ENVIRONMENTAL MONITORING REPORT

ANNUAL SUMMARY - 1961

Atomics International
Canoga Park, California

Summary

The environs of Atomics International's World Headquarters and Nuclear Development Field Laboratory are periodically surveyed to determine the radioactivity of typical surface soil, vegetation, and water samples. In addition, continuous air samples taken at the above sites provide information concerning airborne particulate radioactivity. This report summarizes the environmental monitoring results for the calendar year 1961. The annual averages for the years 1960, 1959, 1958, and 1957 are included for comparison.

Soil and vegetation are sampled monthly at forty-eight locations. Ten of these are within the boundaries of Atomics International sites; the remaining thirty-eight are within a ten mile radius of the sites.

The average soil and vegetation activities, which are averaged for the year, quarterly, and monthly, are shown in Tables I and II.

Table I - Soil

Alpha Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1961	120	0.30 to 0.37	458	0.24 to 0.33
1st.Quarter	30	0.14 to 0.30	118	0.12 to 0.28
2nd.Quarter	30	0.46 to 0.48	112	0.33 to 0.38
3rd.Quarter	30	0.40 to 0.41	114	0.32 to 0.38
4th.Quarter	30	0.21 to 0.31	114	0.18 to 0.30
1960	115	0.34 to 0.41	362	0.27 to 0.37
1959	107	0.43	377	0.32
1958	80	0.27	309	0.26
1957	64	0.32	318	0.35

Beta-Gamma Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1961	120	34.	458	23.
1st.Quarter	30	37.	118	24.
2nd.Quarter	30	35.	112	24.
3rd.Quarter	30	35.	114	22.
4th.Quarter	30	31.	114	24.
1960	114	23.	360	19.
1959	107	15.	379	14.
1958	84	21.	318	10.
1957	72	11.	354	10.

Soil Radioactivity By Month

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
On Site	α	0.00 to 0.24	0.08 to 0.27	0.35 to 0.37	0.41 to 0.43	0.49	0.48 to 0.50	0.38	0.38 to 0.40	0.43 to 0.45	0.25 to 0.32	0.26 to 0.33	0.11 to 0.28
	$\beta-\gamma$	25.	56.	32.	33.	32.	40.	51.	31.	22.	23.	28.	40.
Off Site	α	0.05 to 0.25	0.06 to 0.25	0.25 to 0.34	0.33 to 0.38	0.34 to 0.39	0.33 to 0.37	0.28 to 0.35	0.26 to 0.33	0.42 to 0.45	0.18 to 0.29	0.24 to 0.32	0.13 to 0.29
	$\beta-\gamma$	23.	27.	23.	24.	25.	23.	21.	22.	21.	19.	21.	31.

Table II - Vegetation

Alpha Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram Ash	No. Samples	Average uuc/gram Ash
1961	120	0.32 to 0.35	459	0.26 to 0.29
1st.Quarter	30	0.10 to 0.16	118	0.08 to 0.14
2nd.Quarter	30	0.31 to 0.33	113	0.35 to 0.37
3rd.Quarter	30	0.36 to 0.37	114	0.24 to 0.27
4th.Quarter	30	0.52 to 0.54	114	0.37 to 0.40
1960	115	0.31 to 0.35	362	0.21 to 0.25
1959	96	0.29	293	0.18
1958	65	0.57	250	0.39
1957	58	1.1	304	0.89

Beta-Gamma Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram Ash	No. Samples	Average uuc/gram Ash
1961	120	224.	459	246.
1st.Quarter	30	167.	118	149.
2nd.Quarter	30	152.	113	135.
3rd.Quarter	30	120.	114	109.
4th.Quarter	30	455.	114	593.
1960	113	137.	358	136.
1959	107	212.	380	168.
1958	84	683.	318	356.
1957	70	208.	351	200.

Vegetation Radioactivity By Month

	Activity	J	F	M	A	M	J	J	A	S	O	N	D
On Site	α	0.10 to 0.16	0.08 to 0.15	0.10 to 0.17	0.28 to 0.30	0.47	0.20 to 0.21	0.29 to 0.32	0.36 to 0.37	0.42	0.44 to 0.45	0.42 to 0.44	0.70 to 0.73
	$\beta-\gamma$	181.	158.	162.	189.	131.	137.	136.	137.	88.6	176.	262.	928.
Off Site	α	0.03 to 0.10	0.17 to 0.21	0.05 to 0.12	0.35 to 0.37	0.49 to 0.50	0.21 to 0.24	0.20 to 0.23	0.25 to 0.27	0.27 to 0.29	0.27 to 0.31	0.40 to 0.42	0.43 to 0.45
	$\beta-\gamma$	168.	135.	144.	144.	123.	138.	122.	90.3	115.	156.	287.	1335.

