NICASIO

HIDDEN VALLEY IN TRANSITION

Although obsolete and no longer used, community pride has saved this remnant of the past.

M-Donnell

NICASIO

HIDDEN VALLEY IN TRANSITION

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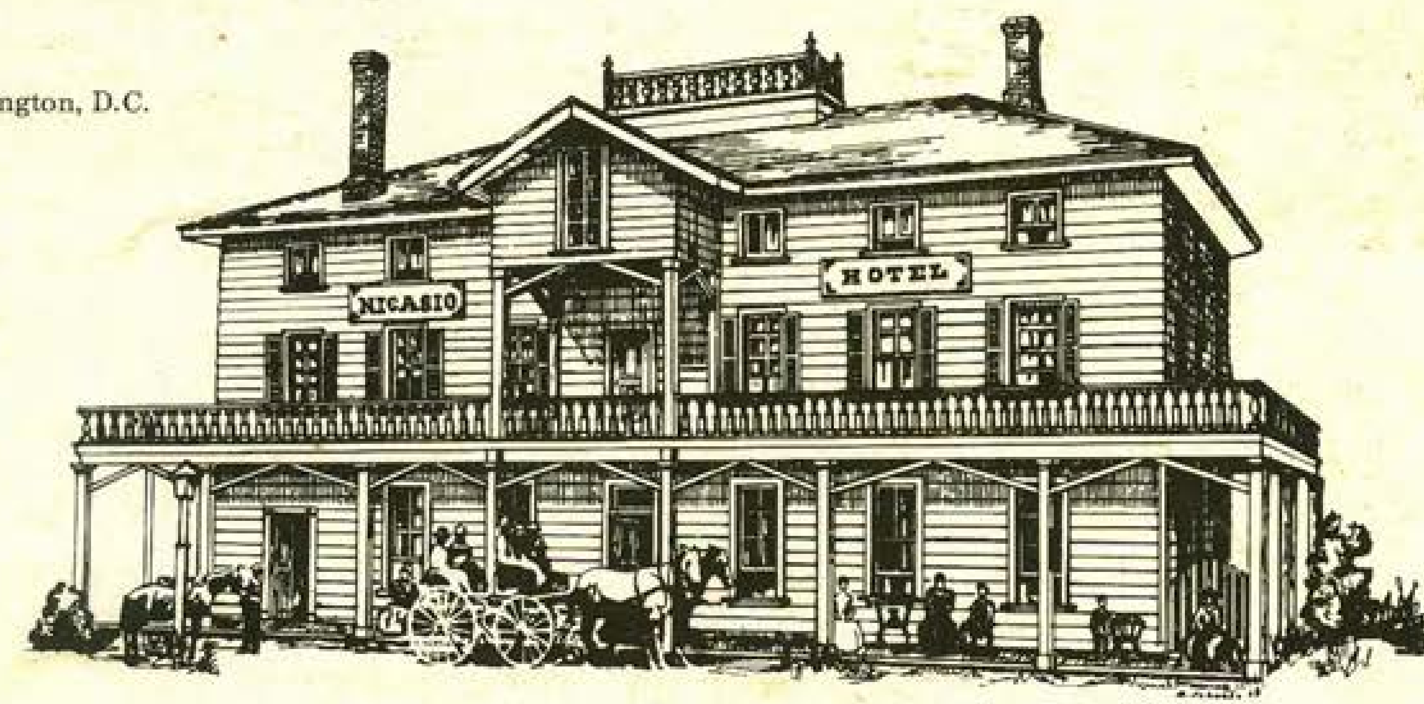

With the exception of historical records, little evidence remains of the bustling 1880's. This building burned down in 1936.

PREFACE

The Nicasio Valley, and similar outstanding areas in Marin County and around the Country, are natural resources of incalculable value. Yet areas like this have traditionally not survived the onslaught of urbanization or suburbanization. Planning agencies have prepared General Plans for such areas with the intent of preserving amenities but somehow the end product seems always the same.

This study was created with the intent of experimenting with new approaches to this time old problem. The idea being if we had a deeper understanding of nature and its processes prior to preparing a General Plan, we might do things differently and the end product might be more satisfying.

This report presents the first part findings of this experimental approach and consists of an analysis of the environment and the natural and historical bases of landscape quality. It is not a General Plan or a Zoning Plan. Part two, underway by the Marin County Planning Department, is based upon this research and other studies and will present alternative development options as well as a recommended General Plan.

Special thanks are in order to the enlightened property owners of Nicasio who have cooperated with this study and who, acting through the Nicasio Landowners Association, Inc., originally asked the County to prepare a long range plan which would preserve the Valley's pastoral beauty.

ACKNOWLEDGMENTS

Nicasio Land Owners Association, Inc.

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Mr. Eugene Kojan, Research Geologist, U. S. Forest Service, identified the need for thorough study; accomplished field work, prepared maps and wrote the sections on geology and geologic hazards.

For interviews on climate: Mr. J. Todd Snow.

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Many residents of Nicasio: Individually, by allowing researchers access to their lands, and by providing invaluable local information especially on climate and history, and in concert through preliminary discussion through the Nicasio Landowners' Association.

CREDITS

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While many individuals and agencies helped make this report possible, any errors in interpretation or reporting are solely the responsibility of the authors.

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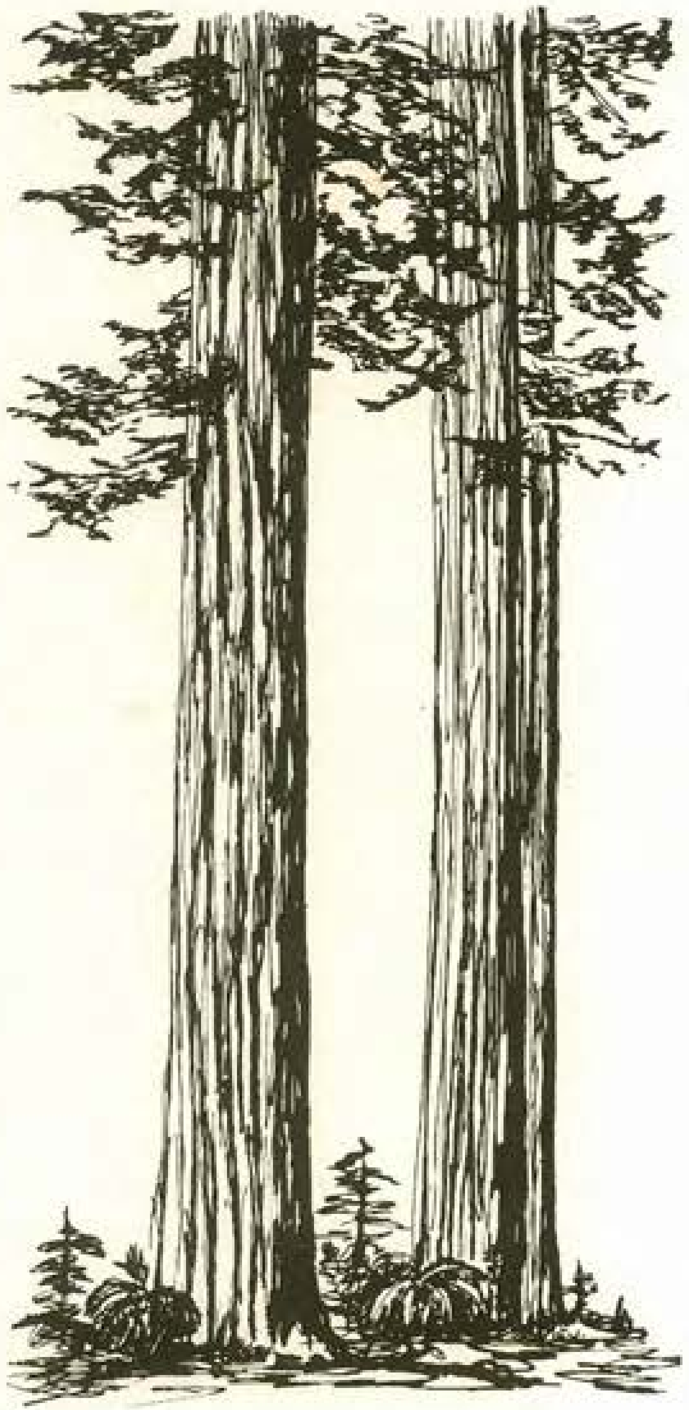
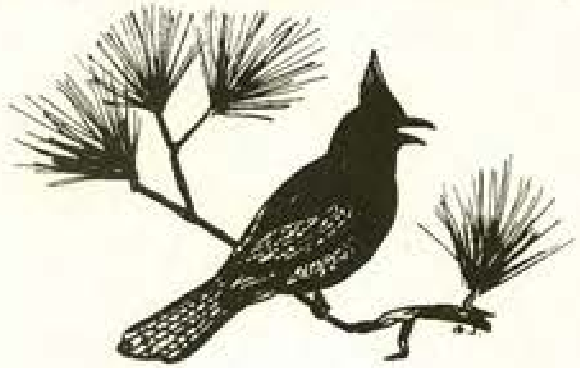


ILLUSTRATIONS



INTRODUCTION

The small community of Nicasio and its surrounding valley of some 36 square miles is certainly one of the distinctive landscapes of the world – a priceless vignette of Early California. The history of development of California has demonstrated that landscapes such as this are vulnerable to despoilation, and that "progress" can quickly destroy both the environment and the way of life our present and future residents expect to enjoy.

Nicasio is on the very threshold of change from isolated ranching and dairy country to suburban and recreational development serving the nearby San Francisco metropolis and the Pt. Reyes National Seashore. Homesites are being sold at an increasing rate with some incidental building beginning. Major highways have been proposed to penetrate the valley ridges, breaking through the historic barriers to development. The expected development can either bulldoze away the landscape we now know and value; or, it can reinforce the Valley's history, and utilize the advantages of nature and resourcefulness of landowners and residents.

It is the purpose of this report to describe the landscape and natural environment of Nicasio Valley in objective terms. In this way, all people may better perceive its present beauty and understand the landscape's genesis through natural processes and years of agricultural use. This understanding of the landscape's structure, valued attributes and limitations, can help guide subsequent Valley-wide planning and development.

The present landscape of Nicasio is a product of not only its natural history, described later, but of man's long and continued use of the land.

HISTORY OF SETTLEMENT

LOCATION OF NICASIO PLANNING AREA IN THE REGIONAL SETTING

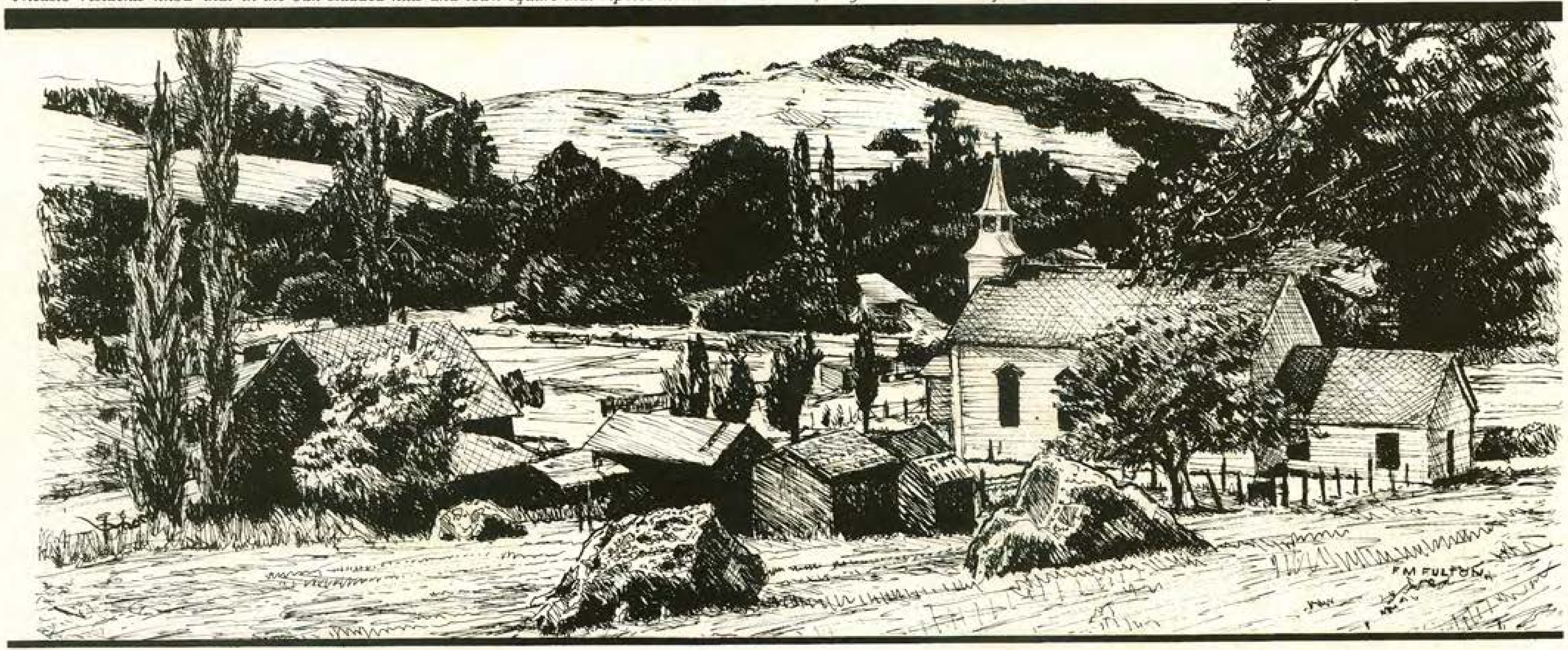
A knowledge of the landscape's history is important because until recent years, developments in Nicasio have built upon and accentuated the natural attributes of the land. But now, it faces development based not on the Valley's natural resources alone, but on "outside" needs being superimposed over the natural pattern.

The Coastal Miwok Indians who frequented the Valley in its early history had little impact on the form of the landscape, except perhaps through the setting of fires and the encouragement of grass and brush as opposed to forest cover. The Indian's presence is evidenced today by at least four mounds, ancient campgrounds valuable now as archaeological sites. Introduction of cattle during California's mission period (1769-1823) must have begun the sharpening of vegetative patterns toward what we see today. Game and Indian trails in and out of the Valley were worn deeper and wider in virtually the same routes as the present County road network.

Over a period of time, the grazing of cattle intensified the boundary between grassland and forest, and increased the homogeneity of the open grassland – grassland being a dominant element of the landscape. And grazing had one more significant effect: that of replacing the native perennial range grasses with introduced types of annual grasses. This happened partly through competition between plant species, and partly through seeding carried out by early cattlemen.

The establishment in 1844 of the vast Rancho Nicasio consisting of 15 square leagues, and its subsequent division into five parcels totaling 56,621 acres in the 1850's set the pattern of large landholdings which continues to this

Nicasio residents know that in the oak studded hills and town square that represents their environment, they have the best of rural America less than 50 miles from the city.



day. This pattern has tended to perpetuate the visual continuity of the Valley by preventing its piecemeal development.

Around 1850, when Nicasio began to form as an agricultural community, there were grain fields, orchards, and vegetable gardens, but over time these areas have reverted to pasture, and little visual evidence of these remain today. Of greater impact to the landscape was the establishment of the Dixon and Ross sawmill in 1862, one and a half miles east of the town center. In 1866 a second mill run by Shaver and Michner was set up one and a half miles southeast of town. Both mills had closed by 1872, but in the interim, they must have cut approximately 50 million board feet of redwood timber. We judge that logging did relatively little to change the distribution of vegetation, or the relative proportions of grassland and forest. Rather, logging must have consisted mainly of working the ravines and wooded side hills where now one sees the second growth forest of redwood, Douglas fir, madrone and oak.

Meanwhile, in 1863, the town square was laid out for the county courthouse that was expected, but never came. Nicasio, although centrally located, was too inaccessible to serve as the county seat.

The 1870's saw the development of Taylor's paper mill and the railroad through the San Geronimo Valley and along Lagunitas Creek to West Marin. In bypassing Nicasio, this further perpetuated the Valley's isolation.

By the 1880's Nicasio was well-known for its production of butter, eggs, fruit, grain, and potatoes. There were two general merchandise stores, the Nicasio Hotel, a church, a school, a blacksmith shop, and a saloon. The population of Nicasio Township stood at 554. (However, the township boundary does not correspond to the Rancho boundaries nor to the present census district or planning area.)

By 1900, when it became possible to ship whole milk from Marin County to San Francisco, the dairy industry increasingly came to dominate other forms of agriculture. And since the turn of the century, Nicasio, like most small rural towns, has changed from an isolated functional center to more of a community – still of social interest, but part of a regional network of economic and functional activities centered in the large cities.

HISTORIC NICASIO

THRESHOLD OF DEVELOPMENT

At present, the land still is devoted mainly to ranching, with eight ownerships producing Grade A market milk and others producing beef, dairy herefords, and sheep. The building of Nicasio Reservoir (finished in 1960) forced four dairies out of production. One ranch in the valley was sold on speculation. Two other ranches are unused because of a combination of marketing problems and sanitation requirements set by the Water District. Ranches that have remained productive have increased in size, but milk production in the Valley is approximately 2/3 of what it was before the dam was built.

There are about 200 cows per dairy. With an average rainfall, pasturing is possible only from March to May, requiring supplemental feeding the remaining 9 months of the year. The long run market outlook for milk and beef production is so poor that we must assume that ranching is in a marginal and transitional phase, and is not likely to be able to compete with residential and urban-related development as land values and taxes increase, unless special measures are taken.

The present agricultural landscape lends itself to a number of recreational activities, but this potential is threated by future intensive development. For local residents of Nicasio the landscape supports a way of life: horseback riding over open grassy fields, deer hunting without undue concern for the hazard to neighbors, outdoor barbecues under smogless sky. Nicasio also offers the San Francisco Bay Area a regional resource for hiking, fishing, photography, and painting.

The nation-wide interest in the Pt. Reyes National Seashore also focuses on the Valley as a scenic gateway. In 1961, in the Land Use Survey for the proposed Pt. Reyes National Seashore, prepared by the U. S. Dept. of Interior, National Park Service, it was predicted that by 1980, there would be 2.1 million day-use visitors per year and an additional quarter of a million overnight and weekend visitors to the National Seashore.

Today the Valley is on the threshold of more intensive use and development. Studies for routing State Highways 17 and 37 through Nicasio are imminent. "For Sale" signs are appearing, still few in number, but scattered widely along the rural roads of the Valley. The residents themselves, recognizing the signs of change, have asked the Planning Depart-

ment for assistance in meeting this challenge. Is all in readiness for development?

