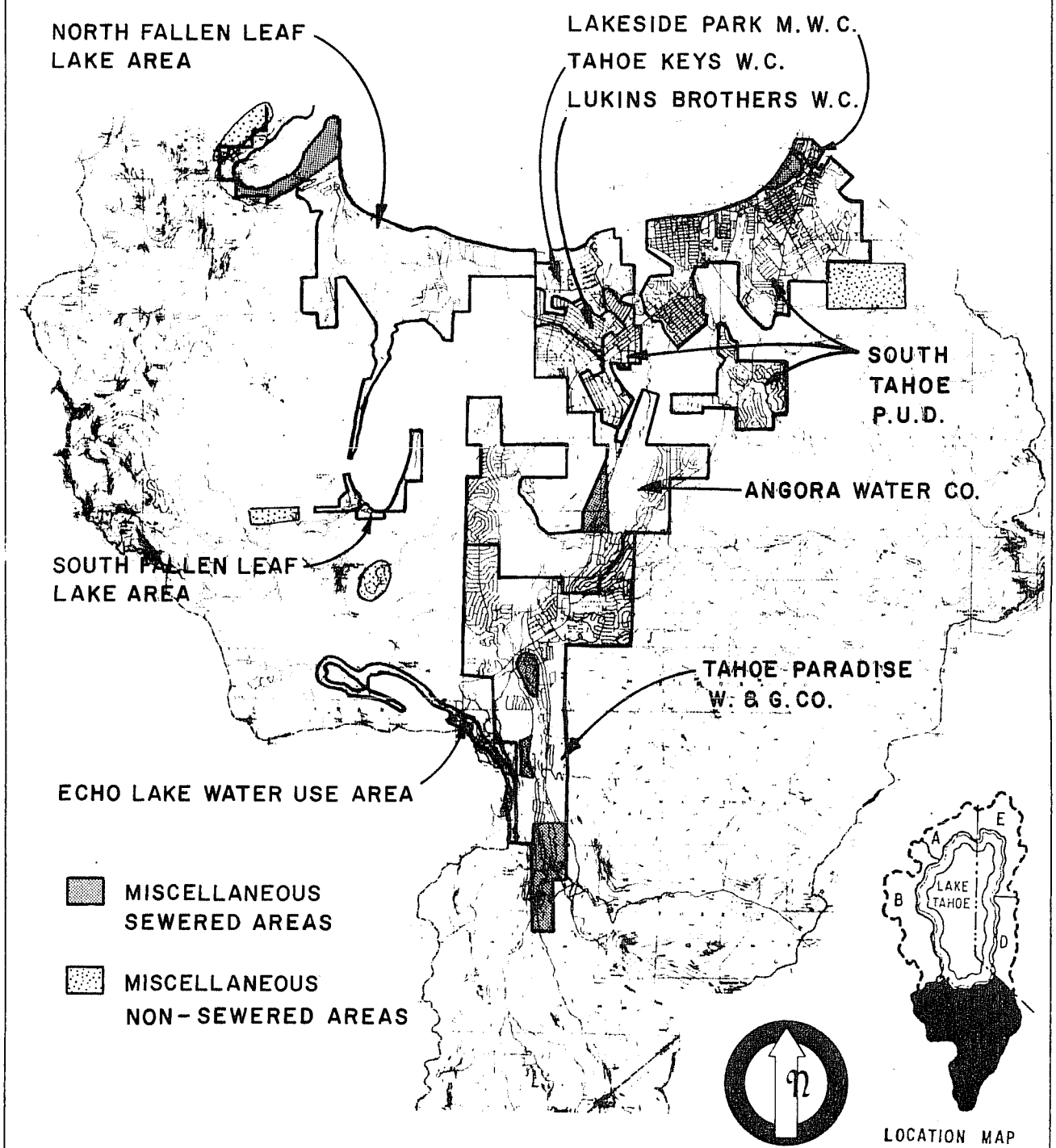
TABLE III-3

SOUTH TAHOE ZONE C MUNICIPAL AND DOMESTIC WATER USE AREAS

WATER USE AREAS	TOTAL WATER USE (AFA) Present Average	Maximum Historical Year
A. Municipal Water Systems		
STPUD Service Area	3964	4024 (76)
Lakeside Service Area	389	527 (74)
Tahoe Keys Service Area	556	600 (77)
Lukins Service Area (UVA)	334	328 (76)
Angora Service Area	650	594 (76)
TPW&G Service Area	614	586 (76)
Misc. Private Well Users	490	500 (76)
B. Sewered Domestic & Recreational Systems		
N. Fallen Leaf Lake Area	107	122 (76)
Misc. Sewered Areas	49	52 (76)
C. Non-Sewered Domestic and Recreational Systems		
S. Fallen Leaf Lake Area	41	41 (76)
Echo Lake Area	17	31 (70)
Misc. Non-Sewered Areas	26	26 (76)
Total	7237	7431

2) By assuming that total water diversion divided by total residential units is representative of the average unit water demand exerted by the Tahoe population, it is not necessary to separate commercial water use. Other than an indeterminable amount of water use by day-users, most commercial and nonresidential water use is generated by residents and overnight vistors who occupy residential dwelling units.

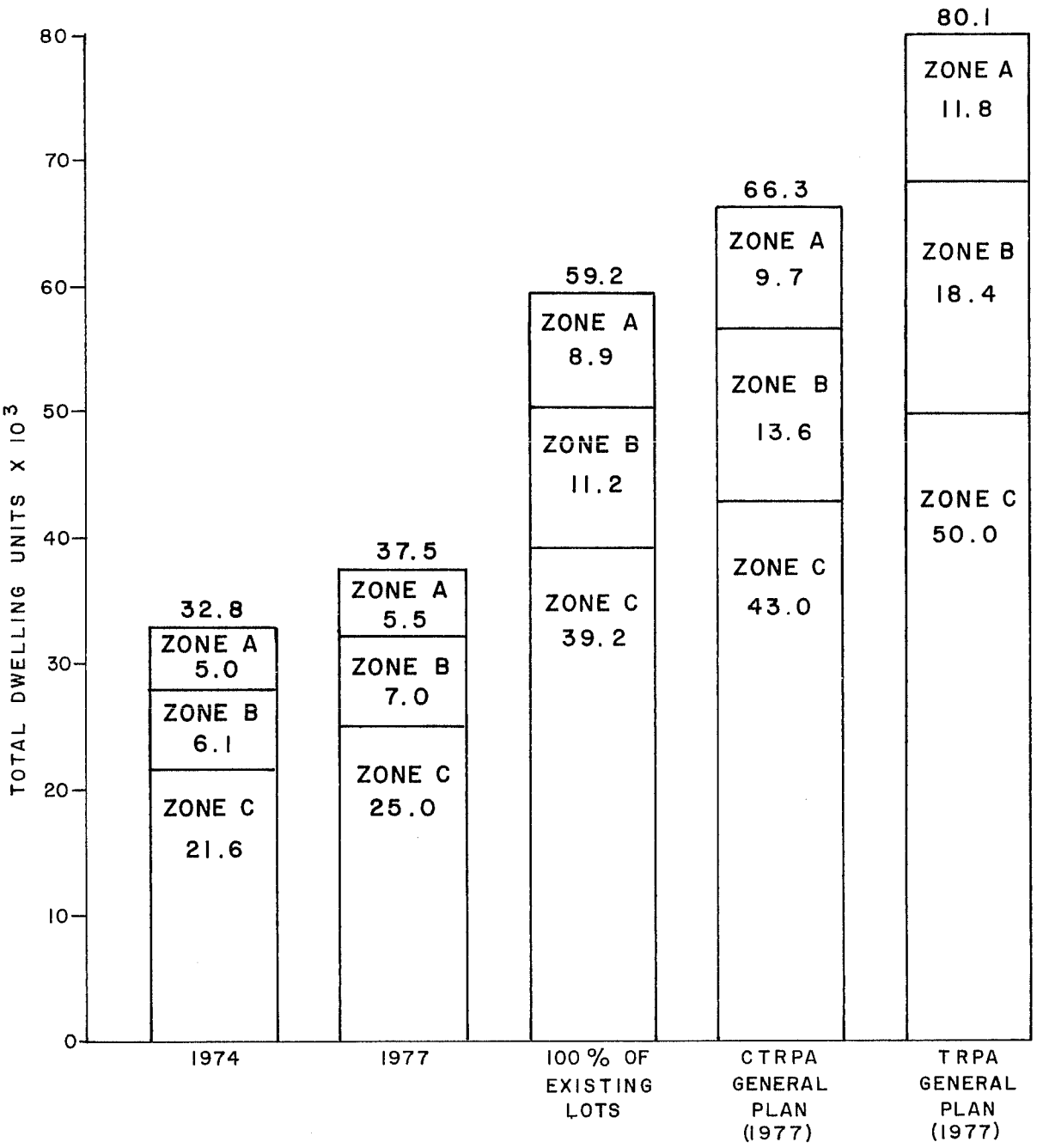
FIGURE III - 4



ZONE C

MUNICIPAL AND DOMESTIC WATER USE AREAS

FIGURE III-5



NUMBER OF RESIDENTIAL DWELLING UNITS FOR EXISTING AND POTENTIAL LEVELS OF FUTURE DEVELOPMENT WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN.

3) By assuming that future increases in resident overnight visitor population will result in equally proportional increases in residential and commercial water use, the separation of commercial and residential water use is not justified.

Where possible, information pertaining to 1974 through 1977 levels of residential development was based upon reliable information provided by the operators of individual water utilities. When this data was unreliable, land use data based upon 1974 and 1978 lot counts conducted by CTRPA were substituted with interpolation for intermediate years. The individual land use breakdowns for each of the water use areas are provided in the appendices. The individual land use counts for each water use area, when totalled for each Zone as listed in Table III-4 correspond quite closely to the total counts provided by CTRPA. For example, the total number of dwelling units derived from the tabulation of individual water systems for Zone C is 24672 units for 1977. CTRPA tabulations for 1978 yield 25073 dwelling units, a 1.6% difference which closely reflects the limited growth observed in Zone C between 1977 and 1978 due to imposition of a sewage connection limitation by the California Regional Water Quality Control Board, Lahontan Region.

In addition to existing development levels, potential future development levels are also considered. As listed in Table III-4, future levels of development include:

- Full development (100%) of existing subdivided lands.

- Potential development with additional subdivisions according to the CTRPA general plan (as of 1977).

- Potential development with additional subdivisions according to the TRPA general plan (as of 1977).

As with any projection of future events, a number of assumptions must be made. This is particularly true at Tahoe where certain land use zones allow

TABLE III-4

PRESENT AND PROJECTED LAND USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

VACANT RESIDENTIAL LOTS (1977)

	Vacant Lots*
North Tahoe, Zone A	2,800
West Tahoe, Zone B	3,600
South Tahoe, Zone C	11,100
	17,500

EXISTING RESIDENTIAL DEVELOPMENT

1974	Single Family Units	Multiple Family Units	Mobile Home Units	Motel Units	Camp-ground Units	Total Dwelling Units
Zone A	2053	1494	162	1283	0	4992
Zone B	3789	1144	122	333	726	6114
Zone C	8363	4556	658	6915	1158	21650
Total	14205	7194	942	8531	1884	32756
1977						
Zone A	2512	1565	162	1252	0	5491
Zone B	4526	1309	122	359	776	7042
Zone C	11189	4584	683	7023	1193	24997
Total	18227	7458	967	8634	1969	37530
ESTIMATED 100% BUILDOUT OF EXISTING LOTS						
Zone A	5124	1619	162	1964	0	8869
Zone B	8375	1560	122	371	726	11154
Zone C	22795	4584	1083	9237	1193	39217
Total	36294	7763	1367	11572	1919	59240
POTENTIAL FUTURE RESIDENTIAL DEVELOPMENT						
CTRPA GENERAL PLAN						
Zone A	5971	1619	162	1964	-	9716
Zone B	9733	2552	122	456	726	13589
Zone C	24778	5816	1083	10097	1193	42967
Total	40482	9987	1367	12517	1919	66272
TRPA GENERAL PLAN						
Zone A	8056	1619	162	1964	-	11801
Zone B	13607	3420	122	506	726	18381
Zone C	29825	6894	1083	10957	1193	49952
Total	51488	11933	1367	13427	1919	80134

* Twenty-five foot lots are counted two for one.

TABLE III--5

ASSUMPTIONS USED TO ESTIMATE FUTURE LEVELS OF RESIDENTIAL LAND USE DEVELOPMENT

FULL DEVELOPMENT OF EXISTING SUBDIVIDED LANDS

1. Vacant lots counts provided by CTRPA were used unless more reliable information was available from operators of individual water systems.

2. All vacant lots in areas zoned GF, RE, LDR, MDR, and HDR were assumed to be developed as single family home sites.

3. Further multiple family units are assumed not to be developed. CTRPA ordinances preclude the possibility of multiple family units until 85% of the vacant lots existing as of August 1975 are developed. For purposes of this report, this is assumed essentially to preclude development of multiple family units on existing lots or parcels.

4. All vacant lots in areas zoned TC and MTR are assumed to be developed as Motel Units at a density of 20 and 15 units per acre respectively.

5. No other residential dwelling units will be built in areas zoned REC, GC, PS, and CR.

6. For practical purposes, in terms of water usage, all remaining twenty-five (25) foot lots were assumed to be developed at a density of 1/2 single family dwelling unit per vacant 25 foot lot.

POTENTIAL DEVELOPMENT OF ADDITIONAL SUBDIVIDED AREAS ACCORDING TO CTRPA AND TRPA GENERAL PLANS

1. All areas zoned for potential future subdivision, regardless of land capacity, were planimetered and assumed for development at either CTRPA or TRPA densities as follows:

	Dwelling Units/Acres		Structure
	CTRPA	TRPA	Type
Rural Estates	1	1	Single(SFU)
Low Density Residential (LDR)	1	4	Single(SFU)
Medium Density Residential (MDR)	4	8	Single(SFU)
High Density Residential (HDR)	8	15	Multiple(MFU)
Tourist Commercial (TC)	20	40	Hotel/Motel
Medium Tourist Residential (MTR)	15	15	Hotel/Motel

2. All other land use zones are assumed not developed or not developed with residential units.

for a wide variety of uses ranging from residential to commercial. The general assumption used to generate levels of future development are listed in Table III-5.

Unfortunately, recent population data does not exist except for the year 1974. In that year, the California Department of Transportation and the Nevada Division of Highways cooperated to conduct a survey entitled "Tahoe Regional Transportation Study" (TRTS). The TRTS was based, in part, upon a 10% door-to-door survey of residential units within each minor traffic zone of the Lake Tahoe Basin. In addition to information such as income, resident/nonresident status, employment, etc., the TRTS survey determined the occupancy rate (percentage of occupied dwelling units) and the population per occupied dwelling unit for the following types of residential structures:

- Single Family Units (SFU's)
- Multiple Family Units (MFU'S)
- Hotel/Motel Units
- Mobile Homes
- Campground Units

To determine the extent of seasonal population fluctuation the TRTS survey was conducted during two 54 day periods in the winter and summer of 1974:

January 14, 1974 through March 3, 1974
July 22, 1974 through September 13, 1974

By multiplying the occupancy rate and the population per occupied unit with the known number of residential dwelling units constructed as of 1974, a reliable estimate can be made of the average summer and winter population levels. These population levels do not represent daily peak or low population levels, but represent the average population level that one would expect to find over the two 54 day periods. Maximum summer population levels based upon 100% summer occupancy are estimated to be about 20% higher than the summer average.

Data on occupancy rates, population per occupied dwelling unit and total population summarized for each zone (A,B,C) and for the Basin as a whole is presented in Tables III-6, III-7, III-8, and III-9. Monthly distribution of basinwide population appears in Figure III-6. This figure is based upon the known summer peak and winter low population levels with monthly population values based upon the known distribution of water diversion for use correlated on a linear basis. In 1974 the overall occupancy rate of residential dwelling units was very low in comparison to other areas throughout the State. The annual average occupancy was 56% with seasonal occupancy ranging from a high of 72% during the 54-day summer peak period, to a low of 48% during the 54-day winter low period. These occupancy rates observed in the California portion of the Lake Tahoe Basin are reflective of the resort type of community and the high degree of weekend and seasonal nonresident visitors to the Basin. Throughout Northern California the average annual urban residential water use is in the range of 500 gallons/dwelling unit/day with occupancy rates of over 95%. At Lake Tahoe, with occupancy rates of 56%, water use is approximately 325 gallons per single family dwelling unit/day. It would appear that increased occupancy rates would lead to increased water use. The California Tahoe Regional Planning Agency (CTRPA), as a basis for determining impacts of land use development, assumes that the ultimate summer time occupancy rate at Lake Tahoe will approach 100%. The possibility of this occurring is increasing due to:

1) Increasing commercial development of Lake Tahoe, including Nevada casinos, which leads to greater permanent population to maintain and operate these facilities.

2) Increasing utilization of the Reno-Lake Tahoe area as a year-round destination resort.

3) Rapidly increasing housing demand and housing costs which have a tendency to result in higher occupancy rates and usage to justify the expense. In recent years there has been an increasing number of rental management agencies and integral ownership arrangements which,

TABLE III-6

NORTH TAHOE ZONE A 1974 RESIDENTIAL DEVELOPMENT WITH TRTS
OCCUPANCY AND POPULATION DATA

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per unit	Total Population
Single Family Units	2043	.65	3.38	4490
Multiple Family Units	1493	.41	3.68	2255
Mobile Homes	162	.67	2.00	217
Hotel/Motel Units	1283	.61	2.76	2163
Total	4981	.57	3.21	9125

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	2055	.47	3.20	3088
Multiple Family Units	1493	.38	5.10	2887
Mobile Homes	162	.72	2.98	348
Hotel/Motel Units	1283	.30	2.99	1151
Total	4993	.41	3.65	7474

Annual Average Occupancy: 43%
with 3.66 Persons/Dwelling Unit

Annual Average Population: 7800

in order to supply the increasing demand for vacation or temporary residential accommodations, will surely lead to higher occupancy and usage rates.

For comparative purposes, in addition to the estimated 1974 population profile, Figure III-6 also depicts the presently potential population profile which would have occurred in 1977 if occupancy rates were increased 40% with a seasonal occupancy rate ranging from a high of 100% during the 54-day summer period to a low of 67% during the 54-day winter low period. This potential population level is referred to as the potential future population profile at

TABLE III-7

WEST TAHOE ZONE B 1974 RESIDENTIAL DEVELOPMENT WITH TRTS
OCCUPANCY AND POPULATION DATA

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	3689	.65	3.80	9120
Multiple Family Units	1230	.54	3.42	2269
Mobile Homes	100	.88	1.86	164
Hotel/Motel Units	333	.58	2.71	523
Campground Units	726	.92	2.88	1922
Total	6078	.66	3.49	13,998

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	3689	.45	4.16	6903
Multiple Family Units	1230	.42	3.81	1970
Mobile Homes	100	.40	2.00	80
Hotel/Motel Units	333	.32	3.02	322
Total	5352	.43	4.03	9,275

Annual Average Occupancy: 51% with 3.63 Persons/Dwelling Units

Annual Average Population: 11,252

1974 buildout with 100% summer occupancy. Thus, for any level of development it is possible to discuss anticipated water use not only at the 1974 occupancy rate, but also at the "potential" or "full" occupancy rate. Based upon this analysis, Table III-10 summarizes various other population levels which may be anticipated at various levels of development for each of the zones and for the California portion as a whole. (See also Figures III-7 and III-8)

TABLE III-8

SOUTH TAHOE ZONE C 1974 RESIDENTIAL DEVELOPMENT WITH TRTS
OCCUPANCY AND POPULATION DATA

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	8473	.735	3.52	21892
Multiple Family Units	4582	.755	2.70	9360
Mobile Homes	658	.856	2.55	1435
Hotel/Motel Units	6905	.775	3.04	16288
Campground Units	1058	.904	3.46	3308
Total	21676	.764	3.16	52283

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	8060	.544	3.25	14249
Multiple Family Units	4582	.709	2.34	7592
Mobile Homes	658	.723	3.02	1437
Hotel/Motel Units	6732	.325	2.61	5714
Total	20032	.514	2.82	28992

Annual Average Occupancy: 60.3% with 2.96 Persons/Dwelling Units

Annual Average Population: 38688

On the basis of ultimate water use of 23,000 afa as specified in the Interstate Water Compact, and

- a continuation of the present distribution of housing unit types,
- a continuation of the present per capita water use (160 gal/capita/day) as discussed in a later portion of this section, and
- a seasonal population distribution as shown in Figure III-6.

TABLE III-9

TOTAL 1974 RESIDENTIAL DEVELOPMENT WITH TRTS OCCUPANCY AND POPULATION DATA FOR CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	14205	.701	3.57	35502
Multiple Family Units	7305	.648	2.93	13884
Mobile Homes	920	.826	2.39	1816
Hotel/Motel Units	8521	.743	3.00	18974
Campground Units	1784	.911	3.22	5230
Total	32735	.715	3.22	75406

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	13804	.508	3.46	24240
Multiple Family Units	7305	.593	2.87	12449
Mobile Homes	920	.687	3.33	2107
Hotel/Motel Units	8348	.321	2.68	7187
Total	30377	.482	3.12	45741

Annual Average Occupancy: 55.9% with 3.16 Persons/Dwelling Units

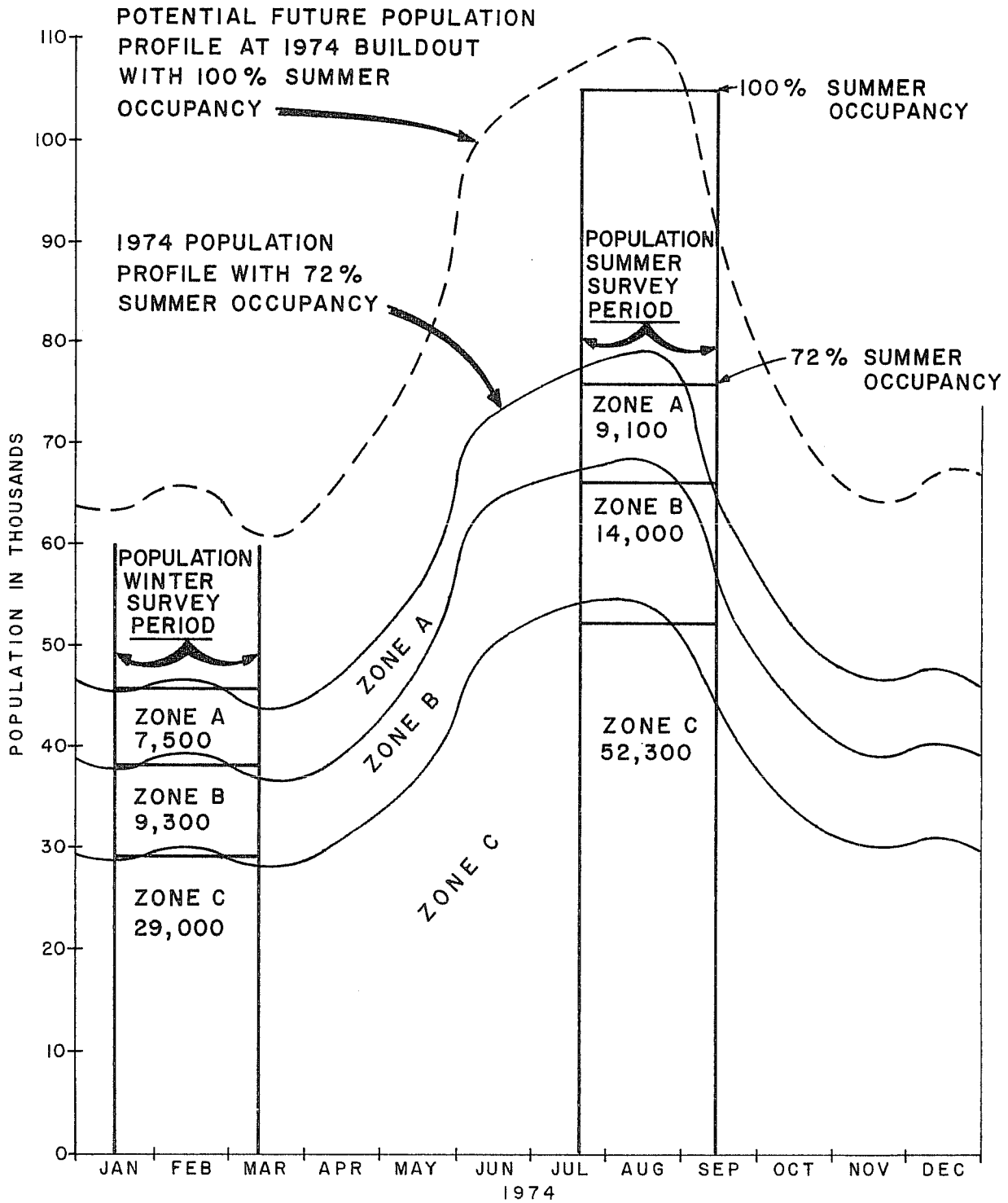
Annual Average Population: 57,740

Ultimate population, not including day use, on all public and private lands within the California portion of the Basin would be as follows:

ESTIMATED ULTIMATE POPULATION
BASED ON WATER ALLOCATION

a.	Peak day	180,000
b.	Summer Average	156,000
c.	Annual Average	120,000
d.	Winter Average	95,000

FIGURE III -6

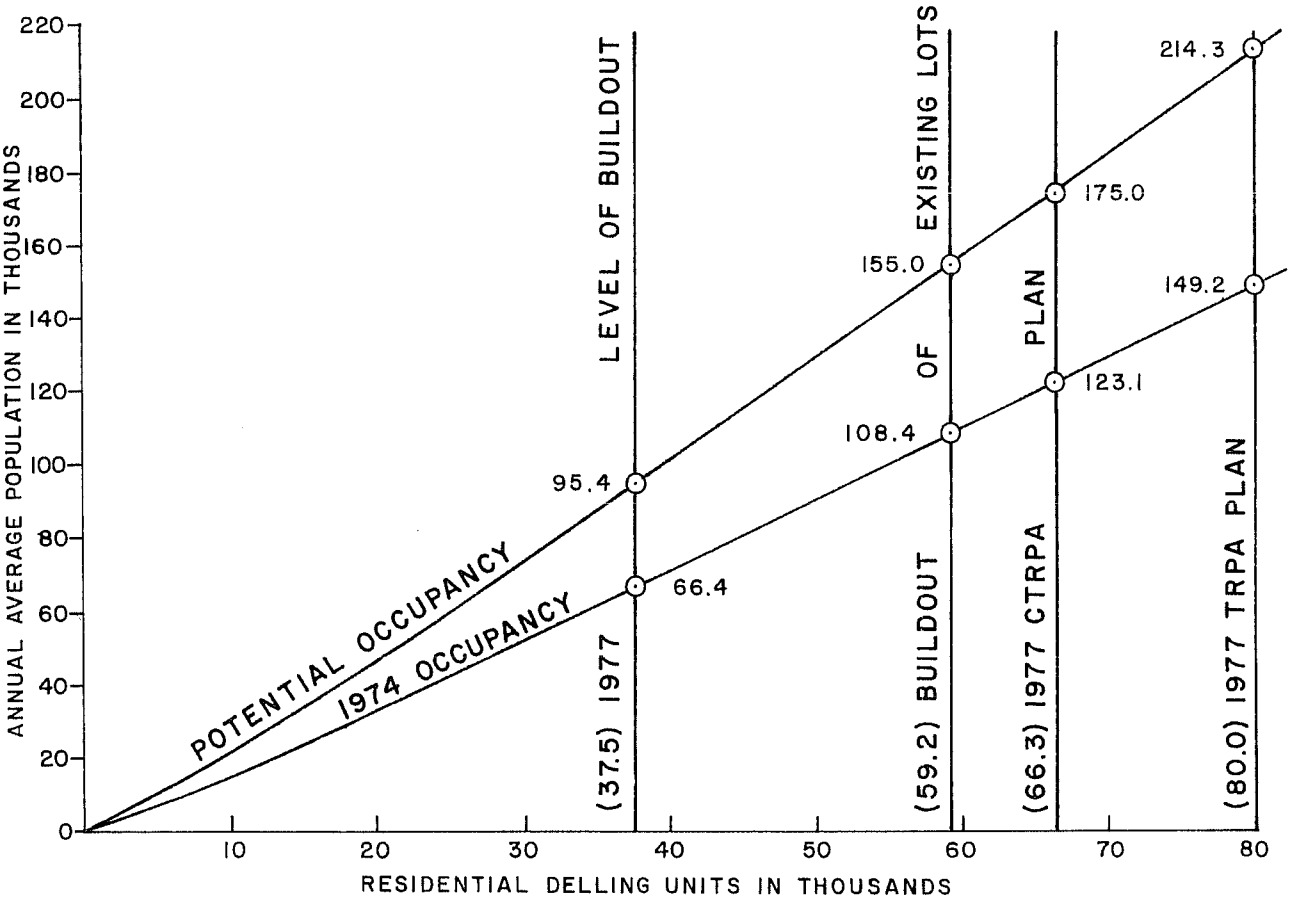


MONTHLY POPULATION DISTRIBUTION FOR THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN FOR 1974 AND POTENTIAL INCREASES IN OCCUPANCY RATE.

TABLE III-10
SUMMER, WINTER AND ANNUAL AVERAGE POPULATION
FOR CALIFORNIA TAHOE AT VARIOUS LEVELS OF
DEVELOPMENT

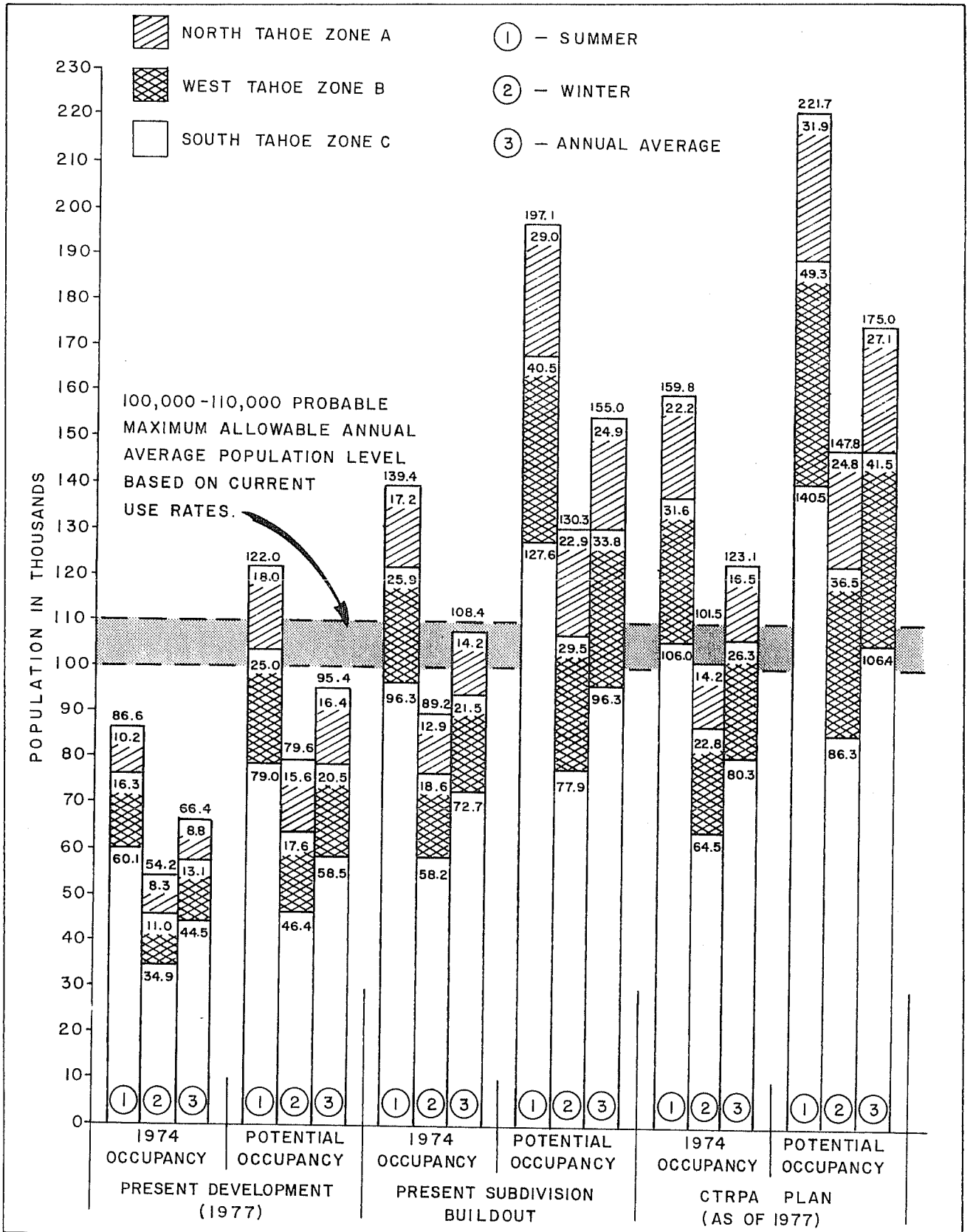
	POPULATION			
	ZONE 'A'	ZONE 'B'	ZONE 'C'	CALIF. TOTAL
I. Present Development (1977)				
A. 1974 Occupancy Rates				
1. Summer	10,200	16,300	60,100	86,600
2. Winter	8,300	11,000	34,900	54,200
3. Annual Average	8,800	13,100	44,500	66,400
B. Potential Occupancy				
1. Summer	18,000	25,000	79,000	122,000
2. Winter	15,600	17,600	46,400	79,600
3. Annual Average	16,400	20,500	58,500	95,400
II. Present Subdivision Buildout				
A. 1974 Occupancy				
1. Summer	17,200	25,900	96,300	139,400
2. Winter	12,900	18,600	58,200	89,200
3. Annual Average	14,200	21,500	72,700	108,400
B. Potential Occupancy				
1. Summer	29,000	40,500	127,600	197,100
2. Winter	22,900	29,500	77,900	130,300
3. Annual Average	24,900	33,800	96,300	155,000
III. CTRPA Plan (as of 1977)				
A. 1974 Occupancy				
1. Summer	22,200	31,600	106,000	159,800
2. Winter	14,200	22,800	64,500	101,500
3. Annual Average	16,500	26,300	80,300	123,100
B. Potential Occupancy				
1. Summer	31,900	49,300	140,500	221,700
2. Winter	24,800	36,500	86,300	147,800
3. Annual Average	27,100	41,500	106,400	175,000
IV. TRPA Plan (As of 1977)				
A. 1974 Occupancy				
1. Summer	23,700	42,900	123,300	189,900
2. Winter	17,300	31,500	75,900	124,700
3. Annual Average	19,200	36,000	94,000	149,200
B. Potential Occupancy				
1. Summer	38,900	67,100	163,800	269,800
2. Winter	29,600	50,300	101,800	241,700
3. Annual Average	32,700	56,900	124,700	214,300

FIGURE III-7

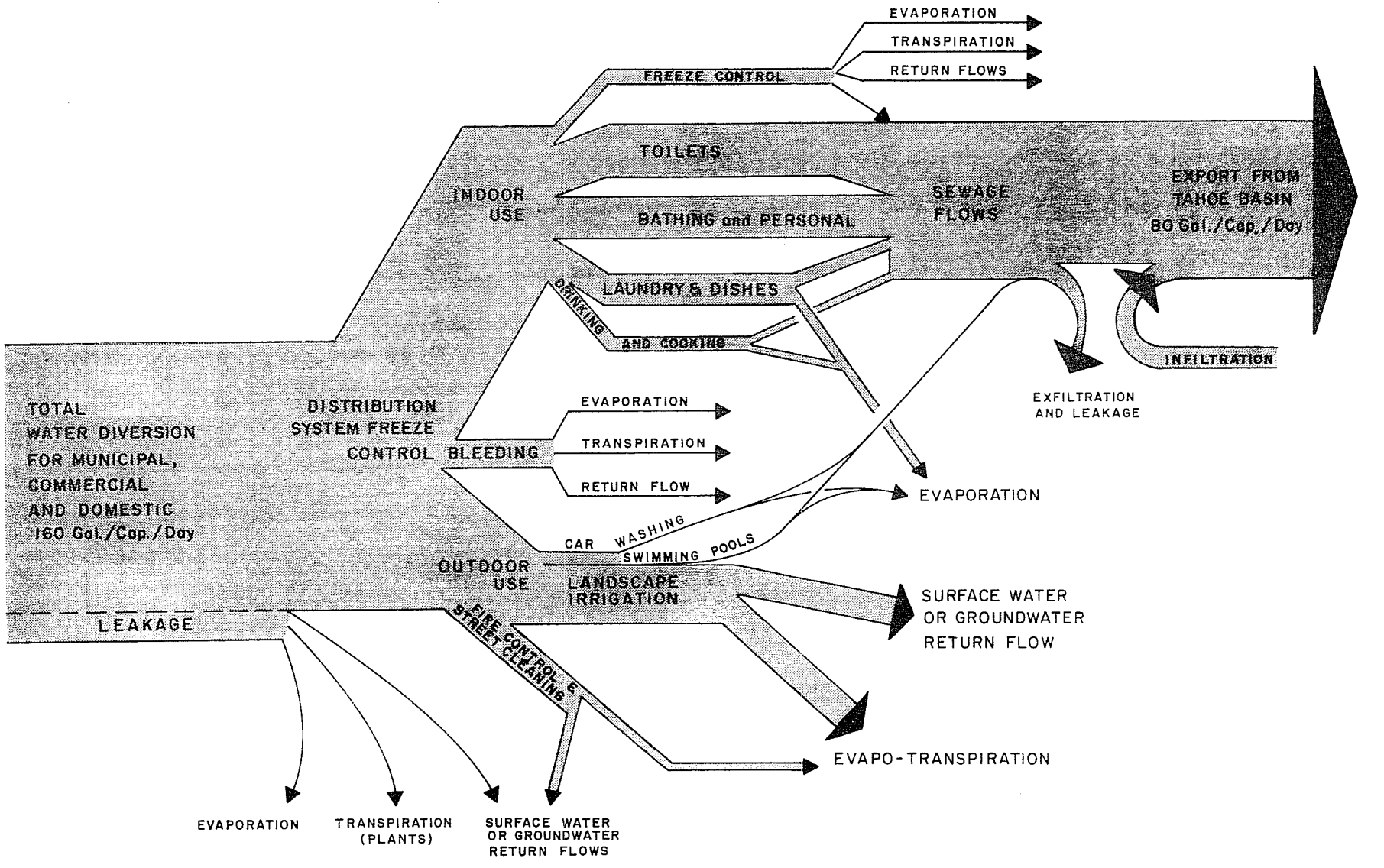


POPULATION LEVELS FOR VARIOUS LEVELS OF RESIDENTIAL DWELLING UNIT DEVELOPMENT AND OCCUPANCY RATES WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN. (SFU'S, MFU'S, MOBILE HOMES, MOTELS and CAMPGROUNDS)

FIGURE III - 8



PRESENT & POTENTIAL SEASONAL & ANNUAL AVERAGE POPULATION LEVELS BASED ON OBSERVED 1974 OCCUPANCY RATES & POTENTIAL OCCUPANCY RATES FOR POTENTIAL LEVELS OF DEVELOPMENT OF THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN.