Two water wells at the N.D.F.L. are sampled monthly to evaluate ground water radioactivity. The annual, quarterly, and monthly averages are shown in Table III.

Table III - Well Water

Year	Alpha		Beta-Gamma	
	No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
1961	24	0.06 to 0.09	24	2.2 to 3.6
1st.Quarter	6	0.01 to 0.05	6	3.3 to 3.7
2nd.Quarter	6	0.08 to 0.10	6	1.2 to 2.8
3rd.Quarter	6	0.12 to 0.14	6	0.68 to 2.8
4th.Quarter	6	0.04 to 0.07	6	3.7 to 5.3
1960	22	0.06 to 0.09	22	1.0 to 2.7
1959	18	0.08	16	1.6
1958	13	0.16	18	4.7
1957	-	-	17	13.

Well Water Radioactivity By Month

Activity	J	F	M	A	M	J	J	A	S	O	N	D
α	0.00 to 0.052	0.00 to 0.052	0.027 to 0.053	0.043 to 0.069	0.098 to 0.12	0.10	0.12	0.25	0.00 to 0.052	0.041 to 0.067	0.00 to 0.052	0.065 to 0.091
β-γ	2.9 to 4.2	4.2	2.8	0.0 to 2.5	1.6 to 2.8	1.9 to 3.1	2.0 to 3.3	0.0 to 2.5	0.0 to 2.5	0.0 to 2.5	2.2 to 3.4	8.8 to 10.

The Chatsworth Reservoir, which is operated by the Los Angeles City Department of Water and Power, is sampled monthly for soil, vegetation, and water. The average water activity is shown in Table IV.

Table IV - Reservoir Water

Year	Alpha		Beta-Gamma	
	No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
1961*	48	0.47	48	10.
1st.Quarter*	5	0.28	5	5.4
2nd.Quarter	15	0.39	15	7.7
3rd.Quarter	15	0.47	15	6.1
4th.Quarter	13	0.63	13	19.

* Gross annual and first quarter averages exclude sample data obtained during January and February since reservoir water sampling stations indicated in Table VII were established in March.

Environmental air sampling is performed continuously at the Headquarters and N.D.F.L. sites. The annual and quarterly average concentrations of long lived airborne beta emitters are shown in Table V.

Table V - Air

Year	Headquarters		N.D.F.L.	
	No. Samples	Average uuc/m^3	No. Samples	Average uuc/m^3
1961	313	4.2	176	3.6
1st.Quarter	95	0.25	42	0.40
2nd.Quarter	47	0.25	*	- -
3rd.Quarter	79	0.89	79	0.89
4th.Quarter	92	13.	55	10.
1960	182	0.24	44	0.44
1959	215	2.5	257	0.93
1958	366	4.9	164	2.7
1957	63	1.6	141	2.7

* No data available during this period.

Some of the data given in Tables I, II, III, and IV is given as a range within which lies the true average. This occurs when one or more of the samples contains an "undetectable" amount of radioactivity. In these instances, two averages are determined. The lowest value assumes that the "undetectable" samples contain no radioactivity. The highest value assumes that these samples contain radioactivity equal to the appropriate minimum detection limit given in Table VI.

Conclusions

Tables I and II show that soil and vegetation alpha radioactivity vary somewhat from month to month. These variations are probably caused by rainfall, rate of vegetation growth, fallout and other such factors. While it is difficult, if not impossible, to correlate environmental activity fluctuations with seasonal changes in weather, growth rate, etc., the effect of fallout on environmental activity levels is most easily demonstrated by the 1961 vegetation data. Vegetation beta-gamma activity shows a decreasing trend during the first three quarters of the year; however, a marked activity increase occurs in the fourth quarter. This increase in vegetation activity is apparent in the monthly averages from October to December; however, on-site activity increases are matched by activity increases in off-site areas which are sampled to a radius of ten miles from the N.D.F.L.. It is apparent that this is a generalized increase throughout the local area, and is not due to Atomics International's operations.

Table III shows that well water activity at the N.D.F.L. varied somewhat from month to month. An increase in beta-gamma activity occurs in December which shows the highest month's activity for the year. Since liquid radioactive waste is not released to the ground, this increase is not a result of Atomics International's operations. Instead, it is believed that fallout and rain-out during the last quarter were the cause of the December activity increase.