Under the present Zoning Classification (A-2), it is possible to subdivide parcels into 7,500 square feet single family lots. (This does not reflect the county's septic tank policy, slope policy or the lands in Agriculture Preserve, as they affect minimum lot size.) Under this situation, one must expect placement of homes on inappropriately sized lots without regard to the impact on other sites or the Valley as a whole. Roads cut on hillsides and hillocks can mar the view for miles around. Buildings and roads can crowd stream banks or unknowingly be placed on areas subject to landslide or earthquake hazard. Treatment of roadsides, and landscape plantings can conflict with the natural landscape.

It is the premise of this report that Nicasio deserves better treatment. Its beauty is such that development should be based upon a respect for an understanding of the existing landscape character. Let us carefully examine the basis of the landscape's beauty in terms of topographic relief, geology, soil, vegetation, and climate. This should not only help to identify particular landscape resources and problems to be faced as development occurs, but will suggest solutions to lessen undesirable effects that usually accompany increased urban development.

Nicasio's present pastoral setting.

Current development patterns in areas similar to the Nicasio setting.

NATURAL ENVIRONMENT

CONFIGURATION AND TOPOGRAPHY

The Nicasio Valley is a compact oval-shaped watershed of roughly 36 square miles. From the reservoir surface's 165 foot elevation, the walls rise to 1,280 feet at Black Mountain on the northwest, and to 1,592 feet at Loma Alta in the southeast. The southwest ridge, which serves as a partial barrier to the ocean is roughly 800 feet in elevation; Big Rock ridge to the southeast is somewhat higher, rising from the 1,200 foot to the 1,887 foot elevation. Two major ridges within the watershed are Shroyer Mountain (1,458 feet), and the ridge between Lucas Valley Road and San Geronimo Road culminating at Loma Alta. At no point is the mountain wall around Nicasio Valley less than 500 feet in elevation, except for the Nicasio Creek outlet.

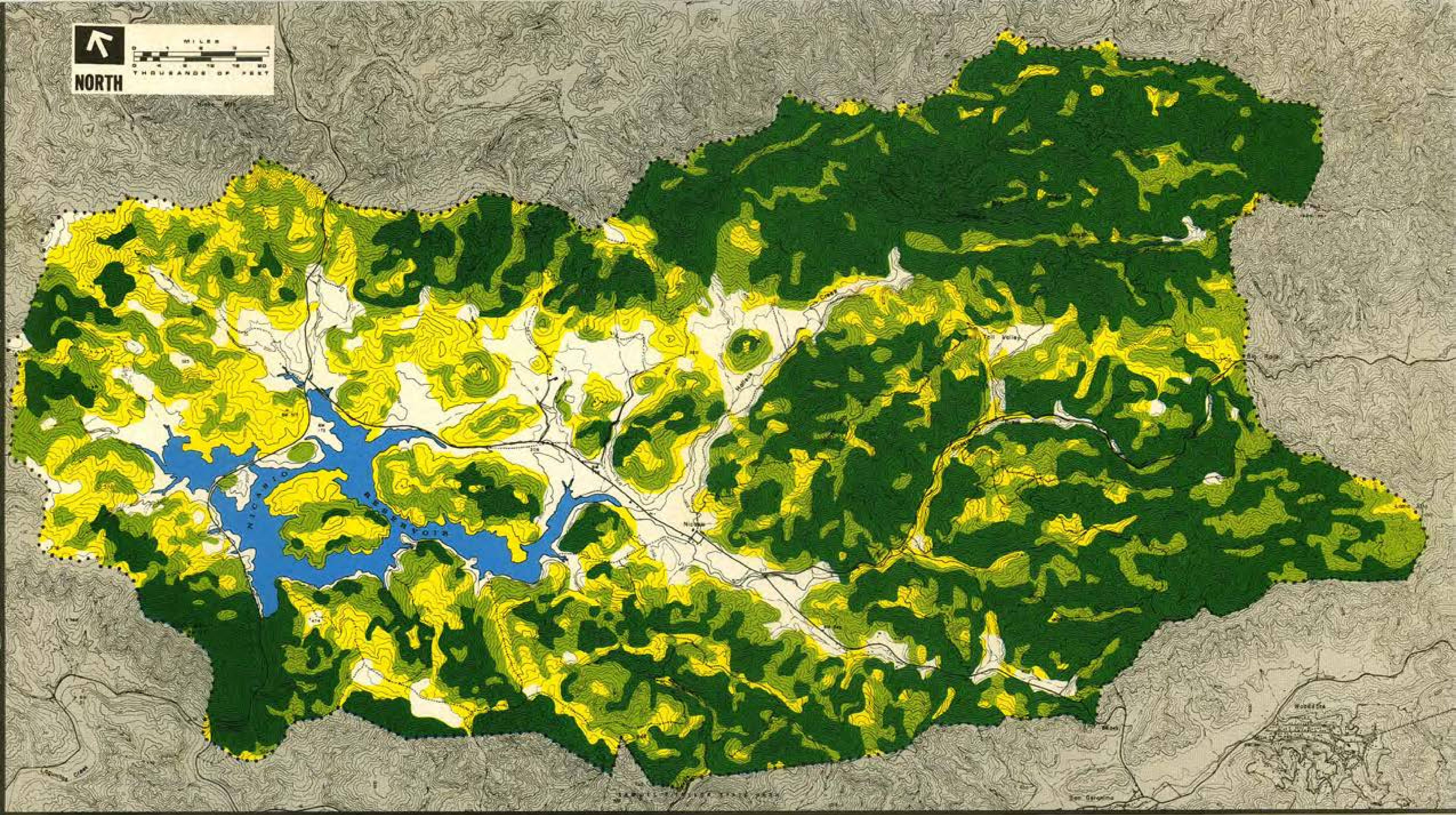
The major topographic units are: the main bowl-shaped basin north of the town center, broken only by low hillocks protruding 200 to 300 feet above the valley floor; and the narrow canyons of Halleck and Nicasio Creeks and their tributaries.

As is common in California's Coast Range, much of the land is steeply sloping. The flat and gentle slopes are mainly in the basin floor, with only small amounts of land along the ridge tops.

PERCENTAGE OF LAND BY SLOPE CATEGORY

SLOPE	PERCENT OF TABULATED LAND AREA	
0 - 10%	7%	1800 ACRES
11 - 25%	17%	3700 ACRES
26 - 40%	23%	5000 ACRES
41% AND OVER	53%	12000 ACRES
	100%	22500 ACRES

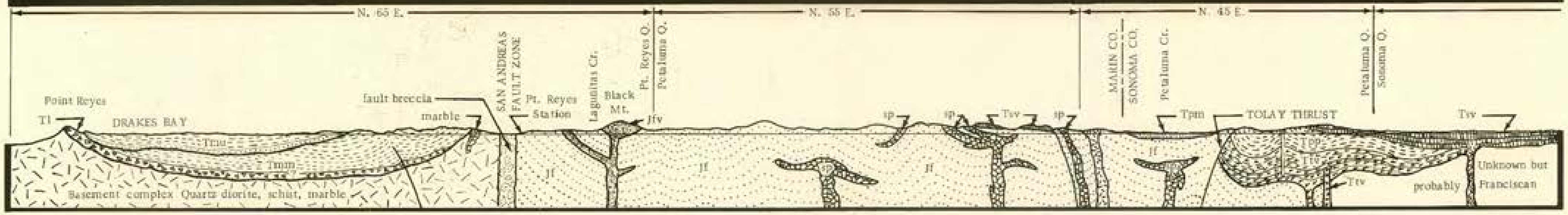
Aerial view of Nicasio Valley



0 - 10 %	26 - 40 %
11 - 25 %	41 + %

SLOPE

GEOLOGY



GEOLOGIC SECTION

LEGEND

Jf	*Sandstone, shale, chert (Franciscan group)*
Jfv	*Basalt, greenstone, etc. (Franciscan group)*
sp	*Serpentine*
Tl	*Laird conglomerate, breccia, sandstone (Lower Miocene or Upper Eocene)*
Tmm	*Monterey shale (Middle Miocene)*
Tmu	*Not exposed (Upper Miocene)*
Tpm	*Merced formation (Upper Pliocene)*
Tpp	*Petaluma formation (Middle Pliocene)*
Tsv	*Sonoma volcanics (Upper Pliocene)*
Tfv	*Tolay volcanics*

Like most of Marin County (excluding the Pt. Reyes peninsula) Nicasio Valley is underlain by the Cretaceous Franciscan formation. This very complex and heterogeneous group of rocks is here represented by graywacke sandstone, various basic volcanics, chert, and metasedimentary and metavolcanic rocks. The entire complex is tightly folded and intensely sheared along northwest-trending axes. In the Bay Area, the Franciscan formation commonly presents very serious slope stability problems (landslides) because of its high precompression, extreme heterogeneity, and intense shearing and fracturing. Additional factors contributing to present instability are its generally high expansive clay contents on weathering and rugged topography of the coast ranges due to recent uplift and proximity to sea level.

The following major geologic map units underlie Nicasio Valley. Their distribution is shown on the accompanying geologic map.

GRAYWACKE is a massive, relatively unstratified sandstone, composed of angular and poorly sorted grains. Mineralogically, the rock is characterized by a high content of feldspar and rock fragments in addition to detrital quartz. Clay is locally abundant in the matrix. It is dense and has a low porosity and permeability. Graywacke is one of the most rapidly weathering rock types found in Nicasio Valley and is often associated with landslides.

The map designation METAMORPHICS represents sedimentary and volcanic rocks that have been altered under physical-chemical environments significantly different from the conditions of deposition. In the Franciscan, such alteration is often associated with moderately intense shearing. The greenstone is a product of retrograde alteration of primary silicates initially present in the basic volcanics. As might be expected, metamorphic rocks vary greatly in the engineering problems they present.

SPILLITE is a variety of basalt volcanic rock, in contrast to the sedimentary origin of graywacke. The rock occurs as dikes, sills and flow sheets of greatly varying thickness. The flows are commonly made up of roughly ellipsoidal, closely-packed "pillows" up to five feet long. The pillows are well interlocked and the bulk strength is high. Slopes underlain by Spillite have relatively high stability and erosion resistance, as demonstrated by the steep slopes and prominence of Black Mountain. This material has also provided the excellent dam site at Nicasio Gap.

QUARTZITE is a relatively pure, cemented quartz sandstone. It occurs in relatively thin strata and has been found at several scattered locations. This rock has a high bulk strength, and is relatively resistant to weathering and erosion.

CHERT is a hard, thin-layered sedimentary rock composed largely of non-crystalline silica. It is highly resistant to weathering and erosion. Slopes underlain by chert are quite stable.

SERPENTINE intrudes other members of the Franciscan formation in somewhat isolated

ALLUVIUM

SERPENTINE

SPILLITE

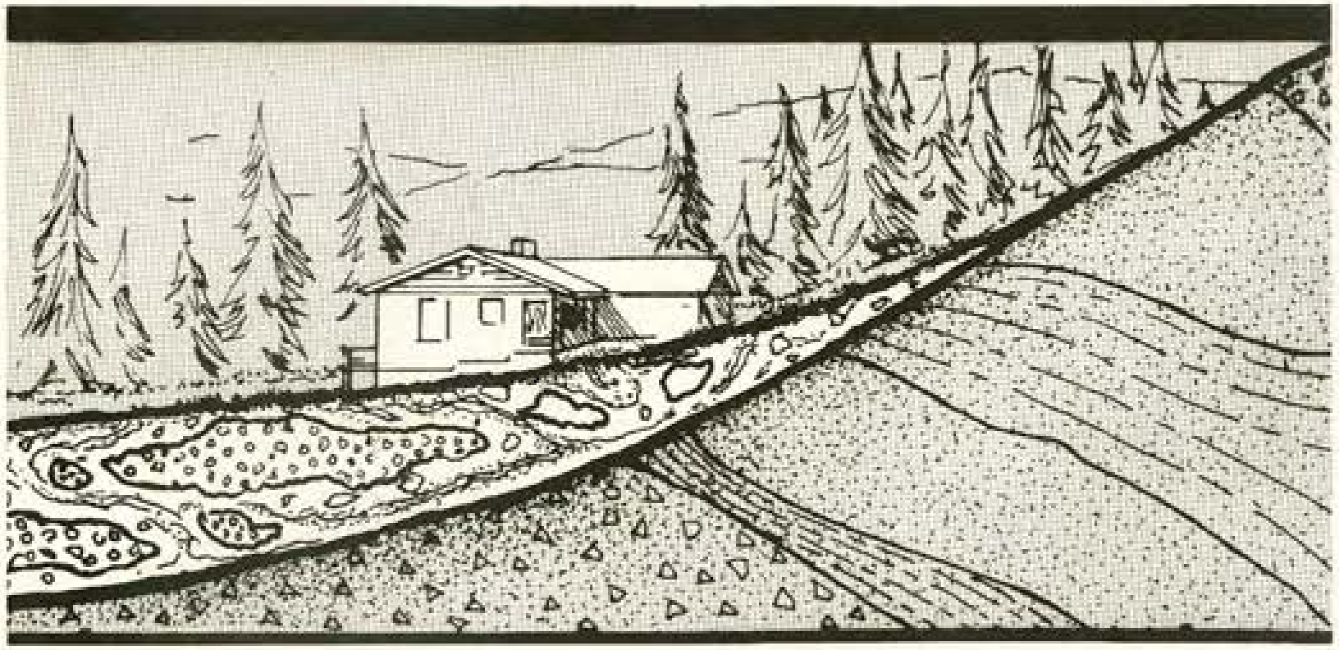
GRAYWACKE

QUARTZITE

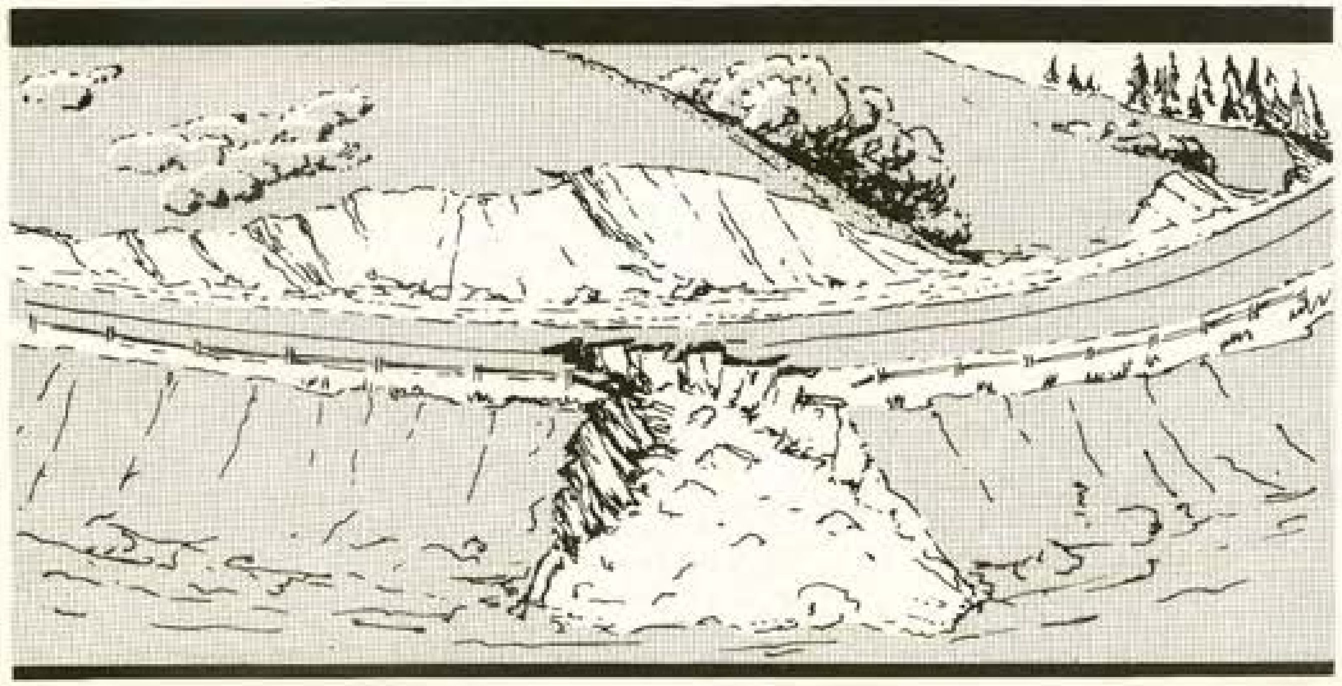
CHERT

METAMORPHIC

GEOLOGY



Differential settlement can be expected (as a result of variable distribution and thickness of alluvium) in response to normal consolidation, imposed static load, and seismic shock.



Added weight of fill and/or expansion of material can trigger or reactivate slide conditions.

masses along major shear zones. The serpentine bodies are intensely sheared, have low bulk strength and are almost always associated with landslides and rapid soil creep. The present road from Big Rock Ridge crosses a serpentine intrusion. The road here is subject to frequent slide damage and is costly to maintain. Another major body of serpentine crops out on the ridge south of the dam. Such areas present serious problems other than stability; soils derived from serpentine cannot support most plants, having a high magnesium to calcium ratio, a high chromium and nickel concentration, and a manganese deficiency.

ALLUVIUM consists of deposits of stream washed material forming nearly level plains on the valley bottoms. It is of varying thickness and consistency, and may settle unevenly under increased load or seismic shock.

EROSIONAL PROCESSES

The inclination of slopes in Nicasio Valley represents a more or less sensitive dynamic equilibrium with respect to erosion processes. The hills are now undergoing rapid regrading and changes in form. This is a consequence of: rapid recent uplift of the Coast Ranges and the consequent headward progression of the fluvial erosion cycle, post-glacial changes in climate, and natural and artificial changes in vegetation and soil associated with fire, deforestation, grazing and other agriculture, road building, and other developments.

In general, the natural and artificial changes which have been imposed in Nicasio Valley in the recent past have contributed to the present marked increase in rates of landsliding and other erosion processes. Slopes have become less and less stable.

GEOLOGIC HAZARDS

The following discussion of the geologic hazards of Nicasio Valley is only a brief review of certain environmental problems which must be realistically confronted by planners, designers, engineers, and developers. These hazards are typical of those throughout Marin County and the Bay Area and require sensitive and responsible detailed planning and design to insure public safety and to preclude large scale damage to buildings, roads, water and sewage lines. Present knowledge and techniques of engineering geology and civil engineering are sufficiently advanced to avoid many of these potential "Acts of God" and to convert others into problems amenable to sound planning and engineering solutions.