LAKE TAHOE WATER USE FLOW DIAGRAM

FIGURE III-9

Water Diversion for Use

For purposes of this report "water use" required for municipal, commercial and domestic purposes is measured at the points of diversion. The Interstate Water Compact also calls for water use to be measured at these points, irrespective of its ultimate destination. A flow diagram pictured in Figure III-9 shows typical municipal and domestic uses to which water is put after the original diversion. The relative quantities are extremely variable not only throughout the Basin, but also within individual systems. No attempt has been made to quantify the magnitude of the uses involved. Tables III-11, III-12, III-13, and III-14 present the total monthly commercial, recreation, municipal and domestic water diversion for use within Zone A, Zone B, Zone C, and the California portion of the Tahoe Basin respectively.

The total water use values appearing in Tables III-11, III-12, and III-13 are based upon an intense one-year analysis of all water systems in the California portion of the Lake Tahoe Basin. Appearing in the separately bound appendices to this report are detailed discussions pertaining to the development of data for the individual systems. Essentially all areas of the California portion of the Lake Tahoe Basin are accounted for. The development of water diversion data for the various water systems or water use areas may be broken down as follows:

Municipal and Domestic Systems with Dependable Diversion Data. In these cases, the data was obtained from diversion meter records provided by the water company. By comparing the unit use rates (per dwelling unit or per capital) with those obtained for similar areas, the reliability of the data could be ascertained. These systems represent about 39% of the total municipal and domestic water diverted for use within the California portion of the Lake Tahoe Basin. Specifically, these systems are as follows:

Zone A (83% of A)

N. Tahoe P.U.D. - Kings Beach
Fulton (Links) Water Co.
Fulton (Cedar Flat) Water Co.
Agate Bay Water Co.
N. Tahoe P.U.D. - Carnelian

Zone B (2% of B)

Fulton (Panorama) Water Co.

Zone C (43% of C)

Lakeside Mutual Water Co.
Angora Water Co.
Tahoe Keys Water Co.
N. Fallen Leaf Lake Area
Tahoe Paradise W. and G. Co.
S. Tahoe P.U.D.
S. Fallen Leaf Lake Area
Echo Lake Area

Municipal and domestic water systems with no diversion data, but for which electric power data could be substituted. In these case, diversion data was estimated from known electrical power requirements of the diversion and/or distribution system. In some cases, correlations between diversions and power use were developed using data for periods when both power data and diversion data were known. In other cases, pump tests were conducted to determine specifically the efficiency and power conversion factors of the system's water pumps. This category of systems represents about 39 percent of the total municipal, domestic and irrigation water diverted for use within the California portion of the Lake Tahoe Basin. Specifically, these systems are as follows:

Zone A (3% of A)

N. Tahoe P.U.D. - Tahoe Marina/Estates

Zone B (51% of B)

T.C.P.U.D. - Dollar Point
T.C.P.U.D. - Tahoe City
T.C.P.U.D. - Rubicon Properties
Lake Forest Water Co.
Tahoe Sierra Estates
Timerland Water Co.
Skyland Water Co.
Glenridge Park Water Co.

Zone C (42% of C)

South Tahoe P.U.D.
Lake Tahoe Country Club

Municipal and Domestic Water Systems with no Diversion Data and for Which Electrical Power Data could not be Used. These systems are generally smaller companies which have gravity diversions, pump from groundwater, or pump to variable head pressure-tank distribution systems. In these cases, electrical power data could not be utilized with any degree of certainty. Thus, to estimate total diversion for use unit water use data (e.g., gallon/ day/dwelling unit) derived from water systems with similar service area characteristics were used. This category of water systems represents 22% of the total municipal, domestic and irrigation water diverted for use within the California portion of the Lake Tahoe Basin. Specifically these systems are as follows:

Zone A (14% of A)

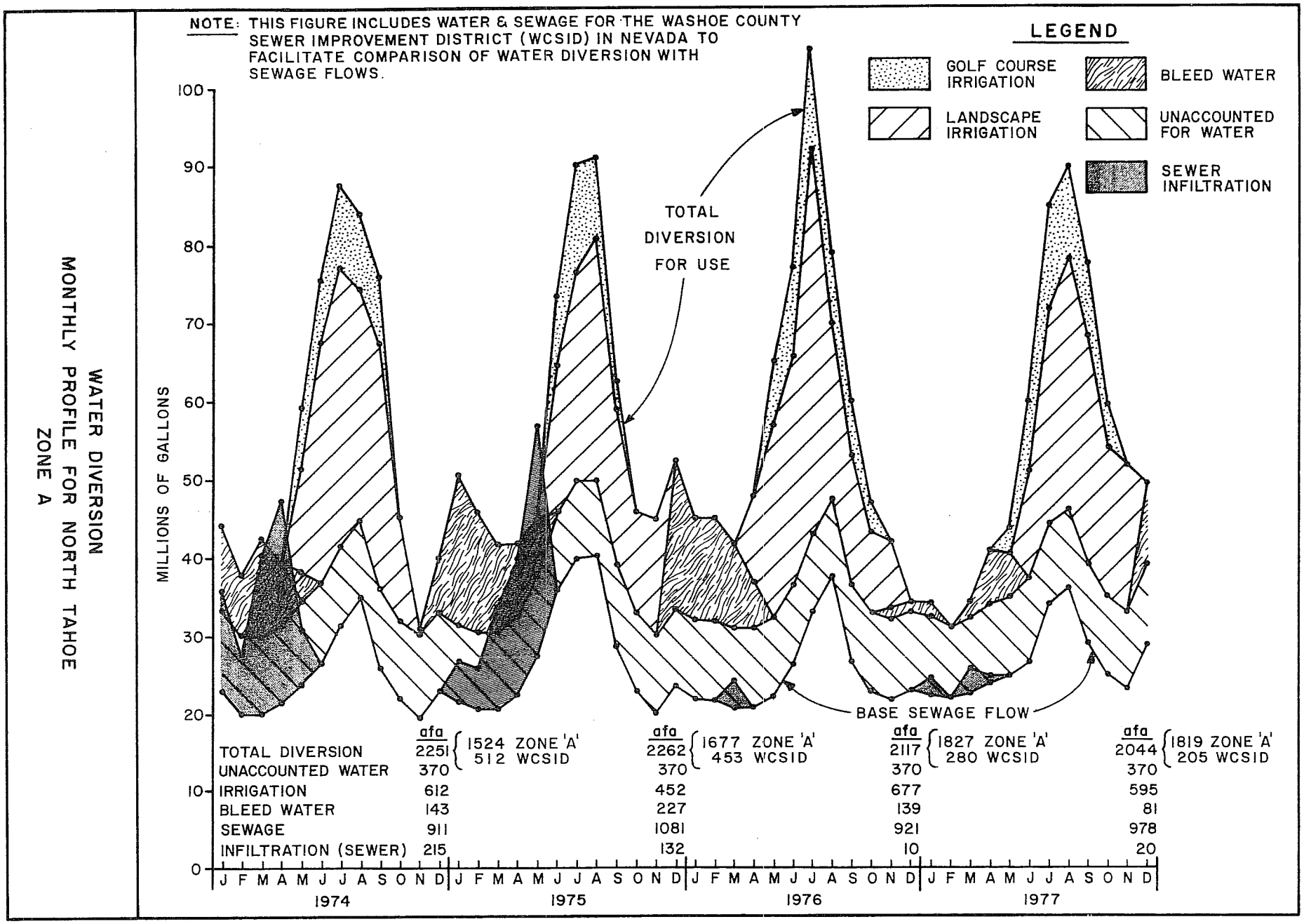
N. Tahoe P.U.D. - Dollar Cove
Misc. Water Systems
Brockway Golf Course

Zone B (47% of B)

TCPUD - Alpine Peaks
TCPUD - McKinney Shores
TCPUD - Rubicon Palisades, Tahoe Hills
Lakeview W.C.
Lake Park Terrace W.C.
Tahoe Park W.C.
Tahoe Park Heights
Talmont Estates W.C.
Ward Creek W.C.
Ward Well W.C.
Tahoe Pines W.C.
Tahoe Swiss Village Water Utility
Madden Creek W.C.
McKinney Creek Water District
Tahoe Meadows W.C.
Tahoe Cedars W.C.
Water°s Edge Condos
Meeks Bay Vista
Tamarack
Miscellaneous Private Domestic Systems

Zone C (15% of C)

Lukins Bros. W.C.
Misc. Sewered Areas
Misc. Un-sewered Areas
Bijou Golf Course
Tahoe Paradise Golf Course



WATER DIVERSION
MONTHLY PROFILE FOR NORTH TAHOE
ZONE A

FIGURE III-10

TABLE III-11

NORTH TAHOE ZONE A MONTHLY, FOUR-YEAR AND PRESENT AVERAGE WATER DIVERSION FOR MUNICIPAL AND DOMESTIC USE (MILLIONS OF GALLONS) A/

	1974	1975	1976	1977	PRESENT AVERAGE
J	36.03	42.36	38.84	30.98	39.57
F	29.85	37.71	41.35	27.85	36.83
M	34.26	32.96	37.56	30.58	36.03
A	30.13	32.52	42.93	36.14	37.65
M	33.90	36.98	46.22	35.19	40.52
J	48.32	53.32	51.74	45.16	53.20
J	56.03	60.78	79.77	63.78	69.26
A	54.56	65.73	62.46	70.18	67.50
S	47.99	44.47	47.10	61.82	53.88
O	28.83	32.88	38.17	47.80	39.21
N	21.56	30.97	28.61	45.47	33.46
D	31.42	38.32	30.96	44.61	38.80
	453.25 (1391 afa)	508.93 (1562 afa)	545.66 (1675 afa)	539.07 (1655 afa)	545.91 (1676 afa)

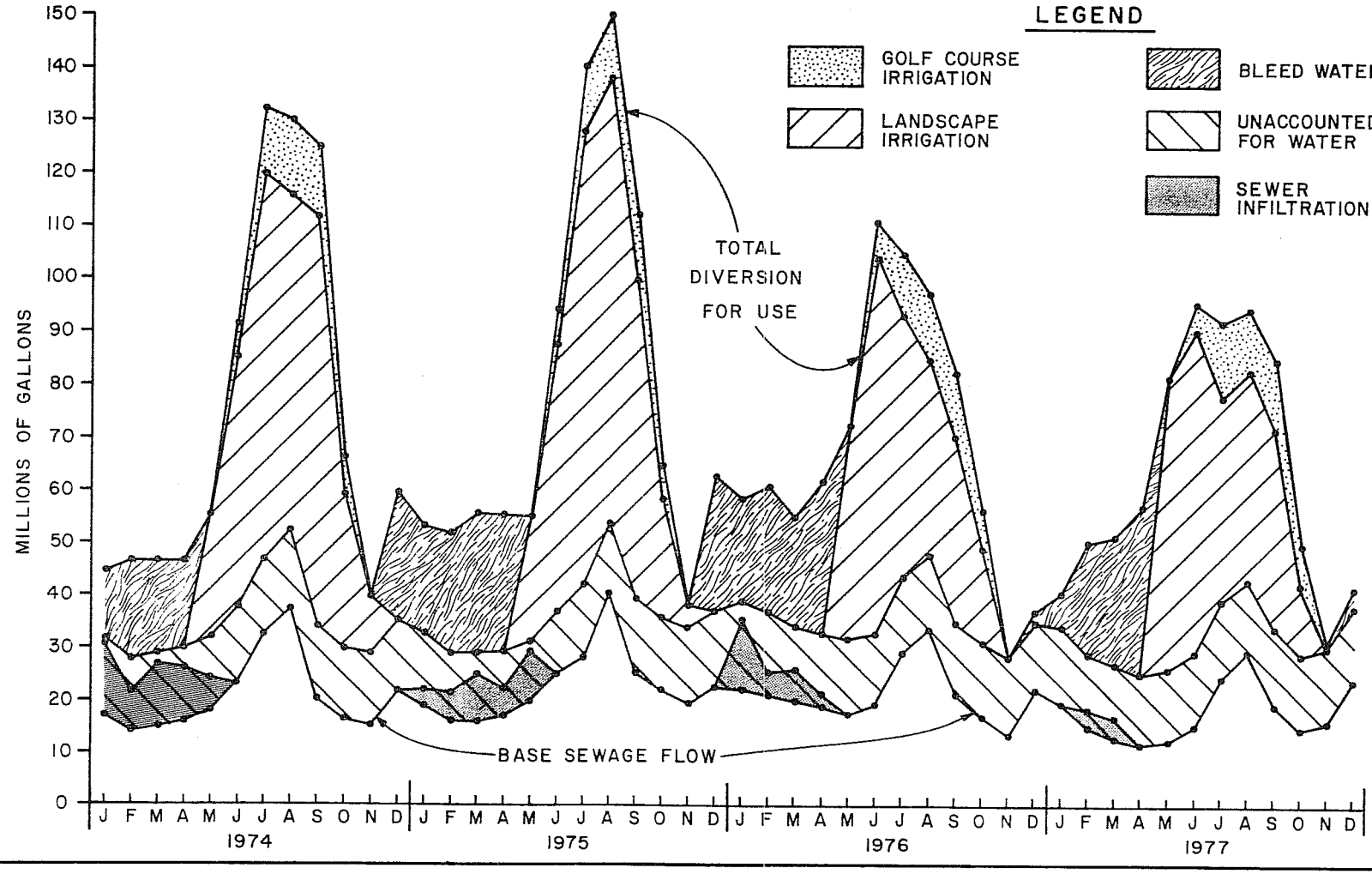
Present Maximum Annual Water Use B/ = 1754 afa

A/ Excludes Brockway Golf Course
B/ Based on water use for 1976 which is expanded according to the present (1977) level of development.

For Zones A, B and C, respectively, Figures III-10, III-11, and III-12 depict the approximate relationships between:

- total municipal and domestic water diversion
- diversion to sewered areas
- sewage flows
- estimated municipal and domestic landscape irrigation
- estimated sewer infiltration
- estimated "unaccounted-for" water
- estimated "bleed water" for freeze control

	afa	afa	afa	afa
TOTAL DIVERSION	2778	2982	2630	2394
UNACCOUNTED WATER	500	500	500	500
IRRIGATION	1240	1346	1066	968
BLEED WATER	279	374	293	273
SEWAGE	759	762	771	653
INFILTRATION (SEWER)	154	97	77	21



WATER DIVERSION
MONTHLY PROFILE FOR WEST TAHOE
ZONE B

FIGURE III-11

TABLE III-12

APPROXIMATE WEST TAHOE ZONE B MONTHLY FOUR-YEAR AND PRESENT AVERAGE WATER DIVERSION FOR MUNICIPAL AND DOMESTIC USE (MILLIONS OF GALLONS) A/

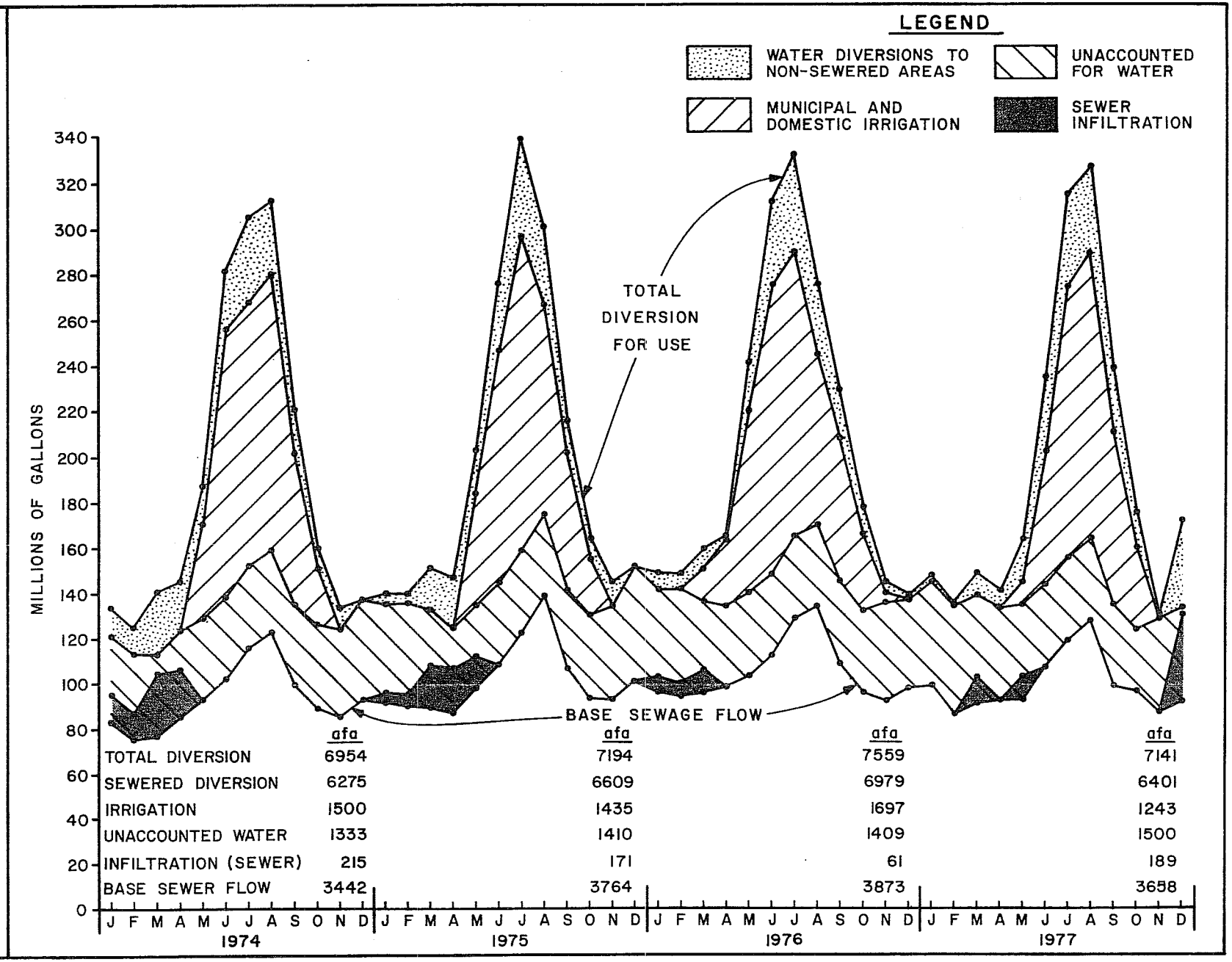
	1974	1975	1976	1977	PRESENT AVERAGE
J	46.38	55.13	60.69	42.62	51.88
F	48.65	53.94	63.20	52.58	62.50
M	48.40	57.76	57.03	53.37	58.37
A	48.36	57.54	64.09	59.22	61.52
M	57.66	57.20	85.59	84.81	74.78
J	87.98	90.59	107.58	93.88	103.70
J	125.13	133.23	96.44	80.99	120.40
A	120.76	143.61	87.84	86.02	121.09
S	115.89	103.64	72.69	74.63	102.11
O	61.49	60.72	50.86	43.74	58.99
N	41.14	39.70	29.55	32.37	38.76
D	61.71	65.56	39.16	43.85	57.85
	863.75	930.21	815.69	738.78	912.49
	(2652 afa)	(2856 afa)	(2504 afa)	(2268 afa)	(2801 afa)

Present Maximum Annual Water Use B/ = 3177 afa

A/ Excludes Tahoe City Golf Course
B/ Based upon water use for 1975 which is expanded according to the present (1977) level of development

"Unaccounted-for" water is that water which is consumptively used or lost between the original diversion and the ultimate use. Unaccounted-for water consists of distribution system leakage or bleeding, internal domestic or commercial consumption and sewer line leakage or infiltration. On a nation-wide average basis, unaccounted-for water in water distribution systems only, accounts for about 13% of the total diversion. In older poorly maintained systems, unaccounted-for water has been known to be as high as 20% or more in distribution systems only. Due to lack of universal metering of water services at Lake Tahoe a reliable estimate of distribution system unaccounted-for water is not possible. Howerver, once infiltration and landscape irrigation values have been estimated, the difference between remaining diversion

WATER DIVERSION
MONTHLY PROFILE FOR SOUTH TAHOE
ZONE C



	afa	afa	afa	afa
TOTAL DIVERSION	6954	7194	7559	7141
SEWERED DIVERSION	6275	6609	6979	6401
IRRIGATION	1500	1435	1697	1243
UNACCOUNTED WATER	1333	1410	1409	1500
INFILTRATION (SEWER)	215	171	61	189
BASE SEWER FLOW	3442	3764	3873	3658

FIGURE III-12

TABLE III-13

SOUTH TAHOE ZONE C MONTHLY, FOUR-YEAR AND PRESENT AVERAGE WATER DIVERSION FOR MUNICIPAL AND DOMESTIC USE (MILLIONS OF GALLONS) A/

	1974	1975	1976	1977	PRESENT AVERAGE
J	122.9	136.4	142.4	146.3	147.4
F	113.2	136.8	142.6	133.8	142.4
M	113.8	113.5	151.8	138.5	145.8
A	125.1	126.7	164.8	133.8	149.8
M	173.4	186.3	222.8	146.4	198.1
J	258.4	251.2	279.0	206.2	262.0
J	272.0	301.4	294.2	277.9	311.4
A	285.6	271.0	248.9	293.2	299.2
S	205.3	205.4	211.2	214.2	226.8
O	153.2	151.7	167.8	162.2	173.6
N	122.2	135.2	142.2	129.6	143.9
D	137.8	144.4	138.7	133.9	151.6
	2070.3 (6356 afa)	2179.2 (6690 afa)	2299.7 (7060 afa)	2110.6 (6480 afa)	2356.3 (7234 afa)

Present Maximum Annual Water Use B/ = 7429 afa

A/ Excludes Bijou Golf Course, Lake Tahoe County Club, Tahoe Paradise Golf Course, Pasture Irrigation and Livestock watering.

B/ Based upon water use for 1975 which is expanded according to the present (1977) level of development.

TABLE III-14

SUMMARIZATION OF ANNUAL MUNICIPAL AND DOMESTIC WATER DEMAND FOR THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN (EXCLUDES GOLF COURSES AND OTHER IRRIGATION)

	ACRE-FEET/ANNUM (afa)						
	1974	1975	1976	1977	PRESENT AVERAGE A/	MAXIMUM HISTORICAL B/	PRESENT MAXIMUM C/
North Tahoe, Zone A	1391	1562	1675	1655	1676	1797	1870 (1975)
West Tahoe, Zone B	2652	2856	2504	2268	2801	2922	3180 (1975)
South Tahoe, Zone C	6356	6690	7060	6480	7237	7431	7770 (1976)
Total	10399	11108	11239	10403	11714	12150	12820

A/ The "Present Average" value is based upon the average rate of water use for the 1974-1977 four-year period expanded to the present (1977) level of development

B/ The "Maximum Historical" value is based upon the total of the maximum levels of water use within each water company within each Zone. Frequently various water companies have experienced their respective peak historical use in different years

C/ The "Present Maximum" value is based upon the year for which the highest unit water demand was experienced. This value is then expanded to the present (1977) level of development

and sewer flows may be computed. In South Tahoe, Zone C, where there does not appear to be a significant amount of winter bleeding for freeze control, total unaccounted-for water is estimated to account for about 20% of the total water diversions for use. Although difficult to assess with available information, a large portion of unaccounted-for water may be due to sewage exfiltration losses. Sewage flows within the California portion of the Lake Tahoe Basin are typically 80-85 gal/capita/day as metered at the sewer plants. This level is about 10-20% lower than would be expected for the Lake Tahoe Region.

Landscape irrigation appears to be an increasing use of water. In 1969 the State Board reported that landscape irrigation appeared to be a rather minor use of water. Based upon information in this study landscape irrigation appears to account for between 19% and 24% of the total diversion for use. Based upon the State Board's determination that 18.5 gallon/100 square feet/day is a reasonable amount, it would appear that about 400 acres (not including golf courses or pasture land) in South Tahoe, Zone C, are being irrigated. Irrigated landscape acreage for the entire California portion of the Tahoe Basin is estimated to be on the order of 840 acres (again not including golf courses and pasture land). This represents 0.42% of the total land area of the Tahoe Basin and is equivalent to about 1000 square feet of irrigated landscape per dwelling unit. A survey of riparian lands in the El Dorado County portion of the Lake Tahoe Basin by the State Board indicated that average irrigated landscaped area for a developed riparian parcel with a single family dwelling was 1,760 square feet. Although riparian parcels are more likely to be irrigated than nonriparian parcels, this survey substantiates the growing influence which landscaped irrigation has on total water use in the Lake Tahoe Basin.

Water use within the Lake Tahoe Basin has increased steadily in recent years. Figure III-13 depicts the historical increase in water use within the California portion of the Lake Tahoe Basin. As shown in Figure III-13, municipal, commercial and domestic water use has been increasing sharply for the past 25 years. The average annual increase in water diversion for use has been 460 af/year for the past 20 years. At this rate, water diversion solely

for municipal, commercial and domestic use, irrespective of other rights or claims, will exceed California's total allocation under the Interstate Water Compact within about 20 years.

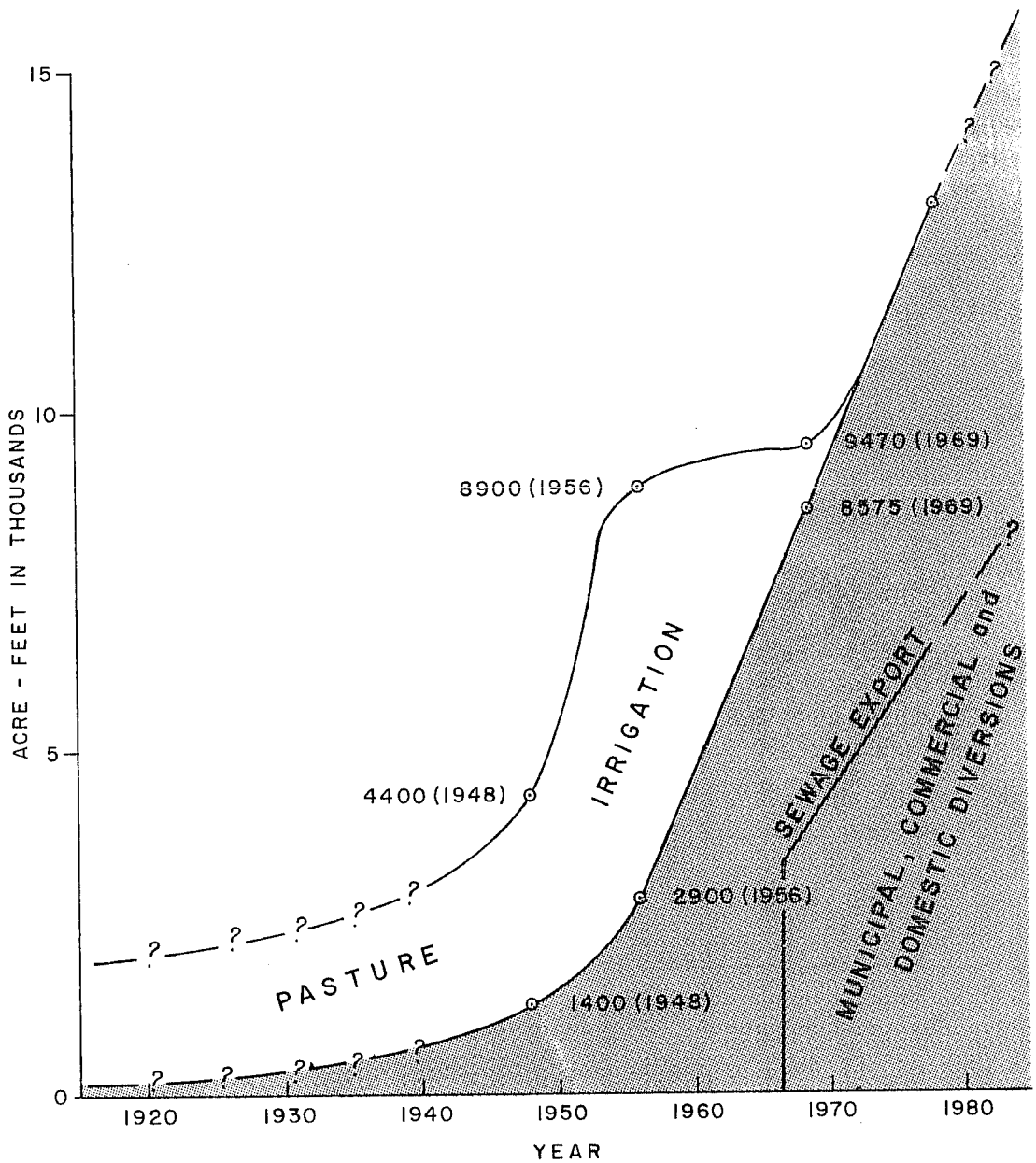
Unit Water Use

Unit water diversion for use values for each water system or zone are readily computed by dividing the total diversion by the total number of units. Unit water use in this report is computed on either a dwelling unit or per capita basis. Unit water diversion for use per dwelling unit may be more than the actual water delivered to the average dwelling unit. Included in the unit water diversion for use value is all water that must be diverted in order to supply the average unit with its water requirements. This would include distribution system leakage, freeze control bleeding, fire protection water, and other demands which must be met along with water which is delivered to an individual unit.

For the most part, unit water use data based upon individually metered services is not available in the California portion of the Lake Tahoe Basin as of 1977. Many utilities, however, intend to increase metering of commerical water users in the near future. The only large area with sufficient individual metering data to justify extensive investigation as part of this report was the old Southside Water Utility in South Lake Tahoe, now operated by the South Tahoe P.U.D. The detailed results of this analysis are presented in the South Tahoe P.U.D. portion of Appendix C to this report (bound separately). A generalized summary of this information is provided in Table III-15. Comparison of the dwelling unit water consumption with the dwelling unit diversion for use indicates that within the old Southside Water Utility system 20.5% of all diverted water goes for non-residential use such as leakage, fire flows, and commercial water use (i.e., shops, restaurants etc.).

Average dwelling unit diversion for use and per capita unit diversion for use for each of the three California-Tahoe Zones (A,B,C) and the entire California

FIGURE III - 13



HISTORICAL WATER DIVERSION FOR USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN. (IRRIGATION, MUNICIPAL, COMMERCIAL and DOMESTIC USES ONLY)

TABLE III-15

UNIT WATER USE PER DEVELOPMENT TYPE WITHIN THE SOUTHSIDE PORTION OF THE SOUTH TAHOE P.U.D.

Development Type	Gallons per day per unit	Gallons per capita per day
Single Family Units	327 C/	153
Multiple Family Units	189	108
Hotel Units	116	79
Mobile Homes & Campgrounds	110	71
Average Unit Use A/	207	117
Average Unit Diversion for Use B/	261	147

A/ Unit use based on only that water actually delivered to that dwelling unit type

B/ Unit diversion for use based on total system water use including leakage, fire flows, commercial use and other non-residential demands. Thus about 20.5% of all water use is for various non-residential uses.

C/ Based upon SFU Unit use observed and Tahoe Paradise Water and Gas Co. and Angora Water Company.

portion of the Lake Tahoe Basin are summarized in Tables III-16, III-17, III-18, and III-19. In most instances, the average unit diversion for use for the years 1976 and 1977 was somewhat lower than for 1974 and 1975 due to water conservation efforts by the various water utilities. In Zones B and C, drought period dwelling unit diversion for use declined 25.5% and 6.5%, respectively, from pre-drought periods. In Zone A, however, drought period dwelling unit diversion for use increased 6.1%. This increase could be due to a less effective conservation program, increased winter bleeding, or increases in occupancy rates over those observed in 1974. The accuracy of flow meters may also affect this value.

TABLE III-16

NORTH TAHOE ZONE A ESTIMATED UNIT MUNICIPAL & DOMESTIC WATER DIVERSION FOR USE

YEAR	DWELLING UNITS	TOTAL DIVERSION FOR USE (million gallons)	AVERAGE WATER USE PER RESIDENTIAL DWELLING UNIT UNIT WATER USE (GALLONS/UNIT/DAY) Annual Avg.	Peak Mth.
1974	4992	453.25	249	362
1975	5111	508.93	273	415
1976	5241	545.66	285	491
1977	5491	539.07	269	412
Present Average	5491	545.91	272	407

Average per capita water diversion for use based on 1974 TRTS Occupancy and Population data for North Tahoe, Zone A.

	Gallons/Capita/Day
Winter	147
Summer	189
Annual Average	159

Due to the lack of yearly population counts, the only year for which reliable per capita water use data could be developed was 1974. In that year the TRTS survey developed average population data for the winter low periods and summer high periods. Using this data with the total water diverted for municipal and domestic use, the per capita unit water diversion for use ranged from 144

TABLE III-17
WEST TAHOE ZONE B ESTIMATED UNIT MUNICIPAL AND DOMESTIC DIVERSION FOR USE

YEAR	DWELLING UNITS	TOTAL DIVERSION FOR USE (million gallons)	AVERAGE WATER USE PER RESIDENTIAL DWELLING UNIT UNIT WATER USE (GALLONS/UNIT/DAY) Annual Avg.	Peak Mth.
1974	6114	863.75	387	680
1975	6330	930.21	402	732
1976	6534	815.69	342	601
1977	7042	738.78	287	444
Present Average	7042	912.49	355	555

Average per capita water diversion for use based on 1974 TRTS Occupancy and Population data for West Tahoe, Zone B.

	Gallons/Capita/Day
Winter	175
Summer	280
Annual Average	210

gal/capita/day during winter time to 186 gal/capita/day during the summer. In 1974 the annual average per capita consumption is estimated at 160 gal/capita/day. To demonstrate the wide variance of unit water use between individual water systems the annual average unit water use rates for each water system or water use area for Zones A, B, and C are tabulated in Tables III-20, III-21, and III-22, respectively. In these tables the water use areas are ranked in order from those areas with the highest unit water use rates to those with the lowest.

TABLE III-18

SOUTH TAHOE ZONE C ESTIMATED UNIT MUNICIPAL AND DOMESTIC WATER DIVERSION FOR USE

YEAR	DWELLING UNITS	TOTAL DIVERSION FOR USE (million gallons)	AVERAGE WATER USE PER RESIDENTIAL DWELLING UNIT UNIT WATER USE (GALLONS/UNIT/DAY) Annual Avg.	Peak Mth.
1974	21650	2070.3	262	426
1975	22510	2179.2	265	432
1976	23847	2299.7	264	398
1977	24997	2110.6	231	378
Present Average	25000	2356.3	258	402

Average per capita water diversion for use based on 1974 TRTS Occupancy and Population data for South Tahoe, Zone C.

	Gallons/Capita/Day
Winter	136
Summer	164
Annual Average	147

As demonstrated by the graph in Figure III-14, per capita unit water use has been on the increase over the past 30 years. During this period the following estimates of per capita unit water use were made by a variety of investigators:

- o 1948 - A cooperative survey by the State Engineers of California and Nevada - 50 gal/capita/day.

TABLE III-19

ESTIMATED AVERAGE UNIT WATER USE
FOR THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

AVERAGE WATER USE PER RESIDENTIAL DWELLING UNIT

YEAR	DWELLING UNITS	TOTAL DIVERSION FOR USE (million gallons)	UNIT WATER USE (GALLONS/UNIT/DAY) Annual Avg.	Peak Mth.
1974	32756	3387.3	283	449
1975	33951	3618.2	291	465
1976	35622	3660.9	281	422
1977	37530	3388.6	247	383
Present Average	37530	3815.6	277	427

Average per capita water diversion for use based on 1974 TRTS Occupancy and Population data for The California portion of the Lake Tahoe Basin

	Gallons/Capita/Day
Winter	144
Summer	186
Annual Average	160

- 1956 - A California Department of Water Resources (DWR) evaluation for the Interstate Water Compact Commission - 110 gal/capita/day.

- 1960-62- Brown and Caldwell report prepared for the South Tahoe P.U.D. - 90 and 92 gal/capita/day.

- 1963 - Engineering Science report - 120 gal/capita/day.

TABLE III-20

NORTH TAHOE ZONE A RANKING OF RESIDENTIAL UNIT WATER USE PER WATER USE AREAS (GALLON/UNIT/DAY)

Rank	Water Use Area	Residential Unit Use Present Average	Residential Unit Use Maximum Historical	1974 per capita Use	Per Capita Ranking
1	NTPUD-Tahoe Marina/Estates	416	504	158	5
2	Agate Bay Water Company	384	453	204	4
3	NTPUD-Dollar Cove	355	375	476	1
4	Caledonia*	342	512	144	6
5	Fulton-Cedar Flat System	326	408	291	3
6	NTPUD-Carnelian	323	340	447	2
7	NTPUD-Tahoe Vista Kings Beach, Etc.	233	252	122	7
	North Tahoe Zone A, Average	272	325	159	

* Diversion estimated by unit value analysis (UVA) of 9 water systems with complete records of use.

- o 1969 - California State Water Resources Control Board water rights report - 125 gal/capita/day.
- o 1973 - Walters Engineering report for the Tahoe Regional Planning Agency - 200 gal/capita/day.
- o 1974 - This report, based upon known diversion and the 1974 TRTS population survey - 160 gal/capita/day.

TABLE III-21
WEST TAHOE ZONE B RANKING OF RESIDENTIAL UNIT WATER USE
PER WATER USE AREAS (gallons/unit/day)

Rank	Water Use Area	Residential Use Unit		1974	
		Present Average	Maximum Historical	Per Capita Use	Per Capita Ranking
1	Glenridge Park	552	1041	222	5
2	Lake Forest	477	528	248	4
3	TCPUD-Dollar Point	473	522	281	2
4	Timberland	446	633	130	28
5	TCPUD-Tahoe City	407	438	219	26
6	TCPUD-Rubicon	402	526	330	1
7	Alpine *	367	433	221	6
8	Homewood *	367	433	221	6-25
9	Lake Park Terrace *	367	433	221	6-25
10	Lakeview *	367	433	221	6-25
11	McKinney Estates *	367	433	221	6-25
12	McKinney Shores *	367	433	221	6-25
13	Meeks Bay Vista *	367	433	221	6-25
14	Quail Lake *	367	433	221	6-25
15	Rubicon Palisades Tahoe Hills *	367	433	221	6-25
16	Tahoe Park *	367	433	221	6-25
17	Tahoe Park Heights*	367	433	221	6-25
18	Tahoe Cedars *	367	433	221	6-25
19	Tahoe Pines *	367	433	221	6-25
20	Tahoe Swiss Vill. *	367	433	221	6-25
21	Tahoma Meadows *	367	433	221	6-25
22	Talmont Estates *	367	433	221	6-25
23	Tamarock *	367	433	221	6-25
24	Ward Creek *	367	433	221	6-25
25	Wardwell *	367	433	221	6-25
26	Water's Edge *	367	433	221	6-25
27	Skyland	348	460	195	27
28	Tahoe Sierra Estates	316	334	103	29
29	Fulton-Panorama	255	384	252	3
	West Tahoe Zone B Average	341	402	202	

*Diversion estimated by unit values analysis (UVA) of 9 water systems with complete records of use.