Table IV shows that Chatsworth Reservoir water activity levels underwent quarterly variations. The reservoir water sampling stations are situated on the lake perimeter, fully exposed to fall-out and rain-out. The table shows that the average alpha activity is small compared with the conservative M.P.C. of 1×10^{-8} uc/cc, while beta-gamma activity shows an averaged value of 1×10^{-8} uc/cc. The fourth quarter increase is attributed entirely to fallout and rain-out.

Table V shows quarterly variations in airborne long lived beta activity. The fourth quarter average for both Headquarters and N.D.F.L. shows a marked increase over previous quarters. This airborne activity has been identified as fission products produced at various times after September 1, 1961. These fission products are attributable entirely to nuclear detonations, and not to Atomics International's operations.

The resumption of nuclear testing by the U.S.S.R. on September 1, 1961 has resulted in the release of fresh fission product debris to the atmosphere of the northern hemisphere. The pronounced beta-gamma radiation increases in all sample types, except soil, reflects this contribution to the environment. This contamination is most readily apparent in vegetation and airborne radioactivity concentrations, although the increase in reservoir water radioactivity is also significant.

Considerable rainfall occurred in the Los Angeles area during the fourth quarter of 1961. A total of 3.7 inches was recorded at the Headquarters weather station, and 4.5 inches at the N.D.F.L. station during November and December. Radioactivity concentrations detected in rainwater collected over this period averaged 1983.0 uuc/liter beta-gamma. Soil contamination from the fall-out and rain-out is less apparent than vegetation contamination because normal soil

activity is comparatively high and the fallout surface area of the samples, which are removed to a depth of ½ inch, is small.

The general increase in environmental radioactivity levels during the fourth quarter of 1961 is entirely due to fission debris produced by nuclear testing and is not attributable to Atomics International's operations.

General Description of Program

Soil and vegetation sample collection and analysis, initiated in 1952 in the Downey, California area, was extended to the then proposed SRE site in May 1954, and to the Canoga Park area in December 1954. The Downey area survey was stopped when Atomics International relocated to Canoga Park. The primary purpose of the environmental monitoring program is to ensure that Atomics International's operations are not contributing measurably to environmental radioactivity and, at the same time, to provide a continuing check on the integrity of engineering safeguards for the containment of radioactivity. Due to the effect of geographical location on environmental radioactivity, comparison between widely spread sampling locations is difficult. Useful information can be obtained, however, by observing the trend of individual or closely spaced groups of locations.

For this reason, samples are collected monthly in six general survey areas including Canoga Park (2), Santa Susana Mountains, Simi Valley, Russell Valley, and the Chatsworth Reservoir which is operated by the Los Angeles Department of Water and Power. Forty-eight sampling stations are currently established within the indicated areas. The maximum sampling station distance from the Nuclear Development Field Laboratory at Santa Susana is approximately ten miles. Sampling station locations are indicated on Figures 1, 2, 3, and 4, and in Table VII.

During each calendar quarter, approximately 144 soil, 144 vegetation, 36 water, and 90 environmental air samples are obtained and analyzed by the Health and Safety Laboratory for gross alpha and/or beta-gamma radioactivity.

Methods

SOIL

Surface soil types available for sampling range from decomposed granite to clay and sandy loam. Collected samples represent the top one half inch layer of ground surface. The soil is packed in small plastic containers which are then taken to the laboratory for analysis. Sample preparation consists of transferring the soil to pyrex beakers and drying in a muffle furnace at 500° centigrade for eight hours. After cooling, the soil is screened to obtain uniform particle sizes for counting. One gram aliquots of the screened soil are then weighed out and transferred to stainless steel planchets for counting.

The prepared samples are counted under a thin window, gas flow proportional counter calibrated with Ra D+E (with and without alpha absorber) and K^{40}. The K^{40} in the form of crystalline KCl is used to correct for self absorption in the soil and vegetation samples. This method affords the minimum detection limits shown in Table VI. While better sensitivity and accuracy are possible, the additional counting time required is not warranted for routine analysis.

Table VI - Minimum Detection Limits

Sample	Activity	Minimum Detection Limit
Soil	α	0.24 ± 0.094 uuc/gram*
	β-γ	6.9 ± 2.1 uuc/gram*
Vegetation	α	0.086 ± 0.089 uuc/gram**
	β-γ	13.8 ± 4.1 uuc/gram*
Water	α	0.052 ± 0.054 uuc/liter**
	β-γ	2.5 ± 1.3 uuc/liter**

* - 95 percent error
** - standard error

VEGETATION

Vegetation samples obtained in the field at each station are of the same plant type wherever possible, and are generally sun flower or wild tobacco plant leaves. These plant types maintain an active rate of growth during the dry season, a characteristic uncommon to most other plant types indigenous to the area. Vegetation leaves to be sampled are stripped from the plant and placed in ice cream cartons for transfer to the Health and Safety Laboratory.