EARTHQUAKES

The town of Nicasio is situated just five miles to the east of one of the world's most active earthquake faults, the San Andreas. Major shocks have been recorded along the San Andreas or its branches in 1836, 1838, 1865, 1868, and 1906. The moderately intense quake of 1906 destroyed eight square blocks of the town of Santa Rosa (then only 6,700 inhabitants) killing 73 people. Santa Rosa is 20 miles from the fault.

Earthquakes subject buildings and other structures to both direct and indirect hazards. During a quake, energy is transmitted from the earth's crust to the surficial soil and rock materials immediately underlying and surrounding the foundation. A major problem of earthquake engineering is to anticipate the dynamic response of these surficial materials. Although very few accurate measurements have ever been made of the actual response of naturally occurring earth and rock materials to major quakes, experience has shown that thick, relatively loosely compacted valley fill deposits are most hazardous. During earthquakes, structures built on such materials will be subject to comparatively higher amplitude vibrations than those built on firm rock.

The areas shown as colluvium, flood plain and terrace deposits on the accompanying geologic hazards map will be especially subject to the potentially hazardous vibrations. However, present earthquake engineering techniques, when conservatively and intelligently applied, can in most cases substantially reduce property damage and resulting loss of life arising from the direct effects of earthquakes.

Unfortunately, major property damage and loss of life associated with earthquakes is often caused by indirect effects of the shock. For example, the Alaskan earthquake of March, 1964 triggered tens of thousands of major landslides, several of which destroyed large portions of the city of Anchorage. Thousands of other landslides triggered by the quake destroyed buildings, railroads, bridges, and roads. Landslides temporarily dammed streams throughout Alaska, causing extensive flooding when these dams were suddenly breached.

In the event of a major earthquake anywhere in this region, it can be expected that many of the existing landslides shown on the accompanying map will be reactivated and enlarged. Many new landslides will suddenly develop, particularly on sensitive slopes undercut by roads or other grading operations.

Construction on slide-prone hillsides, floodplains, and along the reservoir shoreline in Nicasio Valley must be realistically situated and designed, providing for the indirect effects of earthquakes.

LANDSLIDES

The accompanying reconnaissance map of geologic hazards shows the location and approximate boundaries of a large number of the significant landslides now present in Nicasio Valley The mapping was done with the aid of aerial photographs and selective field verification. Due to the limitations of funds and personnel, no attempt was made to exhaustively map all landslides. The areas indicated as dense vegetative canopy were in general not mapped. In such areas landslides are much more prevalent than is indicated.

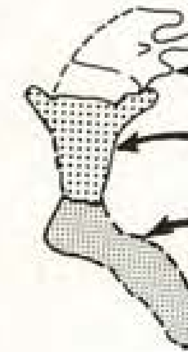
The landslide symbols shown represent significant downslope displacements of bodies of rock and soil along more or less well-defined boundaries. Most of the landslides indicated on the map show evidence of recent movement. Others are dormant and may be reactivated by artificial disturbance or by unusually heavy rains or seismic shocks.

It should be noted that landslides are particularly frequent along the steep headward portions of actively-regrading small tributary streams and bordering the flood plains of major streams. Road cuts have frequently triggered large slides. Some rock types such as serpentine are particularly slide prone, while chert and greenstone are comparatively stable, even on steep slopes.

In addition to landslides, most of the slopes with inclinations greater than 30 percent exhibit general surficial creep phenomena. This process involves a slow, more or less, continuous downslope movement of soil and weathered rock, and is predominantly active in the winter months. Well situated and designed foundations can avoid serious damage by soil creep.

Fan-shaped bodies of colluvium, of greatly varying thickness and engineering properties, have been characteristically deposited downstream from active landslide areas. They are often located at the point where small, steep tributary streams emerge on a flood plain or stream terrace. This material is largely derived from upstream landslide areas and is currently being deposited in the form of sporadic mudflows. Because of its unsorted, porous, and poorly structured nature, such deposits are particularly susceptible to significant differential settlement in the event of an earthquake. It is a poor foundation material.

LEGEND



The accompanying aerial photo has been marked to show existing slides, colluvium, and terrace and flood plain deposits. This illustrates the severity of the problem of geologic hazards in Nicasio Valley and the procedures in engineering geologic interpretation of air photos used to compile the landslide and colluvium map.

SOIL

In general terms, the soils of the flat and gently sloping lands are adequate to support use as pasture, or certain types of limited development. On the other hand, virtually no area in Nicasio has soil well suited for intensive commercial agriculture or for septic tank fields.

There is considerable variation from place to place around the Valley in terms of inherent fertility, natural drainage, subsoil permeability, erosion hazard, water holding capacity and other attributes of interest. Therefore, it is assumed that concerned land managers and developers will consult the detailed "Report and Soil Map, Nicasio Area, Marin County, California", prepared in 1967 by the United States Department of Agriculture, Soil Conservation Service cooperating with the Marin County Soil Conservation District.

While this report is based upon agricultural use criteria, and does not consider such important features as geologic hazard, or suitability for major urban and transportation developments, it does provide helpful guidance.

Thirteen soil types were described for Nicasio. For analytic purposes these were rated in terms of eight classes based on the nationwide agricultural land capability classification system:

CLASS I – Prime agricultural soils with few limitations on use; no soil of this quality occurs in Nicasio.

CLASS II – Soils with some limitations that reduce the choice of plant materials or require special conservation practices, or both. A major limitation found in Nicasio is poor natural drainage in parts of the northern end of the basin. In general, the soils in Class II have moderate to good drainage, medium to slow runoff, slight erosion hazard, moderately high fertility, and are 40 to 60 inches in depth.

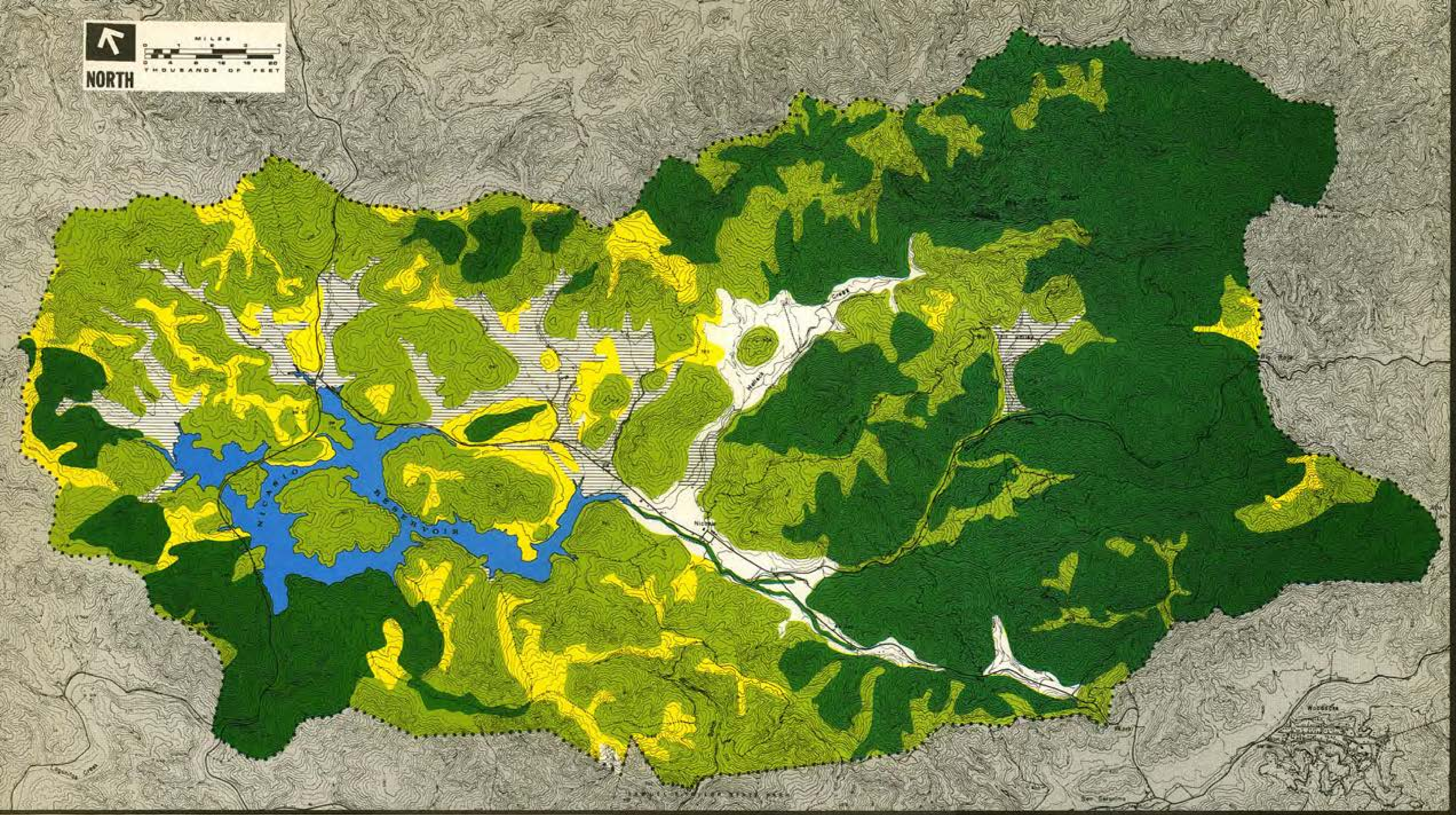
CLASS III – Soils have some severe limitations requiring care in plant selection and/or special conservation measures. Specific problems are those such as slow subsoil permeability, poor drainage, or rapid runoff; but, generally, these soils are moderately well-drained, of moderate erosion hazard, and over twenty inches in depth.

CLASSES IV and VI – Careful management or restricted use are in order. Problems may be those of very low fertility, slow permeability, high erosion in some but not all areas, or depths of less than 16 inches. Generally, however, depths of thirty inches are common, and the limitations are moderate.

CLASSES VII and VIII – Severe limitations make these unsuitable for cultivation, intensive landscaping, or other soil disturbance. Problems may arise from geologic instability, very steep terrain, limited depth, rapid runoff, or low inherent fertility. Nonetheless, many areas have good capability for grazing, wildlife, and for extensive recreational use.

Soil depths are of special interest aside from agriculture, in considering suitability for septic tank fields, for grading, for landscaping, and for tree planting and forestation planning.

Today's Nicasio residents are ranchers and others whose way of life emanates from the capabilities of the soil.



CLASS II: SOME LIMITATIONS

CLASS III: SOME SEVERE LIMITATIONS

CLASS IV–VI: SEVERE LIMITATIONS

CLASS VII–VIII: VERY SEVERE LIMITATIONS

POOR NATURAL DRAINAGE

AGRICULTURAL LAND CAPABILITY

DEEP 40" +

MODERATE 20"–40"

SHALLOW LESS THAN 20"

SOIL DEPTH

HYDROLOGY

Ground water is found mainly in deposits of younger alluvium over the Franciscan bedrock. There is no main aquifer as such, but water is available in varying, but small, quantities. The effect of the reservoir on the water table in Nicasio Valley is not yet known.

The two permanently flowing streams, Halleck and Nicasio Creeks, converge just north of the town. The U. S. Geologic Survey gage station below the confluence has recorded peak flows of 9,000 cubic feet per second with a depth of 14 feet.

Stream levels respond rapidly to rainfall after the initial wetting of the soil by the first fall rains, frequently rising close to the top of their banks. Floods, as of now, are a rare occurence and consist only of local flooding in the immediate vicinity of the streambed. The permanent streams occupy deeply entrenched beds, and therefore, under present conditions, do not wander across the alluvial plains.

Beds of intermittent streams are generally shallow especially where they flow out of the hills onto the alluvial beds. It is likely that these stream channels wander over the plains because they are constantly dropping sediment loads into the streambeds forcing an alteration of course. This is especially a problem on the alluvial fans. The flow of the intermittent streams commonly disappears into the alluvial plain at the base of the slopes; however, flooding all the way to the permanent stream channels occurs during wet winters.

The reservoir, which dominates the northern valley floor was built, and is operated, by the Marin Municipal Water District. Impoundment began in 1961. Maximum capacity is 7.3 billion gallons with an elevation of 165 feet, a depth of 95 feet at the dam, and a surface area of 869 acres. Minimum level as of 1964 was 22 feet below the top with a surface area of 400 acres.

The water level may rise four feet per day during the rainy season and drop one foot every 10 days during the summer. The reservoir is generally full from January to May. The runoff from the watershed averaged about 7 billion gallons per year over the period 1955-65, but with considerable variation from year to year (a maximum of 20.38 b.g. and a minimum of 4.3 b.g.).

If the primary purpose of the reservoir is to serve as a standby or storage reservoir rather than a domestic water supply distribution reservoir, then perhaps the rate of drawdown could be regulated by other than short period fluctuation demand. This would be a policy decision of the Marin Municipal Water District.

If the primary purpose of the reservoir continues to be a municipal water supply, then a drawdown of up to 20 feet (as in 1964) can be anticipated. This would mean a lateral

change in shoreline of up to 400 feet on 5% slope, 200 feet on 10%, 100 feet on 20%, 50 feet on 40%.

Assuming an average of 3.5 feet of evaporation from free water surface during summer drought in this area with negligible streamflow input, the lateral change in shoreline would be up to 70 feet on 5% slope, 35 feet on 10%, 17 feet on 20%, 8 feet on 40%. Retreat of the shoreline exposes the mud bottom to drying, creating an unappealing shoreline transition. Fluctuation of the shoreline also impedes the establishment of shoreline vegetation favorable to waterfowl, wildlife and fish.

The filling of a reservoir with silt is a natural process. In the Nicasio Reservoir, this is probably occurring at a rapid rate, but sedimentation rates are not now being measured. Overgrazing and poor logging can contribute to siltation, given the high erosion hazard of most of the soils in the watershed. Road construction, homesite development, and other land disturbing activities can also be expected to increase siltation. Rates may return to normal after two or three years however, if a new cycle of erosion has not been triggered through the disturbance of stream channels and landslides.

The Nicasio reservoir on the valley floor is a central feature of the landscape. It is also vulnerable to siltation, pollution, and other abuses arising from development in the watershed.

COLD MICROCLIMATE

NORTHERLY EXPOSURE

SOUTHERLY EXPOSURE

LEVEL

SUMMER WIND

TOPO-CLIMATE

CLIMATE

In 1880, this account was given:

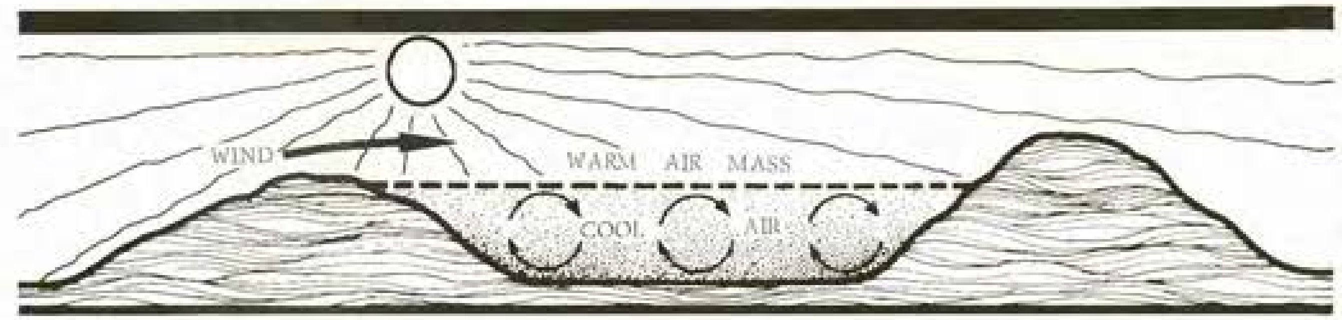
"In Nicasio Valley proper the climate is not excelled anywhere in the County. It is well protected from the blasts of the ocean winds by the range of hills known as the Black Mountains, on the tops of which the fogs seem to cling with wonderful tenacity, and seldom swoop down into the valley." (Munro-Fraser, 1880.)

Nicasio is still noted for its moderate yet invigorating climate. But it is important here not only to extol virtues, but to more objectively describe the climatic factors of temperature, humidity, wind, fog, and precipitation, as they enhance or constrain the use of various portions of the area.

The temperature and humidity is generally moderate in both summer and winter. According to residents, the Valley is cooler than such inland points as Petaluma and San Rafael. The winter low is commonly in the twenties, such low temperatures usually occurring only for a brief period. The seasonal high is usually in the nineties. Probably the extreme for the past 25 years was 104 degrees, reached in the northern end of the valley.

Temperatures vary considerably from place to place within the Valley, depending upon exposure to winds off the ocean, air drainage, slope and incidence of sunlight, and elevation. On what seemed to be a typical August afternoon (8-30-67), measurements made several minutes apart showed that on Lucas Valley Road at Bull Tail Valley it was 85 degrees with relative humidity of 26 percent and a light breeze of 170 feet per minute; in the townsite it was 78 degrees with 45 percent humidity and a breeze of 345 fpm; and by the northeast end of the reservoir it was 70 degrees with 55 percent humidity and a wind of 812 fpm. One rancher reports that his residence which is on relatively low land at the foot of Shroyer Mountain near Halleck Creek, is generally about 10 degrees cooler than it is at the ranch buildings, about a mile up the valley.

Nicasio has a rather persistent temperature inversion characteristic of the Pacific coast. Rather than the air becoming cooler with an increase in elevation, the reverse is true. For example, on August 30 a low of 42 degrees was reached on part of the valley floor, while at the same time it was 24 degrees warmer



Section through the valley showing the inversion lid characteristic.