TABLE III-22

SOUTH TAHOE ZONE C RANKING OF RESIDENTIAL UNIT WATER USE PER WATER USE AREAS (GALLON/UNIT/DAY)

Rank	Water Use Area	Residential Unit Use		1974 per capita Use	Per Capita Ranking
		Present Average	Maximum Historical		
1	Tahoe Keys Service Area	594	641	258	1
2	TPW&G Service Area	288	330	146	4
3	Angora Service Area	287	291	133	6
4	Lukins Service Area*	281	294	141	5
5	N. Fallen Leaf Lake	280	320	85	9
6	STPUD Service Area	263	278	147	3
7	Lakeside Service Area	236	345	200	2
8	S. Fallen Leaf Lake	221	N/A	84	10
9	Misc. Sewered Area	165	175	100	7
10	Echo Lake Area	141	N/A	57	11
11	Misc. Non-Sewered Area	75	N/A	93	8
	South Tahoe Zone C Average	258	284	160	

* Diversion estimated by unit value analysis (UVA) of 9 water systems with complete records of use.

The variation in per capita use values can be attributed to the different estimation techniques and data bases used by the various investigators. In general, however, this information shows the historical trend of increasing water use for the California portion of the Lake Tahoe Basin. Since 1948, per capita water consumption at Lake Tahoe has increased by over 325%. At

present it is unknown whether this trend towards increasing water use will continue. During the 1976-77 drought period, per capita water consumption declined by as much as 20% in some areas although the basin wide decline was closer to 8%. The California Department of Water Resources, however, has reported that most areas of the state in 1978 were back up to their pre-drought levels of water use. Also in Figure III-14 are the levels of water use reported for:

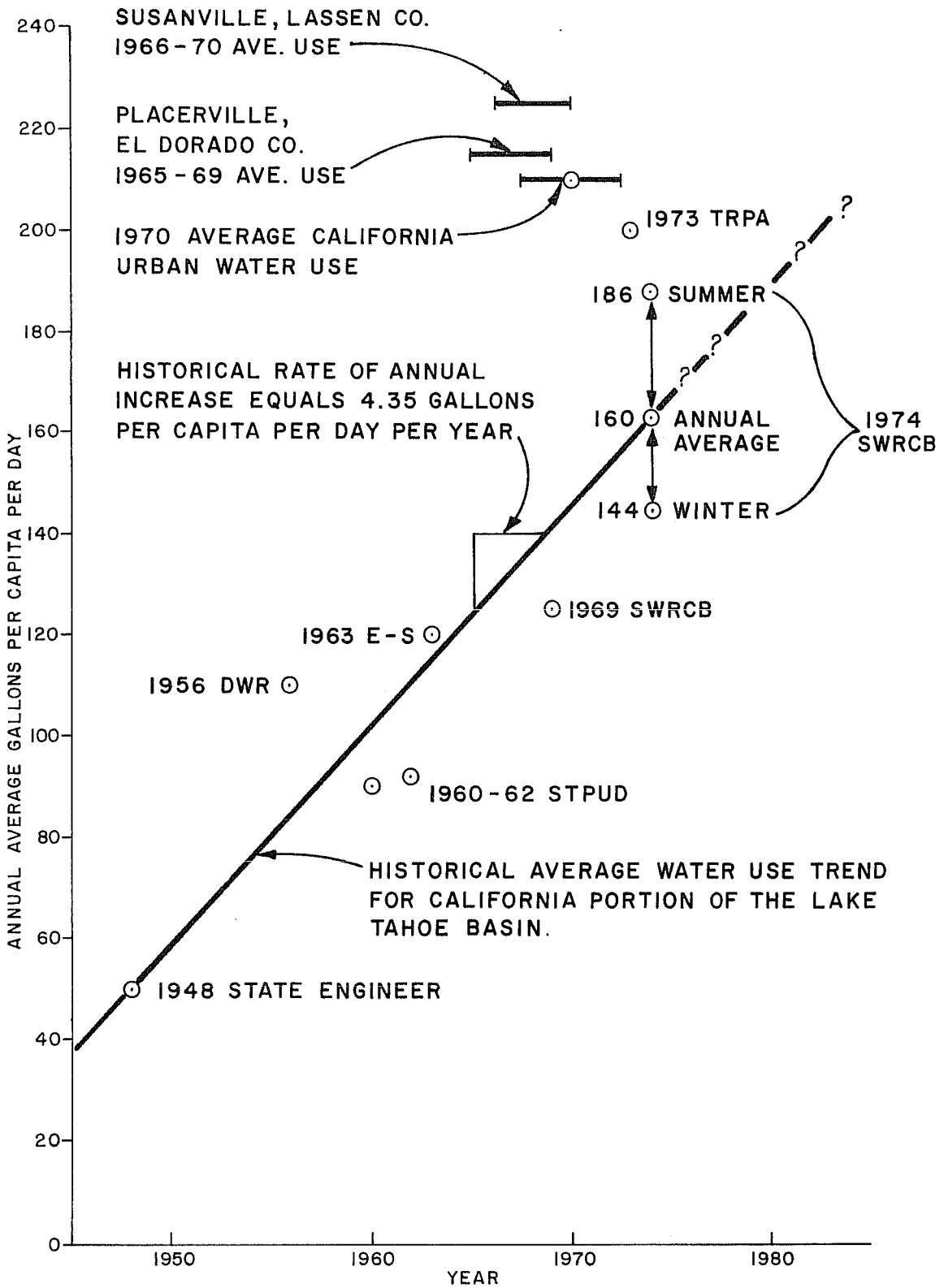
- Susanville, Lassen County, 1966-70 average use - 223 gal/capita/day
- Placerville, El Dorado County, 1965-1967 average use - 214 gal/capita/day
- Average urban water use in California in 1970 - 211 gal/capita/day.

Both Susanville and Placerville are climatically and geographically fairly representative of the Lake Tahoe area. However, the greatest difference in factors affecting water use is in the tourist or non-resident population which Susanville and Placerville have to only a limited degree. The resort nature and limited extent of water using industry in the Lake Tahoe area probably has a tendency to depress overall per capita unit water use rates.

It appears reasonable to expect per capita water diversion for use to increase to 200 gal/capita/day, unless long term water conservation efforts are vigorously implemented. This increase in water use can be expected particularly if the number of household water using devices and extent of landscape irrigation continues to increase at Lake Tahoe. In 1948, when per capita water use was estimated at 50 gal/capita/day, landscape irrigation and water using devices such as dishwashers, washing machines, and garbage disposals were essentially non-existent. Today landscape irrigation, although not precisely known, may have increased to approximately 840 acres not including golf courses. If occupancy rates increase as expected, the extent of landscape irrigation is also likely to increase.

Per capita sewage flows are somewhat more difficult to determine due to metering inaccuracies, infiltration gains and exfiltration losses. Based

FIGURE III-14



HISTORICAL UNIT WATER USE RATE FOR CALIFORNIA PORTION OF THE LAKE TAHOE BASIN AS COMPARED TO OTHER AREAS OF THE STATE

upon the 1974 winter and summer TRTS population for the three sewage service districts in the California portion of the Lake Tahoe Basin, per capita sewage flow estimates are:

	Gallons/capita/day		
	Winter*	Summer	Annual Average*
Zone A, North Tahoe P. U. D.) and Zone B, Tahoe City P. U. D.)	98 (70)	86	89 (72)
Zone C, South Tahoe P. U. D.	107 (91)	75	86 (81)
California Average	104 (84)	78	87 (78)

The values cited above are based upon resident and overnight visitor population. Day users are not included. Although the extent of day use is difficult to assess, inclusion of day use populations would lower the per capita sewage flow an unknown amount.

Fluctuations in unit water use between the various zones are dependent upon difference in service area characteristics, degrees of infiltration or exfiltration, and meter accuracy. These sewage flows are somewhat lower than those osbserved in the Nevada portion of the Lake Tahoe Basin. Summer average sewage flows are 110 and 140 gallons/capita/day for Washoe and Douglas Counties, respectively. The variance between California and Nevada is due, at least in part, to the numerous overnight residents and visitors in California which visit the Casino areas on both the north and south shores in Nevada. In addition, there is a preponderance of low water using dwelling units in California. These include apartments, motel units, mobile homes and campgrounds.

*Values in parentheses indicate per capita flows minus estimated infiltration.

High levels of sewage infiltration are apparent in California during winter and spring snowmelt.

With sewage infiltration is the possibility of exfiltration. A significant amount of exfiltration would violate State law which prohibits the discharge of sewage within the California portion of the Lake Tahoe Basin. Low per capita sewage flow rates (75-90 gallons/capita/day) which do not include day users, and a large body of unaccounted-for water increase the possibility of significant sewage exfiltration losses. However, without a specific and detailed investigation, the extent of sewage exfiltration in the Lake Tahoe Basin is difficult to assess.

C. DIVERSIONS FOR IRRIGATION

In this report, diversions for irrigation are divided into two categories of consumptive use; 1) Agricultural Water Use and, 2) Golf Course Irrigation.

Agricultural Water Use

Prior to about 1955, pasture irrigation was by far the largest beneficial use of water in the Lake Tahoe Basin. Figure III-15 depicts the historical decline in livestock grazing within the Lake Tahoe Basin and the decline in total water demand for both the California and Nevada portions of the Lake Tahoe Basin. This figure is based upon information prepared for the Tahoe Regional Planning Agency in 1971, and known diversion for agricultural use in 1977. At the present time there are no known diversions for irrigation of pasture lands in the California portion of the Lake Tahoe Basin. The only

agricultural water use now is direct use for stockwatering which is estimated not to exceed 15 gallons per animal per day. On this basis, stockwatering demand in the California portion of the Lake Tahoe Basin probably does not exceed 4.5 acre-feet per year. Increased agricultural water use is not expected. A comparison between trends in pasture irrigation and municipal and domestic water use may be seen in Figure III-13.

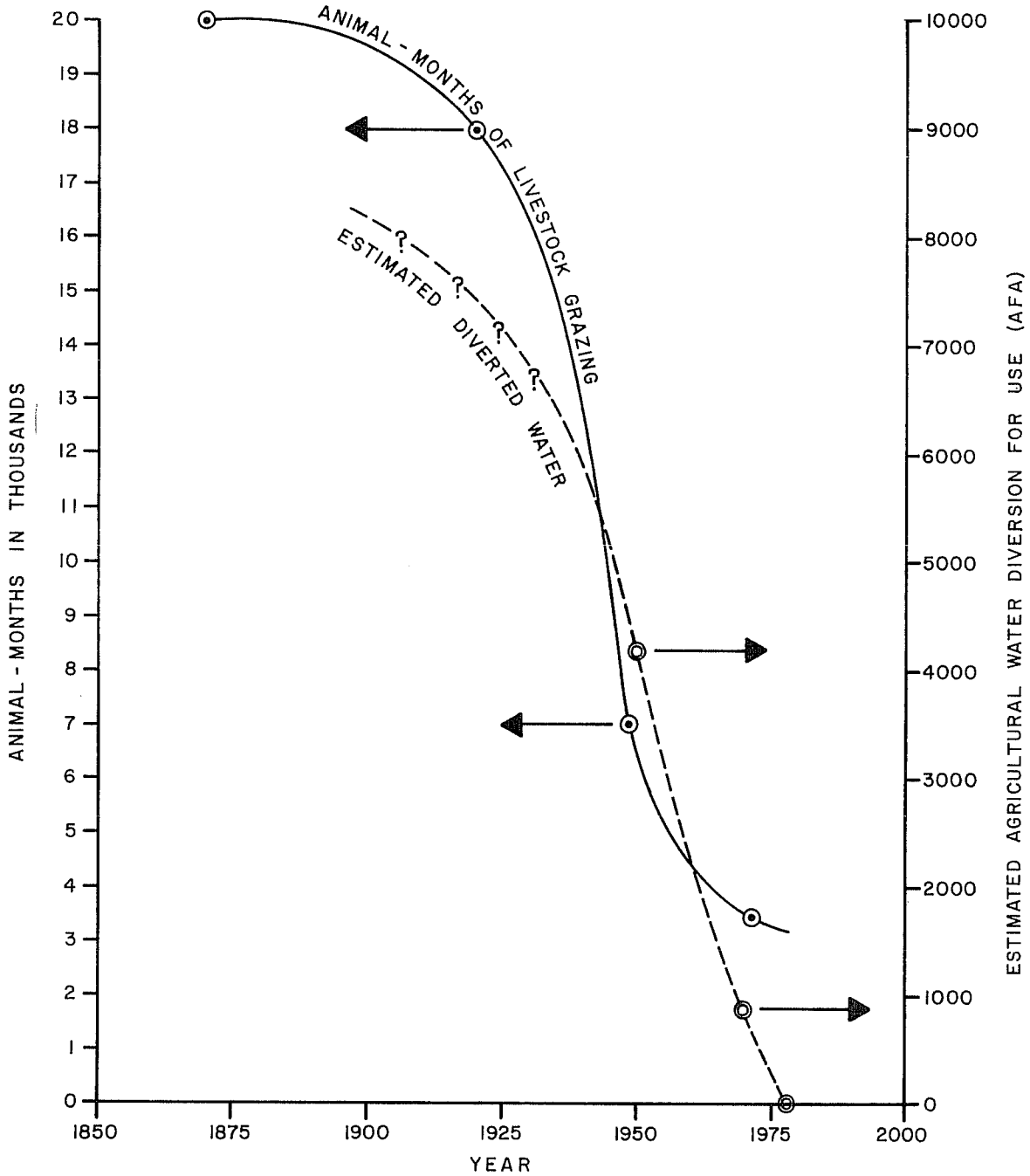
Table III-23 lists the known major areas of agricultural water use in the California portion of the Lake Tahoe Basin. Figure III-16 depicts the locations of these areas. Although agricultural use probably did occur in both North Tahoe, Zone A, and West Tahoe, Zone B, in local areas, such use was never significant. Portions of Zone B were used at one time for grazing, but this is no longer the case. South Tahoe, Zone C, is the only portion of the California Lake Tahoe Basin where noticeable stockwatering now takes place. Of those use areas listed in Table III-23, the Airport-Truckee River, Bijou Creek (Johnson), and Sierra House (Johnson) are notable in that they were extensively irrigated at one time.

The Airport-Truckee River area, although still used for grazing, was extensively flood irrigated. Remnants of diversion structures can still be seen along the Truckee River. The diversions for this flood irrigation were probably based on claims of riparian right, as there is no record of appropriative rights.

The Bijou Creek and Sierra House areas were extensively irrigated by an appropriative diversion (A-10914, L-7170) from Cold Creek and an apparent riparian or pre-1974 diversion from what is now known as Heavenly Valley Creek. The Bijou Golf Course was at one time also irrigated by water diverted from Cold Creek (A-10914, L7170)

Extensive diversion channels and ditches can still be seen, although they have not been in use for over four years and in many places have fallen into a state of disrepair. At one location, a subdivision (Pioneer Village) has completely obliterated the diversion ditch associated with the Cold Creek

FIGURE III - 15



HISTORICAL LIVESTOCK WATER USE AND NUMBER OF ANIMAL MONTHS OF LIVESTOCK GRAZING WITHIN LAKE TAHOE BASIN.

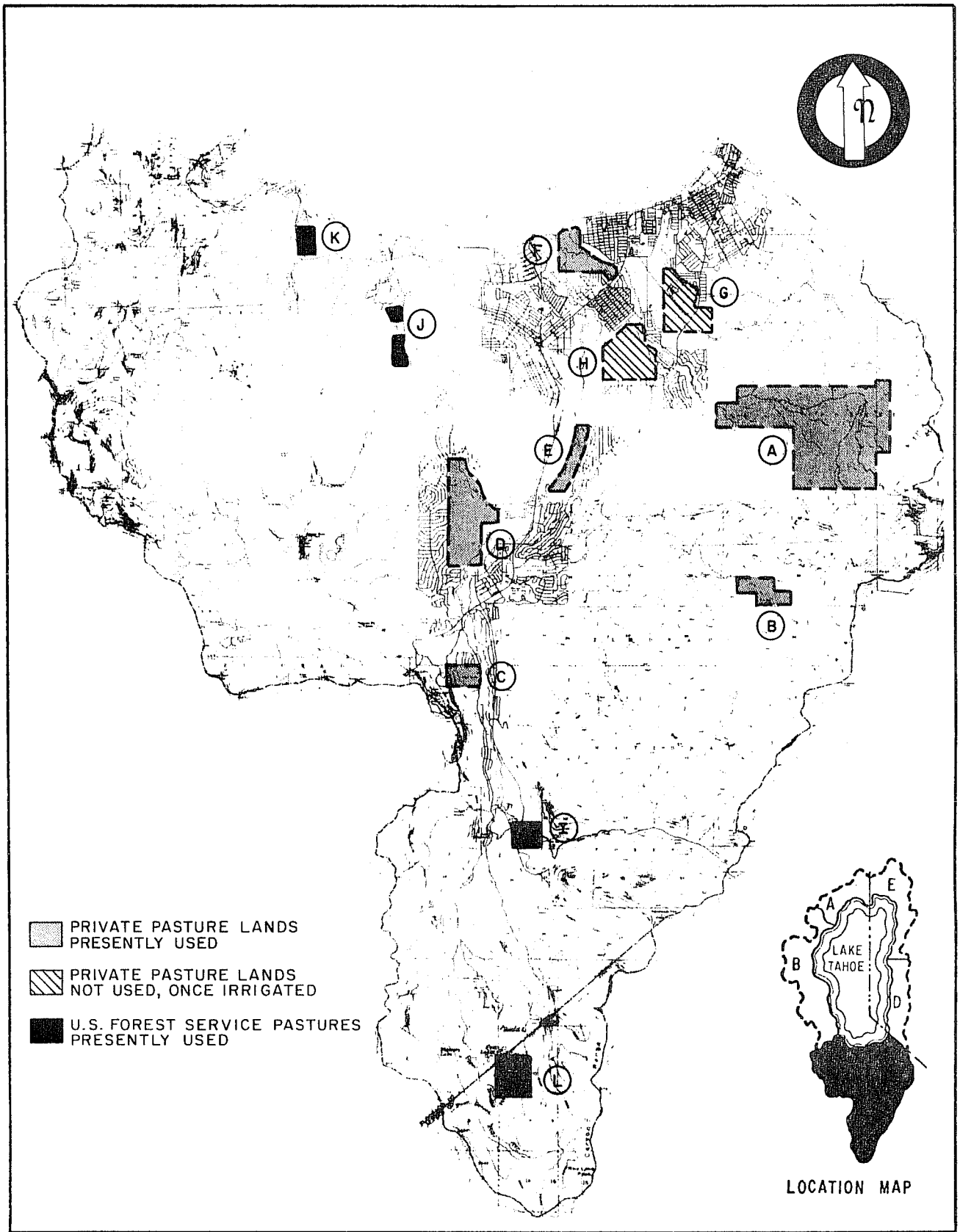
TABLE III-23

AGRICULTURAL WATER USE
STOCKWATERING IN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

Water Use Area	Estimated Stock	Months of Use	Water Demand (afa)
I. Private Lands, Presently used			
A. High Meadows	100	3	0.4
B. Fountain Place	50	3	0.2
C. Celio Ranch	40	4	0.3
D. Amacher Ranch	70	4	0.4
E. Airport-Truckee R.	150	4	0.8
F. Al Tahoe-Barton	70	4	0.4
II. Private Lands, Not presently Used			
G. Bijou Creek (Johnson)	-	-	-
H. Sierra House (Johnson)	-	-	-
III. U.S.F.S. Land- Presently Used			
I. Government Meadow	40	3	0.2
J. Fallen Leaf Pasture	60	3	0.2
K. Tallac Creek	40	3	0.2
L. Meiss Meadow	250	3	1.0
M. Miscellaneous Area	100	3	0.4
	970	3.3	4.5

appropriative right. No diversion from either Cold Creek or Heavenly Valley Creek presently takes place for agricultural use. In recent years, however, water diverted under another appropriative right from Cold Creek (A-11992, P-10067; and a pre-1914 right) held by the South Tahoe P.U.D. is used to

FIGURE III-16



ZONE C

AGRICULTURAL WATER USE

irrigate marginally the Bijou Golf Course. It is unlikely, although possible, that the agricultural diversions from either Cold Creek or Heavenly Valley Creek will be used again, due to encroaching urbanization. The holders of the appropriative right, however, maintain that they would like to preserve some portion of this right for potential future use.

Golf Course Irrigation

The locations of golf courses within the California portion of the Lake Tahoe Basin are shown in Figure III-17. Table III-24 presents information describing these golf courses. Of the golf courses, only the Brockway Golf Course and the Bijou Golf Course have any potential for expansion. No other new golf courses are anticipated.

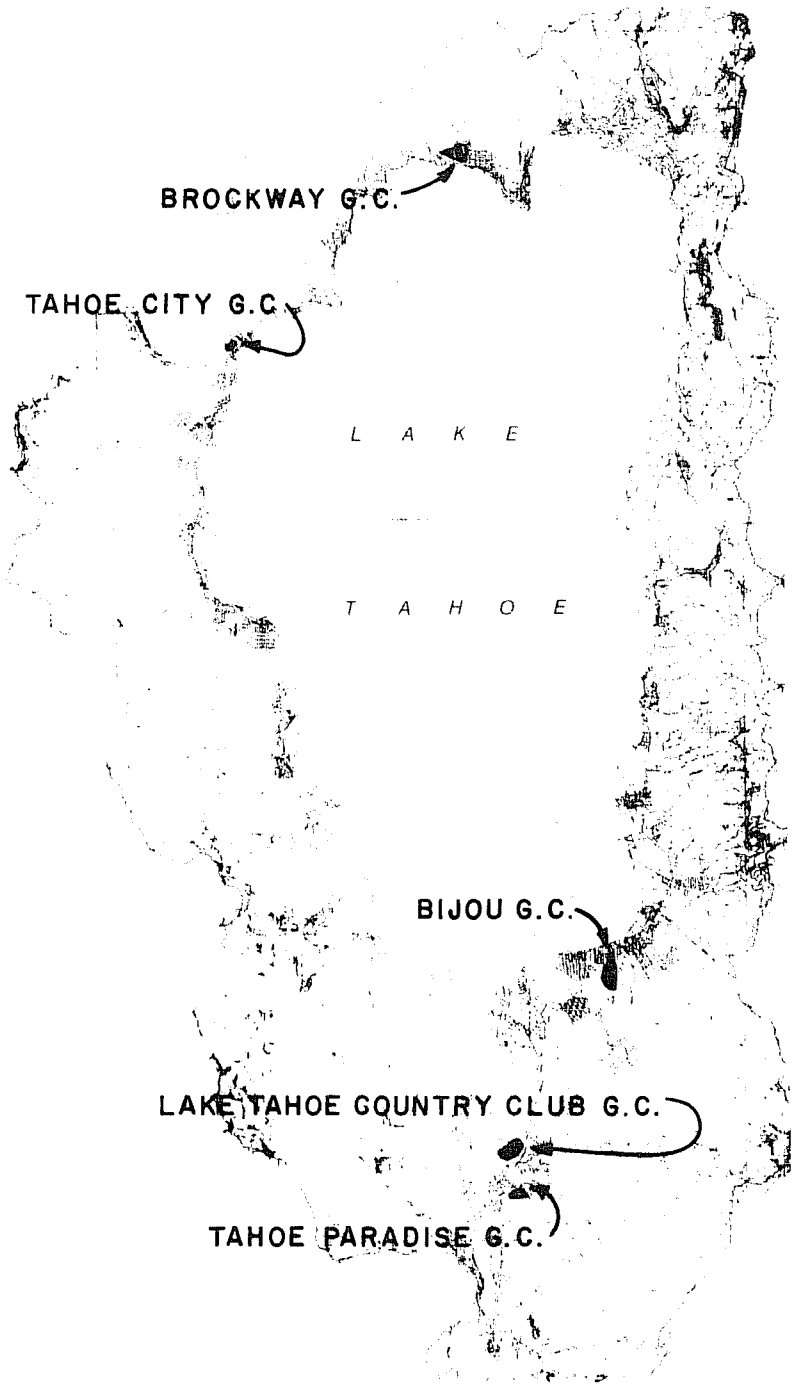
Golf course irrigation demand varies widely from year to year, depending upon weather conditions and availability of water supply. The potential demand for golf course irrigation is estimated at between 833 and 1071 acre-feet per year for a total of 254 acres within the California portion of the Lake Tahoe Basin. Expansion of golf course acreage would require proportionately more water.

For the most part, none of the golf courses now have metered water supplies. The best information on diversions available is for the Lake Tahoe Country Club, which is the largest user of water for golf course irrigation in the California portion of the Basin. Based upon power records, an estimate of the monthly diversion for use for the 90 acre golf course is presented in Figure III-18.

D. DIVERSIONS FOR LAKE STORAGE AND STREAM FLOW ENHANCEMENT

Numerous diversions for lake storage and stream flow enhancement exist in the California portion of the Lake Tahoe Basin. As shown in Figure III-19, most of these diversions are located in South Tahoe, Zone C. Only two diversions, Stoney Ridge and Crag Lakes are located in West Tahoe Zone B. In

FIGURE III-17



MT. DIABLO
BASE and MERIDIAN

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

LAKE TAHOE WATER USE
AND WATER RIGHTS INVENTORY

LAKE TAHOE AREA GOLF COURSES
IN CALIFORNIA

SCALE
0 1 2 6 7 8 MI.

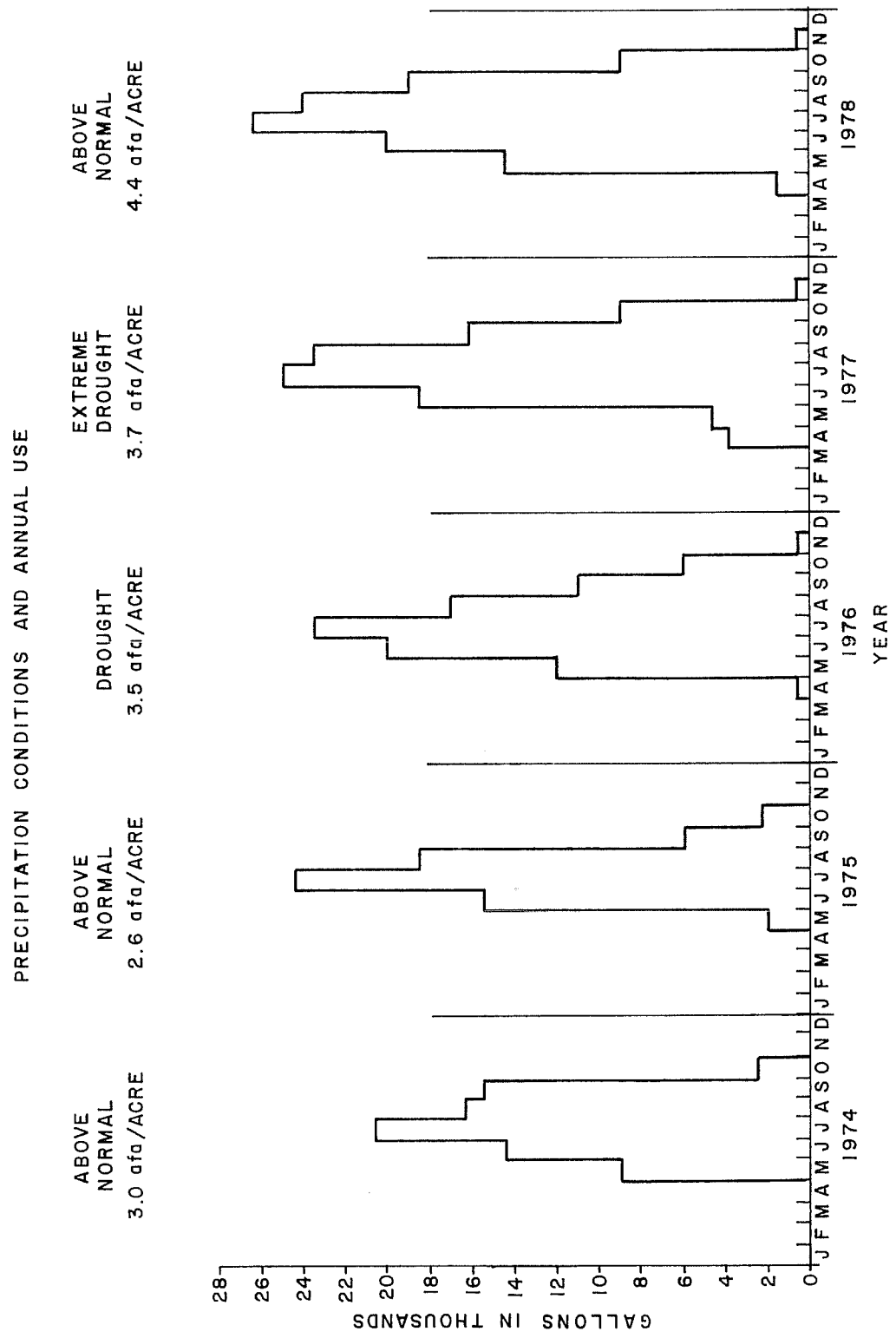
TABLE III-24

GOLF COURSES WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

	Golf Course	Zone	Acreage	Source of Water Supply	Water Right	WATER USE Present Average (afa)	Average Duty (afa/acre)	Maximum Historical (afa)	Potential Demand (afa)
1.	Brockway Golf Course (9 holes)	A	44 ac.	Lake Tahoe	A-17139 P-13525	152 A/	3.45 A/	?	123-195
2.	Tahoe City Golf Course (9 holes)	B	25 ac.	Burton Creek	12-3178	126	5.00	?	100-126
3.	Bijou Golf Course C/ (9 holes)	C	50 ac.	Municipal	(STPUD)	2	0.04	150	150-200
4.	Lake Tahoe Country Club (18 holes)	C	80 ac.	U. Truckee River	Riparian	276	3.45	352	276-352
5.	Tahoe Paradise G. C. (18 holes)	C	45 ac.	Wells	-	155 A/	345 A/	198 A/	155-198
	Totals		244 Ac.			711			833-1071 D/

A/ Estimate based on Lake Tahoe Country Club
B/ 1969 Water Use
C/ Only manually irrigated from municipal supplies. Future use of wells is anticipated
D/ 3.4 - 4.4 afa/acre

FIGURE III-18



LAKE TAHOE COUNTRY CLUB – MONTHLY WATER DIVERSION FOR GOLF COURSE IRRIGATION

addition, the majority of these diversions are operated by the U.S. Forest Service. Only two, Tahoe Paradise Resort Lake and Lake Christopher, are privately owned and operated.

The exact status of these diversions for use is not clear in the language of the Interstate Water Compact. In defining waters of the Tahoe Basin to be charged against the compact limitation, Section D of Article V states, in part,

> "total annual gross diversions for use within the Lake Tahoe Basin from all natural sources including groundwater and under all water rights..."

In addition, Article XIV of the compact also states, in full:

> "Each state may use water for nonconsumptive purposes, including but not limited to flood control, recreation, fishery and wildlife maintenance and enhancement, and hydroelectric power generation, provided that such uses result in no discernible reduction in the water allocated to the other state."

A review of the record of the compact commission negotiations reveals that the 23,000 afa limitation on diversion for use within the California portion of the basin is not restricted to depletion only but is meant to be an easily measured amount to be used instead of actual depletion. The record also shows that the compact negotiations were primarily concerned with diversions for municipal, agricultural, recreational, and domestic water use.

The State Board in its 1969 report on water use in the Lake Tahoe Basin indicated that diversions for lake storage and stream flow enhancement were nonconsumptive. However, in 1972 the State Board adopted a policy for the administration of water rights in the Lake Tahoe Basin which included a statement to the effect that all permits and licenses shall be limited so that their aggregate base value in addition to other rights should not exceed

23,000 acre-feet in the California portion of the Basin. Many of these licenses include rights for diversion for lake storage and stream flow enhancement.

Through evaporation and transpiration some of the water associated with lake storage and stream flow enhancement depletes the total supply available to the basin. Many of the diversions increase the size of a natural water body, thereby increasing evaporation, and make releases for stream flow enhancement during dry periods of the year (late summer - early fall) when significant amounts of water would not be flowing. The main question, therefore, is how much of these diversions are depletion, and is it significant?

For those diversions which are solely for reservoir level maintenance, such as the Tahoe Paradise Resort Lake and Lake Christopher, almost the entire diversion is depleted due to evaporation. In Decision 1200, the State Board intended that the amount of water depleted due to diversion for maintenance of the Tahoe Paradise Resort Lake would be chargeable against the Interstate Water Compact. However, the State Board also indicated that this was an inferior use of water and would have to be discontinued at such a time as the water is needed for superior municipal or domestic purposes. The situation with Tahoe Paradise Resort Lake and Lake Christopher is relatively straightforward due to the completely man-made nature of these lakes. The water lost due to evaporation from the entire surface area of a lake is the depletion. For Tahoe Paradise Resort Lake, this depletion is estimated to be 25% of the face value of the appropriative right.

For Lake Christopher, due to its onstream nature, 100% of the diversion to the lake is depleted due to evaporation. However, no water right application for this diversion has ever been filed.

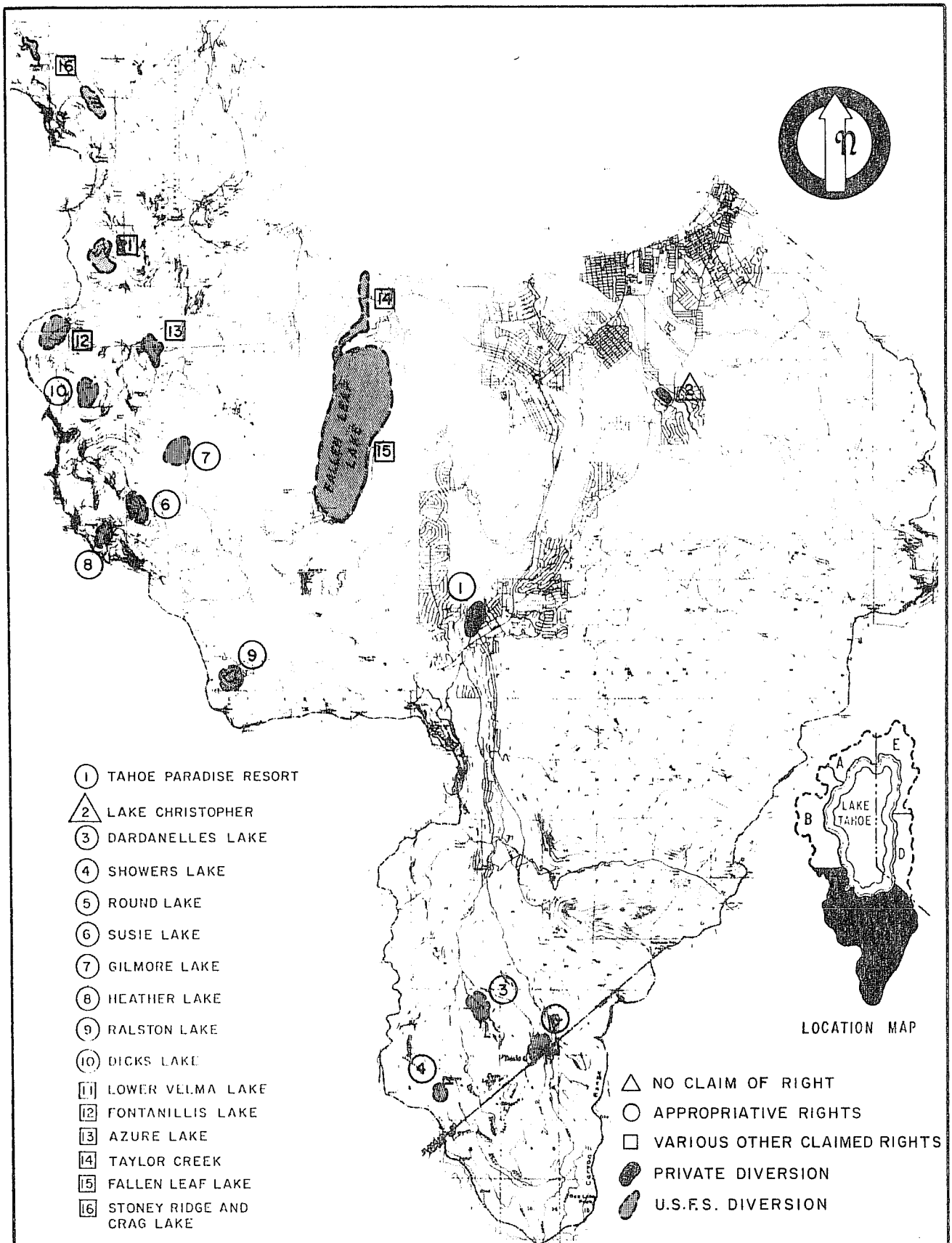
TABLE III-25

CONSUMPTIVE USE (DEPLETION) ASSOCIATION WITH DIVERSIONS FOR LAKE MAINTENANCE AND STREAM FLOW ENHANCEMENT IN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

	Face Value Div. (afa)	Lake Surface Area (acres)	Stream Channel Length (miles)	Est. Consumptive loss (afa)	% of Total Div. (%)
1. Tahoe Paradise Resort Lake[A/]	209	12	-	42	20%
2. Lake Christopher [A/]	70	20	-	70	100%
3. Dardanelles Lake	63	18			
4. Showers Lake	31	8	→ 6.0	29	30%
5. Round Lake	3	35			
6. Suzie Lake	99	38			
7. Gilmore Lake	295	78	→ 6.25	45	8%
8. Heather Lake	142	32			
9. Ralston Lake	133	16	1.0	6	4%
10. Dicks Lake	295	59			
11. Lower Velma Lake	85	32	→ 3.75	32	6%
12. Fontanillis Lake	155	27			
13. Azure Lake	150	32	4.5	19	13%
14. Fallen Leaf Lake	6800	1384	2.5	250	4%
15. Taylor Creek Stream Profile[B/]	2081	-	-	-	-
16. Stoneyridge & Crag Lakes	189	94	5.0	31	17%
Artificial Lake Maintenance	284	32	-	112	39%
Total-Flow Enhancement	8440	1759	29.0	395	5%
Stream Profile Chamber	2081	-	-	-	-
Total	10635	1791	29.0	507	-

A/ Private man-made lakes with no stream losses
B/ Taylor Creek Stream Profile Chamber at 5 cfs diversion rate by U.S. Forest Service

FIGURE III-19



WATER DIVERSION FOR LAKE STORAGE AND STREAM FLOW ENHANCEMENT IN CALIFORNIA

The other diversions for lake storage and stream flow enhancement held by the U. S. Forest Service are not so straightforward. In the first place all of the points of diversion were originally natural lakes. Thus the entire surface of the lake cannot be used to determine evaporative losses, but only the increase in surface area due to increase in storage. Furthermore, a substantial portion of the releases for streamflow enhancement made during the low flow portion of the year may be depleted due to evaporation and transpiration by riparian vegetation.