Preparation of samples for analysis includes rinsing in distilled water to remove foreign matter and placing in porcelain crucibles for reduction to ash. The crucibles are placed in a muffle furnace at 500° centigrade for approximately eight hours. This ashing time is sufficient to produce a finely divided, completely oxidized ash of uniform density. Three hundred milligram aliquots of ash from each crucible are then weighed and transferred to stainless steel planchets for analysis. Analytical methods are the same as for soil samples. Sensitivity and accuracy are shown in Table VI.

WATER

Samples of well water are obtained at the Nuclear development Field Laboratory. The water is drawn into one liter polyethylene bottles for transfer to the laboratory. The samples are measured into 500 milliliter volumetric flasks and then evaporated into crystallizing dishes at approximately 90° centigrade. The residue salts are transferred to stainless steel planchets, wetted to produce an even deposition in the planchet, re-dried and counted in the proportional system. Sensitivity and accuracy are shown in Table VI.

AIR

Environmental air sampling is conducted continuously at the Headquarters and N.D.F.L. sites by automatic twenty-four hour step cycle air monitors. Airborne particulates are collected on a fixed

filter tape which is moved, after each twenty-four period, to place the new sample beneath a thin window G.M. detector. At pre-set intervals, usually twenty minutes, the number of counts observed by the scaler during the interval is recorded.

It has been determined that for this type of instrument twice the counting rate after 18.6 hours decay minus the counting rate after 8 hours decay closely approximates the long-lived contribution. This counting rate can be converted easily to the average long-lived airborne activity (uuc/m^3) during the sampling period. The minimum detection limit, which varies somewhat between instruments, is on the order of 0.04 uuc/m^3.

When abnormally high activities are observed, the data is plotted to determine the presence of short-lived activities other than radon and thoron daughters. If fallout is suspected, samples are removed to the laboratory where their decay is observed for a period of several days to several weeks. If the activity decays as a function of $t^{-1.2}$, the data is extrapolated in order to find the date of origin. This date is then compared with the dates of publicized nuclear detonations in order to demonstrate that the abnormal airborne activity was not caused by Atomics International operations.

Table VII

Sample Station Locations

Station	Location
SV-1	SRE Reactor
SV-2	SRE Perimeter Drainage Ditch
SV-3	Building 064 Parking Lot
SV-4	West of Building 020
SV-5	Building 363
SV-6	Rocketdyne Retention Reservoir, PFL
SV-7	Rocketdyne PFL
SV-8	Rocketdyne PFL
SV-9	Rocketdyne PFL
SV-10	Santa Susana Site Access Road
SV-11	Santa Susana Site Access Road
SV-12	KEWB Reactor
SV-13	Sodium Burning Pad
SV-14	Canyon below Building 022
SV-15	Reseda Blvd. and Ventura Blvd.
SV-16	Topanga Canyon Blvd. and Ventura Blvd.
SV-17	Topanga Canyon Blvd. and Vanowen St.
SV-18	Topanga Canyon Blvd. and Saticoy St.
SV-19	Santa Susana Facility Entrance
SV-20	Topanga Canyon Blvd. and Devonshire St.
SV-21	Reseda Blvd. and Devonshire St.
SV-22	Reseda Blvd. and Nordhoff St.
SV-23	Reseda Blvd. and Sherman Way
SV-24	Headquarters
SV-25	DeSoto Ave. and Plummer St.
SV-26	Nordhoff St. and Mason Ave.
SV-27	DeSoto Ave. and Parthenia St.
SV-28	Canoga Ave. and Nordhoff St.
SV-29	Santa Susana Knolls
SV-30	Los Angeles Ave. at Bridge
SV-31	Los Angeles Ave. and Sycamore Road
SV-32	Tapo Canyon
SV-33	Los Angeles Ave. and Sinaloa Road