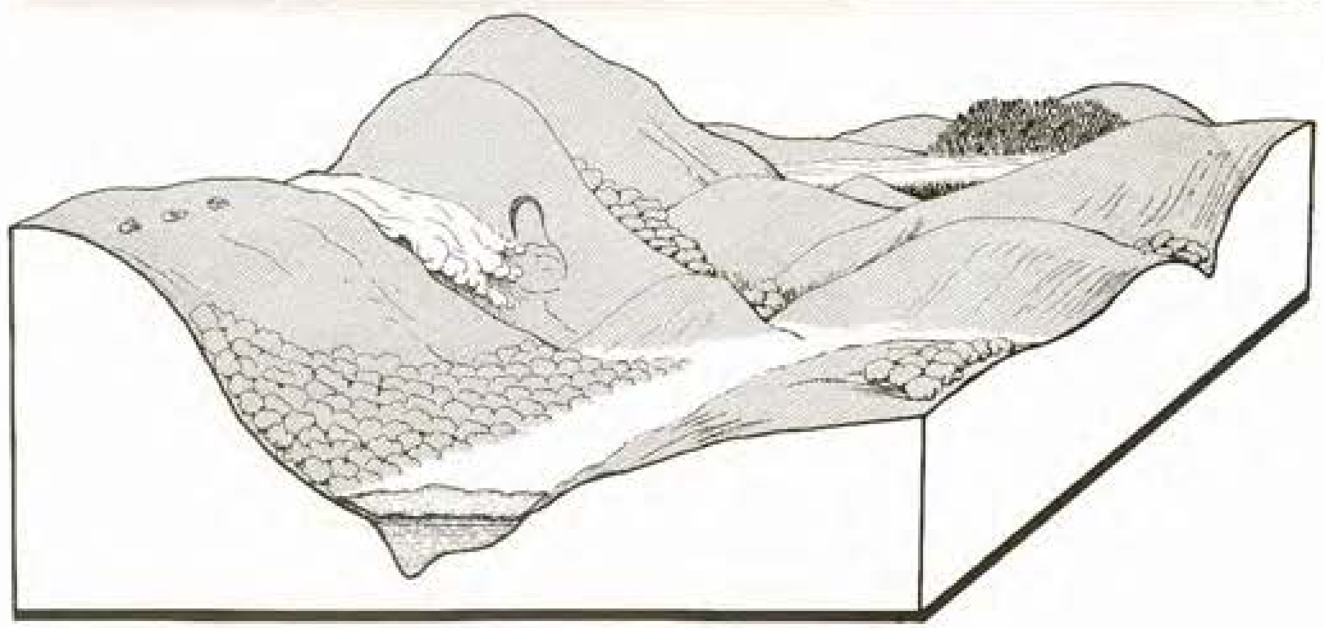
near the top of Shroyer Mountain. Wind, temperature, and topography are such as to trap and hold air and pollutants in the valley. Since in these respects Nicasio Valley is similar to the Los Angeles basin and Santa Clara Valley, planners should be alert to potential sources of air pollution such as home heating, industry and automobile use.

The major winds affecting the Valley are: 1) the prevailing cool summer winds; 2) the hot-dry "foehn" wind; 3) the nocturnal down-valley breezes; and 4) the cyclonic winter storms. The prevailing winds of the summer are from the northwest. They sweep down Tomales Bay, up Nicasio Creek and over the relatively low hills around Black Mountain, through the valley and over the eastern ridge into Hicks, Novato, and Gallinas Valleys. In general, the northern part of the Valley is open to the brunt of these summer winds; but the townsite and the narrow valleys in the southern part are more protected. These cool winds generally are at their peak intensity in the early afternoon and are abated, though rarely stilled, at night.

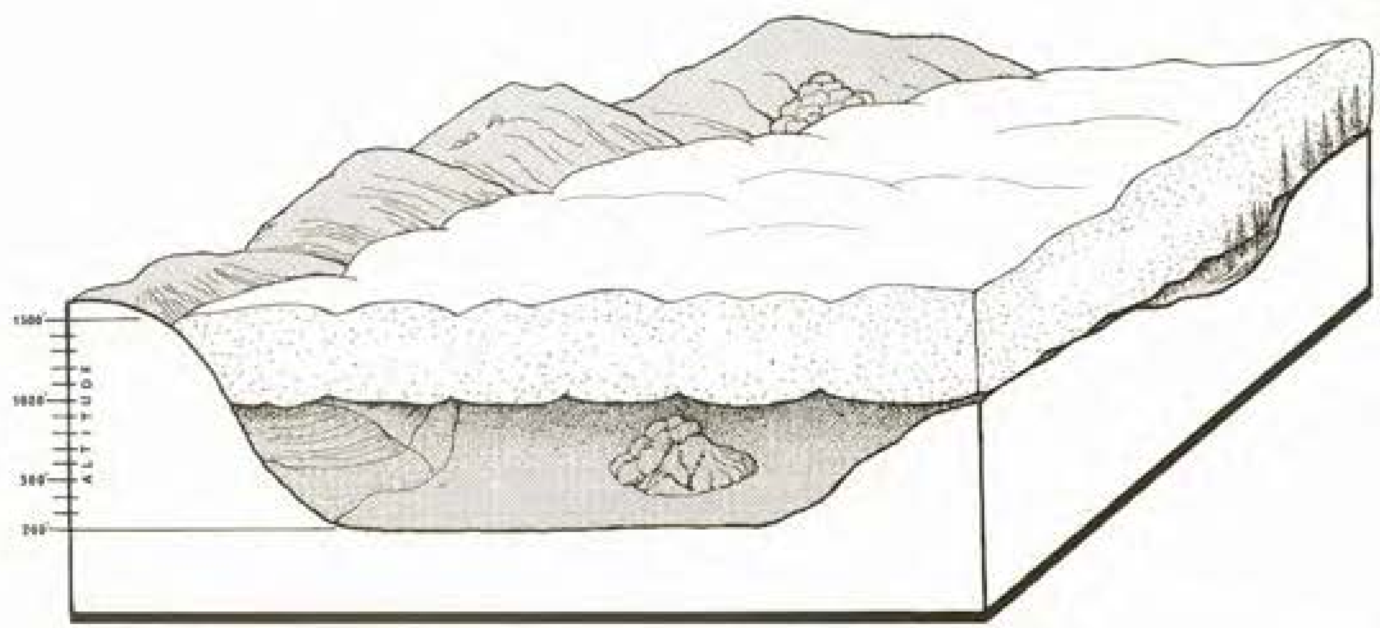
The foehn, or "Santa Ana", wind occurs only occasionally, especially in the early summer and fall. This wind flows from the north or northeast, bringing hot, very dry air into the Valley. The result is a period of fogless weather, the highest temperature of the season, and, generally, the greatest fire danger. Usually this phenomenon lasts for several days at most.

On clear nights when the regional winds abate sufficiently, local down valley breezes develop. These are approximately the reverse of the prevailing winds, although much lighter, flowing in regular channels down the slopes and ravines until stopped by obstructions or constrictions of the terrain.

In winter, winds are more often associated with frontal passage, exhibiting the normal pattern of strong southerly, followed by strong northerly, winds. Severe velocities are uncommon in the valley proper, but the ridge tops and gaps are noted for frequent strong winds (20-30 knots) and occasionally very strong gusts (even to 60 knots and above).



Tule Fog may come from the central valley or form over the reservoir.



Summer fog stratum.

Fog is a frequent visitor and is an important consideration in location of residences, and outdoor-use facilities. Three types of fog can be distinguished: The advection or coastal fog; the radiation or "tule" fog which forms within Nicasio Valley; and the tule fog which forms in the Central Valley of the state and blows westward into Nicasio.

Coastal fog is very frequent in summer. Generally this is a high fog or low cloud cover which flows in during the late afternoon or evening and dissipates by mid-morning, though sometimes it persists throughout the day. The incidence of this coastal fog over the Valley is not certain in spite of several studies of summer fog in the Bay Area, but residents report that it is very common.

The height of the bottom above ground varies somewhat from day to day. Typically (for the Bay Area as a whole) the bottom of the fog is about 500 feet above sea level. It is likely to be closer to the ground late at night or early in the morning than it is during the day or early evening. On a seasonal basis the whole cloud layer tends to be closer to the ground in spring and fall than in the summer months. The top of the layer remains quite uniform and stable for any given occurrence of fog, but it does fluctuate on a daily and seasonal basis. The average height of the top of the fog at Mt. Tamalpais is below 1700 feet. The lookout on Mt. Barnabe reports that his station (1480 feet) is frequently just above the top of the fog.

It is on clear, cold, calm nights that the radiation fog forms in the valley, hanging low over wet pasturelands and the reservoir. The fire lookout on Mount Tamalpais reports that on mornings even when there is no coastal fog near the valley, he often can see fog over the reservoir.

At the town of Nicasio the mean annual precipitation is about 35 inches, over 90% of which occurs in the six months from November through April. Like most places in California, however, the variation from year to year can be considerable: In 1958, over 20 inches fell in the month of February alone, and the total for the season was almost 60 inches. But for the entire next season less than 22 inches were recorded. The amount of rainfall also varies within the Valley itself. At the dam, the mean annual precipitation is three inches less than at the town, although the dam receives somewhat more rain in the late spring and early fall than does the town. The rainfall is probably greater on the higher hills and ridges than on the valley floor. It may well be less in the open northern end of the valley. Snow is uncommon and ephemeral.

The following tables show temperature, humidity and wind speed at several locations to show the range of micro-climatic differences to be expected under the same general summer weather conditions. Note the gradual increase in temperature as one moves east.

TEMPERATURE, RELATIVE HUMIDITY, AND WIND AT POINTS ALONG NICASIO ROAD

	A BIG ROCK El. 560	B BULL TAIL GATE El. 320	C REDWOODS El. 280	D NICASIO CHURCH El. 200	E PT REYES ROAD El. 200	F SAN GERONIMO El. 500
AUG 23 11:10 am	79 30%	78 47%	72 65%	76 1/2 50%	75 51%	
12:50 pm	82 40%	81 42%	77 1/2 50%	79 44%	72 47%	
AUG 28 3:15 pm	78 40% wind	73 47% lt br	70 57% lt br	74 1/2 49% br	72 49% wind	72 47% br
7:45 pm		60 70% calm	62 73% calm	63 67% calm+	61 72% lt br	
AUG 29 12:30 pm	82 1/2 36% lt br	85 30% calm	77 48% calm+	82 1/2 30% lt br	80 33% wind	87 31% calm+
AUG 30 2:20 pm	86 24% 360 fpm	86 20% 170 fpm	78 40% 200 fpm	78 45% 345 fpm	70 53% 412 fpm	78 1/2 42% 220 fpm
7:00 pm	63 1/2 67% 545 fpm	61 1/2 73% calm	61 1/2 50% ? calm	61 72% 141 fpm	58 1/2 85% 460 fpm	
VARIATION	22 1/2 43	25 47	16 1/2 27	21 1/2 33	27 1/2 50	

The time of starting the circuit is given. It took from 1/2 to 3/4 hr to complete circuit. Measurements made with a Bendix electric psychrometer and a Biram's type anemometer.

ADJUSTED TEMPERATURES

	#1 WEST PEAK (Above Devil's Gulch) El. 1066	#2 WEST FLOOR El. 260	#3 CENTRAL HILL (Above Highwy Dep: Yard) El. 440	#4 EAST FLOOR El. 300	#5 EAST SADDLE El. 906	#6 SHROYER MOUNTAIN El. 1420
AUG 24 MIN MAX MEAN		52 78 65	51 77 64	60 77 68 1/2		
AUG 25 MIN MAX MEAN	52 83 67 1/2	52 78 65	51 82 66 1/2	60 83 71 1/2	51 86 68 1/2	61 79 70
AUG 26-28 MIN MAX MEAN	49 86 67 1/2	52 82 67	51 85 68	55 85 70 1/2'	49 87 68	49 82 65 1/2
AUG 29 MIN MAX MEAN	49 93	44 85 64 1/2	48 90 69	50 84 67	48 88 68	51 80 65 1/2
AUG 30 MIN MAX MEAN		42 83 62 1/2	47 82 64 1/2	48 79 63 1/2	54 92 73	56 92 74
TEST Low tube High tube	76 (-2) 73 (+1)	74 (O) 74 (O)	75 (-1) 75 (-1)	74 (O) 78 (-4)	75 (-1) 74 (O)	73 (+1) 73 (+1)

Psychrometer dry = 74+ (In parenthesis is the factor by which each reading has been adjusted)

MICRO-LOCATION

1. On N. side of fence post near crest of hill, 100' ESE of State Park marker. 1 1/2' above ground.
2. On N. side of stump between the 2nd & 3rd trees at W. end of a row of large Eucalyptus. 6' above ground.
3. Under canopy of lone Oak by rock outcrop. 5-6' above ground.
4. On N. side of a large rock out-crop. 15-20' above pasture.
5. On N. side of a timber, part of a cattle loading ramp. 5-6' above ground.
6. Under canopy of lone 2 trunk 18' Bay Tree just off E. of road from Bull Tail Ranch a short distance after TV antenna. 5' above ground.

COMPARATIVE TEMPERATURES

	JAN. 1949*	JUNE 1961*
NICASIO VALLEY**	14°	104°
KENTFIELD	20°	108°
PETALUMA	22°	110°
SAN RAFAEL	26°	110°

* These two months established many record temperatures.

** According to John Gallagher, resident. The general area in which these observations were made is at the northern end of the Valley, one of the more exposed and probably cooler locales.

MEAN ANNUAL PRECIPITATION OF STATIONS IN THE REGION

STATION	YEARS OF RECORD	INCHES
POINT REYES	13	18
POINT REYES STATION	6	27
NICASIO DAM	10	32
NICASIO TOWN	14	35
PETALUMA	22	24
HAMILTON FIELD	?	26

VEGETATION

The Valley's varied and striking plant cover is a key element in the beauty of the landscape. The golden expanse of summer grasslands, the deep shade of the redwood groves, the tangle of streamside trees and vines, the wind sculpted bay trees, all contribute to the early California character of Nicasio.

The present vegetative pattern is a product not only of natural history, but of the history of man's use of the land: extensive grazing under Spanish and Mexican rule, farming, ranching and lumbering in the early settlement period, and the dairying we see today. The present composition, especially some of the more pleasing aspects will change as the Valley undergoes development. The natural processes whereby plant communities grow, extend, and compete will reshape the substance and image of the landscape.

The plant cover is highly mixed and varied; so it is helpful to think in terms of types of cover, or plant communities. Each plant community has distinct species composition, requirements for self-maintenance, and capacity to absorb development without adverse effects. Seven major types have been mapped for the Nicasio Valley. The types and their approximate coverage of the watershed as a whole are: Grassland (63%), Laurel-Live oak (20%), Redwood-Douglas fir (9%), Baccharis (3%), Chamise (3%), Riparian (2%), and Eucalyptus (less than 1% but noteworthy because of its potential for rapid spreading).

GRASSLAND not only dominates the valley in terms of acreage, but its homogeneous texture and color and its low form are critical to the beauty and identity of the landscape. It is mainly wild oats, but with some herbaceous plants, perpetuated by grazing and fire which destroy weeds and tree seedlings. If grazing and fire are curtailed, the natural plant succession is for the low grass to be replaced rapidly by the large, densely growing shrub, baccharis, and eventually by laurel or oak in some locations. Overgrazing, on the other hand, can lead to sheet erosion. Maintenance of grasslands requires continued moderate grazing and/or burning, mowing, or herbicide application.

The LAUREL-LIVE OAK community is composed of laurel (or bay), tanoak, California (or coast) and canyon live oak, Pacific madrone, California buckeye, and Douglas fir in varying proportions. This type is common on north facing slopes or on the north side of rock outcrops. This hardwood forest provides a dense overhead canopy, but is frequently clear and open underneath. The height of stands varies from 6 feet to 8 feet near chamise ecotones, and to 30–40 feet or more on better sites.

This type tends to be "dominant" in central California in that the laurel is a natural climax species which can spread into and hold either what is now in grassland or redwood. Madrone and oak are subject to root rot in damp or irrigated areas. The bay, on the other hand, is tolerant of shade, soil moisture, and soil compaction and would be useful in landscaping and forest planting.

Other species associated with this community are: California hazel (Corylus californica), sword fern (Polystichum munitum), braken fern (Pteridium aquilinum), toyon (Heteromeles arbutifolia), poison oak (Rhus diversiloba).

REDWOOD–DOUGLAS FIR is found along stream channels and on moist northerly slopes with moderately deep soil. Associated species are: Coast redwood (Sequoia sempervirens), Douglas-fir (Pseudotsuga menziesii), California laurel (Umbellularia californica), Pacific madrone (Arbutus menziesii), tanoak (Lithocarpus densiflorus), California hazel (Corylus californica), blueblossom (Ceanothus thyrsiflorus), ocean-spray (Holodiscus discolor), poison oak (Rhus diversiloba).

Redwoods occur in some cases as almost pure stands, and in other as scattered among Douglas fir. Redwood stands are not likely to change in species composition over time unless seriously disturbed physically or through a change in soil moisture. Stand purity can be maintained through periodic flooding, or through removal of bay, oak and Douglas fir seedlings. Douglas fir stands are slightly less stable, in that bay may invade after opening or logging.


Bay


Oak

NICASIO'S BEAUTY DEPENDS ON THE NATURAL PATTERN:


Redwood

Grassland

GRASSLAND

REDWOOD AND DOUGLAS FIR

LAUREL AND LIVE OAK

BACCHARIS

RIPARIAN

EUCALYPTUS

CHAMISE

VEGETATION TYPES

BACCHARIS. A comparison of aerial photos taken in 1954 and 1966 indicates that while most vegetative types appear to be fairly stable in their distribution between 1954 and 1966, this is not true of baccharis. Its distribution has variously expanded and contracted. On areas protected from grazing it appears to be spreading, but on grazed areas some stands seem stable, some apparently were cleared, and others are slowly expanding. Judging from the rate of encroachment observable in comparable areas of California, much of the grassland could be dominated by baccharis in about 50 years if grazing and fire are excluded. When baccharis first advances into grassland, plants are spaced at intervals of 12-20 feet. Over time, the stands become impenetrably dense with an eventual height of three to seven feet.

CHAMISE is found on a number of south slopes, especially on dry soils derived from serpentine or volcanic rock. It is not likely to be replaced soon by other plants but is subject to heavy deer browsing in many places. Associated species are: Chamise (Adenostoma fasciculatum), bush monkey flower (Mimulus aurantiacus), Eastwood manzanita (Arctostaphylos glandulosa), coast ceanothus (Ceanothus ramulosus), coast sage brush (Artemisia californica).

Over a period of twenty or more years, however, these plants may be replaced naturally by Douglas fir, oak, toyon, or bay (especially on moist sites). Once the taller plants break through the chamise canopy, the chamise is fairly rapidly shaded out.

Chamise stands are highly combustible and present a fire hazard, but do serve well to hold soil intact on otherwise highly erosive slopes.

RIPARIAN vegetation is a complex mixture of trees, shrubs, grasses, and forbs. This type has expanded lately in Nicasio but is always restricted to streams or very wet sites. Associated trees: willow (Salix spp.), white alder (Alnus rhombifolia), California laurel (Umbellularia californica), coast live oak (Quercus agrifolia), bigleaf maple (Acer macrophyllum), Oregon ash (Fraxinus oregona), California buckeye (Aesculus californica).

Where moisture is maintained, this aggresive type forces its way along stream channels and lake shores. Such vegetation can be destroyed easily by grazing or physical development.