Table III-25 lists estimates for consumptive use for all diversions for Lake storage and stream flow enhancement. This information is not precise, but gives a potential range of depletion losses associated with such diversions. Evaporative losses from lakes are assumed to be 3.5 afa/acre. The effective surface areas of all natural lakes with diversion for stream flow enhancement are assumed to have been increased by 5%. Losses along stream channels due to evaporation and transpiration by riparian vegetation is assumed to be 1.0 acre-foot/month/mile during a 3 month summer-fall stream flow release period. By comparison, summer and early fall stream flow losses observed in Lonely Gulch Creek on the west shore of Lake Tahoe during an erosion control demonstration project conducted by the State Board from 1974 - 1976 were on the order of 30 acre-feet/month/mile. However, these losses include infiltration to groundwater which cannot be considered depletion.

Based upon the information presented in Table III-25 diversions with a total face value of 10,635 afa exist for lake maintenance and stream flow enhancement of which about 507 afa is depletion. Of the gross diversion, 2081 afa is diverted for the U. S. Forest Service stream profile chamber. There are no consumptive losses associated with this use. A total of 284 afa is diverted solely for artificial lake maintenance with a substantial amount (112 afa) being depleted. The remaining 8440 afa diverted for stream flow enhancement

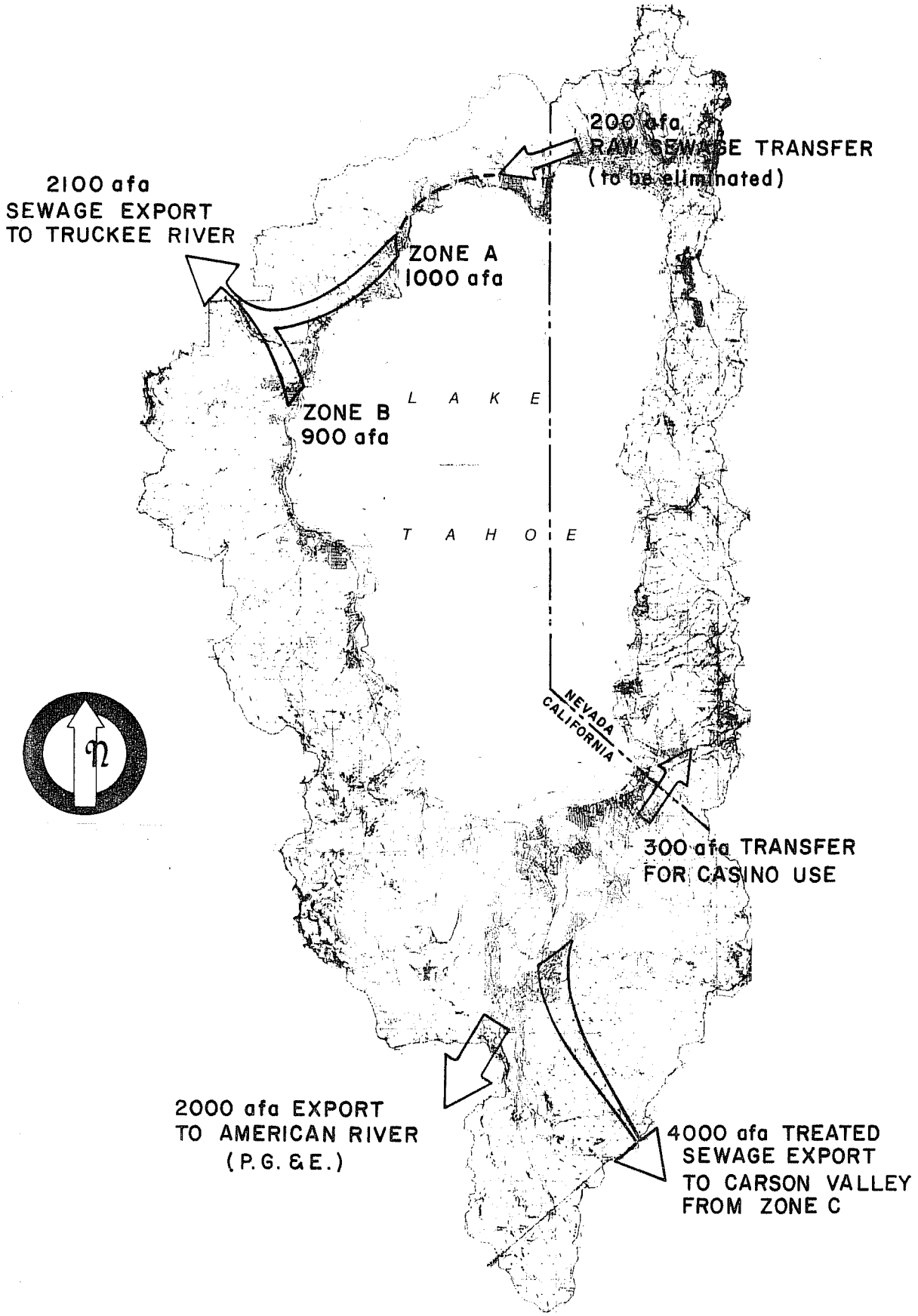
is estimated to result in depletion of less than 5% (395afa). Fallen Leaf Lake is by far the largest diversion in this category with a face value of 6800 afa. Of this amount less than 4% (250 afa) is estimated to be depleted annually. Of the remaining 1640 afa diverted for stream flow enhancement, approximately 162 afa, or 10%, is depletion.

Of the diversions listed in Table III-25, several do not have water rights with the State Board. These include Lower Velma Lake, Fontanilies Lake, Azure Lake, and Fallen Leaf Lake. All of these are operated for stream flow enhancement by the U. S. Forest Service with a total controlled storage of 7190 afa. The Taylor Creek stream profile chamber of U. S. Forest Service is also operated without a water right, but causes no depletion and does not affect any other water right. In addition one private diversion for lake maintenance, Lake Christopher, with a face value and net depletion of 70 afa is maintained without the benefit of a water right.

E. INTERSTATE AND INTERBASIN TRANSFERS OF WATER

All interstate and interbasin transfers of water across boundaries of the California portion of the Lake Tahoe Basin are shown in Figure III-20. Out-of-Basin transfers in existence as of December 31, 1959 are excluded from the terms of the Interstate Water Compact. The only diversion in this category in California is one by Pacific Gas and Electric Company (A5618, L-2542) for 2000 afa diverted from Echo Lake to the American River watershed for purposes of power generation.

In addition, the Interstate Water Compact allows export of water from the Tahoe Basin after initial use. Two such exports, both involving sewage, exist in the California portion of the Lake Tahoe Basin. In the north and west portions of the Lake Tahoe Basin (Zones A & B), raw sewage is collected by the North Tahoe P.U.D. and Tahoe City P.U.D. and exported from the Basin by the Tahoe Truckee Sanitation Agency (TTSA) in a pipeline for advanced treatment and land disposal in the Truckee River watershed near Truckee, California. The other export, from South Tahoe, Zone C, is treated sewage exported to the



INTER-STATE TRANSFER AND BASIN EXPORT OF WATER FROM THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

Carson River watershed for recreational and agricultural uses. A more complete discussion of the South Tahoe sewage export is offered below. The majority of the water exported as sewage is not chargeable against the Interstate Water Compact. However, the portion attributable to infiltration of snowmelt and storm runoff into the sewer system is chargeable against the compact, due to the absence of prior use. Table III-26 presents sewage and sewer infiltration data developed in the Water Diversion for Use part of this Section. The raw sewage values in Table III-26 do not necessarily represent the total amount of raw sewage actually generated. Based upon evidence documented in Section III-B, a considerable amount of unaccounted for water appears to exist. A portion of this amount may be due to exfiltration. As shown in Table III-26, the maximum amount of infiltration over the 4-year base period (1974 - 1977) is estimated at 584 afa. This is approximately 10% of the total amount of sewage waste exported from the California portion of the Lake Tahoe Basin.

In addition to the transbasin exports mentioned above, two small interstate transfers also exist. At the south end of the Basin approximately 300 afa is delivered to Harrah's Casino by the South Tahoe P.U.D. A portion of this water is then exported as sewage to the Carson River watershed by the Douglas County S.I.D. At the north end of the lake, approximately 200 afa of raw sewage generated by the north stateline casino group in Nevada is delivered to North Tahoe P.U.D. for basin export and treatment by TTSA in Truckee. This interstate transfer of raw sewage is expected to be terminated in the near future once proper transport facilities are completed in Nevada.

Wastewater Exported BY South Tahoe P.U.D.

The sewage export by South Tahoe P.U.D. is the only depletive export out of the Lake Tahoe - Truckee River watershed from the California portion of the Lake Tahoe Basin other than the PG&E Echo Lake diversion. For this reason the ultimate use and destination of this water has been carefully analyzed.

TABLE III-26

SEWAGE, SEWER INFILTRATION, AND SEWAGE EXPORT FROM THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

	ACRE-FEET PER ANNUM (afa)				
	1974	1975	1976	1977	Maximum Infiltration
Zone A, North Tahoe P.U.D. (includes Washoe County Sewer Improvement District)					
. Raw Sewage	911	1081	921	978	
. Est. Infiltration	215	132	10	20	215
Subtotal	1126	1213	931	998	
Zone B, Tahoe City P.U.D.					
. Raw Sewage	759	762	771	653	
. Est. Infiltration	154	97	77	21	154
Subtotal	913	859	848	674	
Total TTSA Export	2039	2072	1779	1672	369
Zone C, South Tahoe P.U.D.					
. Raw Sewage	3442	3764	3873	3658	
. Est. Infiltration	215	171	61	189	215
Total STPUD Export	3657	3935	3934	3847	215
CALIFORNIA TOTAL	5696	6007	5713	5519	584

For the calendar years 1974-77 the following amounts of wastewater were treated at the South Tahoe P.U.D. plant in South Lake Tahoe and subsequently exported:

1974	3700 afa
1975	3900 afa
1976	3900 afa
1977	3800 afa

After export the water is stored in Indian Creek Reservoir in a small watershed tributary to the East Fork of the Carson River. Water is released for flood irrigation of approximately 2500 acres of pasture and hay as follows:

I.	Diamond Ditch Association	
	A. Hall (Wade Valley)	200 Acres
	B. Bruns (Paynesville and Fredricksburg)	150
	C. Neddenriep (Fredricksburg)	430
	D. Gannsberg (Fredricksburg)	700
	Subtotal	1480
II.	Schwacke Ranch (Diamond Valley)	100
III.	Heise Land and Livestock (Diamond Valley)	350 Acres
IV.	Smith (Dutch Valley)	170
V.	Springmeyer (Long Valley)	400
	Total	2500 Acres

The above irrigated acreages are identified in Figure III-21. The Diamond Ditch Association receives reclaimed wastewater from Indian Creek Reservoir through the Diamond Ditch. The Diamond Ditch Association is the only water purchaser having a specific contract with the Alpine County Water Agency which operates the reservoir. Excess water applied to the lands of the Diamond Ditch Association above the evapotranspirative requirements of the forage crops may be available for other down-basin uses through drainage ditches or percolation to groundwater. The Schwacke Ranch is the only user

receiving water directly from the export pipeline rather than from Indian Creek Reservoir. Water diverted at this point is hydraulically limited to a flow of about 1.5 cfs which allows a maximum of 100 acres to be irrigated.

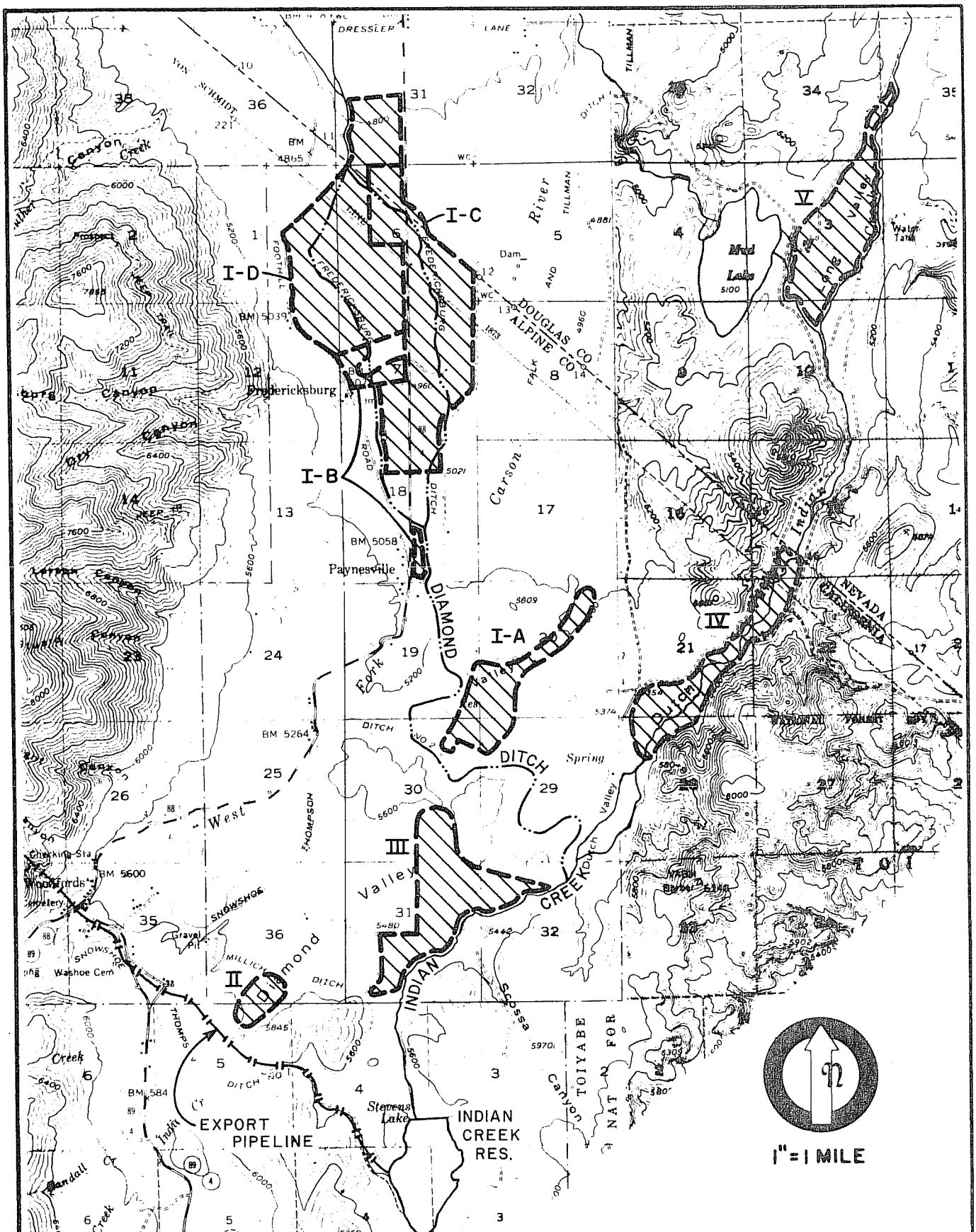
The Heise Land and Livestock receives excess water from Indian Creek Reservoir above that needed to maintain recreational and fishery uses of the reservoir, and after the Diamond Ditch Association and the Schwacke Ranch have satisfied their demand. Excess water from the Heise operation flows through drainage ditches for subsequent down-basin reuse on the Smith and Springmeyer Ranches.

Based upon the Blaney-Criddle method and assuming that half of the irrigated land is in alfalfa and the other half is pasture, the following is the total monthly consumptive evapotranspirative demand for 2500 acres during the irrigation season:

Month	Inches	Acre-Feet
April	1.00	208
May	2.90	604
June	4.41	917
July	5.41	1126
August	4.48	1007
September	3.19	665
	21.39	4527 Acre-feet

The contract between the Diamond Ditch Association and the Alpine County Water Agency requires that reclaimed wastewater be used "for supplemental irrigation only upon land possessing water rights". During years of average hydrology, irrigation water obtained by appropriation of naturally occurring surface water is sufficient to meet consumptive irrigation requirements approximately through the end of July. Therefore, the availability of reclaimed wastewater is beneficial to the irrigators only from the standpoint of extending the effective irrigation season through August and September. Most reclaimed water released from Indian Creek Reservoir for irrigation prior to the end of July will result in either of the following:

FIGURE III - 21



LANDS IRRIGATED BY WASTEWATER EXPORTED BY SOUTH TAHOE P.U.D. TO CARSON RIVER WATERSHED.

1) reclaimed wastewater is applied in excess of the naturally occurring water already applied to meet the consumptive demand of crops and thus becomes available for other downbasin uses through either direct runoff or percolation to groundwater, or

2) reclaimed wastewater is solely used to meet the consumptive demand of the crops grown allowing the naturally occurring water to become available for other down-basin uses, or

3) a combination of the above.

Therefore, any amount of reclaimed wastewater made available while there is still sufficient naturally occurring water to meet net consumptive irrigation requirements, provides a new source of water for other down-basin users. The only time when reclaimed wastewater can be applied for irrigation without constituting a new down-basin supply (either directly or indirectly) is when other sources of water are not normally available during August and September. Reclaimed wastewater applied during these two months will extend the growing season, and, up to the net evapotranspirative requirements of the crops, will be consumptively used.

According to the members of the Diamond Ditch Association most reclaimed wastewater in Indian Creek Reservoir is currently released for irrigation use during the months of August and September, although releases do occur throughout the year. For example, during March 1978, significantly prior to the start of the irrigation season, releases had to be made to accommodate higher than normal natural runoff. The members of the Diamond Ditch Association claim that the following approximate annual amounts of water have been diverted from Indian Creek Reservoir for irrigation use over the past few years:

Diamond Ditch	1600 afa
Schwacke	100 afa
Heise, Smith, Springmeyer	900 afa
	2600 afa

The existing contract between the Diamond Ditch Association and Alpine County Water Agency limits the total amount which may be diverted to 3000 acre-feut per annum, but this amount has never been reached. The total water balance of Indian Creek Reservoir is approximately as follows:

Water Budget

Credits

1.	Reclaimed wastewater	3900 afa
2.	Natural inflow from 1700 acres	800 afa
		4700 afa

Debits

1.	Irrigation releases	2600 afa
2.	Evaporative Losses	400 afa[1/]
3.	Seepage Losses	1700 afa[2/]
		4700

Therefore significant losses apparently do occur by means of percolation from the reservoir itself. This, of course, cannot be considered a consumptive use in itself, as this seepage is ultimately a source of groundwater supply to down-basin users.

This analysis indicates that a considerable amount of reclaimed wastewater is not consumptively used and therefore is available for further down-basin use. These amounts available as a result of reservoir operation are:

1/ Based upon three feet evaporation per year for reservoir with average of 130 acres of surface area and estimated evaporative losses between April 1969 and April 1970.

2/ Based upon 135 acres of seepage areas at a rate of 0.035 feet (0.42 in.) per day as determined by McGauhey in May 1970 report to STPUD.

1)	Irrigation water applied above August-September consumptive crop requirements (2600 - 1772 = 828)	828
2)	Reservoir seepage losses	1700
	Subtotal	2528
	Minus natural runoff to reservoir	-800
	Total basin supply increment	1728 afa

It is quite likely, however, that this amount is used consumptively by other users of water in the Carson River above Lake Lahontan either through prolonged summertime streamflow maintenance and surface diversions via enhanced groundwater levels or through increased availability of water from groundwater pumpage. However, this small amount of supplemental groundwater recharge cannot be significant due to the fact that State of Nevada, Department of Water Resources in 1977 ceased to issue water rights permits for groundwater extraction in the Carson Valley in Nevada. Thus, based upon Nevada's cessation of the groundwater right permitting process, any incremetal amount of water made available to the Carson Valley as a whole in recent years due to the operation of the reservoir, is slight compared to the increasing demands for groundwater in the Carson Valley.

F. WATER RIGHTS CONSIDERATIONS

As shown in the previous discussions, water use within the California portion of the Lake Tahoe Basin has been in a state of continual and rapid expansion for the past twenty years. Although presently well within the Interstate Water Compact Limitation of 23,000 afa, water use in the future may eventually exceed this amount. Factors which will tend to further increase total water diversion for use at Tahoe include:

1. Continued residential dwelling development.

2. Continued commercial development, and resultant increasing permanent year round population.

3. Increasing occupancy and persons per dwelling unit.

4. Increasing per capita or per unit water use rates for landscape irrigation or other purposes.

If water use under any one of the above factors were to be curtailed, water use could still continue to increase due to the other three factors. A halt in residential construction, for example, probably would not halt increasing water use as population could continue to expand through increases in occupancy or use of existing units.

Although water use did drop significantly during the drought period (1976-77), per capita water use has been increasing at an average rate of 4-5 gallons /capita/day per year for the past twenty years. This trend may continue, particularly if there is a continued desire at Lake Tahoe to have irrigated landscape improvements such as lawns. At present, landscape irrigation constitutes only about 20-25% of the total annual water demand within the California portion of the Lake Tahoe Basin. Throughout Northern California, landscape irrigation and outside water use can constitute 50% or more of the total annual water demand.

Potential Levels of Future Water Demand

Water diversion can be extremely elastic, as was demonstrated by the recent drought. The sustenance of drought levels of water use on a continued and permanent basis is open to question, however. To illustrate potential levels of water diversion for use a number of development and water use "scenarios " have been chosen. These scenarios are used to illustrate the wide range of potential water use levels. Four levels of development are chosen for illustration. These are:

1. Current level of development as of December, 1977.

2. Complete buildout of existing subdivided area (there are currently about 18,100 vacant lots within the California portion of the Lake Tahoe Basin.

3. Additional subdivision development beyond existing subdivided areas according to the CTRPA general plan.

4. Additional subdivision development beyond existing subdivided areas according to the TRPA general plan.

The California Tahoe Regional Planning Agency's (CTRPA) general plan would allow further subdivision with residential unit densities ranging from 25% to 50% of those allowed under the Bi-State Tahoe Regional Planning Agency's (TRPA) general plan.

For purposes of this report, four different water use conditions were considered for each of the above levels of development. These are:

1. The minimum drought rate of water use observed in either 1976 or 1977.

2. The "present average" rate of water use observed for the 1974-1977 period.

3. The "present maximum" rate of water use observed in the maximum use year, usually either 1974 or 1975.

4. The present average rate of water use "expanded" to reflect increased occupancy of available dwelling units. Potential annual average occupancy is assumed to expand from the present 56% to a potential 78% within the California portion of the Basin. Average summer occupancy rates are assumed to increase from 72% to 100% with a proportional winter time occupancy increase from 48% to 67%.

An additional scenario could be added to reflect increased per capita or landscape irrigation use. For example, if the per capita landscape irrigation under any of the above scenarios were to double, total water use could be expected to increase by 20% on an annual basis.

Table III-27 lists the 16 potential water use scenarios resulting from the 4 development levels and 4 conditions of water use for each of the three zones (A, B,C) and for the entire California portion of the Lake Tahoe Basin. The values in Table III-27 are indicative of levels of water demand for municipal, domestic and irrigation water use on all lands within the California portion of the Basin. As illustrated in Figure III-22, however, these are not the only uses of water which may be charged against the Interstate Water Compact allocation of 23,000 afa. Other uses which may be charged against the Interstate Water Compact include the following:

Exported Sewer Infiltration Water. Although the Interstate Water Compact allows export of sewage waste after original diversion without charge to the compact, this does not include the additional amount of export resulting from infiltration to underground sewer lines. Based upon an analysis conducted in a previous part of this report the amount of exported sewer infiltration from the California portion of the Tahoe Basin is estimated to be approximately 600 afa in a non-drought year. This amount is principally due to spring time snowmelt saturation of low lying areas and sewer line leaks. Rehabilitation of sewer lines would have a tendency to reduce this amount but probably never eliminate it entirely.

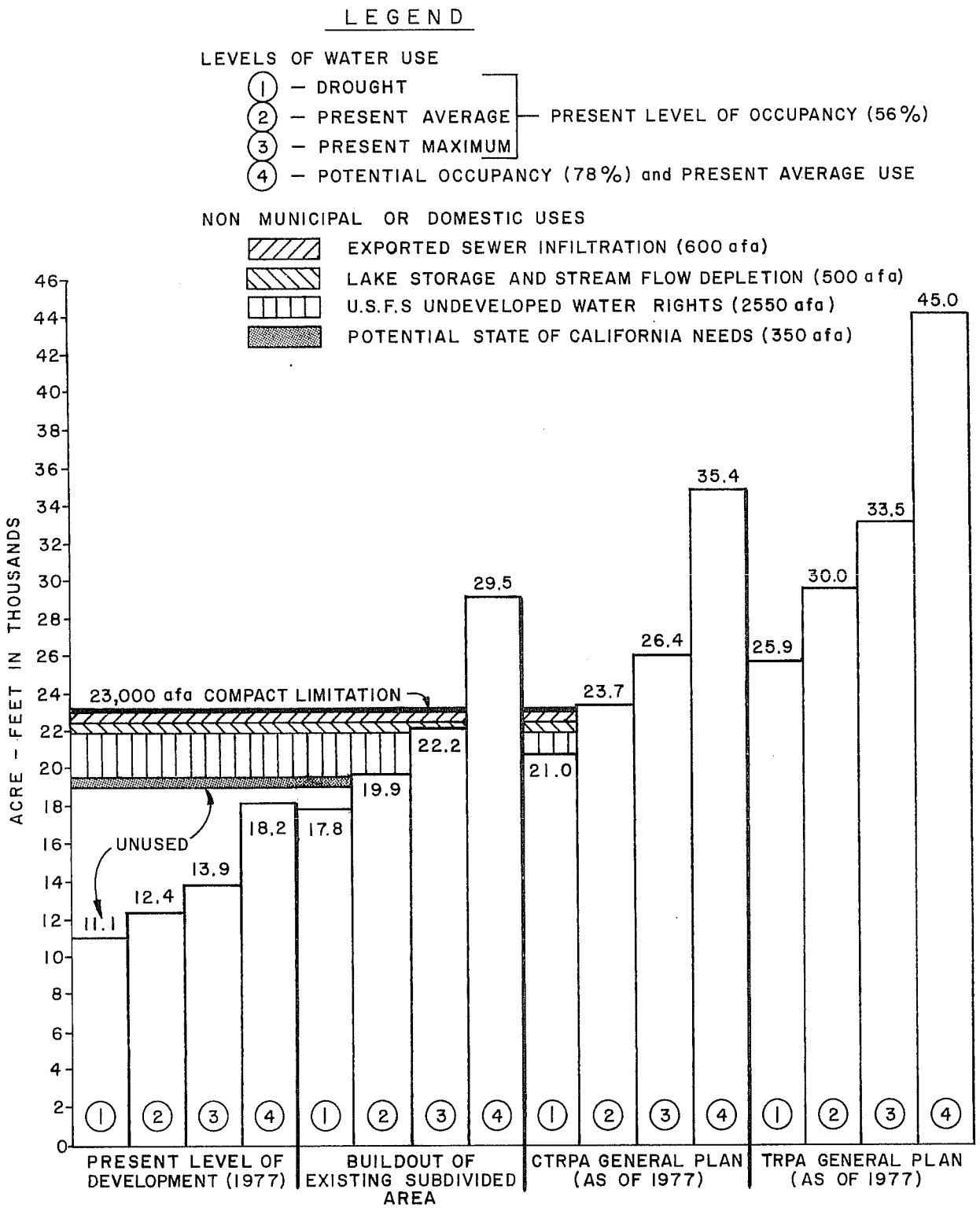
Depletion Due to Lake Storage and Streamflow Enhancement. As discussed in a previous part of this report, the amount of depletion associated with lake storage and streamflow enhancement (not including Lake Tahoe itself) is estimated to be 500 afa. Although the total face value of the amount stored is not chargeable to the Interstate Compact, the amount of actual depletion associated with these uses should be chargeable. Due to the fact that this is a rough estimate only and most of the stored water is under the purview of the U. S. Forest Service, it would be wise for the U.S. Forest Service to conduct an investigation to determine more accurately the depletion associated with these uses.

TABLE III-27

POTENTIAL LEVELS OF FUTURE MUNICIPAL, DOMESTIC AND IRRIGATION WATER DEMAND FOR THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN A/

	ANNUAL WATER DEMAND (afa)			
	NORTH TAHOE ZONE A	WEST TAHOE ZONE B	SOUTH TAHOE ZONE C	TOTAL CALIFORNIA TAHOE BASIN
1. Current Development				
o Drought Condition	1763	2394	6936	11093
o Present Average	1826	2927	7661	12414
o Present Maximum	2067	3303	8518	13888
o Potential Occupancy	3125	4720	10345	18190
2. Full Development				
o Drought Condition	2724	3598	11503	17825
o Present Average	2815	4466	12647	19928
o Present Maximum	3196	5245	13804	22245
o Potential Occupancy	4815	7673	16966	29454
3. Additional Subdivision				
A. CTRPA Plan				
o Drought Conditions	2907	4960	13116	20983
o Present Average	3031	6422	14265	23718
o Present Maximum	3442	2390	15543	26375
o Potential Occupancy	5213	10841	19302	35356
B. TRPA Plan				
o Drought Conditions	3499	7547	14899	25945
o Present Average	3719	9888	16405	30012
o Present Maximum	4232	11391	17895	33518
o Potential Occupancy	6476	16435	22135	45046

A/ Includes golf courses, stockwatering, and pasture lands.



PROJECTED LEVELS OF URBAN WATER USE INCLUDING MUNICIPAL, DOMESTIC & IRRIGATION DEMAND COMPARED TO INTERSTATE COMPACT LIMITATION FOR CALIFORNIA PORTION OF THE LAKE TAHOE BASIN & OTHER DEMANDS.

U. S. Forest Service Water Right Claims and Current Holdings. As discussed in Section IV of this report, the U. S. Forest Service currently holds numerous appropriative water rights and claims a number of other uses under other rights. Many of these rights are not fully exercised at the present time but may be at some future time. These rights and potential uses should be protected until it is determined that these rights are not needed for U.S. Forest Service lands within the California portion of the Lake Tahoe Basin or downstream in the Truckee River.

California State Lands. The State of California owns about 5,800 acres of the Tahoe Basin. These lands which represent (4.2%) of the California portion of the Lake Tahoe Basin are under the jurisdiction of the California Department of Parks and Recreation. At present no appropriative rights are associated with any of these lands. On the basis of 0.06 acre-foot per acre, which approximates the use rate of State lands currently developed for recreation, the potential water demand will be approximately 350 afa. Other uses for which the State may wish to reserve water would be for a program of revegetation purposes of erosion control throughout the California portion of the Basin.

Water Allocation

Based upon the above reservations of water for exported sewer infiltration, lake storage and streamflow depletion, U. S. Forest Service water rights, and State of California lands, the amount remaining available for use upon private lands is approximately 19,000 afa. Thus, of the 23,000 afa Interstate Water Compact allocation for diversion for use within the California portion of the Lake Tahoe Basin, 4,000 acre-feet may be considered not available for municipal, domestic, or irrigation use on private (non-Federal and non-State) lands.

At the present rate of water use (160 gal/cap/day) within the California portion of the Lake Tahoe Basin, the average annual population on private lands within the California portion of the Lake Tahoe Basin could not exceed 106,000 people (38.7×10^{6}/ person-days per year without total water use exceeding 19,000 afa. Based on current seasonal trends, this equates to an

average winter population of 84,000 people and an average summer population of 138,400 people. At the current occupancy rate (56%), approximately 90% of the remaining vacant lots could be developed. At a potential future occupancy rate of 78%, only 20% of the remaining vacant lots could be developed without cutting into U. S. Forest Service water rights or potential water requirements on lands owned by the State of California.

If water use were to increase ultimately to a level of 200 gal/capita/day the annual average population on private lands with the California portion of the Basin could not exceed 84,800 persons (31 million person-days per year) on an average annual basis without total water use exceeding 19,000 afa. Based upon current seasonal trends, this equates to 67,000 and 110,700 people during the winter and summer, respectively.

The trend will be for further development to expand the ultimate level of water use to the limits of the Interstate Water Compact allocation. There is now no central authority to determine the appropriate level of water use within each water district, or water company use area. Each utility continues to plan and develop its water supply without regard for the Compact limitation. There has been no previous attempt to break down the appropriate level of water use for each of the major zones of the California portion of the Basin.

One rational method of allocation would divide the basinwide allocation on the basis of dwelling units and uniform unit water use rates. For example, the unit water use rates for the four different types of dwelling units in the South Lake Tahoe area are as follows:

	gal/unit/day
Single Family Homes	327
Multiple Family Units	189
Hotel/Motel Units	116
Mobile Homes & Campgrounds	110

Furthermore, the expected distribution of non - U. S. Forest Service or non-State Park dwelling units at full development of existing subdivided lands for each zone is as follows:

	North Tahoe Zone A	West Tahoe Zone B	South Tahoe Zone C
SFU's	5124	8375	22,000
MFU's	1619	1560	4,584
MOTELS	1964	371	9,127
Mobile Home's/Campgrounds	162	122	1,610

By applying the unit water use values to the respective dwelling units and dividing by the total hypothetical water use, an estimate of the percentage breakdown of total California water use may be made for each of the zones as follows:

	% of total California-Tahoe Water Use on Private Lands
North Tahoe, Zone A	15.23%
West Tahoe, Zone B	21.12%
South Tahoe, Zone C	63.65%

On the basis of 19,000 afa ultimately being available for use on private lands within the California portion of the Lake Tahoe Basin, the following breakdown per zone may be made:

	afa
North Tahoe, Zone A	2,890
West Tahoe, Zone B	4,010
South Tahoe, Zone C	12,100
TOTAL	19,000

Other similar procedures may also be used to determine a proportional breakdown between various areas within each zone. Differing unit water use values could be used, as could different levels of development. Considerations such as potential non-development of stream zones, flood plains, or high erosion hazard lands could also be applied. Nonetheless, most of these different approaches would yield roughly the same percentage breakdown between water use areas.

Recorded Appropriative Diversions

Appropriative water rights on file with the California State Water Resources Control Board (State Board) fall within two categories:

1. Section 12 Filings

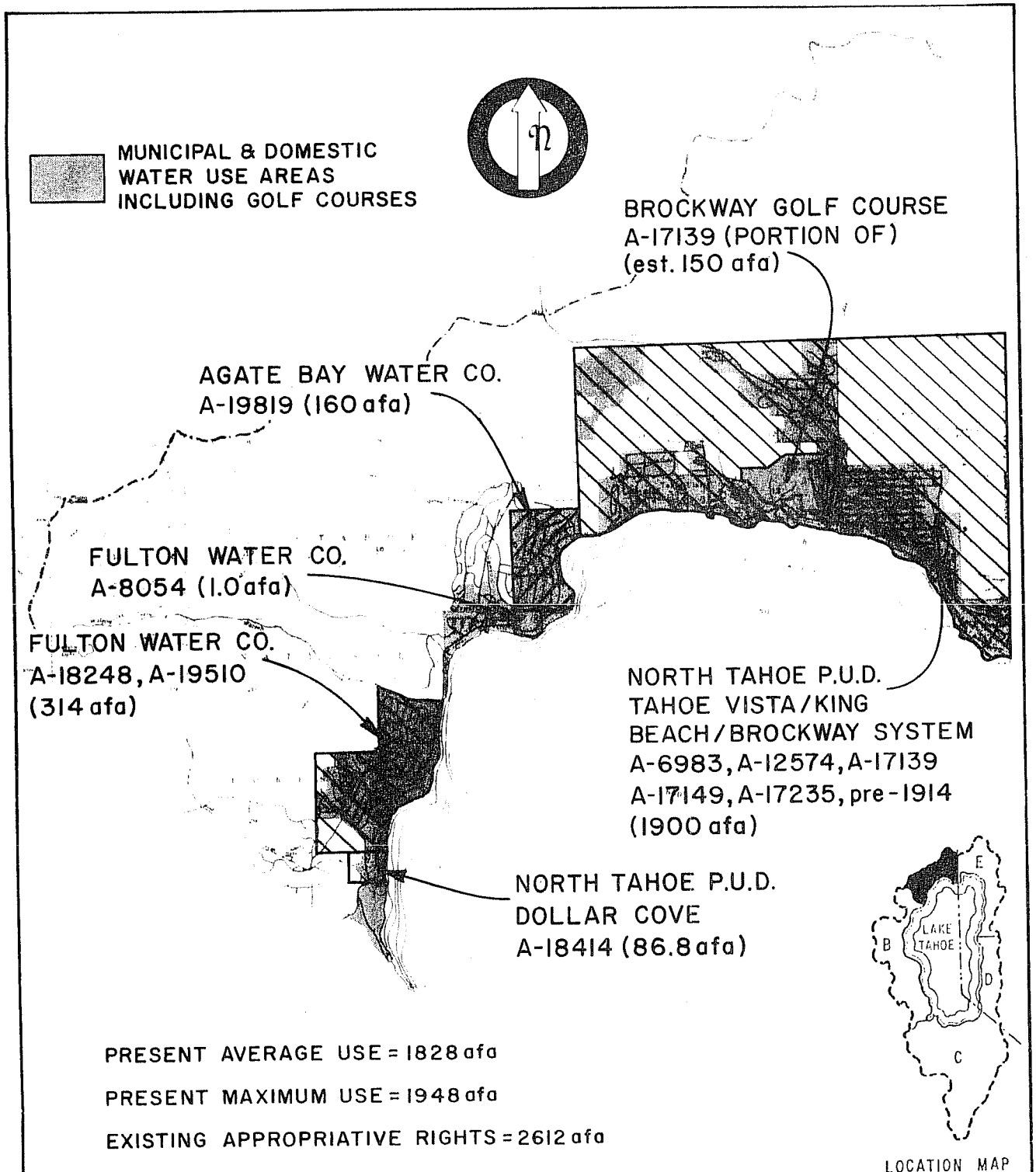
2. Permits and Licenses issued by the State Board or its predecessors since December 19, 1914. These rights are listed in detail in the separately bound Appendix D to this report. Water diverted for use under these rights, however, accounts for only about 27% of the water diverted for use within the California portion of the Lake Tahoe Basin. Those areas where a portion or all of the water diverted for use are based upon appropriative rights are depicted in Figures II-23, II-24, and II-25 for Zones A, B, and C, respectively. Of the 136 water rights currently on file with the State Board for diversion and use within the California portion of the Basin, only 113 are currently being used. The other 23 generally fall into two categories:

    a. Potentially active appropriative rights.

    b. Inactive appropriative rights not likely to be developed or further used.

The water rights which fall into these two categories are listed in Table III-28 and III-29. Potential active water rights should be closely monitored by the State Board in the future, but no action need be taken at present.