Station Con't	Location Con't
SV-34	Meier Canyon
SV-35	Brandeis Camp Entrance
SV-36	Moorpark Road and Camarillo Road
SV-37	Moorpark Road at Oil Pumping Station
SV-38	Moorpark Road and Ventura Blvd.
SV-39	Ventura Blvd. at Potrero Road
SV-40	Ventura Blvd. at Cornell Corners (Agoura)
SV-41	Ventura Blvd. at Calabasas
SV-42	Non Radioactive Materials Disposal Area, Nuclear Development Field Laboratory
SV-43	Chatsworth Reservoir Dam - West Side
SV-44	Chatsworth Reservoir Dam - Mid Point
SV-45	Chatsworth Reservoir Dam - East Side
SV-46	Chatsworth Reservoir Perimeter Road - Northeast Side
SV-47	Chatsworth Reservoir Perimeter Road - North Side
SV-48	Chatsworth Reservoir Perimeter Road - West Side
W 2	SRE Perimeter Drainage Ditch
W 6	Rocketdyne Retention Reservoir, PFL
W 7	Well Water from Engineering Test Building
W 11	Well Water from Building 363
W R.O.	Run Off Collection Sump
W C.T.	Edison Cooling Tower
W R.D.	SRE Retention Dam
W A	Chatsworth Reservoir
W B	Chatsworth Reservoir
W C	Chatsworth Reservoir
W D	Chatsworth Reservoir
W E	Chatsworth Reservoir

SV - Soil and Vegetation

W - Water

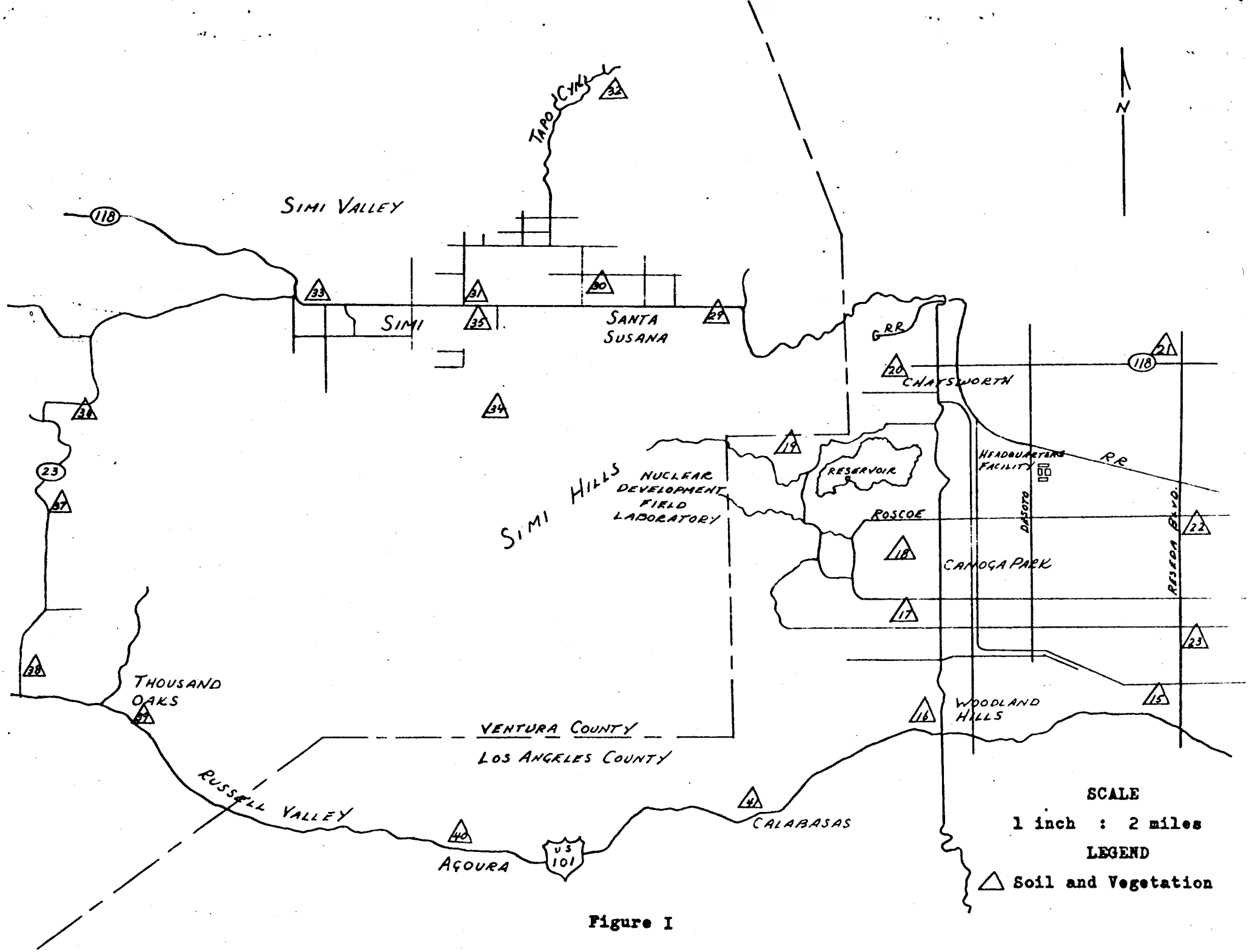
N
TAPO CYN.
SIMI VALLEY
118
SIMI
SANTA SUSANA
CHATSWORTH
RR
HEADQUARTERS FACILITY
RESERVOIR
SIMI HILLS
NUCLEAR DEVELOPMENT FIELD LABORATORY
ROSCOE
DE SOTO
CANOGA PARK
RESEDA BLVD.
THOUSAND OAKS
VENTURA COUNTY
LOS ANGELES COUNTY
WOODLAND HILLS
RUSSELL VALLEY
AGOURA
US 101
CALABASAS
SCALE
1 inch : 2 miles
LEGEND
Soil and Vegetation