Baccharis community

Riparian community

Wind sculpted trees are prominant features

WILDLIFE

Prior to the construction of the Nicasio Dam six species of fish were known to have inhabited the Nicasio Creek. These were silver salmon, steelhead, lamprey, sucker, sculpin and stickleback. It is probable that other species found in the reservoir are also present in the stream because of high flow over the dam during the winter. The fish run in Nicasio Creek is apparently returning to its historical size.

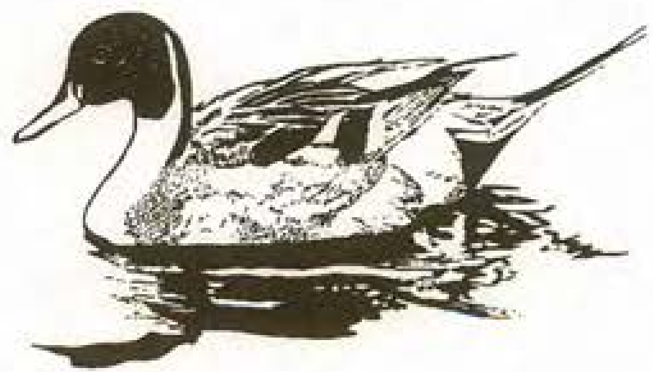
Now inhabiting the Nicasio Reservoir itself are bluegill, largemouth bass, rainbow trout, brown bullhead, golden shiner, hitch, sucker and sculpin.

Rainbow trout require optimum summertime water temperatures in upper oxygen-rich layers of 50-60 degree F. or less. Warm water fish such as largemouth bass and panfish require optimum summertime water temperatures in oxygen-rich layers of about 70-80 degrees F. The summertime upper layer water temperatures in Marin County of 60-70 degrees F. are in between these ideal ranges, and hence, the reservoir is marginal from this standpoint for either trout or warm water fish. Marginal water temperatures have a detrimental effect on both feeding (or "biting") and "fighting" inclinations of game fish. A viable trout population cannot be naturally maintained in the reservoir, but it is stocked by the State with trout of catchable size. A viable, though not substantial, warm water fish population maintains itself in the reservoir, but substantial fishing pressure might necessitate restocking of largemouth bass.

Biotic potential of a reservoir is to a great extent determined by the amount of shallow water. Fifty percent of solar radiation needed for photosynthesis is absorbed by the first six feet of depth under clear water conditions, with

cloudy water greatly reducing the effective depth of light penetration. Because the shoreline of the reservoir drops off steeply to deep water in some areas and the fluctuation of lake level affects the shallow areas, little bottom growth occurs. Hence, biotic potential is fairly low and there is little food, except phytoplankton, to support the micro-organisms-to-fish food chain.

Aside from fish life, there are a number of mammals and birds which enrich the Nicasio environment. There is little scientific data on Nicasio wildlife. However, it is possible to point out the major wildlife types and the habitats which must be preserved or managed to perpetuate the present richness and diversity of animal and bird life.



ADULT SILVER SALMON AND STEELHEAD TRAPPED DURING UPSTREAM MIGRATION AT THE DAM AND RELEASED ABOVE TO CONTINUE UP HALLECK AND NICASIO CREEKS ARE AS FOLLOWS:

	SILVER SALMON	STEELHEAD
1963-64	151	129
1964-65	620	83
1965-66	464	6
1966-67	6363	8

JUVENILE SILVER SALMON AND STEELHEAD COUNTED IN DOWNSTREAM MIGRATION ARE AS FOLLOWS:

	SILVER SALMON	STEELHEAD
1964	938	1465
1965	16371	159
1966	8388	836
1967	8364	195

Black-tailed deer are common in the valley, spending some time in forest areas, but mainly found grazing on grassland and young stands of brush (or even gardens). Densities are related to the forage quality of the range, benefiting from land uses and natural conditions which encourage grass and shrubby vegetation.

Gray squirrels are common, especially to oak woodland areas.

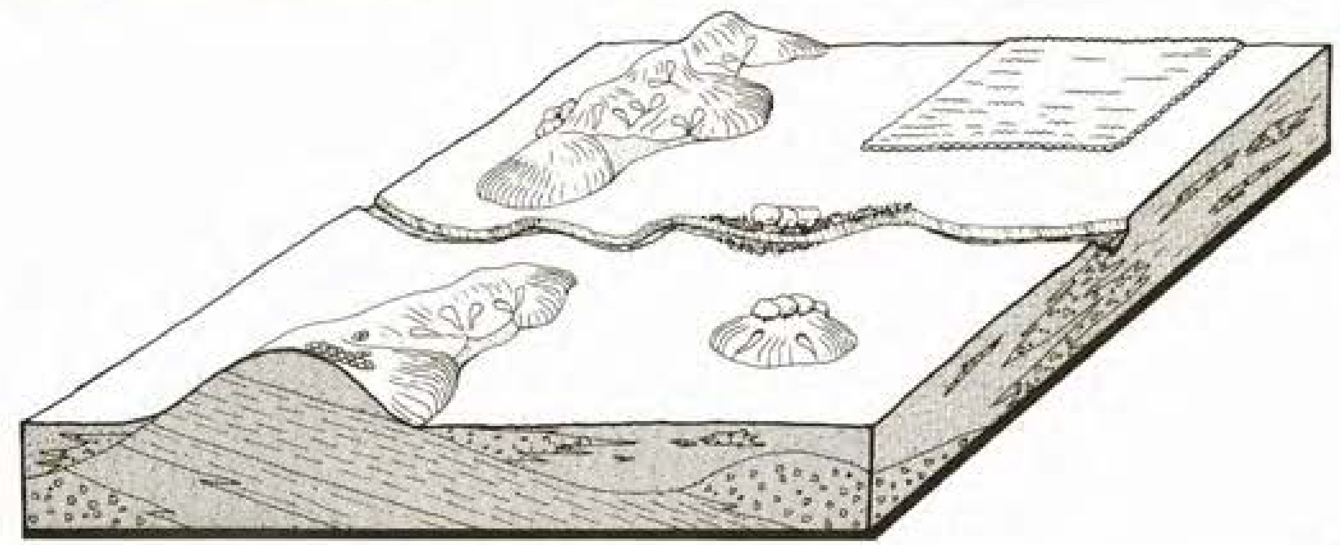
Bird life, an important asset, and indicator of environmental quality and diversity, will react to changes in the environment as development takes place. Species of birds, their required habitats and season of occurence, are detailed in Appendix A.

LAND SYSTEMS

It is evident that Nicasio is a complex assemblage of natural features, not easily comprehended in its totality. Thus, to help understand and discuss the relationship between ecology and development, five resource systems have been synthesized to illustrate the most salient characteristics of the environment. While the whole environment is interwoven, it is nevertheless useful to create prototypical systems based on resource information and professional judgment.

The five systems are: the basin floor, basin walls, reservoir area, Halleck Creek Watershed, and Nicasio Creek Watershed. Their salient natural features and processes are as follows.

BASIN FLOOR



The topography here is flat to gently rolling, punctuated by hillocks rising 100 to 300 feet above the floor.

The geologic base is alluvium of varying consistency and depth and eroded Franciscan rocks. Streams meander somewhat.

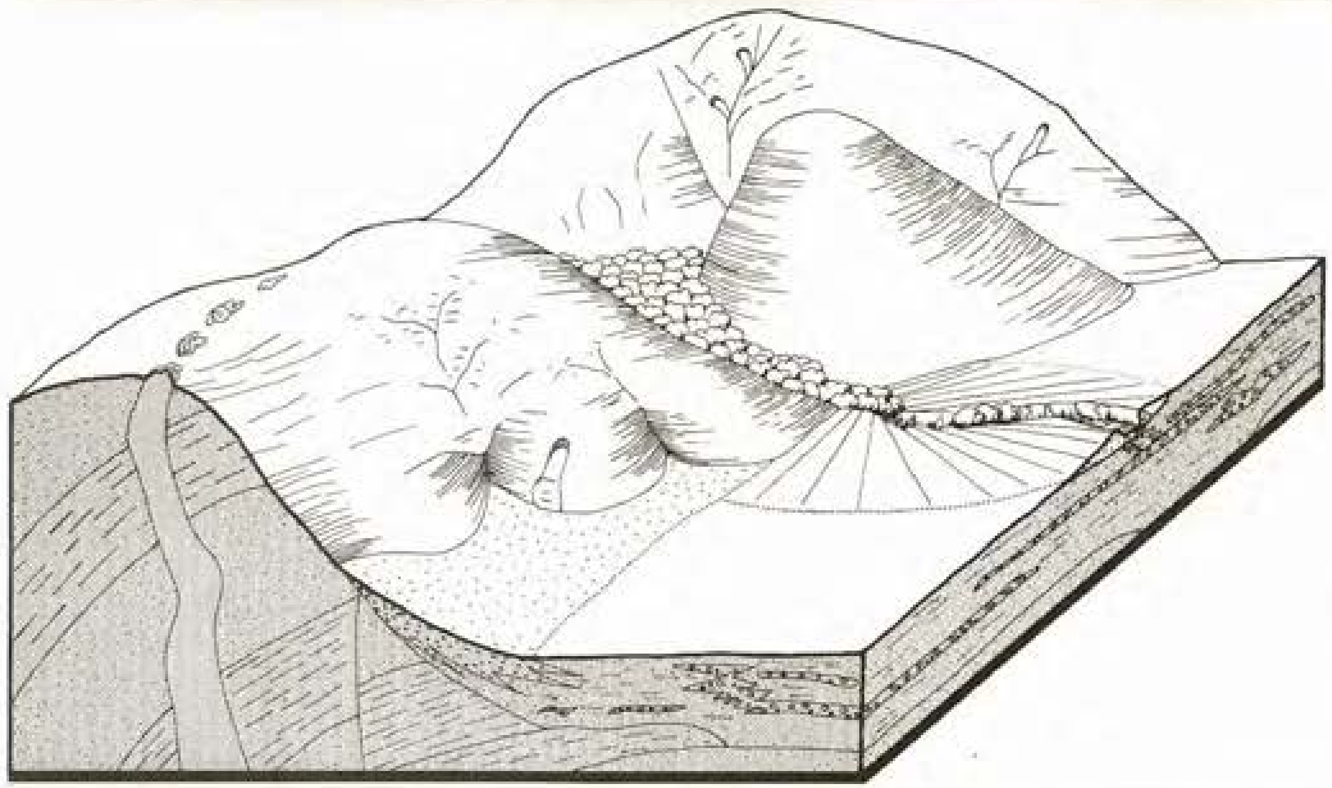
Soils are generally good, moderate in depth, and moderate in natural fertility; but low-lying areas have poor natural drainage in the spring. The hillocks have thinner soils with moderate to high erosion potential.

Vegetation is mostly annual grasses, but baccharis invades unused fields. There are some small stands of chamise on the hillocks. Intermittent streams are not lush with vegetation.

The main basin is open to winds, especially opposite gaps in the western hills. Winter fogs form in low-lying areas; high fog cover in summer is common, burning off by mid-day.

Main processes are plant succession (baccharis invasion of grasslands), uneven settling of alluvial deposits, stream cutting and flooding, and meandering of intermittent streams.

BASIN WALLS



Ridge tops are relatively flat and geologically stable. Below the change-in-slope line, there is active erosion, and landslides are common. Base consists of loose colluvial deposits.

Geology is Franciscan, mixed sedimentary and metamorphic rocks, hard, stable spillite at Black Mountain and Nicasio Gap. Serpentine occurs in isolated areas. Chert outcroppings occur as well, in places.

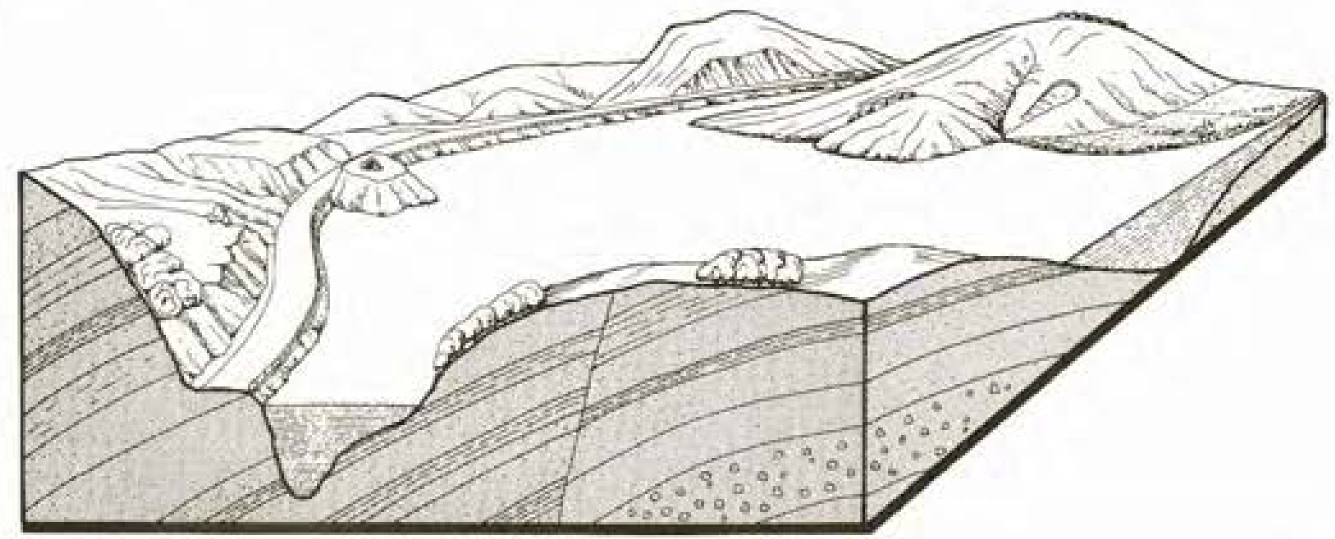
Soils are generally thin with high erosion and low fertility. Those areas with Montara gravelly loam soils have very rapid runoff.

The basin walls are mostly grass covered with laurel and live oak in the ravines and on north facing slopes. Baccharis is found on ungrazed parcels.

Strong winds occur in both summer and winter, especially on the southeast ridges. There are strong differences in micro-climate and vegetation between north and south facing slopes.

Main processes are landslides, active stream cutting into slopes, and plant succession. Disturbance of steep areas is likely to accelerate erosion processes. Colluvial deposits at the base of the slopes are subject to seismic shock and uneven settling.

RESERVOIR AREA



Topography varies here from steep-sided banks to gentle slopes and shallow water.

The geology varies markedly, with hard spillite on Black Mountain, some serpentine on the south side of Nicasio Island, and alluvium on the flats near the town center.

Soil is varied, with moderately erosive Parrish gravelly loams on the island. Blucher loams are found on flat approaches to the water with poor natural drainage and wetness in spring; most of the steep banks have moderate to high erosion and moderate fertility.

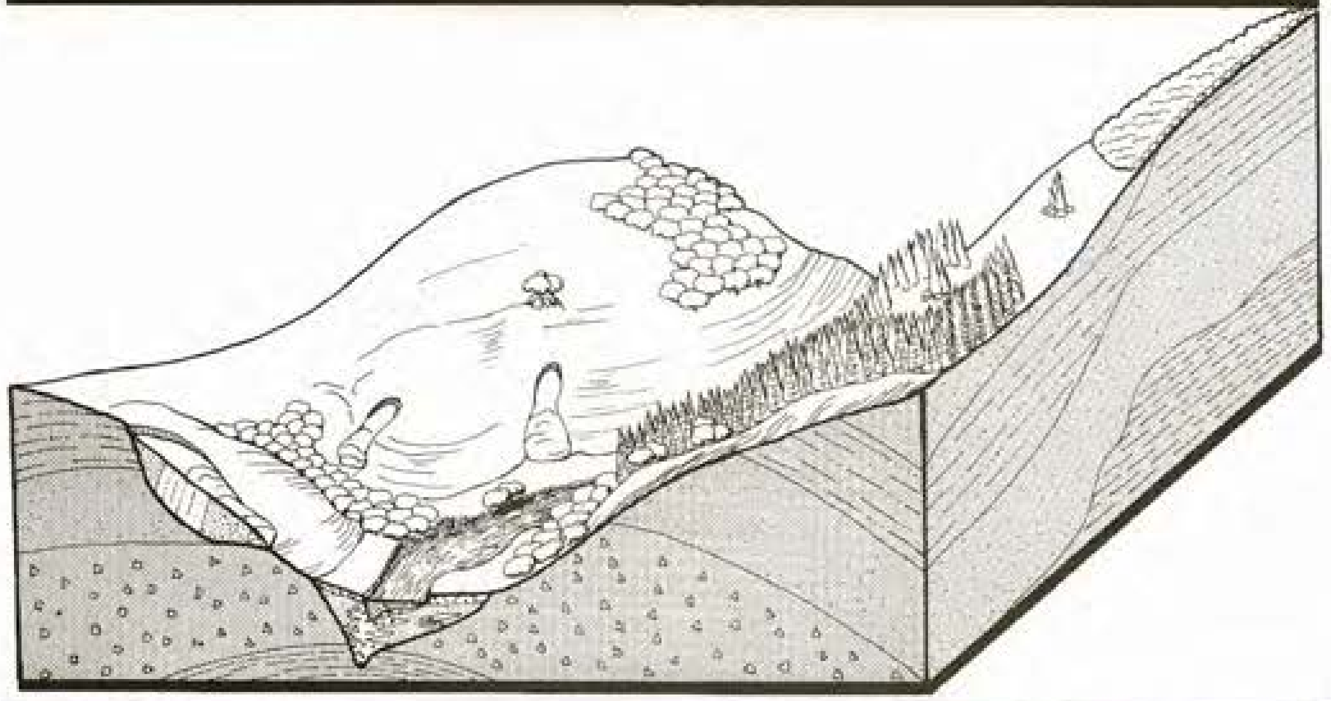
The main vegetation is grass around the reservoir except for some riparian types (willows) near the town. Laurel and live oak occur in shady slopes; baccharis stands are replacing grasses on the island.

It is windy in both summer and winter especially near the northeast end; sunny slopes exist mainly on the island and east of the Nicasio Creek arm. It is difficult to find sites with ideal combinations of recreation characteristics.

At least one archaeological site (an Indian shell mound) is to be found on the bank near the town.

Main processes at the reservoir relate to murkiness and filling due to sedimentation, water pollution from septic tanks and dairying, bank erosion and wave cutting, and trampling and soil compaction near the edge. In general, the shoreline is sensitive to disturbances, due to water fluctuation, and frail soil and geology.

HALLECK CREEK



This watershed is something of a transition, offering both narrow ravines, and partially opened shallow canyons. The actual canyon is narrow between Shroyer Mountain and the hillock to the North, wider in mid-reach, narrow at Redwood Canyon.