FIGURE III-23



PRESENT AVERAGE USE = 1828 afa

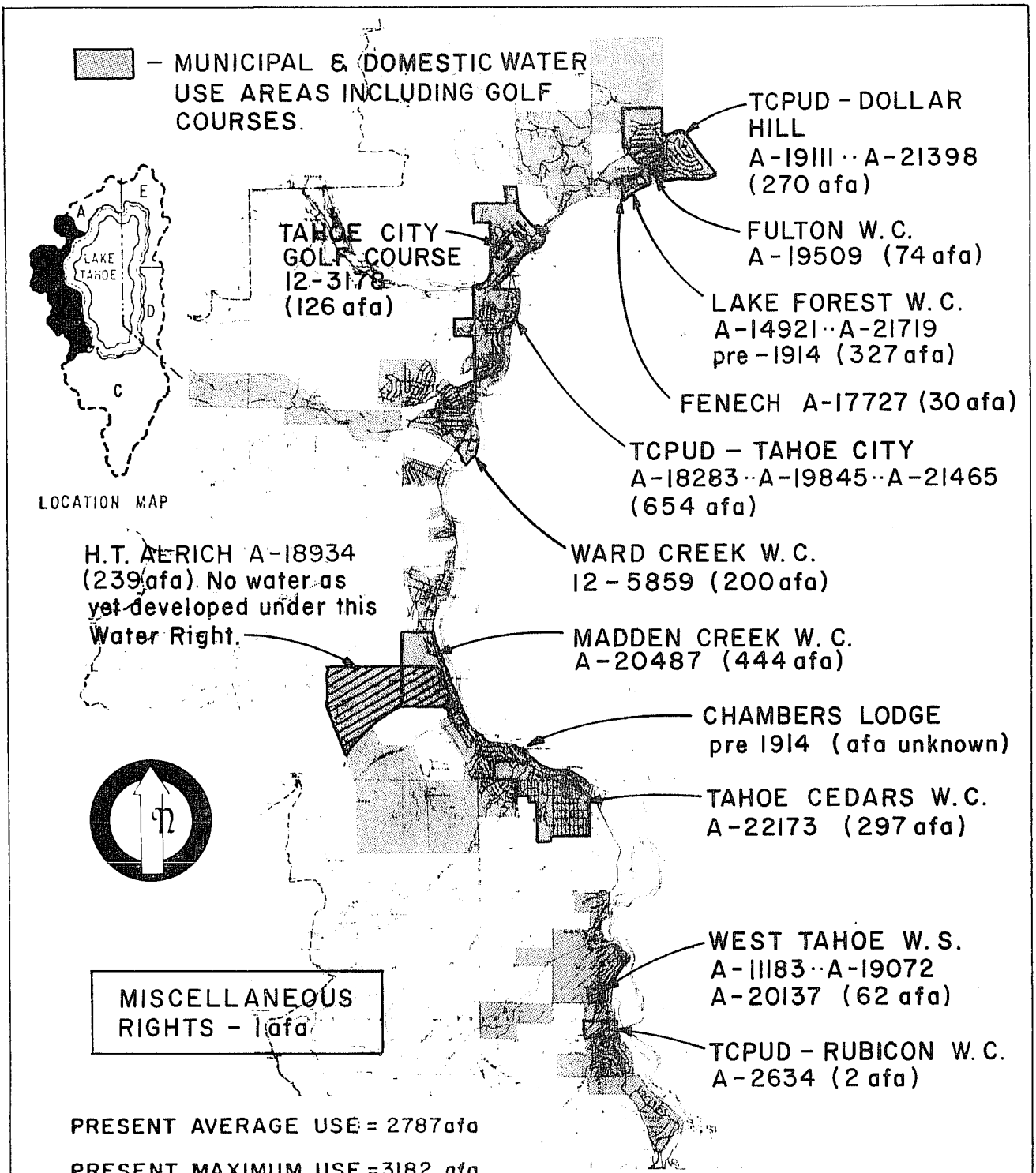
PRESENT MAXIMUM USE = 1948 afa

EXISTING APPROPRIATIVE RIGHTS = 2612 afa

ESTIMATED ZONE A ALLOCATION BASED UPON
19000 afa AVAILABLE FOR MUNICIPAL & DOMESTIC USE = 2890 afa

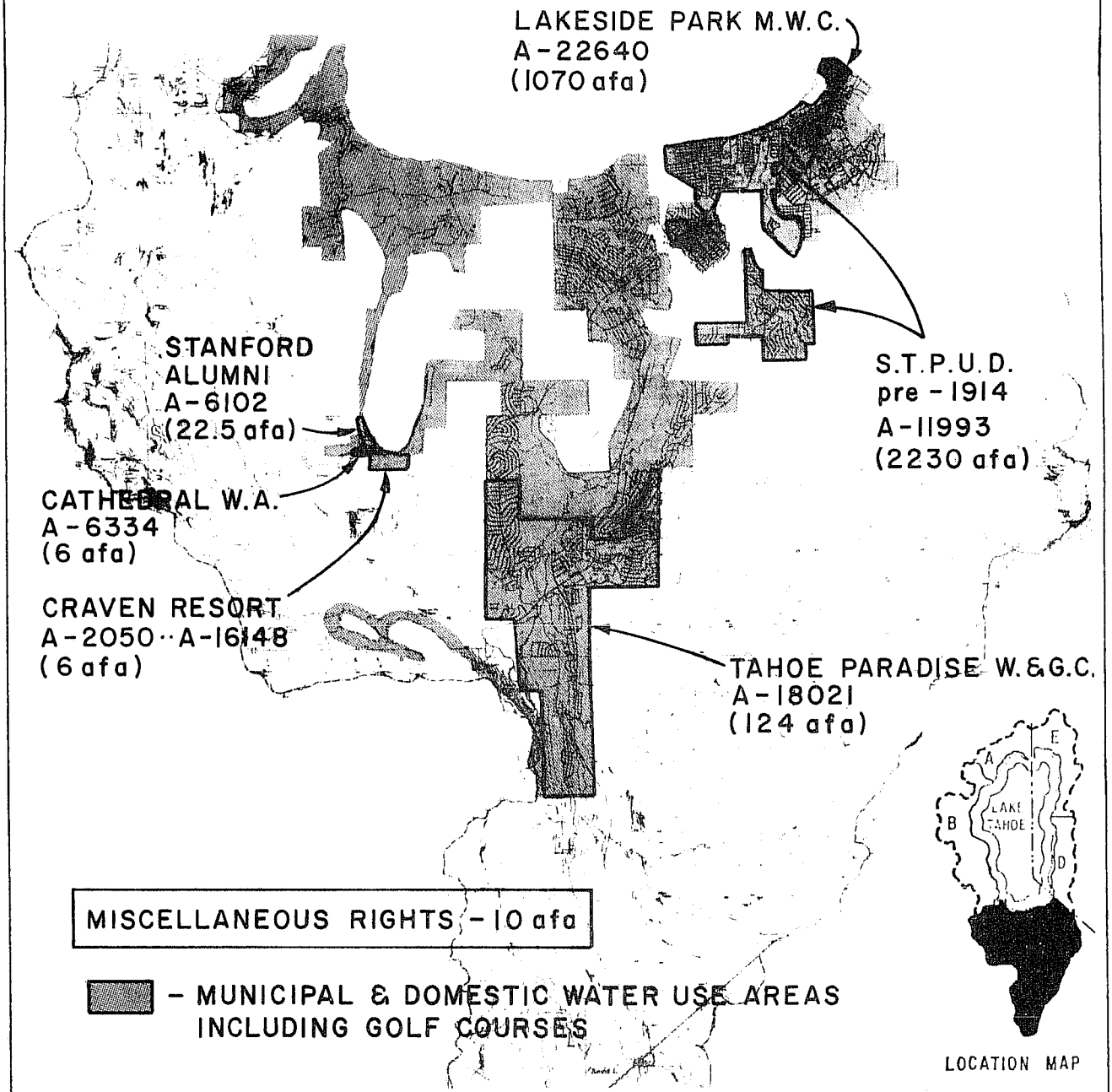
NORTH TAHOE, ZONE A PARTIALLY DEVELOPED, NON-U.S.F.S. APPROPRIATIVE RIGHTS

FIGURE III-24



WEST TAHOE · ZONE B · PARTIALLY DEVELOPED NON - USFS APPROPRIATIVE WATER RIGHTS.

FIGURE III - 25



PRESENT AVERAGE USE = 7670 afa

PRESENT MAXIMUM USE = 8129 afa

EXISTING APPROPRIATIVE RIGHTS = 3469 afa

ESTIMATED ZONE C ALLOCATION BASED UPON
19000 afa AVAILABLE FOR MUNICIPAL & DOMESTIC USE = 12,070 afa

SOUTH TAHOE ZONE C PARTIALLY DEVELOPED NON-USFS APPROPRIATIVE WATER RIGHTS

TABLE III-28

CURRENTLY INACTIVE BUT POTENTIALLY ACTIVE APPROPRIATIVE RIGHTS ON FILE WITH THE STATE BOARD FOR WATER DIVERSION FOR USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

APPLICATION NUMBER	STATUS	APPLICANT	Diversion Amount (cfs or gpd)	Annual Face Value (afa)
		NORTH TAHOE, ZONE A		
A-22651	P-15771	U. S. Forest Service	5.94 cfs	1729
		WEST TAHOE, ZONE B		
A-11449	P-7756	U. S. Forest Service	0.34 cfs	130.5
A-18934	P-14398	H. T. Alrich	0.24 cfs	239
A-19072	P-12497	B. S. Smith	0.07 cfs	32.3
A-20137	P-14338	B. S. Smith	0.06 cfs	19.2
A-21465	P-14572	Tahoe City P.U.D.	0.2 cfs	75
			Subtotal	496
		SOUTH TAHOE, ZONE C		
A-4736	L-1156	H. Lee	250 gpd	0.12
A-6093	L-1793	J. Bath	200 gpd	0.06
A-6903	L-3128	U. S. Forest Service	3000 gpd	1.54
A-9938	L-4031	City of Berkeley	6000 gpd	2.33
A-13953	L-6043	City of Berkeley	10000 gpd	2.33
A-20944	L-8502	City of Berkeley	3500 gpd	2.33
A-18153	L-6913	U. S. Forest Service	3000 gpd	1.93
			SUBTOTAL	6
			California-Tahoe Total	2231

Water rights which are inactive and have no prospect of use in the future should be considered for revocation by the State Board. Table III-30 lists the total face values of appropriative water rights for each zone (A, B, C) which are on file with the State Board, and indicates the amount used and not used under these rights.

TABLE III-29

CURRENTLY INACTIVE APPROPRIATIVE WATER RIGHTS
NOT LIKELY TO BE USED FURTHER OR DEVELOPED
ON FILE WITH THE STATE BOARD FOR
WATER DIVERSION FOR USE WITHIN THE CALIFORNIA
PORTION OF THE LAKE TAHOE BASIN

APPLICATION NUMBER	STATUS	APPLICANT	Diversion Amount (cfs or gpd)	Annual Face Value- (afa)
		NORTH TAHOE, ZONE A		
A-753	L-107	North Tahoe, P.U.D.	2200 gpd	0.9
A-1379 *	P-679	North Tahoe, P.U.D.	0.67 cfs	485
		SUBTOTAL		486
		WEST TAHOE, ZONE B		
		- N O N E -		
		SOUTH TAHOE, ZONE C		
A-9818	L-3270	U. S. Forest Service	7450 gpd	8.4
A-10914	L-7170	W. V. D. Johnson	2.5 cfs	892
A-14077	L-4155	Harrah's Realty	0.11 cfs	80.3
A-18030	P-13527	Tahoe Paradise Water	3.0 cfs	1945
A-18031	P-13528	Tahoe Paradise Water	3.0 cfs	1945
A-18038	P-13529	Tahoe Paradise Water	3.0 cfs	1945
A-18039	P-13530	Tahoe Paradise Water	3.0 cfs	1945
A-19629	P-14335	Tahoe Paradise Water	2.33 cfs	400
			SUBTOTAL	3326
		California Tahoe Total		3812

* Present Watson Creek Diversion is inactive. Change in point of diversion to Lake Tahoe would rectify this condition.

TABLE III-30

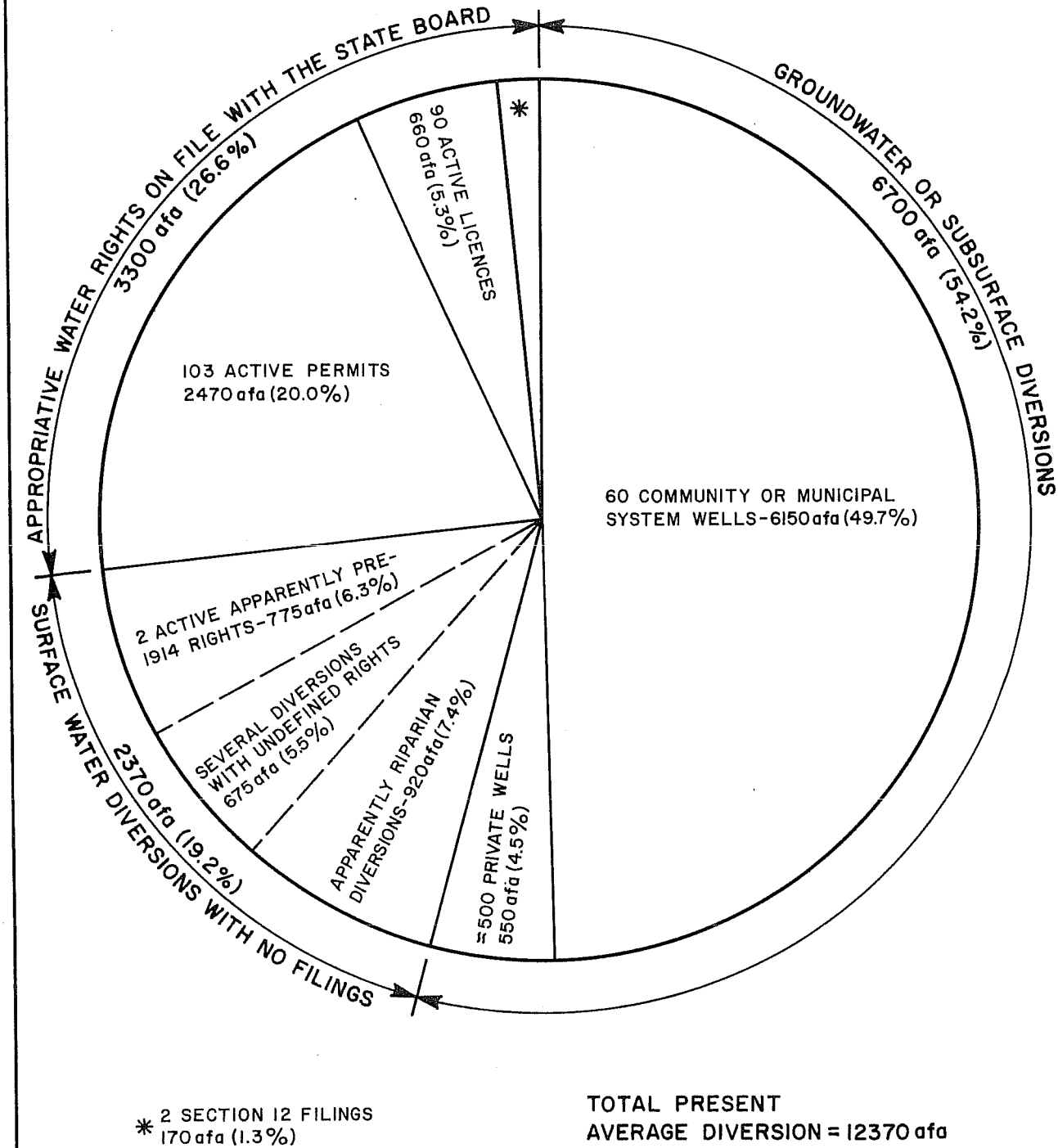
APPROPRIATIVE WATER RIGHTS ON FILE WITH THE STATE BOARD FOR USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN (INCLUDES SECTION 12 FILINGS)

	NORTH TAHOE ZONE A		WEST TAHOE ZONE B		SOUTH TAHOE ZONE C		CALIF-TAHOE TOTAL	
	NO.	afa	NO.	afa	NO.	afa	NO.	afa
I. WATER RIGHTS FOR MUNICIPAL, DOMESTIC OR IRRIGATION USE								
A. Water Rights - Currently active								
1. Face Value	(10)	2387	(18)	2577	(75)	2754	(103)	7717
2. Present Average Use		1307		697		1288		3292
3. Amount not used		1080		1880		1466		4425
B. Water Rights - Potentially Active	(1)	1729	(5)	496	(7)	6	(13)	2231
C. Water Rights not likely to be developed or used further	(2)	486	(0)	--	(8)	3326	(10)	3812
SUBTOTALS 1. Face Value	(13)	4602	(23)	3073	(90)	6085	(126)	13760
2. Amt. Not used		3295		2376		4798		10468
II. WATER RIGHTS FOR LAKE STORAGE OR STREAM FLOW ENHANCEMENT	(0)	--	(1)	190	(9)	1391	(10)	1581
TOTAL (Face Value)	(13)	4602	(24)	3262	(99)	7477	(136)	15341

TABLE III-31

SUMMARY OF WATER RIGHTS FOR PRESENT AVERAGE WATER DIVERSION FOR USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

	NORTH TAHOE ZONE A		WEST TAHOE ZONE B		SOUTH TAHOE ZONE C		TOTAL CALIFORNIA TAHOE	
	Diversion (afa)	% of TOTAL	Diversion (afa)	% of TOTAL	Diversion (afa)	% of TOTAL	Diversion (afa)	% of TOTAL
A. APPROPRIATIVE WATER RIGHTS								
1. Pre-1914 Rights	12.2	0.7	---	--	763	10.0	775.2	6.2
2. Section 12 Rights	--	--	163.6	5.6	--	--	163.6	1.3
3. State Board Filings	1307.8	71.6	533.0	18.2	1288.2	16.8	3129.0	25.2
SUBTOTAL	1320.0	72.2	696.6	23.8	2051.2	26.8	4067.8	32.8
B. APPARENT RIPARIAN RIGHTS	253.5	13.9	351.3	12.0	312.7	4.1	917.5	7.4
C. GROUNDWATER DIVERSIONS	91.6	5.0	1402.0	47.9	5210.0	68.0	6703.6	54.0
D. OTHER DIVERSIONS W/UNKNOWN RIGHTS	161.9	8.9	477.2	16.3	87.0	1.1	726.1	5.8
	1827	100	2927	100	7661	100	12414	100



* 2 SECTION 12 FILINGS
170 afa (1.3%)

TOTAL PRESENT
AVERAGE DIVERSION = 12370 afa

WATER RIGHTS FOR PRESENT AVERAGE WATER DIVERSION WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN (NOT INCLUDING DIVERSIONS FOR LAKE STORAGE AND STREAM FLOW ENHANCEMENT).

Other Diversions

In addition to appropriative water rights on file with the State Board, numerous other water diversions for municipal, domestic, and irrigation use are currently taking place. These diversions fall into one of the following categories:

1. Pre-1914 apropriative rights initiated prior to the passage of the Water Commission Act in 1914. These rights are very poorly defined in most cases.

2. Diversions apparently riparian in nature. These diversions, are complicated by uncertainty of what may or may not be included as a riparian right.

3. Diversions without rights or with undefined rights. Many of the diversions in this category may in fact be valid pre-1914 rights or riparian rights, but at present no determination can be made due to lack of jurisdiction by the State Board. The validity of most of these rights would have to be decided in a court of law through an adjudication procedure.

4. Groundwater or subsurface water diversions. These are by far the largest category of diversions for use within the California portion of the Lake Tahoe Basin. About 54% of the water diverted for use comes from wells.

Table III-31 summarizes the appropriative, riparian, undefined, and groundwater diversions for use within each zone (A,B,C) of the California portion of the Lake Tahoe Basin. Figure III-26 further illustrates the breakdown between categories by means of a pie chart. The dashed lines between pre-1914, undefined, and apparently riparian diversions indicate that these amounts are rather ill-defined, as many of the undefined rights may be valid pre-1914 or riparian diversion. This general grouping as a whole (pre-1914, undefined, and riparian) accounts for all of the surface water diversions in the California portion of the Lake Tahoe Basin which are not on file with the State Board. The majority of all water diversions are not surface water diversions, however. Over 54% of the diversions are of groundwater or subsurface origin. Water diversion for use within the California portion of the Basin as of 1977 may be broadly categorized as follows:

TABLE III-32

PENDING APPROPRIATIVE WATER RIGHTS
APPLICATIONS BEFORE THE STATE BOARD
FOR THE CALIFORNIA PORTION OF THE
LAKE TAHOE BASIN (1977)

APPLICATION NUMBER	APPLICANT AND WATER USE AREA	SOURCE	Diversion Amount (cfs or gpd)	Annual Face Value (afa)
A-23275	U. S. Forest Service Meeks Bay Resort	Lake Tahoe (one)	2.0 cfs	832
A-23393	South Tahoe P.U.D. South Tahoe, Zone C	Lake Tahoe (Several)	52.5 cfs	19,000
A-23475	North Tahoe P.U.D. Dollar Cove System	Lake Tahoe (one)	0.5 cfs	362
A-23479	Tahoe City P.U.D. West Tahoe, Zone B	Lake Tahoe (Several)	15.6 cfs	6500
A-23502	Angora Water Company Angora, TPW&G, T. Keys	Lake Tahoe (one)	14.33 cfs	5968
A23727	North Tahoe P.U.D. Carnelian System	Lake Tahoe (one)	1.0 cfs	72
A-24257	North Tahoe, P.U.D. North Tahoe, Zone A	Lake Tahoe (several)	8.0 cfs	5792
A-24885	L. E. Swanson Homewood Area	Mckinney Creek (one)	300 gpd	0.2
			TOTAL	39,178

		afa	% of total
1.	Appropriative rights on file with the State Board	3300	26.7%
2.	Surface diversions with no filings	2370	19.2%
3.	Groundwater or subsurface diversions	6700	54.2%
	Total	12,370	100 %

Pending Applications Before the State Board

As of 1977 the applications listed in Table III-32 were before the State Board, pending approval. The State Board should consider approving these rights if such approval can be helpful in:

- providing a better management framework for water development and use

- centralizing and coordinating water management authority

- preventing water use in the Lake Tahoe Basin from exceeding the limitations imposed by the Interstate Water Compact.

The eight pending water right applications and factors and recommendations which should be considered in determining their disposition are:

Application 23275 held by the U. S. Forest Service. The U. S.. Forest Service already holds a total of about 2550 afa of appropriative rights or riparian and groundwater diversions. Protection of these sources of water supply is probably sufficient for U. S. Forest Service needs in perpetuity. The State Board should consider allowing changes in place of use, and points of diversion of the already permitted rights to cover U. S. Forest Service water requirements on U. S. Forest Service lands. The State Board should consider denial of A-23275.

Applications 23475 and 23727 held by the North Tahoe P.U.D. These applications are for portions of the North Tahoe P.U.D. water service area. The amounts diverted, places of use and points of diversion are also covered in A-24257 also held by the North Tahoe P.U.D. These applications may be reduced from 362 AFA to 70 AFA and 724 AFA to 125 AFA for domestic use within the Dollar Cove water system, respectively. Alternatively, these applications may be denied and these uses covered under pending application 24257.

Application 24885 held by L. F. Swanson. This water right application is for only 0.2 afa and should be considered insignificant. The State Board should consider approving the application or any other like it in the future if such a diversion would not harm downstream water rights holders.

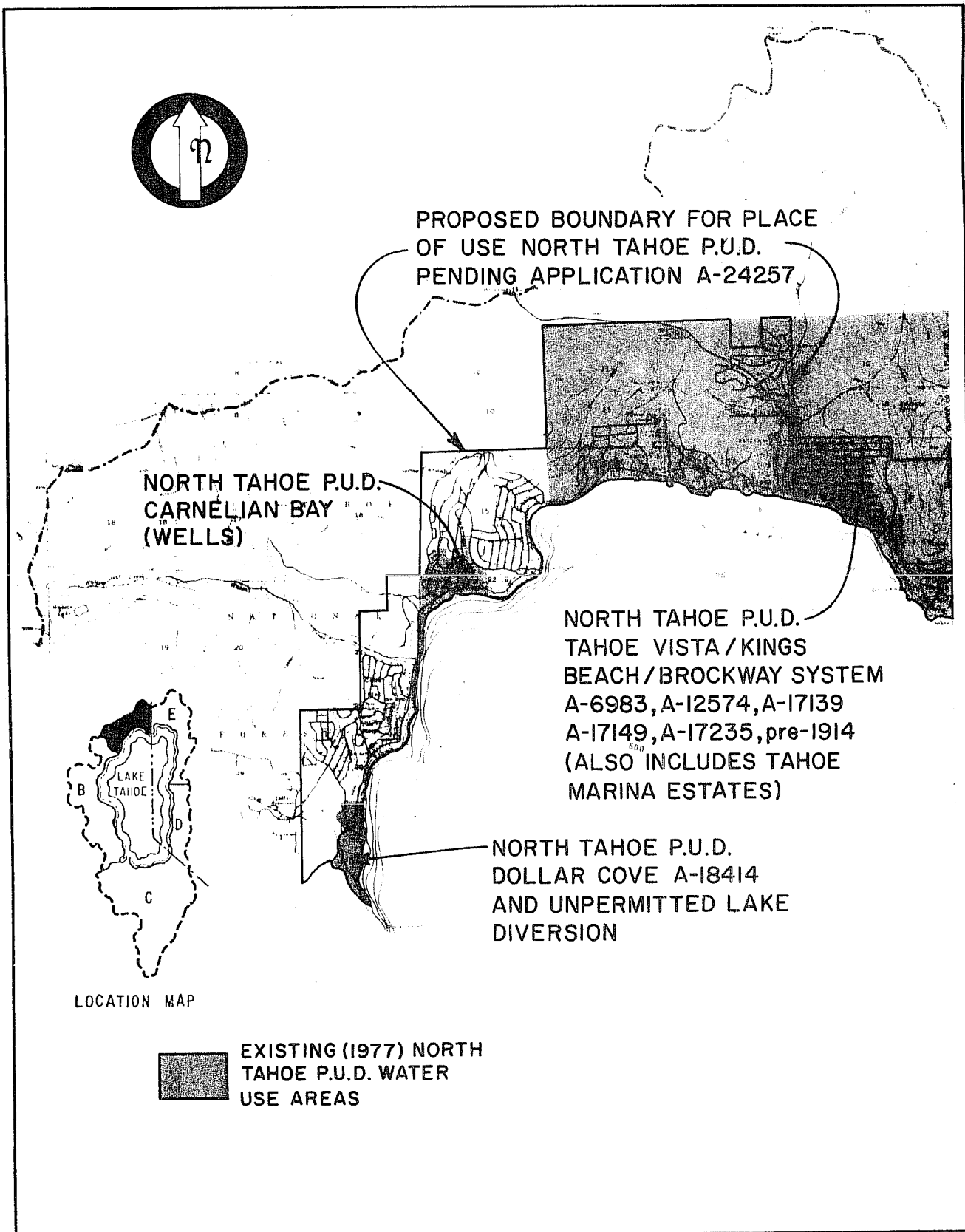
Application 23502 held by Angora Water Company. This application is for exactly the same amount, place of use, and points of diversion as the petitioned changes in permitted applications 18030, 18031, 18038, 18039, and 19629 held by Tahoe Paradise Water and Gas Co. (TPW&G). The proposed place of use includes the service areas of Angora Water Co., TPW&G and Tahoe Keys Water Co. Approximately 95% of the water diverted for these areas is currently provided by wells. It is unlikely that surface supplies will ever be developed. The State Board should consider approving A-23502 but reducing the annual amount from 5968 afa to 5020 afa with the provision that all sources of supply, including groundwater, be included.

Application 23393, held by South Tahoe P.U.D., Application 23479, held by Tahoe City P.U.D., and Application 24257, held by North Tahoe P.U.D. The proposed places of use for these pending applications are shown in Figures III-27, III-28 and III-29. As can be seen from these figures, the places of use encompass essentially the entire extent of privately owned lands in each of the three zones (A,B,C). The only exceptions are in Zone C where Cascade properties, portions of Glen Alpine Canyon and some privately owned livestock grazing lands are excluded from the place of use described in A-23393, held by the South Tahoe P.U.D. The State Board should consider approving these applications, but substantially reducing the allowed diversions as follows:

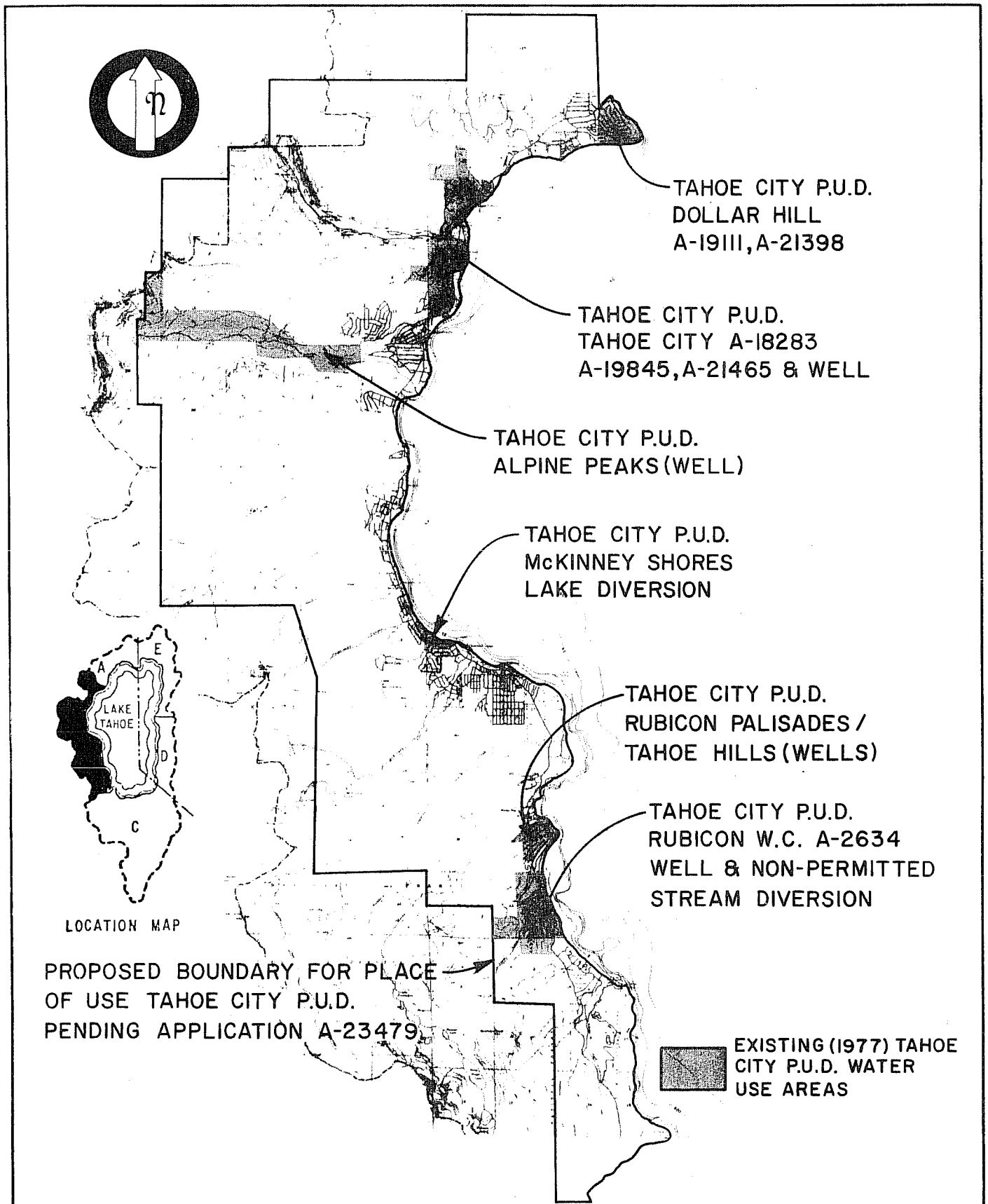
	Peak Diversion (cfs)	Annual Face Value (afa)	Maximum Month (afa)
A23393 (South Tahoe P.U.D.)	33.4	12,100	1730
A23479 (Tahoe City P.U.D.)	11.0	4,010	570
A24257 (North Tahoe P.U.D.)	8.0	2,890	410

These values are derived from the assumption that a total of 19,000 afa is available for diversion for use on private lands within the California portion of the Lake Tahoe Basin. Furthermore, the 19,000 afa is proportionately

FIGURE III - 27

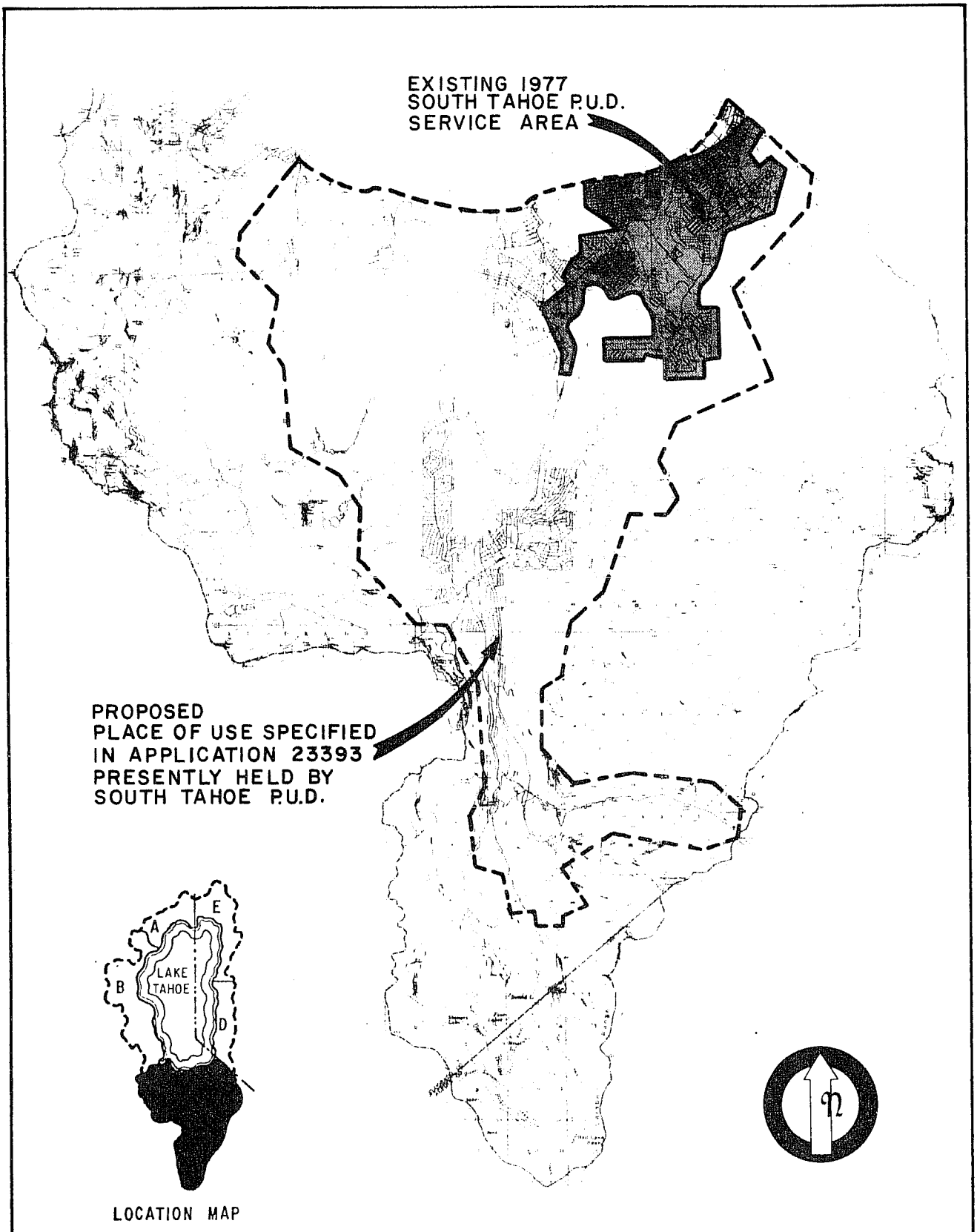


NORTH TAHOE P.U.D. PENDING APPLICATION A-24257 PLACE OF USE IN ZONE A



TAHOE CITY P.U.D. PENDING APPLICATION A-23479 PLACE OF USE IN ZONE B

FIGURE III - 29



SOUTH TAHOE PUBLIC UTILITY DISTRICT
PENDING APPLICATION 23393 PLACE OF USE IN ZONE C

divided between each zone according to present development potential of existing subdivided areas as set forth in the procedure discussed earlier in this section. The basis for these proposed allocations include:

1. Modification of places of use to include the entire zone (A,B,C) for each of the respective rights.

2. Charging of use of water on State or Federally owned lands against rights held by either the State of California or the U. S. Government.

3. Diversions under these appropriative rights, in addition to other diversions for use on private lands within each place of use, including other appropriative rights, riparian diversions, groundwater diversions, and undefined rights shall not exceed the peak instantaneous, annual face value, and maximum monthly amounts as set forth in the above table.