Figure I

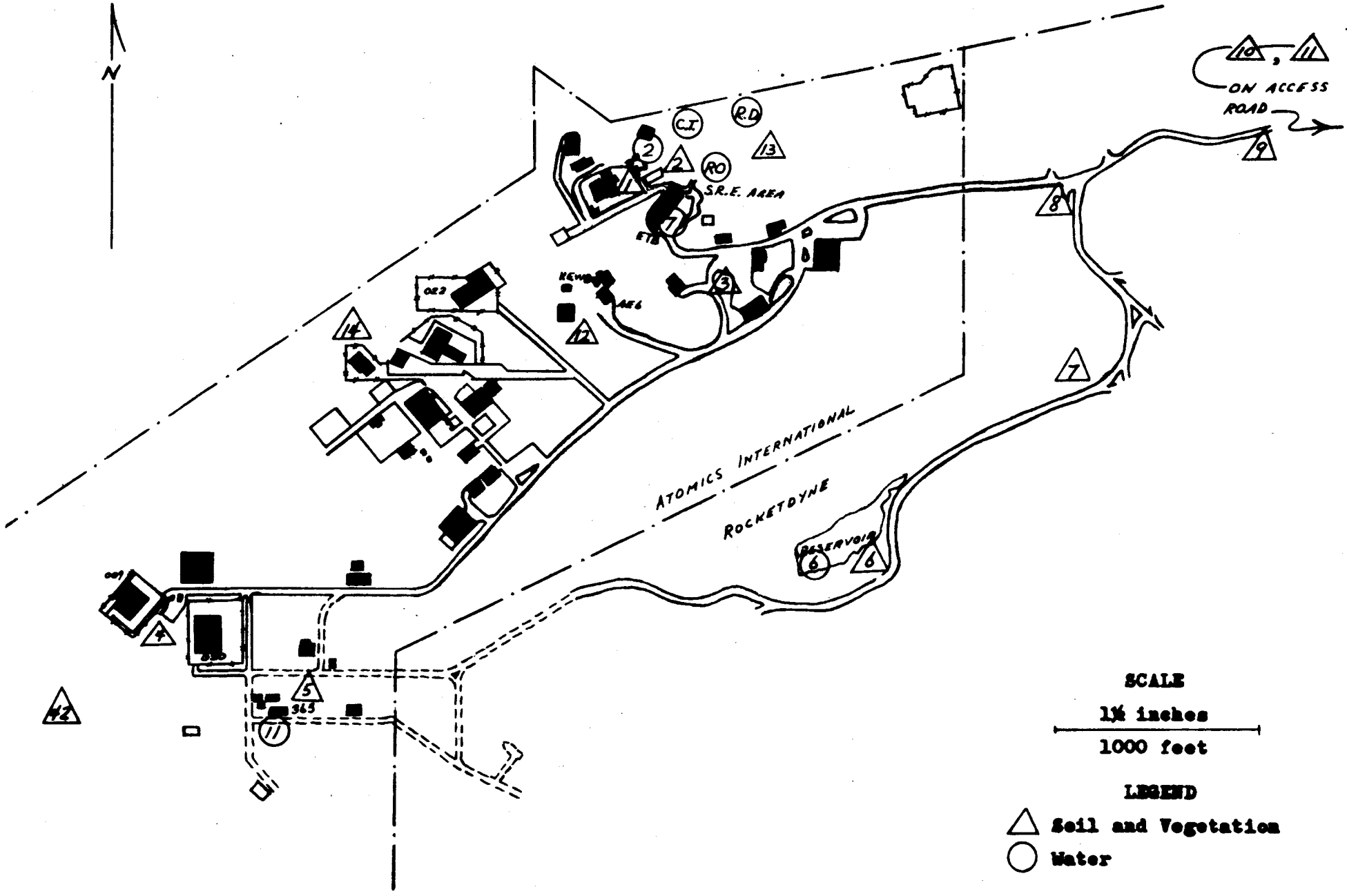
N
ON ACCESS ROAD
S.R.E. AREA
ATOMICS INTERNATIONAL
ROCKETDYNE
RESERVOIR
SCALE
1¼ inches
1000 feet
LEGEND
Soil and Vegetation
Water