The geology is mixed Franciscan assemblage, with some chert above 1000 ft. on Shroyer Mountain. Landslides are common on steep slopes. Heavy stream bank cutting occurs in the lower reaches. Pajaro gravelly loam soils have poor natural drainage at lower elevations. Some slopes have Los Gatos gravelly loam or Hugo-Josephine soils with high erosion potential and low fertility – these frequently are on redwood–Douglas fir sites. Some of the redwood and Douglas fir is of merchantable size, with much of it already logged on Shroyer Mountain.

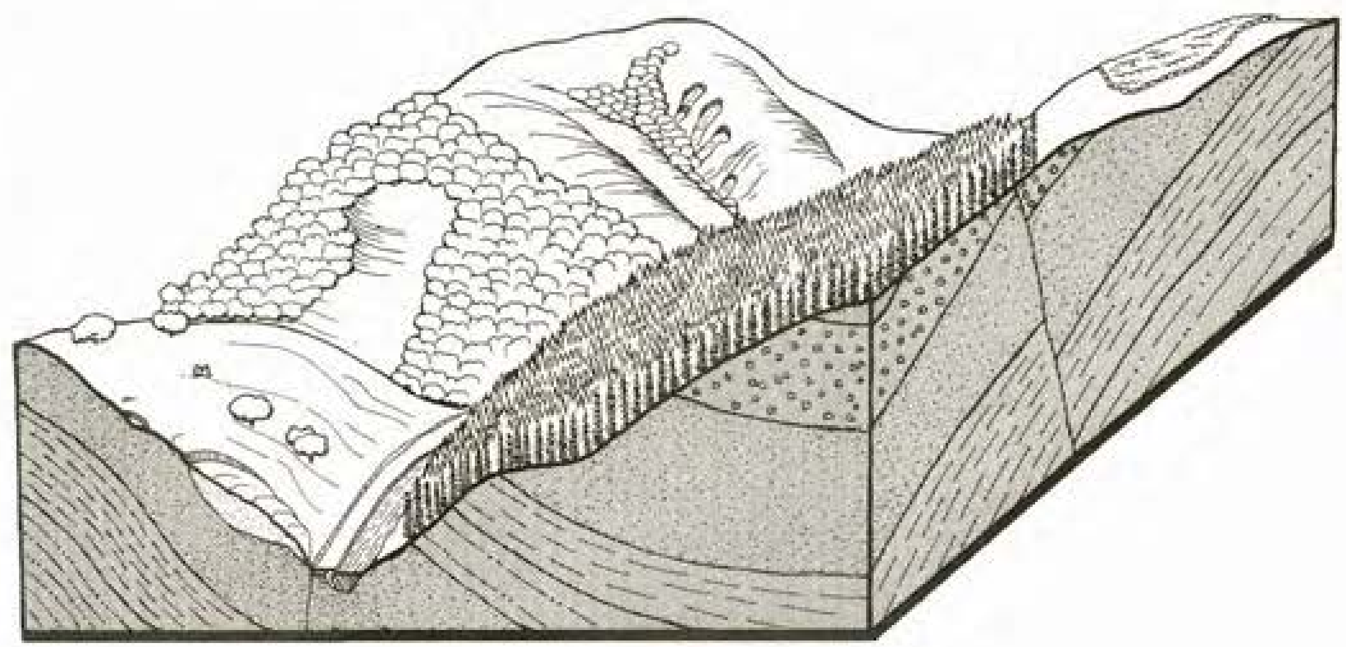
There is a transition in vegetation between redwood–Douglas fir and grassland. Chamise is common on dry ridges.

Summer and winter fogs are less frequent here than in the valley; except that winter fog does sometimes occur on lower Halleck Creek. Dramatic differences in climate and vegetation are found between north and south ridge faces.

A potentially significant Indian shell mound is located at the creek fork.

Important processes are landslides on slopes, soil erosion, and compared to Nicasio Creek, more active washing of the somewhat flatter stream channels.

NICASIO CREEK



Topographically, this area is mainly steep ravines with minor valley flats.

Geology is Franciscan, except for metamorphic and serpentine on surface of hill opposite entrance to Bull Tail Valley, and near Big Rock Pass. There are isolated areas of chert.

Soils generally have a high erosion potential, some have low natural fertility. Blucher clay loam soils in Bull Tail Valley are wet in spring (poor drainage). Serpentine areas have rapid runoff and low fertility.

There are strong climatic differences between north and south facing ridges. Winds are generally not as strong as in the main basin.

Second growth redwood–Douglas fir occurs on shady slopes as do laurel and live oak. Chamise is common on dryer sites. There is some grassland on slopes, intermixed with forest vegetation. There is proportionately more redwood–Douglas fir in the Nicasio drainage than there is in Halleck Creek.

Main processes are land slippage on slopes, active cutting of stream channels, and plant succession.

VISUAL CHARACTERISTICS

The visual quality of Nicasio is due not to a few unique scenic attractions such as mountain peaks, waterfalls, or rugged cliffs. Rather, the distinctive character arises from composite effects of the natural environment and land-use history described thus far.

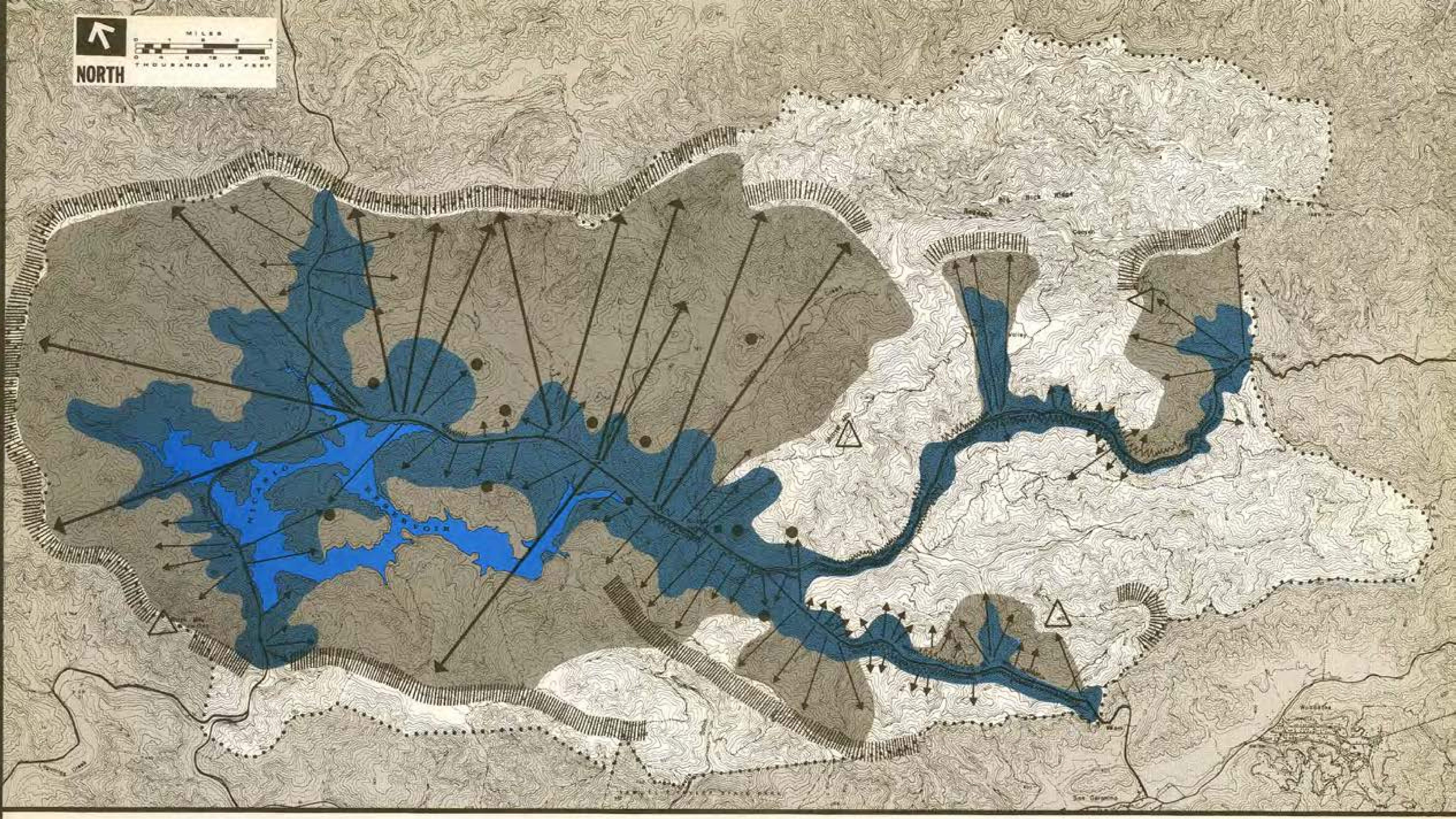
The visual impact of the landscape (and the effect of new developments upon the present setting), depends not only on the natural environment but on the condition of viewing: observer position, the angle, scope, and distance of view, lighting, and other purely visual considerations. We must consider key view points, settings, and overlooks in this context.

Thus at the townsite, the scenic backdrop is of extreme importance to the early California character which now pervades. The base of Shroyer Mountain (especially to an elevation of 500 feet), immediately behind the church is critical, since the open grassland gives a background of homogeneous texture and color, against which the whiteness of the church stands in bold relief. The Shroyer Mountain backdrop is also important because it is so close to the town itself that individual trees and rock outcrops can be seen distinctly. Visibility of this backdrop is heightened by the westerly exposure to midday and afternoon sunlight. In contrast, the wooded ridge to the south is mostly in shade, and is at a greater distance from the town square. Thus, while it is an important visual element, it is much less critical.

The buildings themselves serve to channel the view, such that the square's opening on the south heightens the visual dominance of the Rancho Nicasio, which looks down the row of buildings. Looking the other way from the rancho, the view is mainly of the church, Shroyer Mountain, and the more distant Nicasio Creek watershed. In short, the present configuration of the buildings and associated tree cover makes the town more a visual part of the southern ravines, than part of the main basin and reservoir area.

The scene on the valley floor of the main basin is one of openness. The view is essentially one from the bottom of a flat bowl without vegetation to block the view; with exposure to the sun, wind, and sky. The view from the road is dominated by the immediate foreground: rough fences, weed patches, telephone poles, and the uncurbed edge of the road itself. Hillocks and other elevated features in the middleground stand out espe-

The village of Nicasio, deep in the heart of Marin, has slumbered for over 100 years, in harmony with its landscape



FOREGROUND
MIDDLE GROUND
EDGE
MAJOR LANDSCAPE NODE
MINOR LANDSCAPE NODE
CULTURAL NODE
LONG VIEW
SHORT VIEW
MODERATE CLOSURE
HEAVY CLOSURE

ROAD VIEW ANALYSIS

cially when the road focuses on particular hillsides for more than a few seconds travel time. The hillocks are not only important visual elements as seen from the road, but themselves provide key viewpoints of the valley floor and the rest of the valley.

It is in the valley floor that color contrasts are especially important. Unbroken, homogenious brown in summer and green in winter; the blue of the sky and reservoir, and grey of the roadcuts stand out both because of open direct lighting and because the panoramic view allows comparison of each visual element with the scene in general.

The valley walls and ridges serve mainly as a backdrop or foil for the foreground elements and the grasslands immediately adjoining the road. However, the walls and ridge-tops are close enough to the main roads and principal use areas (1 to 2 miles) that detail is still apparent. Houses, roadcuts and fills, power poles, logging cuts, and other features can still be important visual elements beyond such distances (even up to three to five miles in such terrain).

Of special importance as seen from the valley floor, are the skyline silhouettes – both the clean, bare lines of grass covered ridges, and the jagged relief of the forest slopes. In short, the open, bowl-like spatial characteristics of the valley are such that new elements tend to be highly visible from many angles, and tend to have considerable impact (for better or worse) on the landscape.

Analysis of view from the ridgetops again emphasizes the high visibility or "showroom" character of the valley. However, within the valley there are several areas of somewhat reduced external visibility in which changes would have lesser effects. Another feature of ridgetop views arises from the convex form of the topography. This feature is that from the top of the ridge, the foreground falls away and becomes invisible – especially to the extent that vegetation obscures the view. Implications of this feature are that the area partway down the slope is of relatively low visibility, and that the view from ridge tops is easily subject to manipulation through the location of roads and trails or through control of vegetation – even low brush tends to obscure large areas from view.

In contrast to the openness of the basin, the Nicasio and Halleck Creek drainages offer an enclosive visual setting. The view is often limited to the immediate foreground, the forest base, the roadside itself, or cottages; and there are only occasional focalized views of opposing ridges. One frequently feels disoriented because the sun's position is often obscured, and landmarks are seen only infrequently and in differing perspective.

In short, the theme here is one of invisibility, with features screened by vegetation or hidden in pockets or folds of the mountains.

Can growth and change occur without losing this special identity?

DEVELOPMENT IMPACT

The extent to which Nicasio's environment will be changed by developments depends on at least four variables. The capacity to control the effects of development depends on the extent to which we can:

Match developments to land capabilities. –Developments should be located on sites which meet requirements naturally, thus obviating the need for grading, earth moving, landscape planting and the like.

Anticipate competition. –Needed facilities and their requirements should be identified so that market forces in the early development stages do not foreclose long range decisions.

Forecast environmental impacts. –Types of development must be interpreted in terms of direct actions on the environment.

Estimate and control ecological reactions. –An understanding of ecological interrelationships must become the basis for controlling environmental quality.

MATCH DEVELOPMENTS TO LAND CAPABILITIES

The degree of impact depends first on how wisely the requirements of each type of development are matched to the land's attributes. Patterns of development are most often determined by the location of roads and utilities. Service stations, stores, schools and housing tend to cluster near major intersections, without regard to features of the natural landscape other than topography. However, there are other considerations, which though of obvious importance, frequently are not taken into account.

Moderate-cost buildings require soil and rock that are easily graded. Schools should be located away from fog pockets, with opportunity for both sun and shade. Picnic areas should be on dry ground, out of the wind. Residential development should be patterned so as to interlock with resource-use areas which enhance the natural landscape. Major roads, commercial logging, sand and gravel operations, and other potential environment-dominating activities should be placed so as to have minimum visual and ecological impact on residential, educational and recreation land uses.

Since Nicasio has a limited number of sites with desirable combinations of slope, soil, natural vegetation, and climate, these sites should be devoted to those uses which are in most need of their particular sets of resource

When development occurs. . . does Nicasio have to become a future addition to Noplace, U.S.A.?

attributes. This involves an understanding of the particular environment requirements of roads, buildings, recreation and other major forms of use and development.

It is not an easy matter to match development requirements to each potential site's natural and environmental attributes. First of all, "requirements" are somewhat difficult to establish. Land uses vary in their environmental needs and in the costs associated with overcoming environmental disadvantages. Buildings can even be placed on landslide and earthquake hazard areas; but only with greatly increased risks and costs in design and foundation work. If required, roads can be built over steep ridges, but again at increased direct costs in earth moving and construction and in secondary effects such as the production of reservoir-filling sediment. A cold, damp micro-climate can be partly ameliorated by insulation of buildings, additional heating, and the asphalting of play fields, but these are poor substitutes for natural sunlight and a pleasant outdoor climate. Tourist accommodations can create attractive scenery by planting exotic vegetation and through irrigation, but only at a direct investment in installation and maintenance and in altering the natural character of the landscape.

Other things being equal, it pays to work with rather than against nature. This is not to say that it is always best merely to adapt to the natural environment, any more than one should assume that engineering and technology can overcome all obstacles without exorbitant costs. It is perhaps enough to ask that all significant costs and benefits of site modification should be evaluated in both monetary and environmental terms.

RESOURCES ASSOCIATED WITH DEVELOPMENT

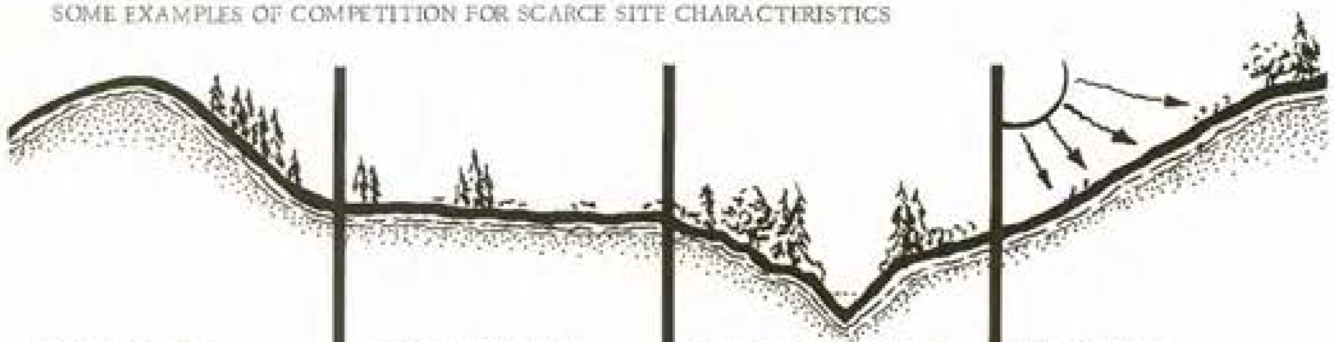
ASSOCIATED RESOURCES

TYPE OF DEVELOPMENT / ENVIRONMENTAL REQUIREMENTS	Level or gently sloping land	Good soil drainage	Workable soil & rock	Low geologic hazard	On line of Low gradient	Septic tank capability	Stream characteristics	Surface water quality	Ground water quality	Natural vegetation	Scenic surroundings	Favorable micro-climate	Historic features
(High density housing, retail, parking......)	●	●	●	●						●	●	●	
Moderate density housing	●	●	●								●	●	
Low density housing		●		●		●	●	●	●		●	●	
Playgrounds and parks (intensive)	●	●	●	●				●		●		●	
Regional Parks (trails)							●	●		●	●	●	●
Golf courses	●	●	●								●	●	
Fishing							●	●		●			
Commercial recreation (clubs, resorts)	●	●	●	●		●		●	●	●	●	●	
Roads	●		●	●	●								
Commercial timber			●				●			●			
Grazing/dairying	●					●	●	●	●	●			
Mining sand/gravel			●										

The table highlights the land attributes or most commonly associated resources with major types of development.