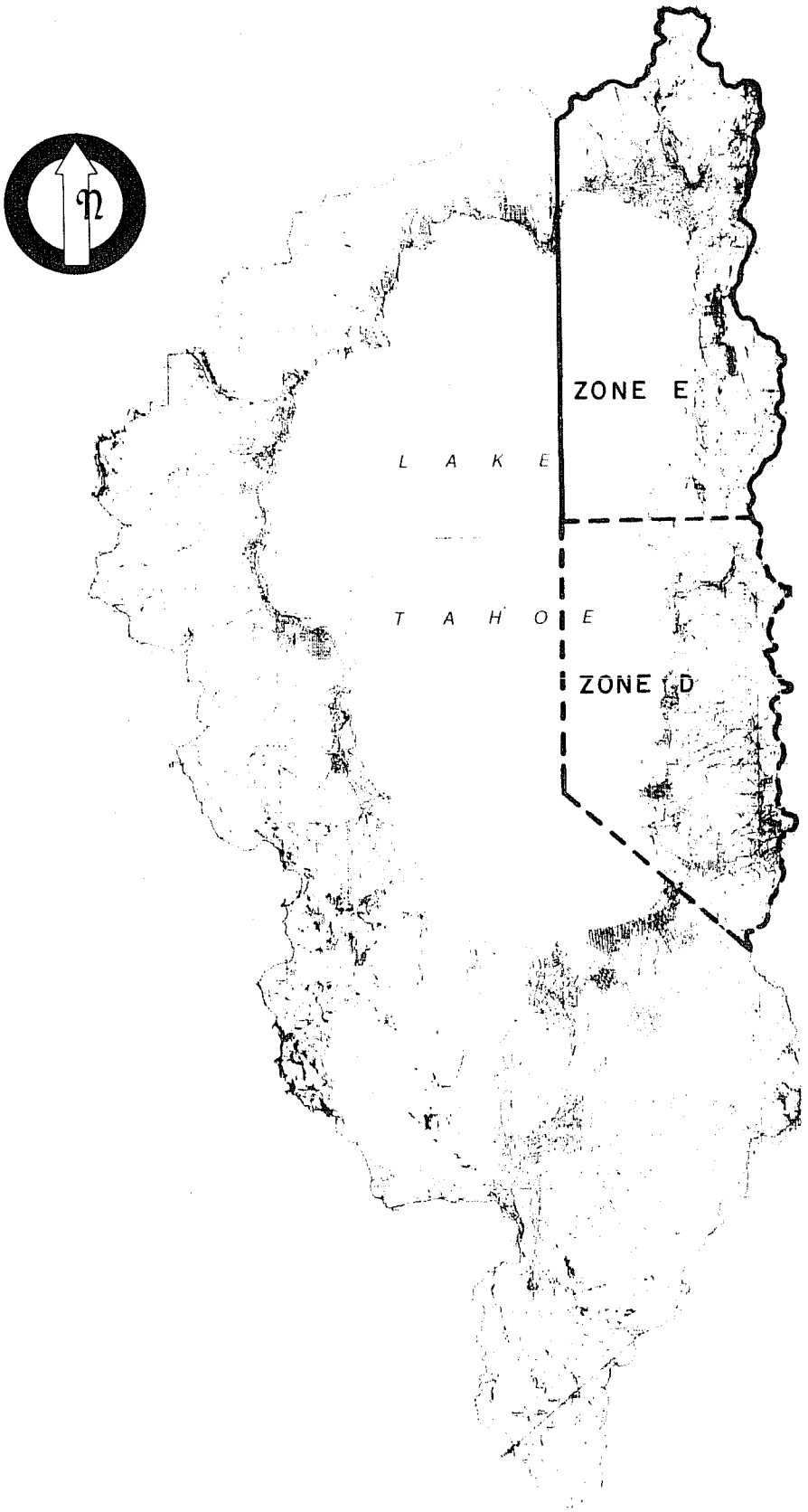
Existing Permits

Permitted appropriative rights which come before the State Board for periodic review should be amended in order that water diverted from all sources, including other appropriative rights, riparian diversions, and groundwater extractions for use within the place of use together with that diverted under the permit does not exceed an amount sufficient for the needs of the place of use and is in proportion to needs of the entire basin.

SECTION IV

WATER USE IN THE NEVADA PORTION OF THE LAKE TAHOE BASIN

FIGURE IV-1



NEVADA WATER USE ZONES

SECTION IV

WATER USE IN THE NEVADA PORTION OF THE LAKE TAHOE BASIN

A. INTRODUCTION

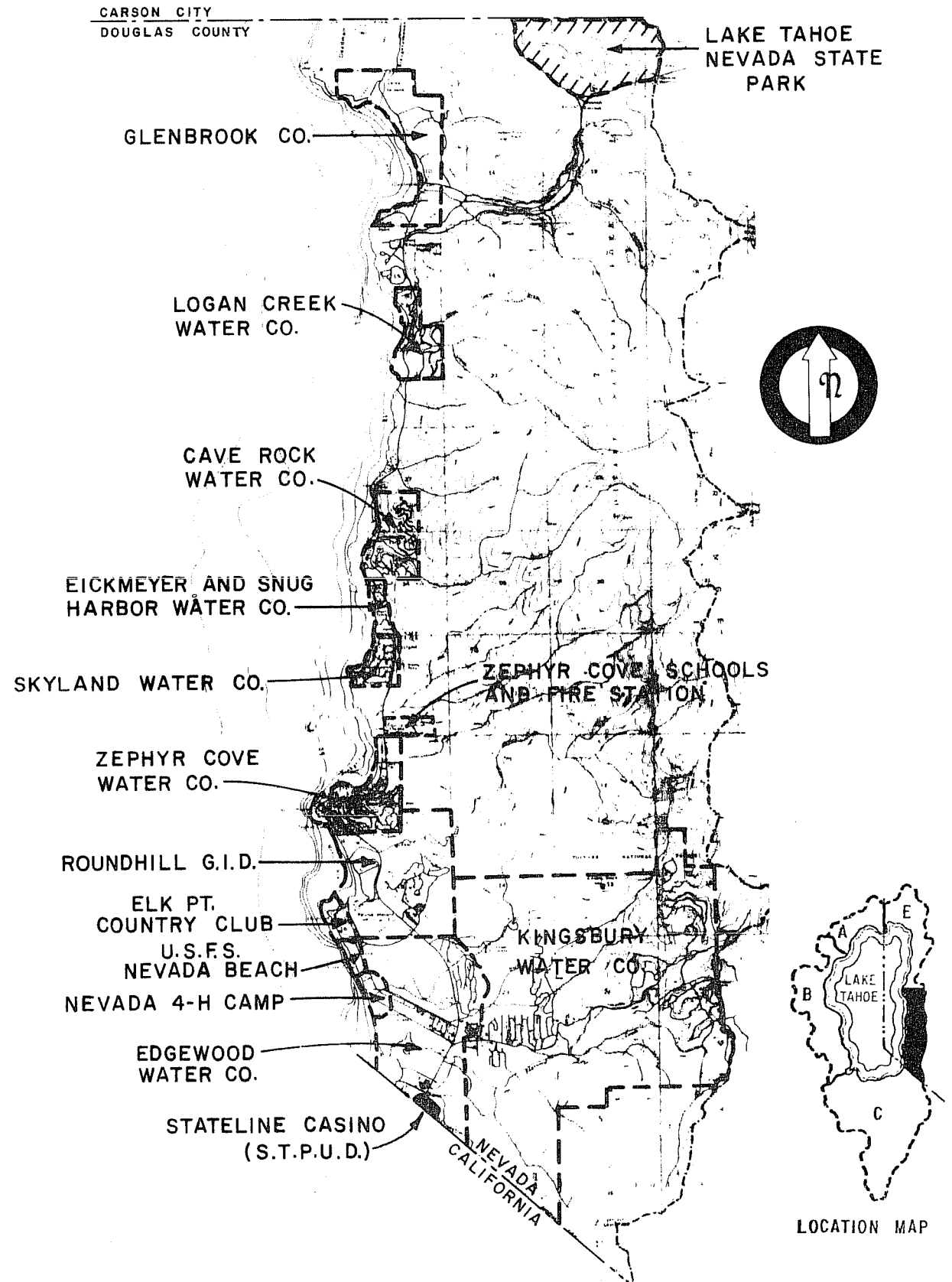
Much of the information contained in this section of the report was provided by the office of the Nevada State Engineer in Carson City. The Nevada portion of the Lake Tahoe Basin is shown in Figure IV-1. For purposes of this report the Nevada portion of the basin is divided into two zones: 1) Douglas County, Zone D, which contains the South Tahoe-Stateline casino area and a series of subdivision developments served by small water companies north to Glenbrook, and 2) Washoe County and Carson City, Zone E, which contains North Tahoe-Stateline casino area, Incline Village, and the majority of the Lake Tahoe Nevada State Park. Figures IV-2 and IV-3 show the relative locations of the major Nevada water companies within Zone D and E, respectively.

Due to lack of intense investigative effort within the Nevada portion of the basin, water use and water rights information is not as detailed as that for the California portion of this report. Monthly water diversion, for example, could not be compared to monthly sewer flows due to lack of data. Similarly, a detailed analysis of the water rights of individual water users was not possible, nor was it deemed necessary. Over the past ten years, the Nevada State Engineer has acted to limit the annual amount which may be diverted in Nevada to ensure that provisions of the Interstate Water Compact were not violated.

B. LAND USE AND POPULATION

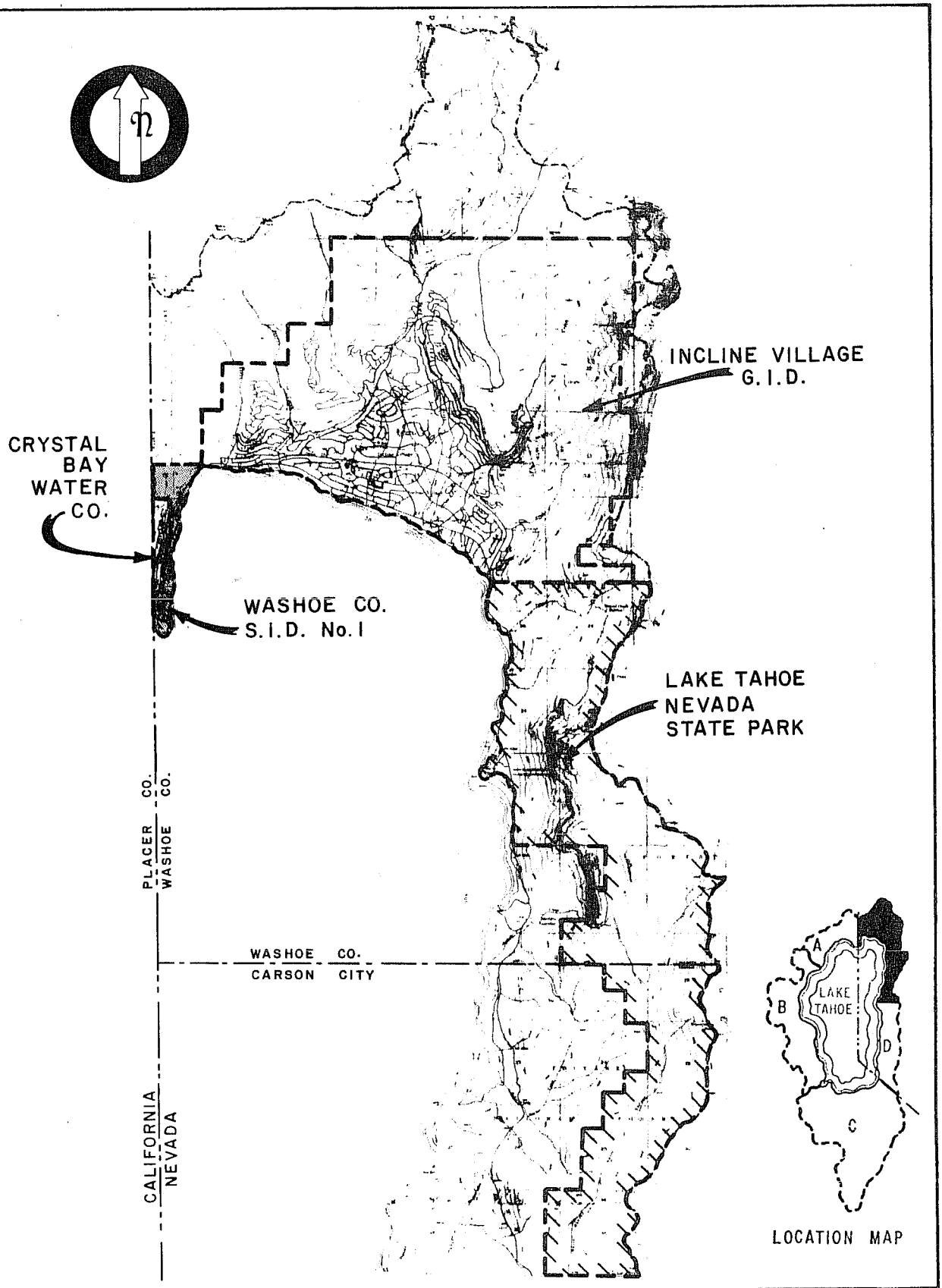
Centrally organized and detailed land use information for the Nevada portion of the Basin does not exist. Base line development data for 1974 is based on the 1974 Tahoe Regional Transportation Survey (TRTS) which was a 10% survey of developed areas. Similarly, population figures were derived from occupancy rates and persons per dwelling unit which were developed by using TRTS data. Dwelling units, occupancy, persons per unit, and total population for the

FIGURE IV-2



DOUGLAS COUNTY
ZONE D, MAJOR WATER USE AREAS

FIGURE IV-3



WASHOE CO. - CARSON CITY
ZONE E, MAJOR WATER USE AREAS

TABLE IV-1

ZONE D 1974 RESIDENTIAL DEVELOPMENT WITH TRTS OCCUPANCY AND POPULATION DATA

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	1635	.823	2.96	3980
Multiple Family Units	1510	.629	2.27	2160
Mobile Homes	470	.829	1.98	770
Hotel/Motel Units	1225	.941	2.49	2869
Campground Units	150	.892	3.47	464
Total	4990	.796	2.58	10243

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	1535	.561	2.65	2280
Multiple Family units	1340	.533	2.03	1450
Mobile Homes	430	.905	1.80	700
Hotel/Motel Units	986	.730	2.71	1924
Total	4291	.626	2.37	6354

Annual Average Occupancy: 70%
with 2.5 Persons/Dwelling Unit

Annual Average Population: 7975

various residence types in Zones D and E are tabulated in Tables IV-1 and IV-2, respectively. The summer and winter categories demonstrate the seasonal nature of dwelling unit use at Lake Tahoe.

While gaming facilities exist in both Zones D and E, the major concentration of gaming development exists in the South Tahoe-Stateline area of Zone D. In addition to the high concentration of casino and hotel-motel development in the Stateline area, Zone D has approximately 1600 primarily high

TABLE IV-2

ZONE E 1974 RESIDENTIAL DEVELOPMENT WITH
TRTS OCCUPANCY AND POPULATION DATA

SUMMER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	1390	.679	3.32	3130
Multiple Family Units	1980	.536	3.44	3650
Mobile Homes	84	.860	3.32	240
Hotel/Motel Units	699	.534	2.53	946
Total	4153	.590	3.25	7966

WINTER - 1974

	Housing Units	Occupancy Rate	Population Per Unit	Total Population
Single Family Units	1140	.611	2.83	1920
Multiple Family Units	2250	.373	2.63	2210
Mobile Homes	84	.500	3.10	130
Hotel/Motel Units	634	.288	2.17	397
Total	4108	.429	2.67	4707

Annual Average Occupancy: 50%
w/3.0 Persons/Dwelling Unit

Annual Average Population: 6065

income, single family homes in the Kingsburg Grade area and along the lakeshore to Glenbrook. Approximately 1500 primarily moderate income, multiple family dwellings exist in the Kingsburg Grade and Stateline areas. The annual average occupancy rate for all dwelling units in Zone D in 1974 was 70 %.

This is a relatively high occupancy rate for the Lake Tahoe Basin and is due to the heavily used hotel-motel and casino development in the Stateline area.

Zone E, with Incline Village as the major developed area, has a somewhat less intense gaming industry than does Zone D. This is reflected by the fewer number of hotel-motel units and a lower annual average occupancy rate of about 50%. The lower occupancy rate reflects the second home type of development and seasonal use which predominates in the area. The various levels of development for the 1974-1977 period for Zones D are E and tabulated in Table IV-3. These levels are based upon building permit records compiled by the Tahoe Regional Planning Agency (TRPA).

Due to the lack of clear information pertaining to vacant lots or anticipated levels of future development, anticipated levels of future water diversion for use are not included for the Nevada portion of the Lake Tahoe Basin.

C. WATER DIVERSION FOR USE

In Nevada all water use falls under the jurisdiction of the State Engineer. As a result, reliable records or estimates of water diversion for use are available for the Nevada portion of the basin. Table IV-4 contains a listing from the best available information of the diversions for use of water. In the absence of metered data, estimates were based on related uses for locations where where metered data is available. In determining consumptive use for domestic, commercial, quasi-municipal or other such uses, certain assumptions were made to coincide with the estimates of Nevada Division of Environmental Health, such as the use of 500 gallons per day per single family residence of four persons (125 gal/capita/day). In general, this is a very small percentage of the total diverted by water companies with metered service. In determining the consumptive use of water on lands for pasture and cultivation, for some rights given the duty by court decree has been used while for others consumptive for use was calculated using a duty based on investigations by the State of California of water requirements in high mountain meadows.

TABLE IV-3

RESIDENTIAL DEVELOPMENT GROWTH IN THE NEVADA PORTION OF THE LAKE TAHOE BASIN

	Single Family Homes	Multiple Family Units	Mobile Homes	Hotel/ Motel Units	Camp-ground	Total
A. Douglas County, Zone D						
1974	1635	1510	470	1225	150	4990
1975	1711	1591	470	1225	150	5147
1976	1814	1657	470	1225	150	5316
1977	2014	1795	470	1225	150	5654
B. Washoe County and Carson City, Zone E						
1974	1390	1980	84	699	-	4153
1975	1443	1992	84	699	-	4218
1976	1508	1995	84	699	-	4286
1977	1643	2018	84	699	-	4444

Table IV-4 reflects the estimated annual use of water for twelve oneyear study periods compiled from the metered water service records of major water companies and from the best information available to the Nevada State Engineer. The yearly change in the use of water in the Nevada portion of the Lake Tahoe Basin is easily determined from Table IV-4 and reflects the effect of important factors concerning the basin, such as sewage export, low precipitation periods conservation measures, increased interest rates, and new promotional developments.

TABLE IV-4

ANNUAL WATER DIVERSION FOR USE WITHIN THE NEVADA PORTION OF THE LAKE TAHOE BASIN

	acre-feet (Water Years, Oct through Sept)					
	1965 1966	1966 1967	1967 1968	1968 1969	1969 1970	1970 1971
I. MUNICIPAL & RESIDENTIAL USE						
A. Douglas County, Zone D						
1. Nevada Water Companies						
Kingsbury Water Co.	238.3	249.1	317.7	333.7	348.9	355.5
Edgewood Water Co.	316.4	349.7	345.5	367.4	408.3	411.2
Round Hill Gen. Imp. Dist.	75.2	61.2	84.6	93.4	109.9	108.3
Elk Point Country Club	10.9	40.3	35.6	40.3	40.3	40.3
U.S. Forest, Nev. Beach	2.4	3.0	2.8	3.2	7.0	5.5
Nevada 4-H Camp	4.2	4.2	4.2	3.3	5.1	1/
Camp Galilee	1.0	1.0	1.0	1.0	1.0	1.0
Presbyterian Conf. Pt.	17.9	19.5	10.9	10.9	10.9	10.9
Zephyr Cove Water Co.	53.4	55.0	55.0	55.0	116.2	160.7
Zephyr Cove Lodge	27.5	27.5	27.5	27.5	27.5	27.5
Skyland Water Co.	67.1	67.1	67.1	67.1	93.9	93.9
Eickmeyer Water Co.	2.6	2.6	2.6	2.6	2.6	2.6
Snug Harbor Water Co.	1.2	1.2	2.7	2.7	2.7	2.7
Zephyr Cove Schools	17.7	17.7	17.1	18.0	17.5	18.3
Zephyr Cove Fire Sta.	0.7	0.7	0.7	0.7	0.7	0.7
Cave Rock Water Co.	15.9	18.3	21.1	24.3	28.7	31.4
Logan Creek Water Co.	1.8	3.3	3.3	3.3	3.3	3.3
Glenbrook Co.	121.9	121.9	121.9	121.9	121.9	121.9
S. Tahoe Prop. Utility Co.	-	-	-	-	-	-
Subtotal	976.1	1,042.6	1,121.3	1,176.3	1,362.7	1,408.8
2. Calif. Water Companies						
South Tahoe P.U.D.	144.5	138.8	114.8	170.5	109.9	110.7
Total	1,120.6	1,181.4	1,236.1	1,346.8	1,472.6	1,519.5
B. Washoe County & Carson City, Zone E 3/						
1. Nevada Water Companies						
State Park	0.4	0.5	0.8	0.6	0.7	0.8
Incline Vil. Gen. Imp. District 5/	705.1	791.5	953.9	1,111.5	1,194.2	1,393.1
Crystal Bay Water Co.	11.4	11.4	11.4	11.4	28.9	28.9
Incline Beach Assoc.	5.0	9.5	5.0	5.0	5.0	5.0
Subtotal	721.9	812.9	971.1	1,128.5	1,228.8	1,427.8
2. Calif. Water Companies						
North Tahoe P.U.D.	132.5	185.0	82.0	110.2	179.4	468.9
Total	854.4	997.9	1,053.1	1,238.7	1,408.2	1,896.6
C. Miscellaneous Private Water Users	78.6	78.6	78.6	78.6	78.6	78.6
MUNICIPAL & RESIDENTIAL GRAND TOTAL	2,053.6	2257.9	2367.8	2,664.0	2,959.4	3,494.8
II. IRRIGATION WATER USE						
Glenbrook	529.6	529.6	529.6	529.6	529.6	529.6
Bourne	149.3	149.3	194.3	194.3	149.3	149.3
Whittell	159.9	159.9	159.9	159.9	159.9	159.9
Park	226.3	226.3	791.0	791.0	791.0	791.0
Rabe	150.0	150.0	150.0	150.0	--	--
Subtotal	1,215.1	1,215.1	1,779.8	1,779.8	1,629.8	1,629.8
NEVADA GRAND TOTAL	3,268.7	3,473.0	4,147.6	4,443.9	4,589.2	5,124.6

1/ Now served by Kingsbury Water Co.

2/ Now served by Incline Village General Improvement District

3/ Carson City portion of Tahoe Basin is considered to have negligible water use

4/ Served by Washoe County S.I.D. #1 as of May 1, 1975

5/ Includes Irrigation Water to Incline Village Golf Course

TABLE IV-4

ANNUAL WATER DIVERSION FOR USE WITHIN THE NEVADA PORTION OF THE LAKE TAHOE BASIN

acre-feet (Water Years, Oct through Sept)

	1971 1972	1972 1973	1973 1974	1974 1975	1975 1976	1976 1977
I. MUNICIPAL & RESIDENTIAL USE						
A. Douglas County, Zone D						
1. Nevada Water Companies						
Kingsbury Water Co.	407.7	445.2	521.2	623.1	626.2	624.8
Edgewood Water Co.	514.9	535.9	529.4	576.7	603.8	622.4
Round Hill Gen. Imp. Dist.	133.8	147.9	162.2	176.3	185.5	176.3
Elk Point Country Club	40.3	40.3	40.3	40.3	40.3	40.3
U.S. Forest, Nev. Beach	5.5	5.5	5.5	5.5	5.5	5.5
Nevada 4-H Camp	1/	1/	1/	1/	1/	1/
Camp Galilee	1.0	1.0	1.0	1.0	1.0	1.0
Presbyterian Conf. Pt.	10.9	10.9	10.9	10.9	10.9	10.9
Zephyr Cove Water Co.	138.2	138.2	131.9	139.2	151.8	168.4
Zephyr Cove Lodge	27.5	27.5	27.5	27.5	27.5	27.5
Skyland Water Co.	93.9	93.9	84.0	89.6	127.2	127.6
Eickmeyer Water Co.	12.0	12.0	12.0	12.0	12.0	12.6
Snug Harbor Water Co.	2.7	2.7	2.7	2.7	2.7	2.7
Zephyr Cove Schools	18.6	18.6	18.6	18.6	18.6	18.6
Zephyr Cove Fire Sta.	0.7	0.7	0.7	0.7	0.7	0.7
Cave Rock Water Co.	32.4	30.5	31.2	30.5	37.7	37.3
Logan Creek Water Co.	3.3	3.3	3.3	3.3	3.3	3.3
Glenbrook Co.	121.9	121.9	121.9	121.9	121.9	121.9
S. Tahoe Prop. Utility Co.	13.1	13.1	13.1	13.1	13.1	13.1
Subtotal	1,578.2	1,649.1	1,717.4	1,892.9	1,989.7	2,014.9
2. Calif. Water Companies						
South Tahoe P.U.D.	114.3	113.8	177.0	284.1	281.8	261.3
Total	1,692.5	1,762.9	1,894.4	2,177.0	2,271.5	2,276.2
B. Washoe County & Carson City, Zone E 3/						
1. Nevada Water Companies						
State Park	5.9	6.6	5.3	5.3	6.7	7.6
Incline Vil. Gen. Imp. District 5/	1,695.9	1,676.9	1,842.4	1,861.7	1,842.6	1,790.0
Crystal Bay Water Co.	28.9	28.9	30.4	30.4	30.4	30.4
Incline Beach Assoc.	5.0	2/	2/	2/	2/	2/
Subtotal	1,730.7	1,712.4	1,878.1	1,897.4	1,879.7	1,828.0
2. Calif. Water Companies						
North Tahoe P.U.D.	489.4	497.3	509.6	429.9 4/	333.3 4/	190.5 4/
Total	2,220.1	2,209.7	2,387.7	2,327.3	2,213.0	2,018.5
C. Miscellaneous Private Water Users	82.5	86.6	90.7	95.2	100.0	105.0
MUNICIPAL & RESIDENTIAL GRAND TOTAL	3995.1	4,059.2	4,372.8	4,599.5	4,584.5	4,399.7
II. IRRIGATION WATER USE						
Glenbrook	529.6	529.6	529.6	529.6	529.6	529.6
Bourne	149.3	149.3	-----	-----	-----	-----
Whittell	159.9	159.9	-----	-----	-----	-----
Park	791.0	791.0	791.0	791.0	791.0	791.0
Rabe	-----	-----	-----	-----	-----	-----
Subtotal	1,629.8	1,629.8	1,320.6	1,320.6	1,320.6	1,320.6
NEVADA GRAND TOTAL	5,624.9	5,689.0	5,693.4	5,920.1	5,904.9	5,720.2

1/ Now served by Kingsbury Water Co.

2/ Now served by Incline Village General Improvement District

3/ Carson City portion of Tahoe Basin is considered to have negligible water use

4/ Served by Washoe County S.I.D. #1 as of May 1, 1975

5/ Includes Irrigation Water to Incline Village Golf Course

In Table IV-4 some diversions for use are shown unchanged through the twelve study years. In some of these cases the use is unchanged and in others new information has not been developed. Table IV-4 also indicates the water diverted in California and used in Nevada.

Table IV-5 is a recapitulation of the total use in the Nevada portion of the basin for the twelve study years, and the increase in each year, both in acre-feet and percent, over the previous study year. It can be seen from this table that the use has increased a total of 2,451.5 acre-feet, or 75% over the twelve-year study period.

Figure IV-4 graphically depicts the increased water use which has occurred in the Nevada portion of the Lake Tahoe Basin over the past several years. Prior to 1948, when a joint survey was conducted by the State Engineers of California and Nevada, municipal and domestic water use was quite low. Over 90% of the approximately 2,000 afa diverted in 1948 was for pasture irrigation. By 1956, when a water use estimate was prepared for the Interstate Water Compact Commission, municipal and domestic water use was beginning to increase substantially with pasture irrigation remaining fairly constant. After 1956, irrigation began to drop substantially as urbanization increased. In recent years, irrigation has accounted for only about 1300 afa, while municipal and domestic water use increased at the average rate of 283 afa during the pre-drought years of 1965-1975 to an all-time high of 4,600 afa in 1974. During the 1976-77 drought years municipal and domestic water use dropped slightly to 4,400 afa.

Figure IV-5 displays a graphical comparison of the municipal and domestic water diversion for use with the amount of sewage exported from the Nevada portion of the Lake Tahoe Basin. Figure IV-5 includes all municipal and domestic water diverted in California for use in Nevada, and sewage transported from Nevada for treatment and disposal in California.

In the Douglas County, Zone D, portion of the basin, sewage exports represented about 58 percent of the pre-drought diversion and use. During the 1976-77 drought period, however, when the rate of increase of diversion for use dropped somewhat, sewage exports continued to expand. In Douglas County during 1977, sewage exports represented 75% of the total diversion for use. It would therefore appear that reduction of water use during the drought period was at the expense of nonsewered uses such as landscape irrigation. In Douglas County,

TABLE IV-5

TOTAL ANNUAL WATER USE IN NEVADA PORTION OF LAKE TAHOE BASIN

Water Year (Oct.-Sept)	Total Use (ac-ft)	Increase Over Previous Year (ac-ft)	(%)
1965-1966	3,268.7	----	----
1966-1967	3,473.0	204.3	6.2
1967-1968	4,147.6	674.6	19.4
1968-1969	4,443.9	296.3	7.1
1969-1970	4,589.2	145.3	3.3
1970-1971	5,124.6	535.4	11.7
1971-1972	5,624.9	500.3	9.8
1972-1973	5,685.0	60.1	1.1
1973-1974	5,693.4	8.4	0.1
1974-1975	5,920.1	226.7	4.0
1975-1976	5,904.9	-15.2	-0.2
1976-1977	5,720.2	-84.7	-3.1

Total Study Increase from 1965-1966 to 1976-1977 = 2,451.5 A.F.

Total Study Increase from 1965-1966 to 1976-1977 = 75.0%

the drought appeared to have little impact on municipal and domestic indoor use, as represented by sewage flows. In general, sewered water use in Douglas County appears to represent a similar, although slightly higher, proportion of water diversion for use than other areas of the Lake Tahoe Basin. In the South Tahoe, Zone C, portion of the Tahoe Basin sewage exports represent about 55% of the municipal and domestic water diversion for use, while in North and West Tahoe, Zones A and B, sewage exports appear to represent 45% of the municipal and domestic use.

In the Washoe County, Zone E, portion of the basin, sewage exports represent a lesser amount of the total municipal and domestic diversion for use (40-54%) than is seen in Douglas County. This is probably due to higher landscape irrigation

TABLE IV-6

UNIT WATER DIVERSION FOR USE IN NEVADA

ANNUAL DIVERSION FOR USE PER RESIDENTIAL DWELLING UNITS

	DOUGLAS COUNTY, ZONE D			INCLINE VILLAGE, ZONE E			Nevada Average Unit Use (gal/unit/day)
	Diversion For Use (afa)	Total Res. Dwelling Units	Unit Use (gal/day/unit)	Diversion For Use (afa)	Total Res. Dwelling Units	Unit Use (gal/unit/day)	
1974	1890	4990	338	1630	4153	350	345
1975	2180	5147	378	1670	4218	353	367
1976	2270	5316	381	1600	4286	333	350
1977	2280	5644	360	1520	4444	305	328

Four-year Average 364

1974 Per Capita Water Diversion and Use

	Annual Average Gal/Capita/Day
. Douglas County, Zone D	211
. Washoe County, Zone E	240

use in the Incline Village area. As was true in Douglas County, the percent of total diversion for use that appeared as sewage flows increased significantly during the drought years in Washoe County.

D. UNIT WATER DIVERSION FOR USE

Due to the lack of monthly water diversion data, a monthly water demand profile for the Nevada portion of the Tahoe Basin is not available. Table IV-6 summarizes the estimated unit water use, both residential and per capita, for the Nevada portion of the Lake Tahoe Basin based upon available data. The diversion for use value is the estimated diversion for municipal and domestic use minus known diversion for golf course and pasture irrigation. Based upon this data, per unit water diversion for use appears to be considerably higher in Nevada than in California. In California per capita diversion for use is on the order of 160 gal/capita/day, while Nevada's diversion for use is about 225 gal/capita/day.

E. WATER RIGHTS CONSIDERATIONS

Unlike California's water development which is supported by several water right doctrines, Nevada's water development is regulated only by appropriative rights. Appropriative rights within Nevada include all diversions for use from all sources (including groundwater and riparian diversions) with the exception of wells for domestic single family residences. With the exception of domestic well development, all water users are subject to the following, appropriative procedure.

The Application. To acquire a new right an application must be filed with the State Engineer with various supporting information and a filing fee. This step is similar to the filing of an application under California's appropriative procedure.

The Permit. Subject to availability of supply and existing rights, the State Engineer is required to permit the appropriation. Nevada's permit procedure is similar to California's in that time schedules for development are set as are the place, manner and period of use.

Proofs. In order to show that he is proceeding to perfect his water right in a reasonable manner with due diligence, the permittee is required to file a series of "Proofs" with the State Engineer, all within time limits specified by the State Engineer. These are:

- Proof of Commencement.
- Proof of Completion (of the diversion works).
- Proof of Beneficial Use. The time period for filing this final proof is dependent on the time period for full water development as originally contemplated by the permittee. Extensions of time may be made by the State Engineer.

Certificates. Once all proofs have been filed and all terms of the permit complied with, the State Engineer issues a certificate describing the use as shown on the proof of beneficial use. The certificate is similar to the water right license issued by the California State Water Resources Control Board. The date of priority of the certificate is the date of the original filing of the application.

Beginning in 1966, near the end of the Interstate Water Compact negotiations, the Nevada State Engineer initiated a program to put annual acre-foot limitations on all existing water rights in the Nevada portion of the Lake Tahoe Basin and to ensure that any new rights would also be limited.

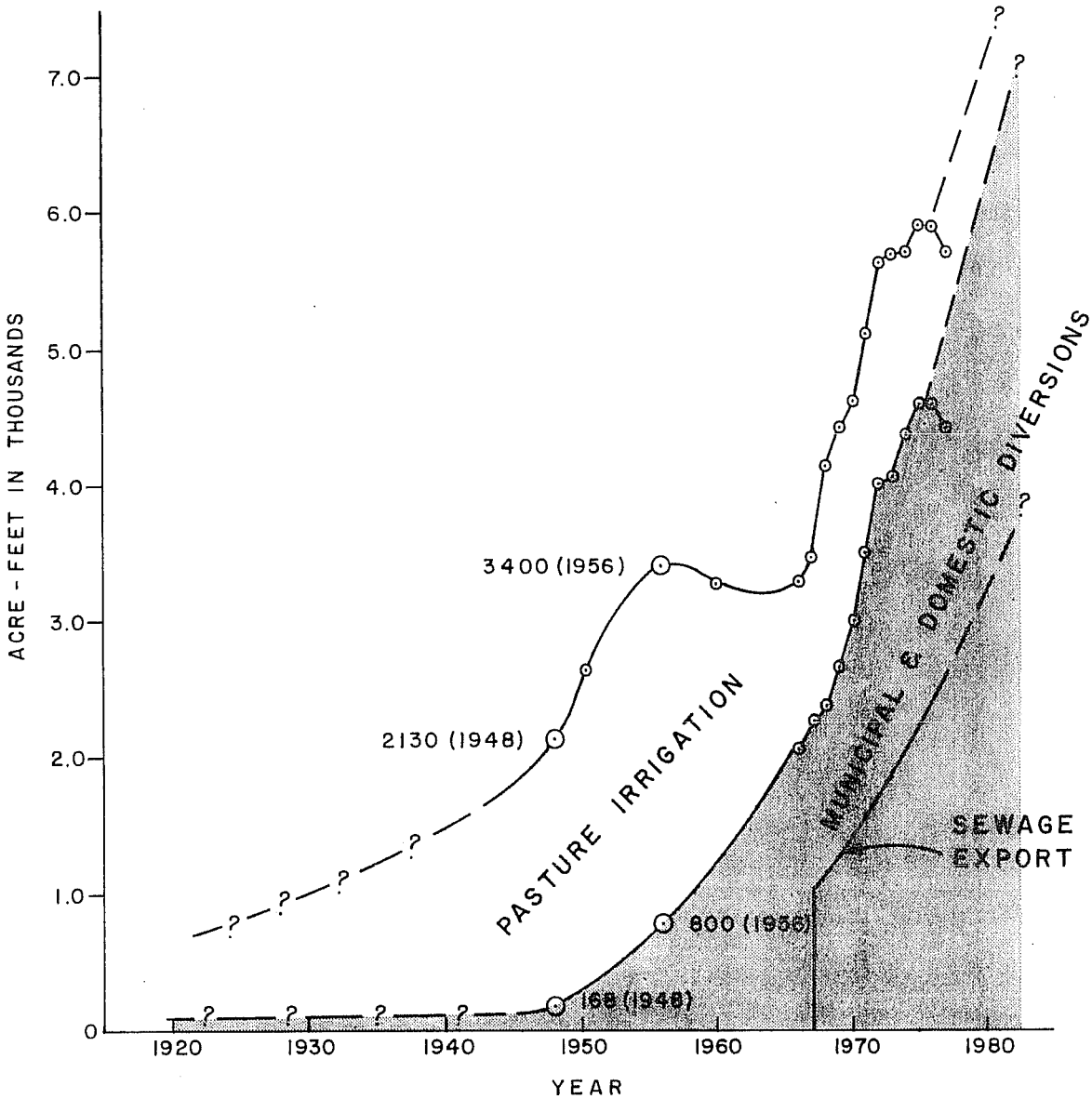
Table IV-7 summarizes the status of all water filings of record within the Nevada portion of the Lake Tahoe Basin at the beginning of the program in 1966. Of the 46 applications in Table IV-7 pending as of August 1, 1966, eight were withdrawn by the applicants, 17 were denied by rulings of the State Engineer, 20 were granted permits and one is still pending with no further action having been taken, as of September 25, 1978.

Table IV-8 summarizes the status of all water filings of record for the Nevada portion of the Lake Tahoe Basin as of September 25, 1978, including proofs, certificates, permits, and pending applications. Many certificates and permits issued prior to this study granted a diversion or flow rate of water only, and did not place a duty or upper annual acre-foot limit on the total quantity of water to be diverted. These diversions, shown as "Water Allocated Without Annual Acre-Foot Duty," have all been expanded to tabulate a maximum possible demand for water required to fully satisfy existing water rights of record.