Figure II

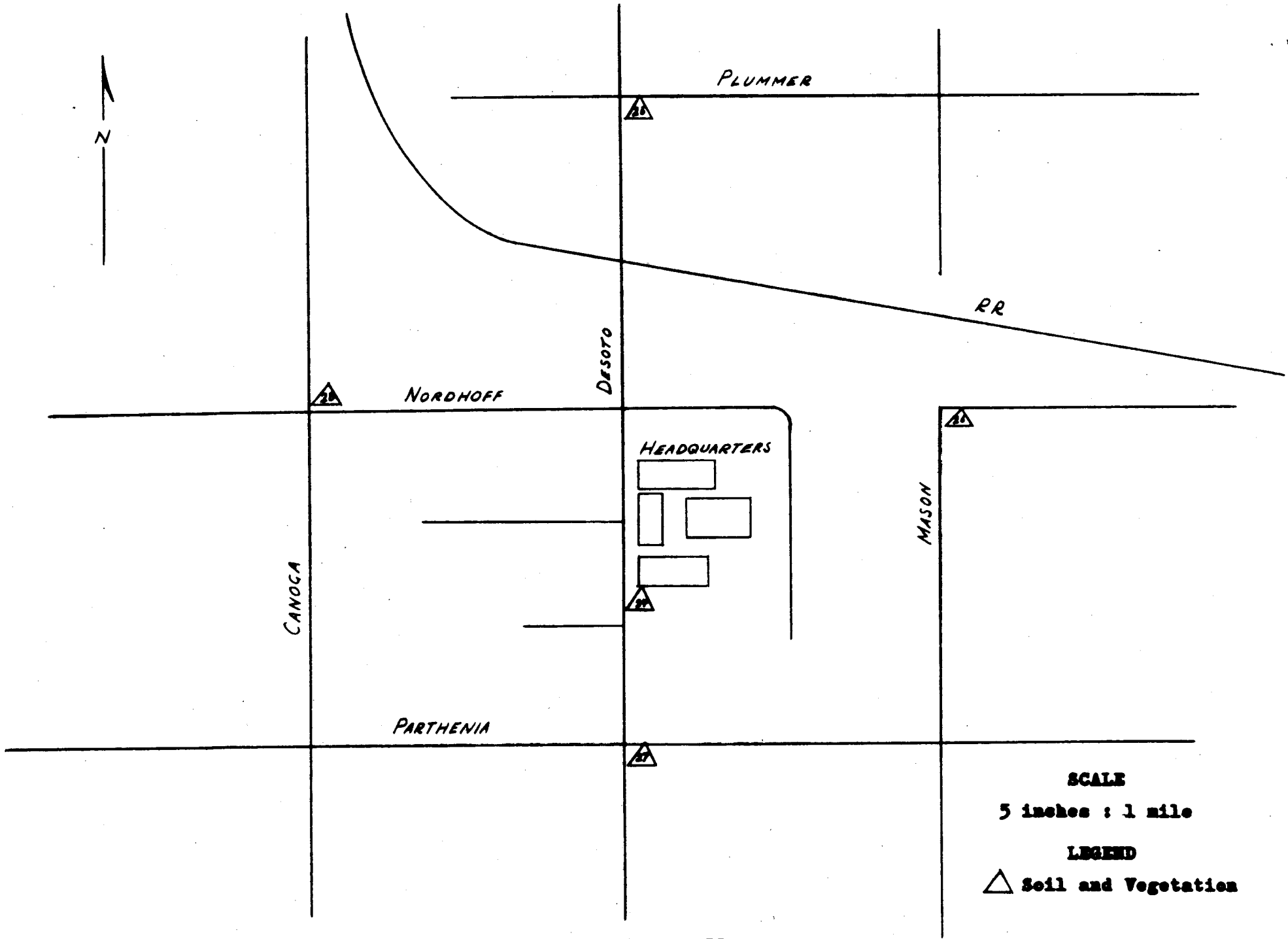
N
PLUMMER
RR
DESOTO
NORDHOFF
HEADQUARTERS
CANOCA
MASON
PARTHENIA
SCALE
5 inches : 1 mile
LEGEND
Soil and Vegetation