EXAMPLES OF SITE COMPETITION

SOME EXAMPLES OF COMPETITION FOR SCARCE SITE CHARACTERISTICS



SCENIC AREAS	LEVEL, WORKABLE LAND	STREAM CHANNELS	FAVORABLE TOPOCLIMATE
Low density housing	Low density housing	Low density housing	Low density housing
	Med. density housing		Med. density housing
	High density development		High density development
	Schools		Schools
Utilities (towers)	Utilities	Utilities (sewers)	
Roads	Roads	Roads	
	Parks (intensive)		Parks (intensive)
Parks (regional)	Parks (regional)		Parks (regional)
Wildlife		Wildlife Fishing	
Tourism/resorts			Tourism/resorts
Grazing	Grazing	Grazing	
Commercial timber		Commercial timber	

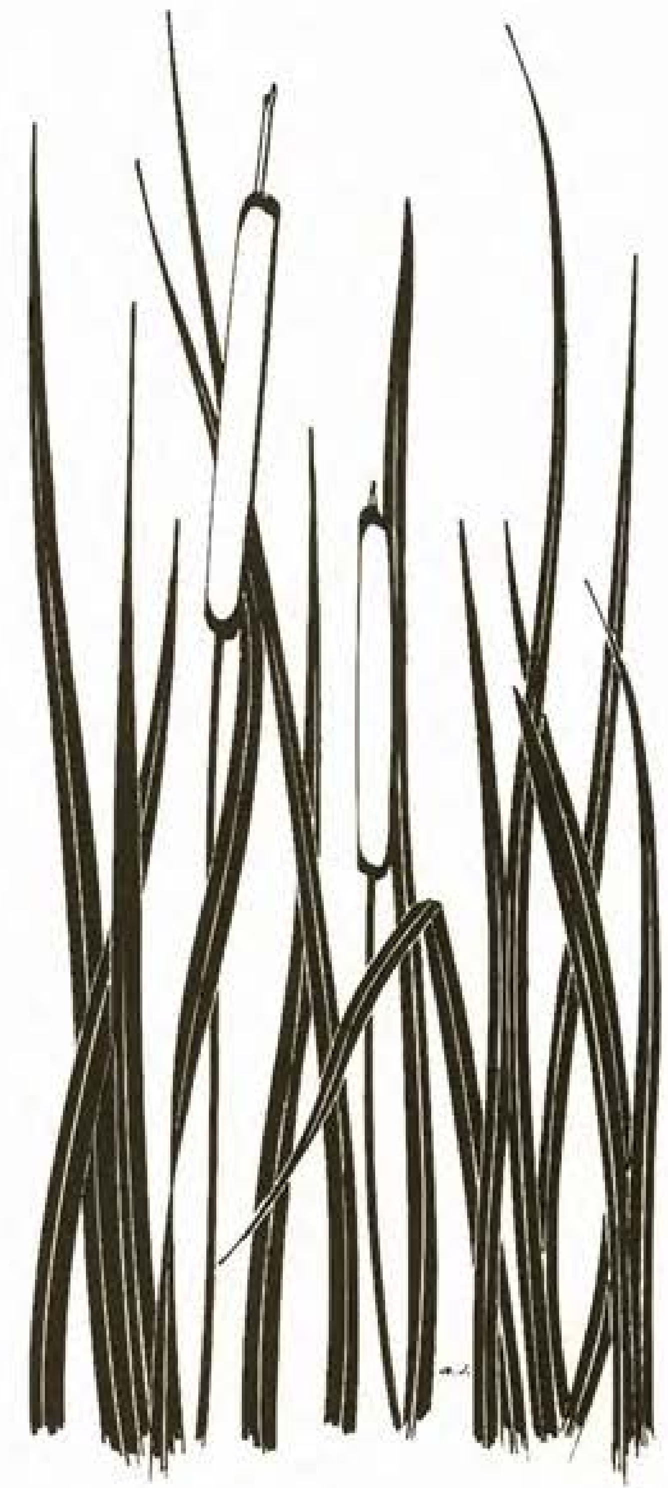
ANTICIPATE COMPETITON

Because of the openness and sensitivity of Nicasio's landscape, the development of key locations is of general concern. Care should be taken so that the first houses, service stations, corporation yards and the like, do not preempt the few sites that would be best for schools, parks, historic sites, or scenic easements. While the economic marketplace is a major force in the competition for valuable sites, there should also be a full recognition of environmental consequences not necessarily reflected on the real estate market.

If competition can be anticipated, the resolution of some potential conflicts can at least become a matter of public policy. For example, competition for four types of sites can be expected to take the following form:

FORECAST

Developments vary in their environmental impact. The determination of impact rests on an understanding of the physical changes involved; that is, the amount of earth moving, paving, and vegetative disturbance in relation to a particular type of site to be developed. The degree of action on the environment varies with the scale and design of the development and with a particular site. For example, a road of freeway scale would, of course, require more site manipulation in the rough terrain of a stream canyon than in the flatter ridge tops or valley floor. A simple itemization of direct actions is helpful at this point, however, to illustrate the potential environmental impacts of major types of development.



ESTIMATE AND CONTROL ECOLOGICAL REACTIONS

Physical changes wrought by development are not merely those seen in an artist's sketch or three dimensional model. Rather, they include secondary changes to the broader environment, which in turn may influence the quality of other sites. These changes must be pointed out in order to better estimate the incidence of costs and benefits that accrue to nearby sites or are passed on to the general public through chains of ecological reaction.

For example, extensive areas of irrigation, as in golf courses or housing tracts, does change the natural pattern of vegetation. Frequent irrigation or sprinkling of the turf saturates soil so that it acts almost like asphalt paving during the first heavy rains, causing rapid water runoff. The water runoff enters into drainage ways and streams, causing potential flood problems downstream, where previously floods may not have been frequent or serious. Moreover, the added flow of water from irrigation during the dry summer months allows vegetation to grow in formerly dry stream bottoms. During the spring runoff, this vegetation slows the flood waters, allows suspended sediment to settle and raises the level of the stream bottom; thus, making it more likely that a given amount of water will go over the stream's previous high water mark. If stream-side housing has already developed downstream, this in turn precipitates requests for stream channel clearing, channel straightening, levying or other measures destructive to the natural stream course.

COMMON DEVELOPMENT ACTIONS

DIRECT ACTION

COMMON ACTIONS ON THE ENVIRONMENT

TYPE OF DEVELOPMENTS	Excavation, cutting	Earthmoving, filling	Paving	Building	Tiling, drainage improvement	Irrigation	Fertilization	Landscape planting	Fencing	Timber clearing, cutting	Chemical waste products	Biological waste products	Burning	Stream blockage	Stream channel straightening
Intensive (High density)	●	●	●	●	●	●	●	●	●	●	●	●			●
Medium density housing	●	●	●	●	●	●	●	●	●	●	●	●			
Low density housing	●	●	●	●	●	●	●	●	●	●	●	●			
Playgrounds	●	●	●		●	●	●	●	●	●		●			
Regional parks			●	●				●	●			●	●	●	
Golf courses	●	●	●		●	●	●	●	●	●	●			●	
Fishing															
Commercial recreation & tourism & resorts	●	●	●	●	●	●	●	●	●	●		●			
Roads	●	●	●		●	●	●	●	●	●	●			●	●
Commercial timber	●	●								●			●	●	
Grazing									●	●					
Mining	●	●		●					●		●			●	●

	ENVIRONMENTAL VARIABLES	Excavating (large scale)	Filling, Mowing (large scale)	Paving	Building	Drainage improvements	Irrigating	Fertilizing	Landscaping (large scale)	Fencing	Timber clearing, harvesting	Chemical waste	Biological waste	Burning (slash, forest fire)	Grazing, mowing	Mining (sand/gravel)	Stream blocking	Stream channel improvement	TYPES OF MONITORING	POTENTIAL CONTROL MECHANISMS
		DIRECT ACTIONS																		
GEOLOGY	landslide potential	●	●		●	●					●			●		●			engineering-geology-maps and reports detailed site studies	grading permits zoning hazard areas public acquisition geologic reports
	settling, compacting loose material		●		●	●	●													
	deposition of sediment	●	●	●							●			●	●	●	●	●		
	deposition of alluvium	●	●								●			●	●					
	reaction to seismic shock		●																	
HYDROLOGY	total available water						●												stream gauging flood-plains mapping well drilling logs well production records	well permits grading permits impoundment permits watershed plans fish & game & health codes flood control legislation water quality legislation
	timing, period or duration of flow		●	●	●	●	●				●			●	●			●		
	high water level		●	●	●	●	●				●			●	●		●	●		
	flood peak frequency		●	●	●	●	●				●			●	●					
	stream blockage (vegetation, damming)		●				●		●	●	●			●						
	suspended sediment	●	●			●			●		●			●		●	●			
	bedload	●	●								●					●	●			
	force, speed of flow			●	●	●					●			●			●	●		
	runoff rate	●	●	●	●	●	●				●			●	●					
	water temperature		●			●					●			●			●	●		
	chemical content (residue, salts)					●	●	●			●	●	●	●	●					
	clarity	●	●	●	●			●			●	●	●			●				
	pathogenic organisms																			
	ground water flow, level	●	●	●	●	●	●				●			●						
SOIL	depth	●	●	●	●				●		●								agricultural soil surveys site surveys farm and ranch conservation plans post-fire rehabilitation	grading permits planting plans soil stabilization requirements soil report review
	consistency, density, compaction	●	●	●	●		●				●				●					
	fertility	●	●	●	●			●	●			●	●	●	●					
	water holding capacity	●	●	●	●	●														
	erosion hazard	●	●	●	●				●		●			●	●					
	permeability	●	●	●	●						●									
	shrink-swell behavior	●	●	●	●															
	corrosivity	●	●	●	●									●						
	reaction (pH, acidity/alkalinity)	●	●	●	●	●	●	●				●		●	●					
	soil-forming micro-organisms	●	●	●	●		●	●			●	●	●	●	●					
VEGETATION	type of plants	●	●	●	●	●	●	●	●		●		●	●	●		●	●	detailed maps range carrying capacity studies landscape analysis brush conversion plans timber management plans	state forest practice rules fire control codes landscape architecture review boards recommended plant lists logging plan review
	amount of vegetation (biomass, fuel)	●	●	●	●	●	●	●	●		●		●	●	●		●	●		
	plant community succession	●	●	●	●	●	●	●	●	●	●			●	●		●	●		
	evapo-transpiration rate	●	●	●	●	●	●		●		●			●	●		●	●		
	soil holding properties	●	●	●	●		●		●		●			●	●					
	plant pathology	●	●	●	●	●	●		●		●	●		●	●					
	food or cover properties	●	●	●	●	●	●	●	●		●			●	●		●	●		
CLIMATE	temperature			●	●				●		●			●	●				detailed topoclimate studies air pollution monitoring weather records	air pollution codes development plan review highway location density zoning
	humidity			●	●	●	●		●		●			●			●			
	wind speed			●	●				●		●			●						
	wind direction				●				●		●									
	precipitation and fog drip								●		●			●						
	fog cover, summer type																			
	fog cover, winter type		●			●	●										●	●		
	insolation				●				●		●			●	●					
WILDLIFE	types of fish and wildlife	●	●	●	●		●	●	●		●	●		●	●	●	●	●	wildlife census wildlife management plans	state fish and game codes firearm ordinances refuge development
	number of fish and wildlife	●	●	●	●		●	●	●		●	●		●	●	●	●	●		
	food-chain system	●	●	●	●	●	●	●	●			●		●	●	●	●	●		
	behavior (predator/prey, home range)	●	●	●	●				●		●			●	●	●	●	●		
	disease	●	●	●	●		●					●	●	●	●					
VISUAL	form	●	●	●	●				●	●	●			●	●	●	●	●	seen-area mapping scenic classification detailed landscape analysis	scenic easements architectural review boards open-space acquisition
	texture	●	●	●	●				●	●	●			●	●	●	●	●		
	color (hue)	●	●	●	●				●		●			●	●	●	●	●		
	color (brilliance)	●	●	●	●				●		●			●	●	●	●	●		
	reflective property	●	●	●	●				●	●	●			●	●	●	●	●		

The accompanying table lists some major direct actions on the environment that are commonly associated with principal types of development, their associated reactions or secondary effects, and types of monitoring and control mechanisms.

ENVIRONMENTAL CONSERVATION PROGRAMS

Specific actions, plans, and regulatory measures will be the subject of subsequent plans prepared by the Marin County Planning Department, and later, by landowners and developers. But it is important at this point to raise environmental needs suggested by this study, and to point out the types of control measures that might be considered.

Action is needed on at least four fronts:

LAND ALLOCATION – locating facilities and land uses in correct relation to available natural resources, both in terms of efficiency and visibility, and in terms of compatibility with the natural environment.

LAND MANAGEMENT – active, sensitive husbandry of Nicasio's grasslands, forests, streams, and atmosphere.

DESIGN WITH THE ENVIRONMENT – the application of skill and creativity to the engineering of roads, buildings, the use of landscape plans, and other design decisions affecting the use and visual quality of the landscape.

RESEARCH – a factual basis for predicting and controlling environmental problems for protecting valued assets.

LAND ALLOCATION

Major goals in land allocation are to:

- Match uses and facilities.
- Minimize the risks and costs of floods, landslides, and earthquakes.
- Provide a continuity of open space and recreation areas allowing freedom of access and circulation.
- Maintain land in parcels large enough to accommodate natural features and processes.

These goals will be reached only through careful Valley-wide planning and sensitive private development. At this point it is possible to make only general recommendations as a basis for subsequent planning.

Streams in the main basin which have reached gradient and tend to meander and flood would best be set aside as drainage ways. Also in the main valley floor, flat lands in the roadside foreground and hillocks in the middleground might be set aside for grazing under scenic easement provisions.

On the basin walls, colluvial and landslide areas might be reserved or otherwise earmarked for very careful treatment. The ridge tops are more suited for development if conflicts between residential, recreational, and commercial uses, and the problem of visual disruption of the skyline silhouette can be resolved.

For the reservoir area, it is recommended that as much as possible of the shoreline be designated for private or public recreational or educational uses. In any event, it is important that the erosive banks on the north and east shores be protected from uncontrolled uses that hasten erosion. The archaeological site at the stream mouth near the townsite should be considered for historic treatment.

Halleck Creek also has archeological sites which require protection as development pressures increase. Farther up Halleck Creek, Redwood Canyon contains important redwood groves worthy of consideration for park status. In both Halleck and Nicasio Creek drainages, the streams, to at least the historic highwater marks and limits of streamside vegetation, should be designated for special treatment. Ridge tops and slopes in many locations need to be preserved to augment related parks or easements, as deemed necessary in later planning studies.

The townsite area itself is worthy of special consideration. Similarly, a positive recreation and open space program should be emphasized in the county's planning effort.

There are a number of means available for influencing land allocation. The present zoning which relates density to slope, is appropriate in that many hazards such as landslides are closely related to steepness of slope. The simple slope/density formula used at present is inadequate, however, in that it does not face such problems as earthquake hazard on alluvial terraces and colluvium, and in that it encourages building on streamsides and flood plains.

Land trusts or property-owners' associations may be required to provide for grazing districts, and shared provision for use of open space. To the extent that properties can be developed on a large scale, planned-unit-development basis, detailed studies in site engineering and landscape architecture will point up many opportunities for detailed land allocation.

LAND MANAGEMENT

Even in the face of heavy development pressures, it is likely that much of the land in Nicasio will be undeveloped. This would include steep and inaccessible areas, easements and rights-of-way, extensive recreation areas, flood or other hazard zones, open land between housing groups, and land being held for speculation. If these lands are neglected, they will quite certainly fail to yield the desirable environmental benefits accruing today.

Important goals of land management and conservation are:

- To maintain valuable natural vegetation, especially the forests and open grasslands;
- to protect key natural and cultural features;
- To maintain air and water quality;
- To control the entrance of sediment into the creeks and Nicasio reservoir;
- To reduce the hazard from forest and brush fires;
- To protect wildlife habitat, and the steelhead and salmon fishery.

To attain these goals, programs should be developed for managing Nicasio's rangelands and pastures, forests, watersheds, and airshed.

Range management is needed to encourage growth of grasses that hold and develop the soil. Minor engineering works in a number of places are needed to prevent erosion and gullying. There should be continued efforts at weed and brush control through the use of grazing, the controlled use of fire and herbicides, and improving the forage quality of grasses through fertilization and seeding. The size of the grazing herd should be adjusted to the carrying capacity of the land, as the situation permits. Continued range management is also needed to maintain fencing, watering places, and the myriad of ranching facilities and tasks now common to Nicasio, but likely to go out of the picture as residential development takes place.

Perpetuation of grazing and range management may involve the creation of new grazing districts. Or perhaps, it means the perpetuation of existing ranches by including present ranch lands in larger land trusts so that development, investments, and profits are shared. The inclusion of land in agricultural reserves is to be encouraged. Other possibilities might include dude ranches, resorts, or equestrian clubs, if land husbandry could be made an important part of the group's function. Such groups might also become involved with supervision of hunting, with management of the deer herd, trespass controls, and other tasks likely to become important as development takes place.

Forest management is needed to insure sustained value accruing from forest lands: continued soil holding and soil building capability; continued scenic and recreation values; water retention, and the reduction of air pollution. Other management goals would be the prevention and control of wildfire, both small fires started within Nicasio's forests, and conflagrations which might someday sweep broad areas of the coast range. Fire control measures include not only the provision of fire-fighting capability, but the reduction of brush and undergrowth on a broad scale, the construction and maintenance of fuel breaks and fire access roads, and other forestry operations.

Good forestry is especially difficult to achieve where no single owner has sufficient resources to become involved in either commercial or recreational forest management, and where logging or clearing is commonly done without adequate planning, professional forestry expertise, or proper safeguards for environmental quality. Careful forest management is especially important because most of Nicasio's forests are on steep slopes, with soils which have high erosion potential. Many forested areas also have characteristics which are associated with landslides.

Assistance may be sought from the California Division of Forestry which administers the State Forest Practices Act, and provides for fire control. The University Extension Forester, and private forestry consultants are available for more detailed forest planning.

Watershed management is especially important in Nicasio, as it is elsewhere in Northern California, not only because of the young erosive soils and geology, but because the watershed drains into Nicasio reservoir which may fill with sediment and bedload. Active conservation of forest and range lands will for the most part also result in good watershed management.

But several items need special attention. For example, most roads follow stream valleys, for nowhere else does it seem possible to gain grade and yet hold climbing gradient to an economical level. Important to watershed management are such features as: the effect of roads on streams and shorelines themselves; the disposition of water collected by drainage ditches; the effect of cuts and fills in channeling or blocking water flow; the problem of placing fills on seepage areas; and the size and placement of culverts so as to prevent washouts.