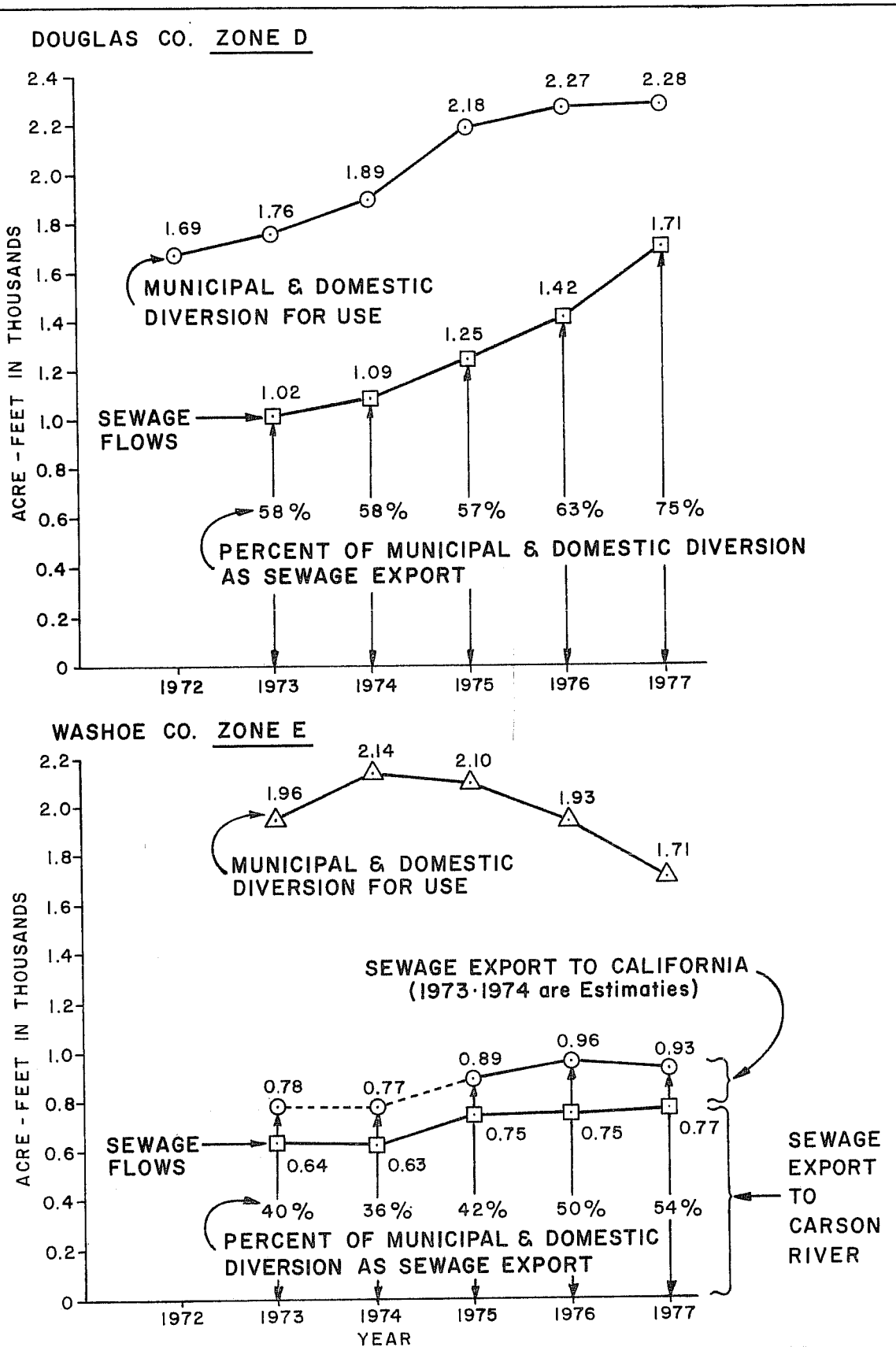
After July 1, 1966, all permits issued by the State Engineer to appropriate water in the Nevada portion of the Lake Tahoe Basin granted a diversion in cubic feet per second with an annual limit or duty in gallons or acre-feet of water.

Table IV-7 and Table IV-8 do not include three claims of vested rights totaling an estimated 1,838.9 acre-feet which have not been adjudicated and are therefore undetermined rights. Also, three permits with certificates for power generating purposes are considered to be nonconsumptive and were not included in Table IV-7 and Table IV-8. In addition, one permit issued for storage of 3,000 acre-feet of water in Marlette Lake and one permit with certificate to divert 5.5 cfs of water from North Creek are both recognized in the California-Nevada Interstate Compact as transbasin diversions and are not included in the totals of Table IV-7 and Table IV-8.

FIGURE IV-4



HISTORICAL WATER DIVERSION FOR USE WITHIN THE NEVADA PORTION OF THE LAKE TAHOE BASIN. (IRRIGATION, MUNICIPAL and DOMESTIC USES ONLY)



COMPARISON OF SEWAGE EXPORTS WITH MUNICIPAL AND DOMESTIC DIVERSION FOR USE WITHIN THE NEVADA PORTION OF THE LAKE TAHOE BASIN (Does Not Include Golf Course Irrigation)

TABLE IV-7

NEVADA PORTION OF THE LAKE TAHOE BASIN

STATUS OF WATER RIGHTS AS OF JULY 1, 1966

Type of Water Right	Number	Source	Water Allocated With Annual Acre-Foot Limit	Water Allocated Without Annual Acre-Foot Limit	Total
Proof	9	Stream	1,439.8	419.7	1,859.5
Certificate	34	Stream	1,551.2	2,385.1	3,936.3
Certificate	53	Lake	537.1	29.0	566.1
Certificate	23	Well	206.1	750.8	956.9
Permit	5	Stream	627.5	2,181.0	2,808.5
Permit	17	Lake	2,906.6	2,182.9	5,089.5
Permit	11	Well	313.5	6,515.0	6,828.5
Application	37	Stream	1,400.0	40,452.1	41,852.1
Application	7	Lakes		17,738.0	17,738.0
Application	2	Well		434.2	434.2
TOTAL	198		8,981.8	73,087.8	82,069.6

TABLE IV -8

NEVADA PORTION OF THE LAKE TAHOE BASIN

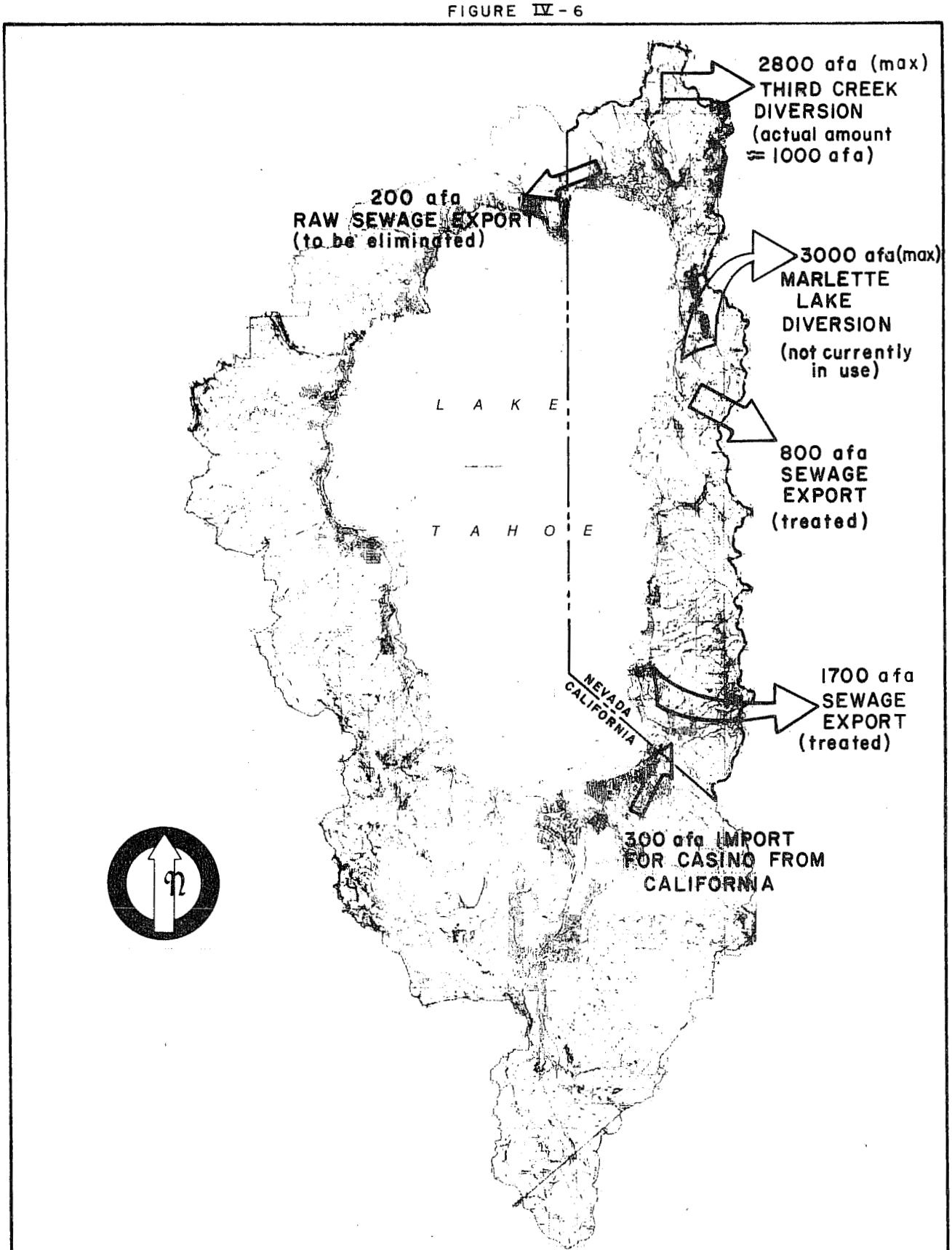
STATUS OF WATER RIGHTS AS OF SEPTEMBER 25, 1978

Type of Water Right	Number	Source	Water Allocated With Annual Acre-Foot Limit	Water Allocated Without Annual Acre-Foot Limit	Total
Proof	9	Stream	639.5	337.4	976.9
Certificate	44	Stream	1,644.9	2,244.1	3,889.0
Certificate	69	Lake	2,758.92	29.0	2,787.92
Certificate	37	Underground	128.93	693.1	882.03
Permit	7	Stream	2,247.84	-----	2,247.84
Permit	17	Lake	3,212.14	2.24	3,214.38
Permit	1	Underground	3.38	-----	3.38
TOTAL	184		10,635.61	3,305.84	13,941.45

Applications to appropriate pending:

7 stream-11,692.48 acre-feet
9 lake-8.926.57 acre-feet
3 underground-5.6 acre-feet
TOTAL-20,624.65 acre-feet

FIGURE IV-6



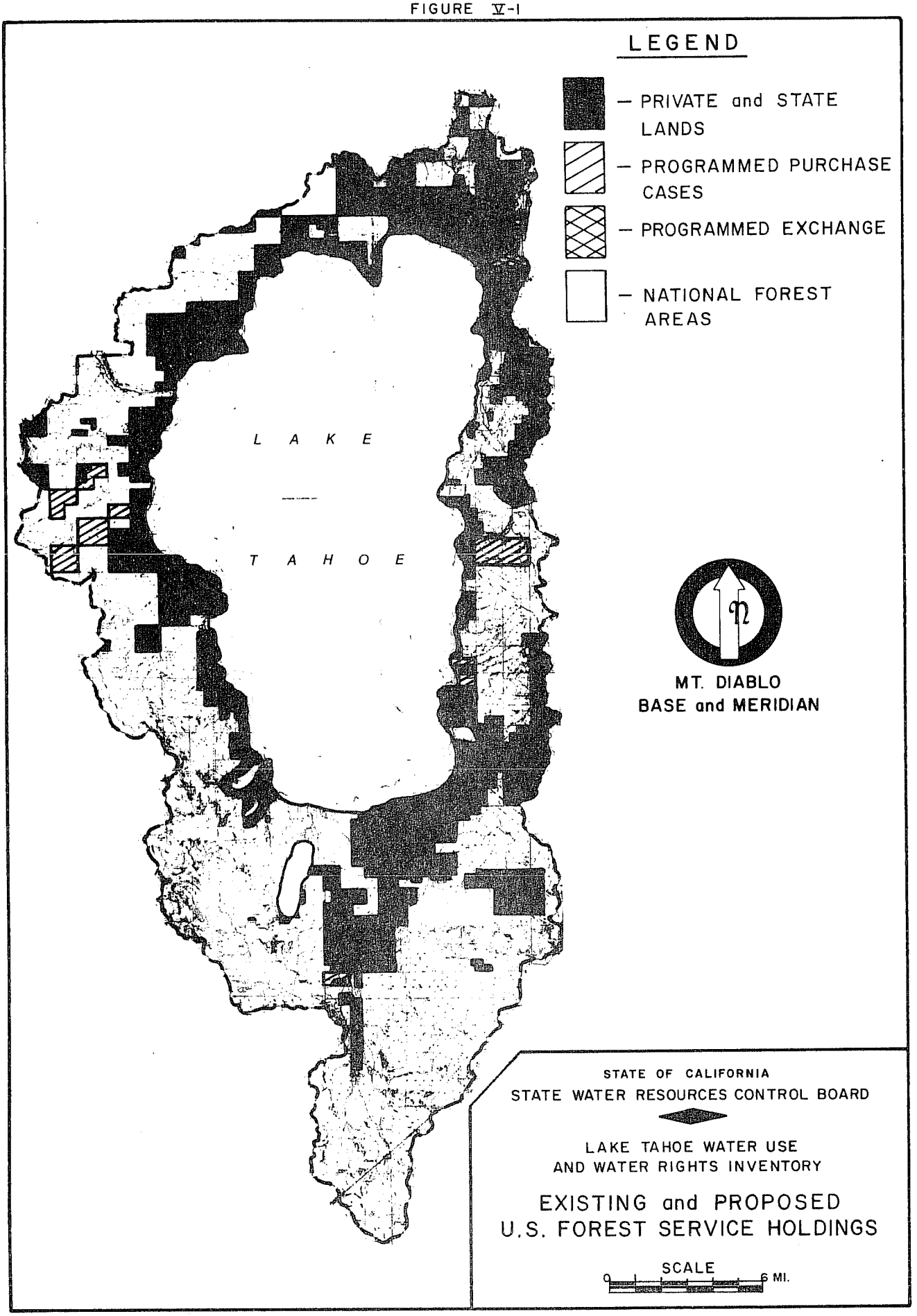
INTER-STATE TRANSFER AND BASIN EXPORT OF WATER FROM THE NEVADA PORTION OF THE LAKE TAHOE BASIN

Figure IV-6 depicts the various interstate and transbasin transfers of water into and out of the Nevada portion of the Tahoe Basin. In addition to the two transbasin diversions which are exempt from the terms of the Interstate Water Compact,there are two transbasin treated sewage exports, one interstate raw sewage export to the California portion of the basin at the north shore, and one import of municipal water supply from the South Tahoe P.U.D. in California for Harrah's Club.

SECTION V

WATER USE AND WATER RIGHTS ON NATIONAL FOREST LANDS WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

FIGURE V-1


LEGEND
— PRIVATE and STATE LANDS
— PROGRAMMED PURCHASE CASES
— PROGRAMMED EXCHANGE
— NATIONAL FOREST AREAS
L A K E
T A H O E
MT. DIABLO
BASE and MERIDIAN
STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
LAKE TAHOE WATER USE
AND WATER RIGHTS INVENTORY
EXISTING and PROPOSED
U.S. FOREST SERVICE HOLDINGS
SCALE
0
6 MI.

SECTION V

WATER USE AND WATER RIGHTS ON NATIONAL FOREST LANDS WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

A. INTRODUCTION

The Lake Tahoe Basin Management Unit of the U. S. Forest Service has jurisdiction over the use and development of the national forest lands within the Lake Tahoe Basin. These lands constitute 132,800 acres or 64.7% of the total land area of the Lake Tahoe Basin. Within California, national forest lands total 155,700 acres or 71.5% of the California portion of the Basin. Total public lands (including Federal, State and local) within the Lake Tahoe Basin cover 144,800 acres, or 70.5% of the total land area of the Basin. U. S. Forest Service lands are shown in Figure V-1. The U. S. Forest Service has an ongoing program to acquire additional holdings within the Lake Tahoe Basin. Their current objective is to place 85% of the lands of the Lake Tahoe Basin into public ownership.

B. LAND USE

Land use on national forest lands within the California portion of the Lake Tahoe Basin falls into the following categories:

1. Leases for private residential summer houses and private camps.
2. Leases to private individuals for development of public recreation (e.g., resorts, ski areas).
3. Public campground facilities.
4. Public day use facilities.
5. U. S. Forest Service management and maintenance facilities.
6. Undeveloped lands and wilderness areas.

The undeveloped lands constitute over 95% of the national forest lands within the Lake Tahoe Basin. These lands receive little use other than ongoing forest management activities, hiking, camping, and preservation of natural conditions. The ultimate level of residential, recreational and day use facility development is unknown, but has been increasing steadily for the past

twenty years. Currently the U. S. Forest Service is preparing a land use plan through the early 21st Century, but further development and increased intensive use is expected to continue past that time. Due to the relatively low level of current development and use of national forest lands within the Lake Tahoe Basin, the potential for future development and use is extensive. The rate of U. S. Forest Service land development within the Tahoe Basin has been greatly overshadowed by private development up to the present.

C. WATER DIVERSION AND USE

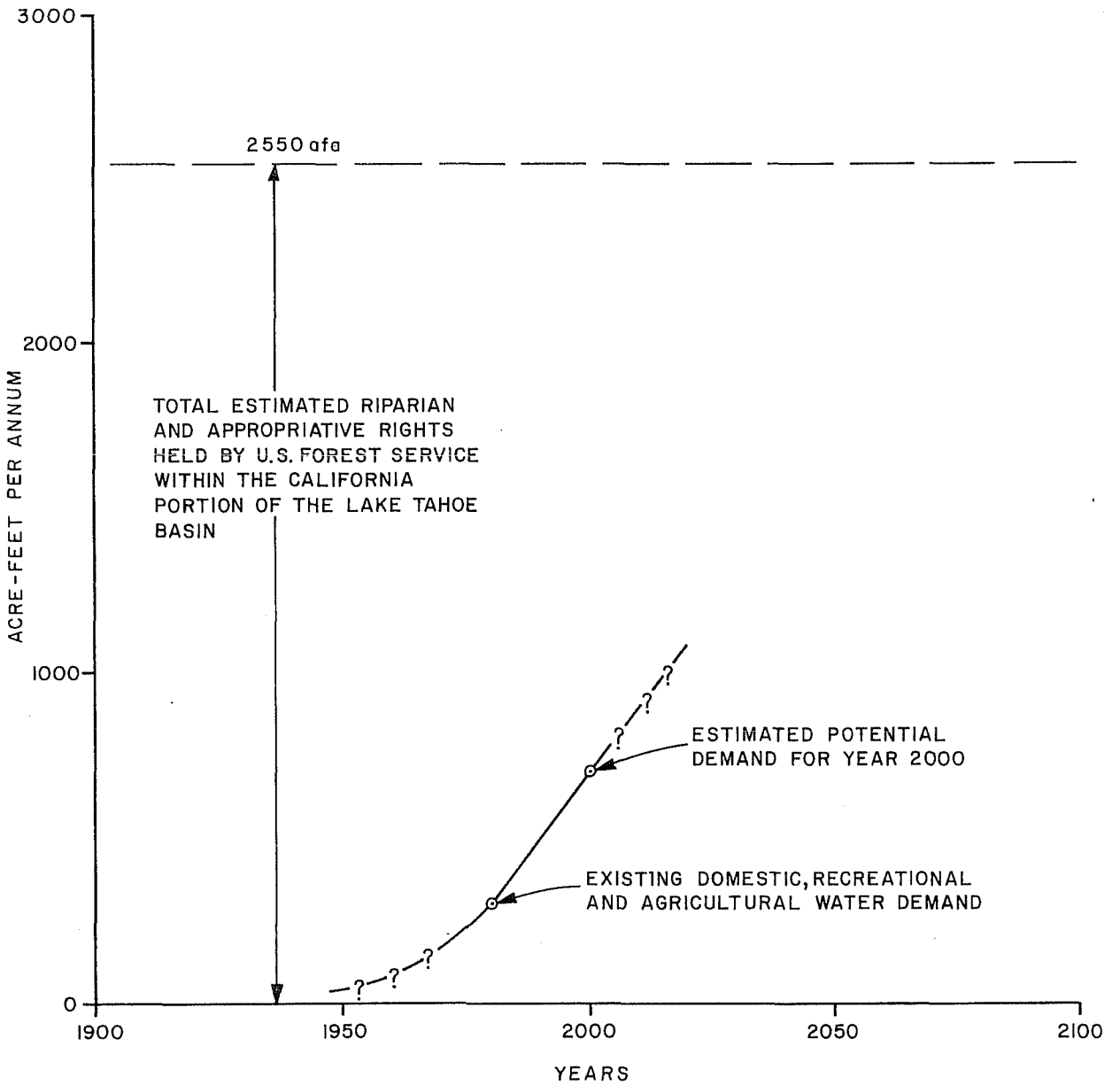
Water diversion for consumptive use on U. S. Forest Service lands currently totals about 350 acre-feet/annum (afa). Although national forest lands constitute over 70% of the California portion of the Basin less than 2.5% of the present water diversion is for use on these lands.

Present water diversion and use is from the following sources:

	acre/feet/annum
Appropriative rights	72 (134.56 face value)
Claimed Riparian Diversions	115
Claimed reserved rights (including groundwater)	38
Purchased water	58
Undefined rights	67
	350

In addition to these rights mentioned above, the U. S. Forest Service currently holds two undeveloped, yet permitted, appropriative rights (2) with a combined face value of 1860 afa. This value in combination with current appropriative rights and potentially developable riparian rights total 2550 acre-feet per year. Based on the current level of use of 350 afa, only 14% of potential water rights have been developed thus far. The Tahoe Basin Management Unit estimates that water development and use will have reached 740 acre-feet/annum by the year 2000. Figure V-2 depicts the current and project level of water use as measured against total appropriative and estimated

FIGURE V-2



U.S. FOREST SERVICE WATER USE AND WATER RIGHTS POTENTIALLY CHARGEABLE TO INTERSTATE WATER COMPACT WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN.

riparian water right availability. A detailed listing of water rights and current water development is provided in the separately bound Appendix E to this report.

D. UNIT WATER USE

Unit water use on U. S. Forest lands is somewhat lower than on other private lands in the Tahoe Basin. In many instances extensive water use is not possible due to the required use of sewage holding tanks and export of human waste. Furthermore, leased summer home developments do not employ many water using devices such as garbage disposals dishwashers, and washing machines. Water use for various types of residential units on national forest lands are estimated as follows:

	Unit Use (gal/unit/day)	Per Capita Use (gal/capita/day)
Sewered Single Family Units	275	130
Un-Sewered Single Family Units	140	60
Sewered Campground Units	160	50
Sewered Resort Units	175	60

Insufficient data exists to make unit use estimates for other types of uses, including day use. The above listed values are based upon known water diversion for use for similar residential unit types on national forest lands and private lands, given 1974 summer occupancy rates.

E. WATER RIGHTS CONSIDERATIONS

The total face value, current use, and anticipated future use of appropriative rights held by the U. S. Forest Service and diversions made under the claim of other rights are listed in Table V-1. A detailed, individual breakdown of the diversions in each of these categories is presented in the separately bound Appendix E. Water diverted for domestic, recreational and agricultural use on U. S. Forest Service lands is expected to increase to 741 afa, from the present 350 afa by the year 2000. Only about 18% (135 afa) of the anticipated

TABLE V-1

U.S. FOREST SERVICE WATER RIGHTS AND WATER USE WITHIN THE CALIFORNIA PORTION OF THE LAKE TAHOE BASIN

WATER DIVERTED FOR DOMESTIC, RECREATIONAL AND AGRICULTURAL USE

	Present Use (af)	Estimated Year 2000 Use (afa)
1. Appropriative rights (face value=134.56 afa)	72	135
2. Riparian rights	115	404
3. Claimed reserved rights (including groundwater)	38	45
4. Purchased Water	58	89
5. Other diversions	67	68
	350	741

WATER DIVERTED FOR LAKE STORAGE AND STREAMFLOW ENHANCEMENT

	afa
1. Appropriative rights (face value=1249.65 afa)	1250
2. Claimed reserved rights	390
3. Riparian rights*	2081
4. Other diversions**	6800
	10521 afa

UNDEVELOPED APPROPRIATIVE RIGHTS REQUIRED FROM OTHERS THROUGH LAND PURCHASE

	afa
1. Appropriative rights (face value=1859.5)	1860

* 5 cfs diversion for Taylor Creek Stream profile chamber. Full amount is returned to Taylor Creek undiminished in amount.

** Storage in Fallen Leaf Lake used for fishery maintenance releases to Taylor Creek.

year 2000 diversion can be made under claim of existing developed appropriative rights. The remaining 82% apparently will be made under claim of rather poorly defined riparian, reserved, groundwater, or prescriptive rights, and through water purchased from private utilities, or by development of additional appropriative rights.

Water diverted for lake storage and stream flow enhancement totals 10521 afa. This includes 6800 afa stored in Fallen Leaf Lake for stream flow and fish maintenance in Taylor Creek. Also, 2081 afa diverted briefly from Taylor Creek for maintenance of an educational stream profile chamber is subsequently returned to the stream undiminished in quantity. The Fallen Leaf Lake storage is currently without the benefit of known or clearly defined water rights.

In addition to the above fully or partially developed rights and/or diversions, the U. S. Forest Service currently holds two undeveloped appropriative water rights with a total face value of 1859.5 afa. These are:

APPLICATION	PERMIT	ORIGINAL OWNER	Annual Face Value (afa)
11444	7756	L. TAHOE GOLD MINING	130.5
22651	15771	FIBERBOARD CORP	1729
		TOTAL	1859.5

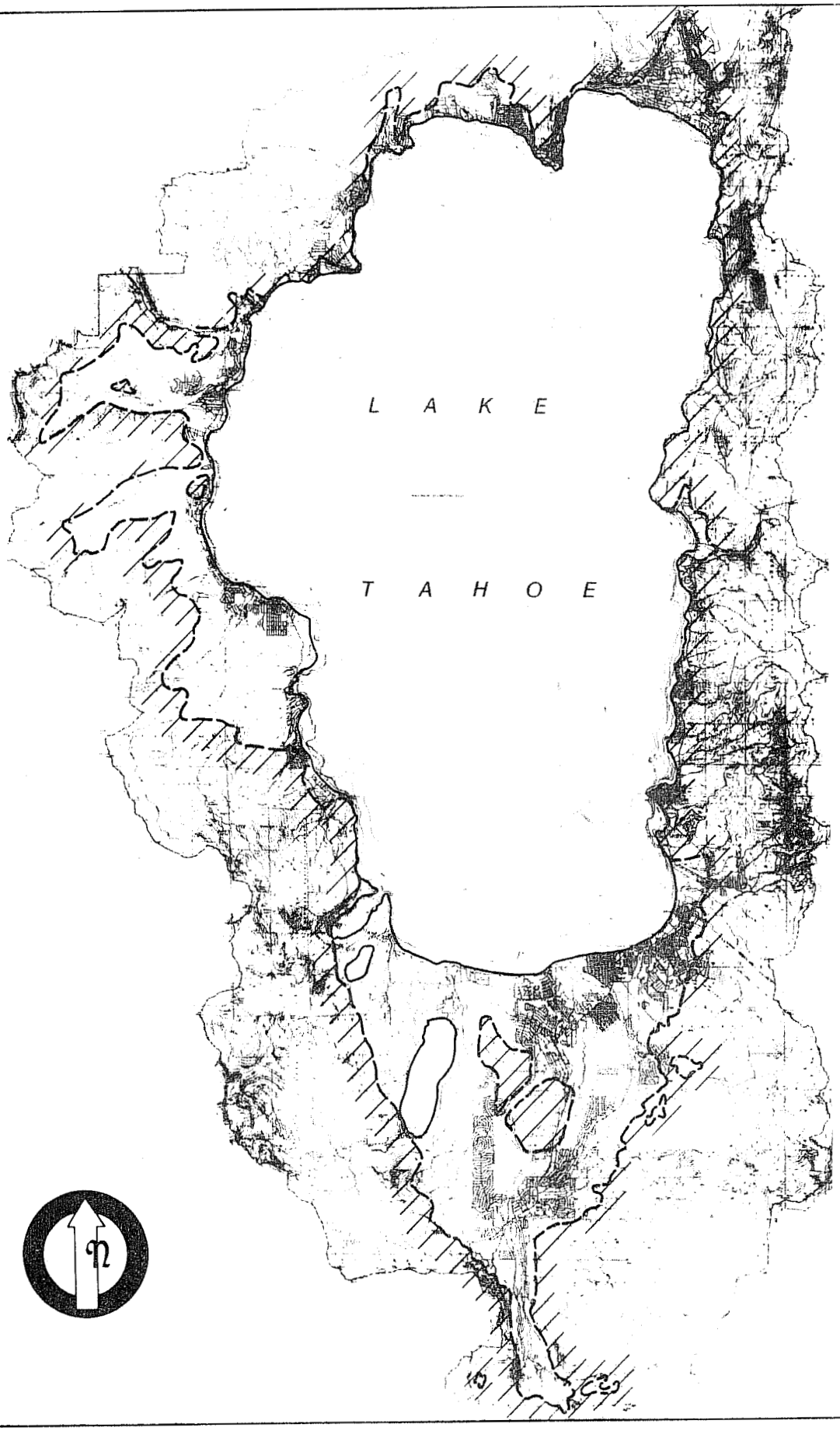
A-11449 was originally permitted for diversion from Ellis Creek to serve an anticipated residential development, and A-22651 was originally permitted to serve the municipal water needs of a massive 25,000 acre develpment in both the Lake Tahoe Basin and Martis Creek watershed tributary to the Truckee River. In acquiring the property which was originally planned for these developments the U. S. Forest service also acquired the water rights. The U. S. Forest service estimates that over $1 million was paid for the acquisition of these rights. Furthermore, the U. S. Forest Service has indicated a strong desire to keep these water rights active for potential future development in not just the original place of use, but throughout the Lake Tahoe Basin and Truckee River watershed. Potential uses include domestic, recreation, and stream flow maintenance. The total face value of these rights

and existing appropriative rights is 1994 afa. The inclusion of riparian rights and groundwater diversions brings the total available for potential use to 2550 afa. This amount appears to be sufficient for all anticipated water development and use on U. S. Forest Service lands within California in perpetuity. Preservation of these rights would ultimately allow 10.7% of the waters allocated to California in the Interstate Water Compact to be utilized on U. S. Forest Service lands which, at present, constitute 71.5% of the California portion of the Lake Tahoe Basin.

In addition to the two permitted, yet undeveloped, water rights mentioned above, the U. S. Forest Service also holds the unpermitted application A-23275. This application was originally filed by the Macco Corporation for the diversion of 2 cfs from Lake Tahoe to serve a proposed residential development in Meeks Bay. Since then, the U. S. Forest Service has acquired the property and has maintained the pending application. The annual face value for this as yet unpermitted right would be 940 afa.

SECTION VI

LAKE TAHOE BASIN HYDROGEOLOGY



BOUNDARY OF LAKE TAHOE GROUNDWATER BASIN

SECTION VI

LAKE TAHOE BASIN HYDROGEOLOGY

A. INTRODUCTION

An important element of the Lake Tahoe/Truckee river water rights picture is the role played by groundwater in the Lake Tahoe Basin. A substantial fraction (54%) of the municipal and domestic water needs of the basin's rapidly expanding population is being met by use of groundwater. It is reasonable to expect that the water needs of any continued population expansion in the Lake Tahoe Basin may likewise be met through use of groundwater.

There is not, however, an inexhaustible supply of groundwater available in the basin. Any water consumption, whether from surface waters or groundwater, reduces the quantity of water leaving the basin. These facts are of great importance in the interstate Tahoe-Truckee watershed where water demand exceeds or threatens to exceed the water supply. The limits set in the Interstate Water Compact on Lake Tahoe Basin water use in both California and Nevada represent an important attempt to settle this problem. In the Interstate Water Compact, groundwater diversions are specifically chargeable against the Lake Tahoe Basin's total allocation. However, the California water law system, separate from the terms of the Interstate Water Compact, does not provide a means of allocating groundwater diversions other than by court adjudication or by a determination that the groundwater is flowing in a "known and definite channel." A good understanding of the basin's geohydrology is necessary to evaluate water rights in the Lake Tahoe Basin as well as for long-range planning.

B. AREA OF INVESTIGATION.

In a broad sense, this investigation included all groundwater basins within the 505 square mile Lake Tahoe Basin. The basin comprises that portion of the Truckee River watershed above the head of the Truckee River Gorge in Section 12, T15N, R16E, MDB&M as shown on Figure VI-1, Boundary of Groundwater Basin. A high percentage of this area is not included in the groundwater basins:

1. The crystalline rock highlands surrounding Lake Tahoe have thin and discontinuous soil and sedimentary cover. In these highland areas, wells and springs producing groundwater from rock fractures or thin soils produce dependable water supplies only for small scale domestic use.

2. Lake Tahoe is underlain by saturated sediments of variable thickness. The lake has a maximum depth of 1,645 feet and an average depth of 1,000 feet. Since the groundwater contained in the sediments underlying the lake is hydrologically connected to the lake but is not developed by water wells, this portion of the watershed was not considered in this study.

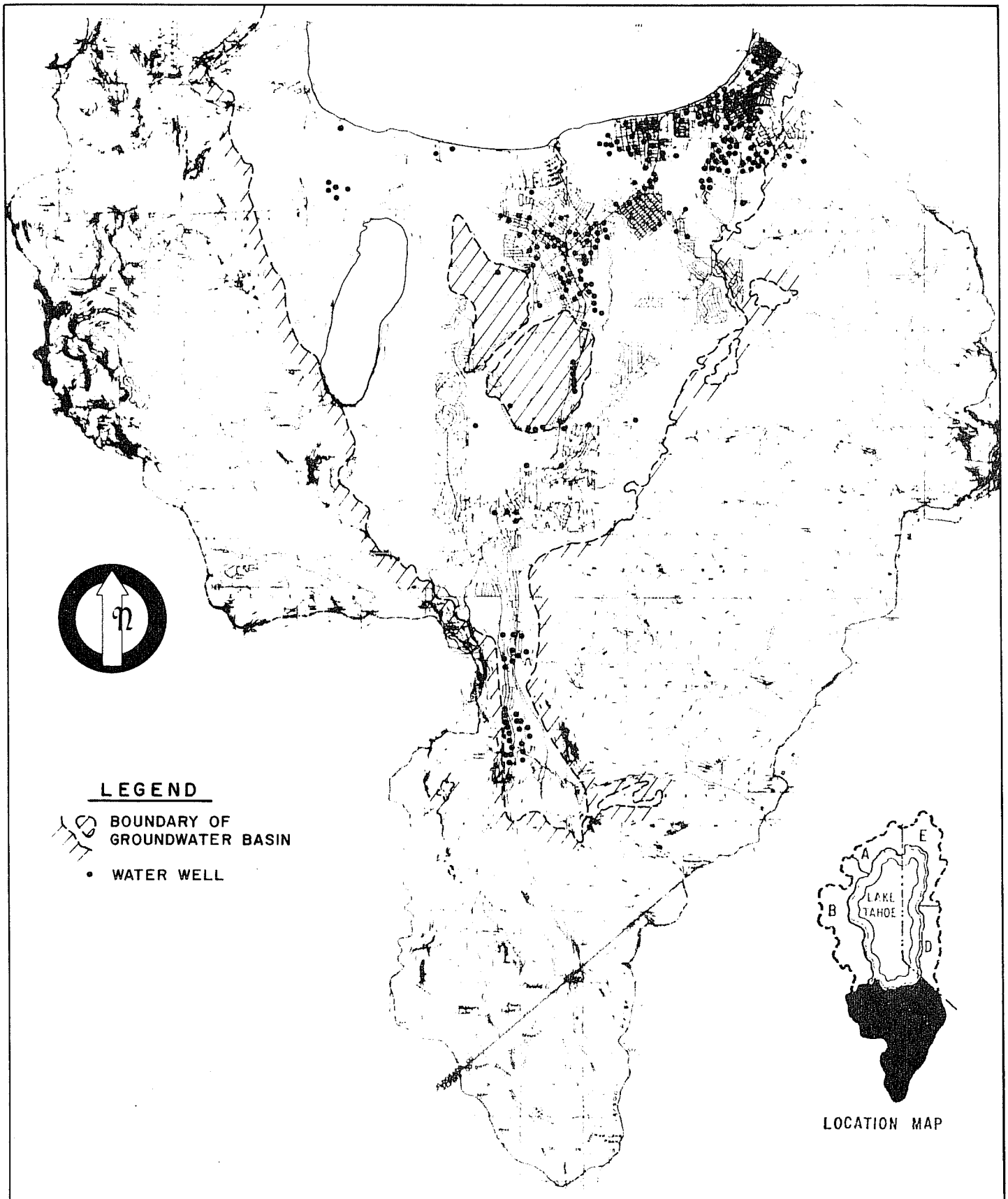
The principal emphasis was on the South Lake Tahoe Groundwater Subbasin. This subbasin is defined in general terms as all water-bearing sediments in excess of 100 feet thick south of the shoreline of Lake Tahoe and within the watersheds of all drainages entering Lake Tahoe between Tallac Creek (Section 26, T13N, R17E, MDB&M) and Burke Creek (Section 22, T13N, R18E, MDB&M). The largest of these watercourses is the Upper Truckee River. (See Figure VI-2)

Other smaller portions of the Lake Tahoe Groundwater Basin include, proceeding clockwise around the lake, the canyon alluvial fillings of Cascade Creek, Eagle Creek, Meeks Creek, General Creek, McKinney Creek, Homewood Canyon, Madden Creek, Blackwood Creek, Ward Creek, Griff Creek, and Third Creek.

C. AVAILABLE DATA

In addition to the geologic and groundwater reports listed at the end of this report, the files of the Department of Water Resources, Central District, contained 115 water well logs with enough information to pinpoint their locations as well as many more well logs within uncertain locations. The depth of these wells as well as the quality of the descriptions on the logs varied considerably. Further, these wells tended to be clustered within early urbanized areas which lacked a community water supply system at the time of original development. A few of these well logs contained pump test data useful for estimating transmissivities of the aquifers penetrated. The Department of Water Resources' files also included a substantial body of groundwater level data.

FIGURE VI-2



KNOWN
SOUTH TAHOE WATER WELL LOCATIONS

The principal South Lake Tahoe area water purveyors provided much useful well log, pump test, and water level data.

Field work for this investigation consists solely of groundwater level data obtained during August 1978.

D. GROUNDWATER GEOLOGY

A unique set of geologic processes has combined to produce the Lake Tahoe Basin as we see it today. There is the combination of a large lake having its deepest point at an elevation of approximately 4,700 feet and a maximum surface elevation of 6,229 feet, and surrounding peaks some over 10,000 feet in elevation.

There are large areas underlain by granitic rocks, glacial moraines, lakebed deposits, and volcanic rocks. In the following paragraphs, the general geology of the Lake Tahoe Basin will be discussed followed by a more detailed description of the groundwater geology.

Geologic Structure

The geologic structure of the Lake Tahoe Groundwater Basin is basically a fault-bounded trough (graben) sloping down to the north. A tremendous succession of lava flows and other volcanic rocks as much as 4,000 feet thick block the north end of the valley. Faults bounding the basin on the east and west show no evidence of recent activity and have in fact been covered in many places by glacial moraines, lakebeds, and lava flows. The fault on the west side of the basin apparently extends from the west end of Donner Lake, through the Squaw Valley ski area, off Rubicon Point, to the foot of Myers Grade. Less in known about the faults along the east side of the basin. Mapping of the lake bottom suggests their locations are a short distance out from the east side of the lake.

Except for the effects of weathering and erosion, the sedimentary rocks and soils in the Lake Tahoe Basin are essentially in the same state in which they were originally deposited. There is no evidence of the near--surface sediments being folded or faulted.

Geologic Units

The rocks of the Lake Tahoe Basin range in age from about 190 million years to the present; and as sources for groundwater, from nonwaterbearing to excellent aquifers. The areal extent of the several geologic units is shown on the maps by Burnett and Matthews.

Nonwaterbearing Rocks. Nonwaterbearing rocks in the Lake Tahoe Basin are metamorphic, granitic, or volcanic.