Figure III

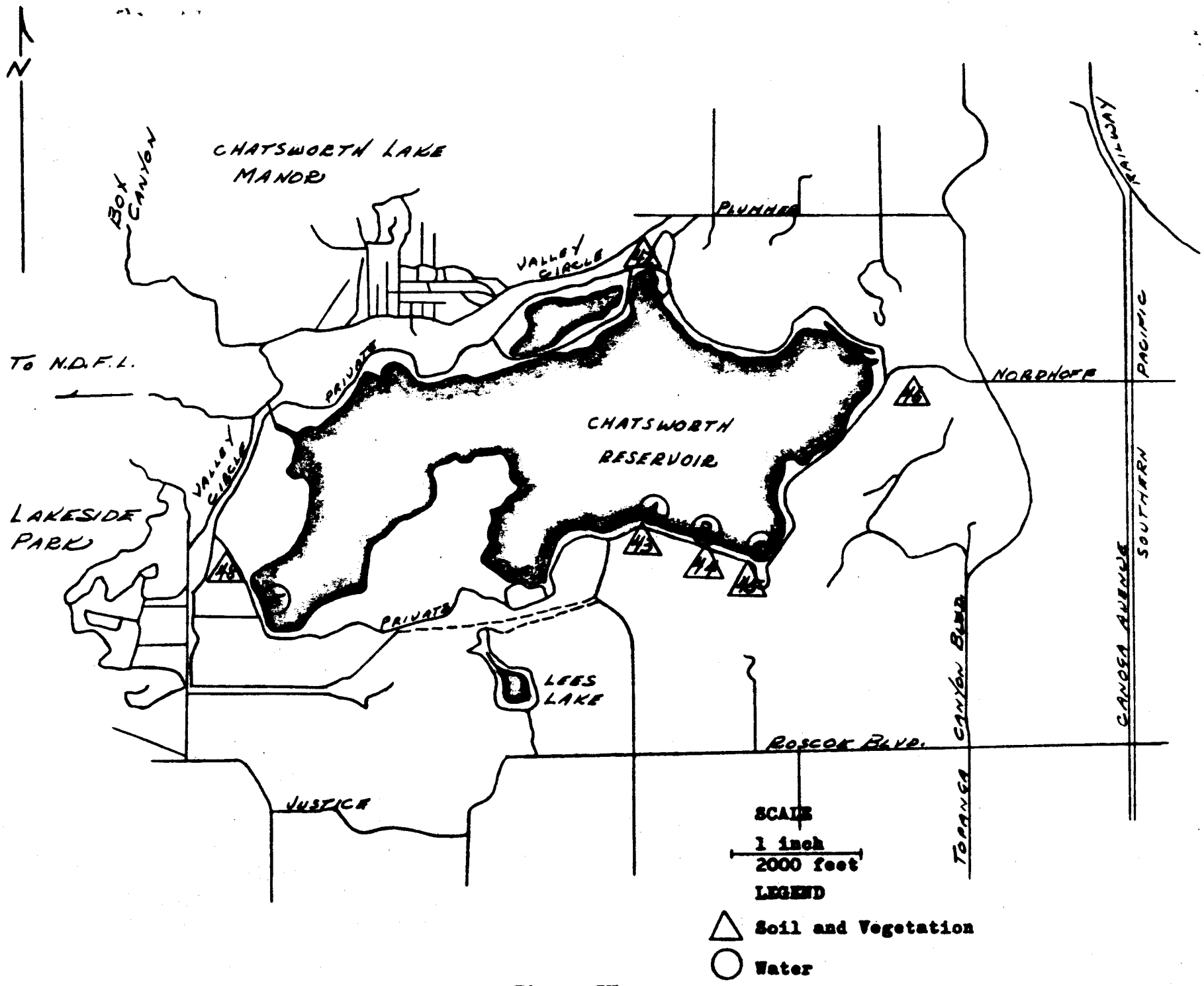
N
BOX CANYON
CHATSWORTH LAKE MANOR
PLUMMER
VALLEY CIRCLE
TO N.D.F.L.
PRIVATE
CHATSWORTH RESERVOIR
NORDHOFF
PACIFIC RAILWAY
VALLEY CIRCLE
LAKESIDE PARK
PRIVATE
LEES LAKE
ROSCOE BLVD.
CANOGA AVENUE
SOUTHERN
CANYON BLVD.
TOPANGA
JUSTICE
SCALE
1 inch
2000 feet
LEGEND
Soil and Vegetation
Water

Figure IV