- Metamorphic rocks are the oldest units in the Lake Tahoe Basin. They were metamorphosed about 190 million years ago and for the most part have been subsequently eroded away. These rocks occur in widely scattered locations about the basin, principally in the vicinity of Fallen Leaf Lake, Genoa Peak, and the upper portions of the Blackwood Creek and Bear Creek watersheds. These rocks include meta-volcanics and metasediments including (altered mudstones, sandstones, and conglomerates). These rocks are not important as a source of groundwater. They contain water only in minor quantities in near-surface fractures.

- Granitic rocks are widespread, especially in the higher elevation areas of the Lake Tahoe Basin. These rocks, estimated to be between 100 and 150 million years old, have intruded and thus are younger than the metamorphic rocks. Subsequent erosion of many thousand feet of overlying rocks has uncovered the granitics and exposed them to chemical weathering and erosion. The granitic rocks are also not important as reservoirs of groundwater. Most water wells penetrating granitic rocks produce water from the fractures or near-surface decomposed material with yields normally adequate only for limited domestic water supplies. Often, these wells together with springs located in the granitic areas dry up during the summer.

- Volcanic rocks exposed in much of the northwest corner of the basin overlie the granitic rocks and range in age from possibily 7,500,000

years to as recent as 1,000,000 years ago. Groundwater seems limited to a few interflow sediments and is insignificant as part of the Lake Tahoe Basin groundwater supplies.

Waterbearing Rocks. The principal groundwater bearing rocks of the Lake Tahoe Basin include glacial deposits, lakebeds, and alluvium.

- o Glacial deposits were laid down as a result of the wide-spread glaciation in the higher areas to the south and west of the lake between 3 million and 12 thousand years ago. These rocks can be divided into two sub-groups, glacial moraines and glacial outwash deposits.

  1) Glacial moraines are jumbled deposits ranging in size from clay to boulders that were carried down by the glaciers from the uplands. Common types of moraines include terminal moraines, which are arcuate ridges marking the furthest advance of a glacier during one time in its history, and lateral moraines which are steep sided, linear ridges along the edge of the glacier's path. The moraines range in height from a few feet to as much as 1,000 feet. The older moraines are generally more compact and weathered and have higher clay content than the young moraines. Thus, the younger morainal deposits are distinctly better aquifers than the older. In the Lake Tahoe area, glacial moraines are very widespread and form major groundwater reservoirs. Although the glacial moraines are often quite thick, some of the areas shown on the geologic map as glacial moraines are relatively thin morainal deposits on steep slopes. In this circumstance, the groundwater content of the morainal deposits will be significant only during the late spring, when they act as a conduit carrying water from melting snow at high elevations down to the valley and lake below.

  2) Glacial outwash deposits are frequently well stratified beds of sand and gravel with interbeds of silty clay. These deposits were laid down by glacial meltwaters and by streams draining

morainal areas. There was substantial sorting of sediments and washing away of fine grained material. They are generally found at lower elevations than the bulk of the morainal deposits and form excellent aquifers in much of the study area.

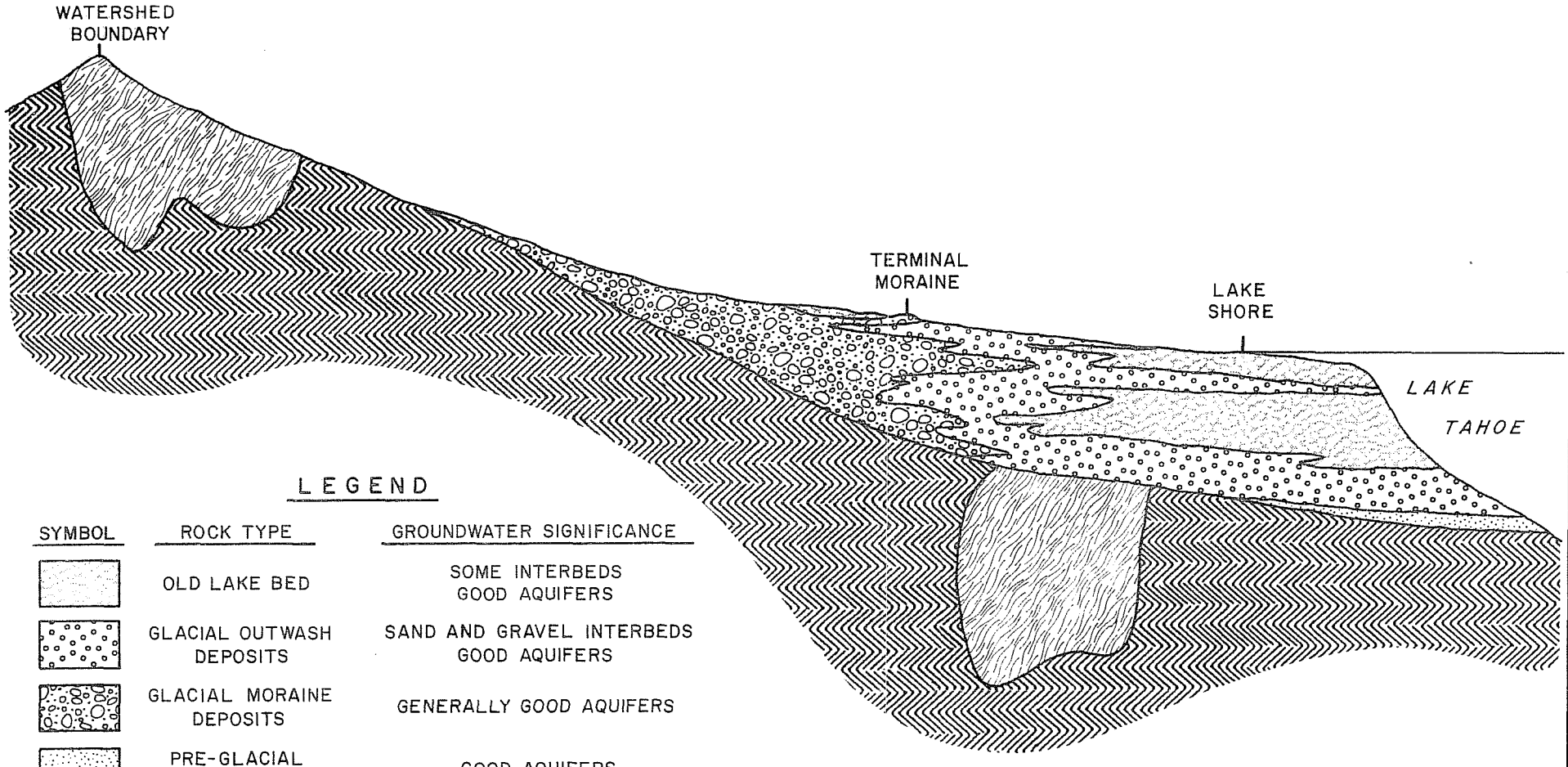
- Lakebed deposits are generally thin-bedded fine sands, silt and clay, with occasional sand or gravel interbeds. Through its history, Lake Tahoe's water levels have fluctuated more than 600 feet, so that lakebed deposits are found in many scattered locations especially near the present lake shore. In addition, there are lakebed deposits laid down by other past and present lakes and ponds in the Lake Tahoe Basin. These sediments are commonly saturated; however, because of the fine average grain size, they are rather poor aquifers.

- Alluvium deposits are recent sediments deposited by streams carrying weathered rock particles down from higher elevations, depositing them in relatively well sorted beds wherever a stream gradient is flattened. The geologic map shows several large areas of recent alluvium near the east edge of the lake. The value of these materials as aquifers is dependent upon the relative absence of silt and clay.

Aquifers/Aquitards

All of the principal aquifers of the Lake Tahoe Basin are found within the many canyons leading down to the lake from the uplands surrounding the basin.

Typically, the upper end of the groundwater basin is the highest point at which there is a significant thickness of glacial moraine deposits in the bottom of the valley (Figure VI-3, Typical Cross Section of Canyon). At this point, a substantial fraction of the flow from streams draining the higher areas will infiltrate the stream beds and continue its flow down the canyon as groundwater (underflow). The aquifer at this point could be likened to an immense sand box with a relatively high specific yield (15-25%) and high permeability (200-1,000 feet/day). Groundwater levels here commonly show great fluctuations with highest elevations during the snowmelt season and



LEGEND

SYMBOL	ROCK TYPE	GROUNDWATER SIGNIFICANCE
	OLD LAKE BED	SOME INTERBEDS GOOD AQUIFERS
	GLACIAL OUTWASH DEPOSITS	SAND AND GRAVEL INTERBEDS GOOD AQUIFERS
	GLACIAL MORAINE DEPOSITS	GENERALLY GOOD AQUIFERS
	PRE-GLACIAL SEDIMENTS	GOOD AQUIFERS
	GRANITIC ROCKS	GROUNDWATER IN NEAR SURFACE FRACTURES
	METAMORPHIC ROCKS	GROUNDWATER IN NEAR SURFACE FRACTURES

LAKE TAHOE GROUNDWATER BASIN

TYPICAL CROSS SECTION OF CANYON SOUTH OR WEST OF LAKE TAHOE

NOT TO SCALE

lowest elevations during the late fall and winter. The aquifers are commonly quite thin in the upper ends of the canyons. Therefore, wells here are often unreliable as sources of water supply during part of the year.

Proceeding down the canyon, the waterbearing sediments gradually become thicker and outwash deposits and occasional lakebed deposits are found interbedded with glacial moraine deposits.

Near the lower end of the canyons, the sediments are commonly fine sand with interbedded gravels being the principal aquifers while silts and clays are aquitards. Thickness of the sedimentary section may be in the 200 to 600 foot range; specific yield, between 7 and 11%; and permeability, between 1 and 200, averaging 10 to 30 feet/day. Depths to groundwater is commonly 10 to 30 feet, with the shallowest depths nearest the major streams.

Next to the shore of Lake Tahoe, the sediments are commonly interbedded lakebed and glacial outwash deposits. Here, glacial moraines are found only along the sides of the canyons. The shore area deposits are mostly silt and fine sand, with some significant gravel interbeds acting as aquifers (often confined) and clay interbeds acting as aquitards. Near the lake shore, the sediments may range in depth from 500 to 1000 feet. The average yield is around 7 or 8% and permeability is around 3 feet/day. Because of the proximity of the lake and the presence of the previous interbeds, groundwater elevations in the near-shore deposits are very close to that of the lake.

Groundwater Levels And Flow Patterns

A set of groundwater levels taken at approximately the same time over the entire study area is an important element of any groundwater geology study. Normally, when these data are contoured, they describe a groundwater surface roughly parallel to but more subdued than the ground surface.

Exceptions will occur wherever there is significant groundwater recharge or pumping taking place a pressure aquifer or fault, or a dramatic change in permeability, or basement depth. In early August 1978 groundwater levels

were measured at about 60 wells throughout the South Tahoe Basin. Figure VI-4 shows a groundwater level contour map based on these data as well as water levels of perennial water bodies. The only anomally noted was a significant pumping depression located directly south of Lake Tahoe. Thus, some of the groundwater in the area of Lake Tahoe that normally would be flowing toward the lake probably was flowing southward toward the pumping depression.

Present Groundwater Development

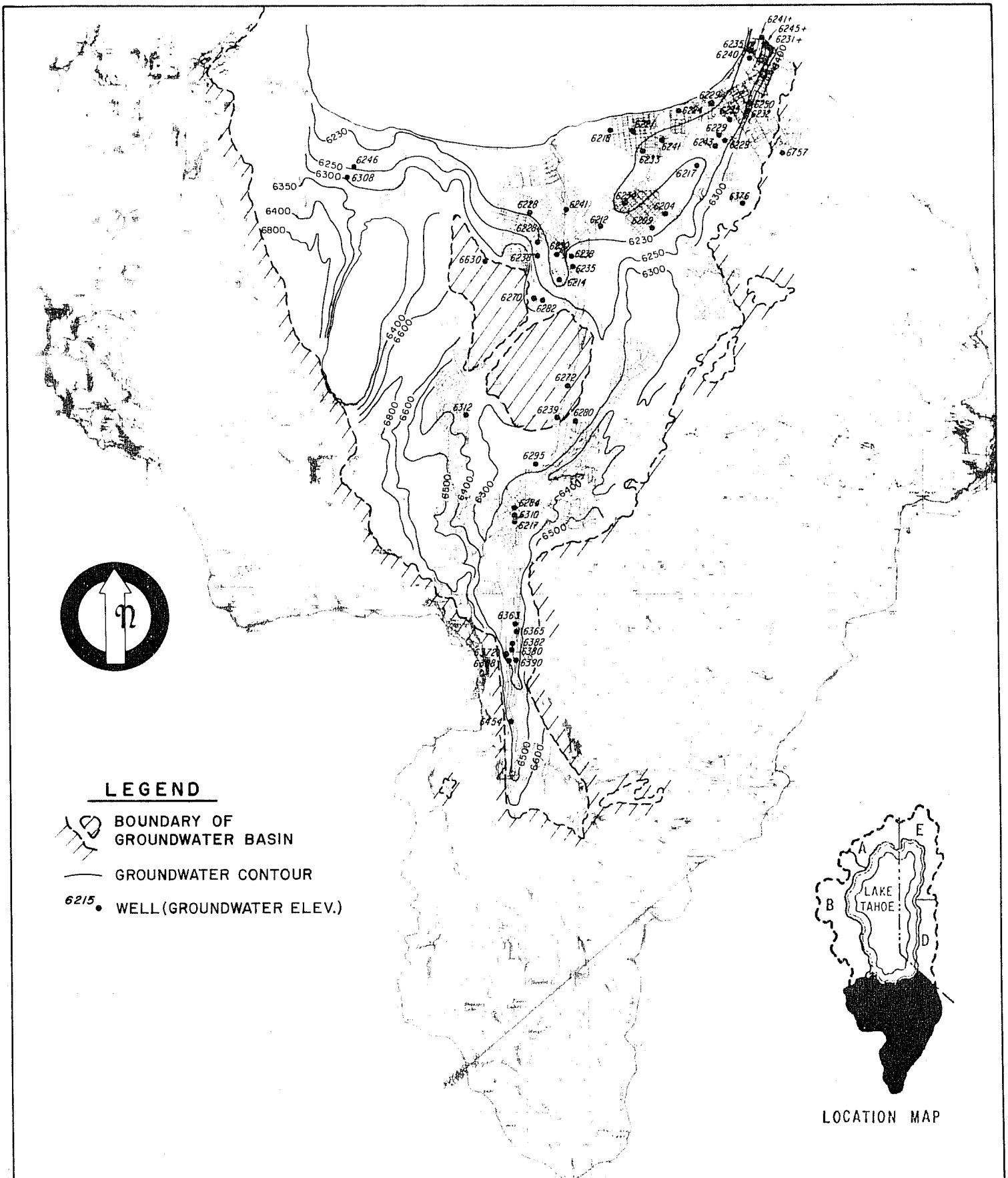
In a general sense, groundwater development in the South Lake Tahoe groundwater subbasin coincides with urban development. Few if any wells are found in those areas where surface water or springs can be used. These areas include Montgomery Meadows, the Fallen Leaf Lake development, or the Tallac Creek areas. Further, some areas which had a good public water system available at the time homes were built, such as portions of the Angora Water Company Service area and portions of the Tahoe Paradise/Christmas Valley area, have few private wells. Some of the wells in the South Lake Tahoe Groundwater Sub-Basin are probably considered by the owners as backup water supplies in case the public water system fails at any time. An analysis of well records discussed in Appendix C indicates that approximately 420 private wells in the South Tahoe area provide about 500 acre-feet to private users each year.

Thickness of Sedimentary Cover

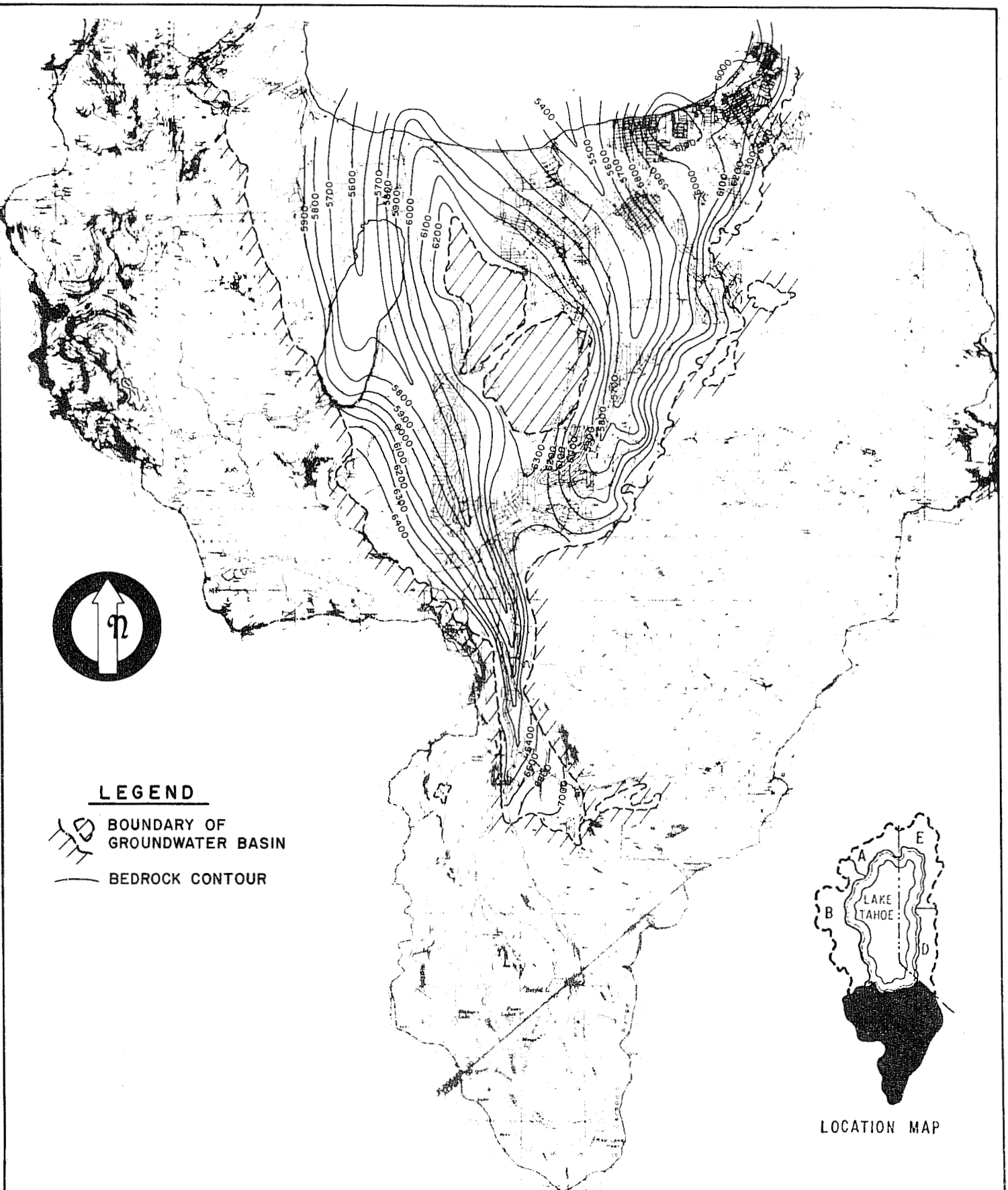
In order to make any estimates of the quantity of groundwater in the basin, data on the basin thickness must be obtained. Three methods are commonly used to do this--analysis of well log data, geophysical surveys, and geomorphic data.

Water Wells. Well logs generally provide the most reliable data as to the depth of the "basement". However, particularly in the deeper portions of a basin, water well drillers rarely drill a hole through the entire thickness of the saturated sediments. Even so, the total depth of the deeper wells does establish a minimum thickness of the sedimentry cover.

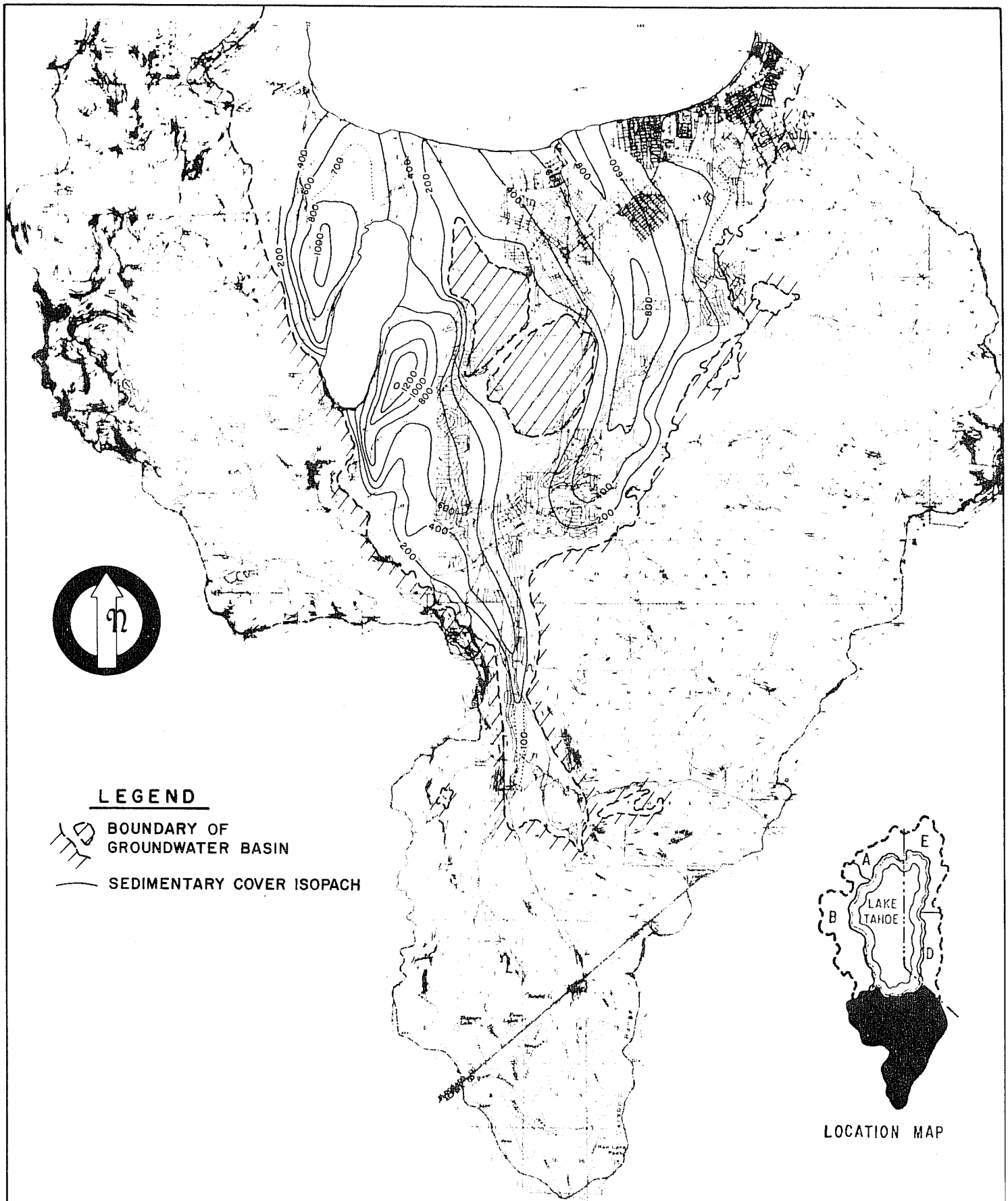
FIGURE VI-4



SOUTH TAHOE GROUNDWATER ELEVATIONS
AUGUST 1978



ESTIMATED ELEVATION OF BASEMENT
SOUTH LAKE TAHOE GROUNDWATER SUBBASIN



SOUTH TAHOE THICKNESS OF SEDIMENTARY COVER

Geophysical surveys. These methods require the underlying rocks to have some physical properties such as density, longitudinal wave velocity, electro conductivity, etc., that are distinctly different from those of the overlying sediments. Often, several geophysical methods are used together or the results are used to complement data from other sources in order to obtain the best estimates. The California Division of Mines and Geology and Justin Bloom, candidate for a Masters Degree at University of California at Davis, have conducted a gravity surveys in the South Lake Tahoe area and obtained much helpful data as to the depth of basement in the South Tahoe area.

Geomorphology. The shapes of local landforms, such as stream gradients, canyon slopes, drainage patterns, etc., can often be used to infer the depths to bedrock.

Although there is a general paucity of data in most of the South Lake Tahoe area that which was available was used to prepare a map showing the estimated basement elevation (Figure VI-5). It was assumed that the ancestral upper Truckee River earlier had a different path flowing on the west side of Tahoe Mountain across what is now Fallen Leaf Lake and into the southwest corner of Lake Tahoe.

A thickness of sedimentary cover map (Figure VI-6) was prepared by comparing the elevation data on the basement contour map with the ground surface elevations on the topographic maps of the area. The results showed substantial thicknesses of sedimentary cover at the mouth of the upper Truckee River under the massive lateral moraines flanking Fallen Leaf Lake and at the southwest corner of Lake Tahoe.

E. BASIN PARAMETERS

Some of the important hydrogeological variables in the South Lake Tahoe groundwater sub-basin are quantified in Table VI-1. These estimates are largely based on water well data and so they are least reliable where there are the fewest water wells. Estimates are given for each square mile survey section. However, in those cases where only a small portion of a section is in the groundwater basin, it is combined with an adjacent section. Where there are over-sized sections, they are split in half.

Variables Evaluated

Area in acres. Generally, all areas shown on maps of the Division of Mines and Geology as lakebeds, alluvium, and glacial deposits are included. Those locations where the morainal material constitutes a veneer overlying a steep slope of bedrock are not included. The areas range in size from 30 to 900 acres and average about 500 acres. Total for the study area is 25,310 acres.

Average surface elevation in feet. The surface elevations range from 6,235 to 6,900 feet and average about 6,400 feet.

Average depth to bedrock in feet. In some cases, these data include decomposed granite where this material is a significant source of groundwater. The depths range from 20 to 1,100 feet and average about 350 feet (Figures VI-5 and VI-6).

Average difference between water table elevations and Lake Tahoe surface elevation in feet. These differences range from 0 to 675 and average about 140 feet.

Average depth to groundwater in feet. These depths range from 0 to 400 feet and average about 35 feet.

Average specific yield stated as a percentage. This parameter is the ratio of the volume of groundwater that will drain from a given soil or rock under the influence of gravity to the total volume of soil or rock. The specific yields range from 6 to 20 percent and average about 10 percent.

Gross storage capacity in acre-feet. This is the hypothetical total quantity of groundwater thatcould be stored in the basin and later pumped out assuming groundwater levels at the ground surface and no infiltration of water from Lake Tahoe into the groundwater basin. This capacity is the product of the section's area, its average thickness of sediments, and its average specific

TABLE VI-1

SOUTH TAHOE VALLEY GROUNDWATER BASIN
SUMMARY - ESTIMATED HYDROGEOLOGIC PARAMETERS

SECTION(S)	AREA (ACRES)	AVERAGE SURFACE ELEVATION (FEET)	AVERAGE DEPTH OF BEDROCK (FEET)	AVERAGE DEPTH TO LAKE WATER LEVEL (FEET)	AVERAGE DEPTH TO GROUNDWATER (FEET)	AVERAGE SPECIAL YIELD (%)	GROSS STORAGE CAPACITY (ACRE-FEET)	TOTAL GROUNDWATER IN STORAGE (ACRE-FEET)	GROUNDWATER IN STORAGE ABOVE LAKE LEVEL (ACRE-FEET)	AVERAGE PERMEABILITY OF SEDIMENTS (FEET/DAY)	AVERAGE TRANSMISSIVITY OF SEDIMENTS (SQUARE-FEET/DAY)
T11N/R18E-20	30	6700	10	475	2	20	80	60	60	80	800
-17	250	6580	60	355	25	18	2,700	1,125	1,125	30	1,800
-7&8	280	6500	120	275	15	14	4,700	4,120	4,120	16.7	2,000
-5&6	400	6420	220	195	15	14	12,320	11,480	10,080	13.6	3,000
T12N/R17E-36 T12N/R18E-31	720	6500	320	275	20	16	36,900	34,600	29,410	12.5	4,000
T12N/R18E-32&33	380	6440	150	215	20	13	6,240	5,410	5,410	13.3	2,000
T12N/R17E-25	770	6620	320	395	30	17	41,900	38,000	38,000	16.9	5,400
T12N/R18E-30	620	6400	450	175	25	12	33,500	31,600	11,170	11.1	5,000
-29	640	6370	200	145	25	13	16,600	14,600	9,960	13.0	2,600
-28	350	6430	220	205	20	13	10,000	9,100	8,410	15.9	3,500
T12N/R17E-23&24	900	6720	750	495	250	16	108,000	72,000	35,280	20	15,000
T12N/R18E-19	640	6370	450	145	20	13	37,400	35,800	10,390	8.9	4,000
-20	450	6370	150	145	15	8	5,400	4,900	4,680	7.0	1,050
-21	640	6380	420	155	30	7	18,800	17,500	5,600	12.0	5,040
-22	280	6380	300	155	20	10	8,400	7,840	3,700	10.0	3,000
T12N/R17E-14	550	6500	400	275	0	8	17,600	17,600	12,100	1.3	500
-13	640	6800	950	575	400	8	48,640	28,160	8,960	5.0	2,750
T12N/R18E-18	450	6420	350	195	25	7	11,025	10,240	5,350	3.0	1,050
-16	570	6300	350	75	15	6	11,970	11,460	2,050	5.0	1,750
-15&14	500	6380	375	155	15	6	11,250	10,800	4,200	3.5	1,310
T12N/R17E-10&11	800	6900	700	675	10	7	39,200	38,640	37,240	1.8	1,260
-12	640	6560	600	335	15	6	23,040	22,460	12,290	2.0	1,200
T12N/R18E- 7	250	6700	400	475	20	7	7,000	6,650	6,650	2.5	1,000
- 8	300	6360	180	135	30	12	6,480	5,400	3,780	8.0	1,440
- 9	600	6300	530	75	40	6	19,080	17,640	1,260	4.0	2,100
-10	640	6340	550	115	80	7	24,640	21,060	1,570	5.0	2,750
-11	270	6370	150	145	40	12	4,860	3,560	3,400	15.0	2,250
T12N/R17E- 3	280	6900	200	675	20	15	8,400	7,560	7,560	30	6,000
- 2	640	6550	850	325	30	10	54,400	52,480	18,880	7.0	5,900
- 1	640	6400	450	175	10	7	20,160	19,710	7,390	1.4	630
T12N/R18E-6(5½)	400	6500	150	275	50	7	4,200	2,800	2,800	3.0	450
- 5	600	6280	350	55	40	7	14,700	13,020	630	2.0	700

TABLE VI-1

SOUTH TAHOE VALLEY GROUNDWATER BASIN
SUMMARY - ESTIMATED HYDROGEOLOGIC PARAMETERS

SECTION(S)	AREA (ACRES)	AVERAGE SURFACE ELEVATION (FEET)	AVERAGE DEPTH OF BEDROCK (FEET)	AVERAGE DEPTH TO LAKE WATER LEVEL (FEET)	AVERAGE DEPTH TO GROUNDWATER (FEET)	AVERAGE SPECIAL YIELD (%)	GROSS STORAGE CAPACITY (ACRE-FEET)	TOTAL GROUNDWATER IN STORAGE (ACRE-FEET)	GROUNDWATER IN STORAGE ABOVE LAKE LEVEL (ACRE-FEET)	AVERAGE PERMEABILITY OF SEDIMENTS (FEET/DAY)	AVERAGE TRANSMISSIVITY OF SEDIMENTS (SQUARE-FEET/DAY)
-4(S½)	640	6250	620	25	10	7	27,780	27,330	670	1.5	930
-3(S½)	640	6290	570	65	40	8	29,180	27,140	1,280	1.3	740
-2(S½)	280	6300	100	75	40	10	2,800	1,680	980	10	1,000
T13N/R17E-34	300	6550	200	325	30	9	5,400	4,590	4,950	10	2,000
-35	640	6400	700	175	30	9	40,320	38,590	8,350	4.0	2,800
-36	640	6320	420	95	15	8	21,500	20,740	4,100	3.0	1,260
T12N/R18E-6(N½)	620	6250	270	25	20	7	11,720	10,850	220	3.0	810
-5(N½)	670	6235	600	10	10	7	28,140	27,670	0	2.0	1,200
-4(N½)	710	6235	700	10	10	7	34,790	34,290	0	2.0	1,400
-3(N½)	710	6250	300	25	20	9	19,170	17,890	320	3.0	900
-2(N½)	740	6380	70	155	30	11	5,70	3,260	3,260	8.0	560
T13N/R18E-26	280	6235	550	10	10	7	10,780	10,580	0	3.0	1,650
-25	200	6240	400	15	5	6	4,800	4,740	120	2.0	800
T13N/R18E-31	100	6230	900	5	0	6	5,400	5,400	5,400	3.0	1,800
-32	250	6250	300	25	20	7	5,250	4,900	90	3.0	900
-33	450	6255	130	30	25	7	4,095	3,310	160	3.5	455
-34	420	6300	70	75	30	9	2,650	1,130	1,130	6.0	420
-26&27	500	6270	100	45	20	9	4,500	3,600	1,120	4.0	400
-22	400	6270	100	45	20	8	3,200	2,560	800	4.0	400
GRAND TOTALS	25,310	-	-	-	-	-	936,760	827,625	341,155	-	-

yield. The gross storage capacity data range from 80 to 108,000 acre-feet and averages about 18,000 acre-feet. The total gross storage capacity in the South Tahoe Groundwater Basin is 936,760 acre-feet.

Total groundwater in storage in acre-feet. The groundwater in storage is the same as the gross storage capacity, except that, the fraction of the gross storage capacity from the ground surface to the average depth of groundwater is not included. For each section storage ranges from 60 to 72,000 acre-feet, and averages about 16,000 acre-feet. Total groundwater in storage is 827,620 acre-feet.

Groundwater in storage above lake levels in acre-feet. This storage is the same as the estimated groundwater in storage after that quantfty of groundwater at elevations below 6,225 feet has been admitted. For each section the storage ranges from 0 to 38,000 acre-feet, and averaged about 7,000 acre-feet. Total storage is 341,000 acre-feet.

Average permeability in feet/day. This is a measure of the rock or soil capacity for transmitting water. It is the distance/unit of time that water will will move under unit hydraulic gradient. The common range of values is from 10^{-6} feet/day for a clayey soil to 10^{+4} feet/day for a clean gravel. Estimated average values range from 1 to 80 feet/day.

Transmissivity in square-feet/day. Transmissivity is the quantity of fluid/unit of time that will move under unit hydraulic gradient through a unit width of aquifer from the groundwater table down to the base. The transmissivities range from 400 to 15,000 square-feet/day.

An ideal method of checking estimated values for geohydrologic parameters in a groundwater basin is to compute a groundwater balance whereby all inflow and outflow quantities are calculated and balanced. Considering the watershed as a free body, on one side of the balance is the amount of water coming into the basin each year as precipitation, balanced out by the sum of (1) consumptive use including water lost to evaporation and transpiration by plant life and the water consumed through domestic, municipal, and industrial use; (2)

surface outflow down the Truckee River; (3) subsurface outflow and underflow of the Truckee River; and (4) exported water including the diversions of water from Echo and Marlette Lakes and the exportation of wastewater from the area's major sewage treatment plants. This type of analysis was not conducted, because of the lack of good data on the extremely important evaporation and transpiration water losses. Even small errors in estimating these factors would introduce errors far larger than most of the other variables.

F. IMPACT OF FUTURE DEVELOPMENT

With a general knowledge of the groundwater geology of an area, the effects of any changes imposed on the groundwater systems can be forecast within broad limits. A most significant change in the Lake Tahoe Basin would be increased consumption of water by a rapidly increasing population.

Water supplies have been developed for the rapidly growing population by extraction of groundwater from wells, development of springs, and diversion of surface streams. Since most of the sewage in the Tahoe Valley Basin is exported from the basin for water quality reasons and an increasing amount of water is used for landscape irrigation, an estimated 75 to 80% of the water developed for municipal needs results in a reduction in the surface outflow from the basin. On the other hand, there is a small, perhaps insignificant groundwater augmentation as a result of man's activities--the changes to flora of the basin. In recent times, there has been a net loss in the number of trees. Willows and marsh vegetation have been removed where building lots have been developed in marsh areas. In a few places lowering of the groundwater table has in a few places caused a dying back of phreatophytes--the plants that are prolific water users. Lower groundwater levels and a groundwater gradient away from the lake shore in a portion of the Al Tahoe area mean that some of the municipal water demand has been met by dewatering some formerly saturated soils. Most of the water demand, however, has been met by the actual interception of water which otherwise would have been surface or subsurface inflow into Lake tahoe.

If there are no restrictions on further groundwater development, the water needs of further additions to the area's population will probably be met by

use of groundwater. This will result in further interception of inflow to Lake Tahoe, and, thus, the lower Truckee River outflow. Any development of water supplies within the Tahoe Basin, whether they are surface or groundwater will have the effect of reducing the Lower Truckee River flow. Further, areas of heavy groundwater pumpage will exhibit further declines in groundwater levels as groundwater is taken out of storage.

Development of groundwater does have the advantage of simplifying the "plumbing" with areas using wells not needing water mains to bring water from distant surface water sources. Further, in drought years, some of the groundwater in storage can be used, in effect borrowing from the future year's inflow to Lake Tahoe.

Within the conditions imposed by the proposed Interstate Water Compact, the following appear to be the only options available for long range water development and use:

- o Conservation methods to reduce the per capita water use.

- o Reuse of some of the municipal sewage effluent (common methods of replacement such as landscape watering or groundwater recharge may not be acceptable because of the possibility of increased nutrient loading in Lake Tahoe and public health hazards).

- o Limitation of potential development and population levels substantially below those presently envisioned by local and regional planning agencies.

- o Import water from out of basin or transfer of other Truckee River water rights for use within the Lake Tahoe Basin.

G. SUMMARY

- o Within the Lake Tahoe watershed there is a substantial volume of waterbearing sediments. These are mostly at the south end of Lake

Tahoe, but significant quantities are also found in the several large watersheds draining into the west and north end of Lake Tahoe.

- These sediments contain an estimated 0.8 million acre-feet of groundwater.

- There is no evidence of any subsurface outflow from the Lake Tahoe Basin; the only surface outflow is that in the Lower Truckee River.

- Groundwater flow through the Lake Tahoe Basin is analogous to underflow in a river channel with the beds and banks of the channel being the non-waterbearing crystalline rocks on the bottom, east, and west sides of the basin. Thus, any additional water consumption within the basin will reduce of the inflow into Lake Tahoe and the outflow down the Lower Truckee River.

- Except for a very slight reduction in water consumption by vegetation, the development of the Lake Tahoe Basin has substantially increased the quantity of water consumed and/or exported from the basin.

- Further population increases in the Lake Tahoe Basin, if not accompanied by conservation measures to reduce the per capita water consumption will further reduce in the flow of the lower Truckee River.

SECTION VII

SELECTED REFERENCES

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