Ground water must eventually be managed to insure continued availability and purity of ground water, to monitor the ground water for public health standards, and to help set criteria for septic tank use (to the extent that they are allowed in early stages of development).

A number of agencies and programs must be involved in watershed management: the Marin Soil Conservation District, of course can play a key role; the California Department of Fish and Game may assist relative to water quality and in enhancement of streams and the reservoir as fish habitat; also, regional and federal water quality control measures, and various public health measures can be useful tools.

Air is another key resource that must be considered at the earliest stages of development before air pollution has set in. Given the smog-trapping temperature inversion which exists during most of the long summer and even frequently in winter, serious study should be undertaken before locating major automobile traffic routes through the Valley. Air quality should also be considered in recommending the size of total population desirable for the Valley.

With regard to the potential for future air pollution problems, the Marin County Planning Department has tested a hypothetical sketch plan for a future Nicasio of 13,000 dwelling (population 42,000) units and an assumed 1990 level of auto travel from external origins based on projections of State Division of Highways 1963 volumes. The total air pollutant level for Nicasio from these auto emissions was calculated by the staff of the Bay Area Pollution Control District. The specifics of smog occurring as a result of certain patterns and densities of development will be analyzed fully in the general plan publications which will follow this report. However, certain general facts about Nicasio and air pollution should be understood as prerequisites for proper environmental planning.

Nicasio is vulnerable to the development of photochemical smog, due to the occurrence of temperature inversions which prevent dispersion of air pollutants. For example, it was calculated that if a build-up of auto exhaust emissions were to occur over a three day period of persistent inversion and low wind speeds in a Nicasio urbanized to the extent referred to above, an eye irritating and unhealthy level of smog could be expected even if the strengthened 1974 air quality control standards for auto exhaust emissions were being met.

However, any discussion of Nicasio's vulnerability to befouled air may be dismissed by skeptics as speculative since it deals with the uncertain future. Therefore, let's look at the Livermore-Amador Valley which is somewhat like Nicasio in that it is an inland valley ringed with hills and thus subject to a number of the same meteorological conditions. The Livermore-Amador Valley area studied is 100 square miles compared to the 36 square miles of the Nicasio Planning Area.

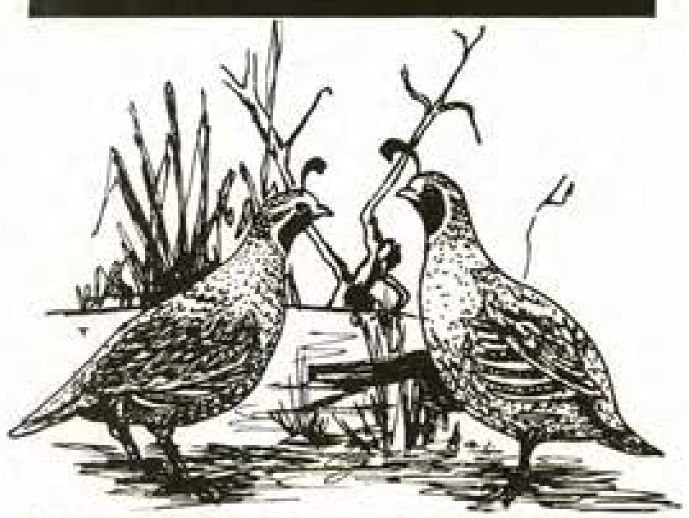
The important difference here is that air pollution is a problem in the Livermore-Amador Valley NOW. Once a rural-agricultural area, the valley has exploded with suburban housing and highway traffic in recent years. In 1967, when its population was 62,000, the smog season (May to October), was monitored by the Bay Area Air Pollution District. The indicator of photo chemical smog conditions used was total oxidants in the average high hour. "The State of California has set up air quality standards related to total oxidant as follows: 0.15 parts per million oxidant, defined as an adverse day. This is the level at which one normally considers it a smoggy day. It's also the level at which people's eyes start experiencing irritation, plants start being damaged and visibility is reduced", quoted from Air Pollution – Present & Future Livermore-Amador Valley – published by the City of Livermore Air Pollution Control Study Committee: March 1968.

(At the present time, the State Air Resources Board is considering an air quality standard for oxidants in all of the basins of the State of 0.10 ppm for one hour. The air quality standard will be said to be exceeded if values greater than 0.10 ppm are measured on any three consecutive days, or seven times in any 90-day period.)

During this 1967 period the valley experienced 75 potentially adverse days and 30 adverse days. Thus 58% of the days during the '67 smog season were potentially or actually smoggy. This was the highest frequency of adverse days for any location in the Bay Area. (In contrast, the recordings in San Rafael during the same period measured 17 days as potentially adverse, four days as adverse, or 12% of the season as having potential or adverse smog.)

Livermore-Amador Valley does differ from Nicasio in a number of important respects. Firstly, it doesn't have Nicasio's moderating incidence of fog to keep the sun from cooking air pollutants into smog. More importantly, Livermore imports about half of its air pollution by being downwind from San Francisco and East Bay. Even so, there are as many days when the smog is purely local as when it is mostly imported.

The major lesson Nicasio can learn from the Livermore-Amador Valley air pollution crisis is that early planning control over population growth, freeway and highway locations, and other sources of air pollutants is essential if the maintenance of a clean breathable air supply is to be assured.



DESIGN WITH THE ENVIRONMENT

Assuming that major land use decisions could be made wisely, and that programs for resource management could be put into effect, there is still much to be done in designing to fit particular structures and facilities to their selected sites and the surrounding environment. Goals of design from an environmental point of view are:

- To strengthen or enhance the natural composition of the landscape;
- To fully utilize desirable natural features of climate and natural vegetation;
- To compensate for environmental deficiencies such as climatic extremes or geologic instability;
- To minimize detrimental external effects of development such as visual dominance from view sites through use of incongruous form, scale, or color.

Roads should be designed to low speed, scenic standards where possible.

Widths, alignments, grades, curbing, and drainage should be keyed to the rural setting. Stream channels should be avoided. Cuts and fills should be minimized, and areas of unstable soil and geology avoided. Alignments should adapt to topography, with bridging and tunneling to be preferred over earth cuts and fills.

Housing densities should reflect geologic hazard, stream channel preservation, and visual/esthetic considerations. Height limits should vary with topography and vegetation, with, for example, three to four stories encouraged in Douglas fir, and low profiles in open grassland. Building materials should be chosen so that the brilliance, reflectivity, and texture fit with the surrounding landscape. Such controls might be achieved through the creation of architectural control zones.

Consolidation of power, and telephone easements is desirable, with below-ground utilities favored in open grasslands where poles are highly visible. Sewer trunk lines should avoid stream channels and geologically unstable areas.

Landscape plantings should be of native materials or closely related introduced species. A list of preferred materials is given in Appendix B. Exterior landscaping should be minimized in grassland areas and confined to interior courtyards or walled-in areas. Housing developments or building groups proposed for grassland areas should evidence strong architectural response to the topography and openness of the landscape, or provide for massive landscape planting to simulate natural plant groupings. All landscaping for buildings or roads should be keyed to the natural plant communities shown on this report's vegetation map.

RESEARCH

Environmental programs and plans must begin as soon as possible without necessarily waiting for completion of all research that ideally might be useful. At the same time, it is important to begin studies on a number of topics:

GEOLOGY: While existing, visible landslides were mapped for this report, further work is needed to determine potential slide areas, given slope and rock type. Some further work is underway at the Forest Experiment Station, but other agencies such as the State Division of Mines and Geology, and the U. S. Geological Survey should also be consulted and encouraged to participate.

SOIL: Granting the usefulness of the present soil report, further studies and interpretations could focus on the implications for physical development, as opposed to agriculture. Maps might indicate such factors as ease of grading, suitability for major earth movement, or composite suitability for residential or road development.

HYDROLOGY: As alluded to earlier, there is need for determination of: ground water availability and quality and the effect of the reservoir on ground water supply; trends in reservoir clarity and sedimentation should be documented; detailed effects of upstream development on lower stream courses and flood plains should be examined; careful monitoring of pollution, contamination, and degradation (i.e. variables such as water temperature which affect the stream's capacity to handle pollution) should be of perhaps highest priority.

VEGETATION: Practical measures for controlling baccharis and other unwanted shrubs in the grasslands should be tested. The number of livestock needed to control weed invasion without overgrazing or causing soil erosion must be determined, probably on a case by case basis. More detailed study is also needed on natural plant communities, and their capabilities in terms of visual and ecological absorption.

CLIMATE

Description of topoclimate, air circulation and other variables important to air pollution potential should be begun as soon as possible, perhaps on a county-wide basis.

WILDLIFE

More accurate and periodic census or estimates should be conducted, and forecasts made as to the effects of development. The spawning beds for steelhead and salmon should be located and analyzed as to their continued viability under development pressure. The possible need for a fish ladder to replace the present trap and haul arrangement should also be investigated.

VISUAL

Detailed seen-area, and visual impact studies should precede all major developments.

ECOLOGY

Even with existing and potential studies on hand, it will be difficult to forecast the environmental consequences of specific proposed developments. This is because most studies thus far are descriptive, rather than experimental in nature, and because ecology is a complex and inexact discipline. Therefore it may be necessary to explore and develop new types of ecological-planning simulations where planners, natural scientists, and designers are brought together so as to achieve the best possible professional judgments on development issues.

It is evident that the conservation of Nicasio's environment involves many complex and difficult tasks. Yet, the challenge must be met.

ACTION BY MANY INDIVIDUALS AND AGENCIES IS NEEDED

The county government must play a pivotal role in developing specific plans for recreation and open space, forest and resource management, housing, sewers and other utilities, public health, schools, and transportation. These functional plans will influence environmental quality in so many ways, that perhaps a county resource coordinator or Environmental Quality Board should be appointed to initiate and coordinate studies and control systems.

Regional, state and federal agencies can be expected to assist as their means permit; but local initiative is important to secure needed services. Private foundations, such as the Nature Conservancy, might also play a catalytic role in financial support and guidance.

Regardless of the interest and support of government agencies and private foundations, the key to Nicasio's future is held by the local residents and landowners: in their stewardship of the land, acting individually; and in their joining together to create, support, and implement conservation policies.

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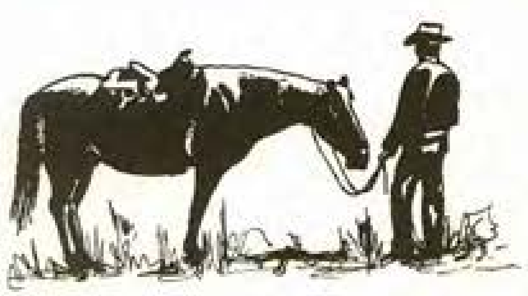

APPENDIX A

BIRD LIST

KEY FOR NICASIO VALLEY BIRD OCCURRENCE LIST

HABITATS

- O - OPEN WATER - includes lakes and streams
- G - GRASSLAND/MEADOWLAND - grass or grass like vegetation. Includes pastures, fields, meadows, and areas with scattered shrubs and trees.
- S - SHRUBLAND - dry areas with brush 1-10 feet tall, usually continuous and may have scattered trees.
- R - RIPARIAN
- W - WOODLAND - drier areas with round-crown trees (hardwood, pinion, digger pine, etc.)
- F - FOREST - includes predominantly conifers, but in the Coastal District it includes laurel, madrone, or tanbark oak.
- A - AERIAL - strong-flying species, overflying

FREQUENCY OF SEASONAL OCCURRENCE

- C - COMMON
- F - FAIR
- R - RARE OR IRREGULAR

SOURCE

McCaskie, Guy & Paul DeBenedictis
1966 Annotated field list. Birds of Northern California
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SPECIES	HABITAT	OCCURENCE AND SEASON			
		SPRING	SUMMER	FALL	WINTER
Great Blue Heron	O	C	C	C	C
Canada Goose	O			R	R
White-fronted Emperor Goose	O, G			R	R
Mallard Duck	O	R	R	C	C
Gadwall Duck	O			R	R
Pintail Duck	O, G	C	R	C	
Green-winged Teal Duck	O	F	R	F	F
Blue-winged Teal Duck	O	R	R	R	R
Cinnamon Teal Duck	O	F	R	F	R
Wood Duck	O, R	F	F	F	F
Redhead Duck	O			R	R
Ring-necked Duck	O			F	F
Canvasback Duck	O	R	R	R	C
Common Goldeneye Duck	O	R	R	R	C
Ruddy Duck	O	R		C	C
Hooded Merganser Duck	O			R	R
Common Merganser Duck	O			F	F
Turkey Vulture	A	C	C	C	F
Sharp-shinned Hawk	F, W, R	C	F	C	C
Cooper's Hawk	W, F, R, S	C	F	C	C
Red-tailed Hawk	A, G, W	C	C	C	C
Red-shouldered Hawk	R, W	F	F	F	F
Rough-legged Hawk	A, G				R
Ferruginous Hawk	A, G				R
Golden Eagle	A	F	F	F	F
Osprey	A, O	R	R	R	R
Pigeon Hawk	A, G	R			R
Sparrow Hawk	A, G, W, R	C	C	C	C
Blue Grouse	F	F	F	F	F
California Quail	S, G, R	C	C	C	C
Ring-necked Pheasant	G, S	F	F	F	F

SPECIES	HABITAT	OCCURRENCE AND SEASON			
		SPRING	SUMMER	FALL	WINTER
Killdeer	G	C	F	C	C
Long-billed Curlew	G	C	R	C	C
California Gull	O	C	R	R	C
Ring-billed Gull	O	C	R	R	C
Band-tailed Pigeon	F, W	C	C	C	C
Mourning Dove	G, R, W	C	C	C	C
Barn Owl	R, G	F	F	F	F
Screech Owl	W, R, F	C	C	C	C
Great Horned Owl	W, F, R	C	C	C	C
Pigmy Owl	F, W	F	F	F	F
Burrowing Owl	G	C	C	C	C
Spotted Owl	F	R	R	R	R
Long-eared Owl	R, W, F	F	F	F	F
Short-eared Owl	G	R	R	R	R
Saw-whet Owl	F, W	F	F	F	F
Anna's Hummingbird	S, W, R	C	C	C	C
Rufous Hummingbird	F, S	C			
Allen's Hummingbird	S, R, F	C	C		C
Calliope Hummingbird	S, F	F	F		
Belted Kingfisher	R, O	C	F	F	C
Red-shafted Flicker	F, R, W	C	C	C	C
Pileated Woodpecker	F	R	R	R	R
Acorn Woodpecker	W	C	C	C	C
Yellow-bellied Sapsucker	F, R, W	F		F	F
Hairy Woodpecker	F, W	C	C	C	C
Downy Woodpecker	R, W, F	C	C	C	C
Eastern Kingbird	G, R			F	
Ash-throated Flycatcher	W, S, R	C	C		
Black Phoebe	R, G	C	C	C	C
Say's Phoebe	G				F
Thrall's Flycatcher	R	F	R	F	

SPECIES	HABITAT	OCCURRENCE AND SEASON			
		SPRING	SUMMER	FALL	WINTER
Hammond's Flycatcher	F	R		R	
Western Flycatcher	F, W, R	C	C	C	
Olive-sided Flycatcher	F		C		
Western Wood Pewee	F, W, R		C		
Horned Lark	G	C	C	C	C
Violet-green Swallow	A, F	C	C	C	
Bank Swallow	A		R		
Rough-winged Swallow	A		C		
Barn Swallow	A		C		
Cliff Swallow	A		C		
Steller's Jay	F, W	C	C	C	C
Scrub Jay	W, S	C	C	C	C
Common Raven	A, G	F	F	F	F
Common Crow	G, R, W	C	C	C	C
Chestnut-backed Chickadee	F, R, W	C	C	C	C
Common Bushtit	W, R, S	C	C	C	C
Red-breasted Nuthatch	F, W, R	C		C	C
Pigmy Nuthatch	F	F	F	F	F
Brown Creeper	F	C	C	C	C
Wrentit	S, R	C	C	C	C
House Wren	W, R, F, S	C	C	R	R
Winter Wren	F	F	F	F	F
Bewick's Wren	S, W, R	C	C	C	C
Mockingbird	G, R, W	C	C	C	C
California Thrasher	S	C	C	C	C
Robin	F, W, R	C	C	C	C
Varied Thrush	F, R, W, S	F	F	R	R
Hermit Thrush	F, W, R	C	C	C	C
Swainson's Thrush	R, F		C		
Western Bluebird	G, W	C	C	C	C
Townsend's Solitaire	F, W, R	R		R	R

SPECIES	HABITAT	OCCURENCE AND SEASON			
		SPRING	SUMMER	FALL	WINTER
Golden-crowned Kinglet	F	C	C	C	C
Ruby-crowned Kinglet	R, W, F	C		C	C
Water Pipit	G	C		C	C
Bohemian Waxwing	W				R
Cedar Waxwing	F, W, R, S	C	R	C	C
Northern Shrike	G				R
Loggerhead Shrike	G, W	C	C	C	C
Starling	G, R, W	C	C	C	C
Hutton's Vireo	W	F	F	F	F
Solitary Vireo	W, F, R	F		F	
Warbling Vireo	R, F		C		
Black-and-White Warbler	R, W	R		R	
Yellow Warbler	R		C		
Myrtle Warbler	R, S, W, F	F		F	F
Audubon's Warbler	R, W, F, S	C		C	C
Townsend's Warbler	F, W	F		C	F
Hermit Warbler	F, W	R	F	R	R
Palm Warbler	R, S	R		R	R
Yellowthroat	R	C	C	C	F
Yellow-breasted Chat	R		F		
Wilson's Warbler	R, S, F	C	C		
American Redstart	R	R	R	R	R
House Sparrow	Buildings	C	C	C	C
Western Meadowlark	G, S	C	C	C	C
Yellow-headed Blackbird	G	R		R	R
Redwinged Blackbird	G	C	C	C	C
Tricolored Blackbird	G			F	R
Hooded Oriole	R	R	R		
Bullock's Oriole	R, W	R	R	R	R
Brewer's Blackbird	G	C	C	C	C

SPECIES	HABITAT	OCCURRENCE AND SEASON			
		SPRING	SUMMER	FALL	WINTER
Brown-headed Cowbird	G, R, W, F	C	C	C	F
Western Tanager	F, W, R	C	F	R	R
Black-headed Grosbeak	R, W, F	C	C		
Lazuli Bunting	S, G, R, W		C		
Evening Grosbeak	R, W	R		R	R
Purple Finch	F, W	C	C	C	C
Cassin's Finch	R, W, F				R
House Finch	G, W, R	C	C	C	C
Pine Siskin	F, W, R	C	C	C	C
American Goldfinch	R, S, G	C	C	C	C
Red Crossbill	F	F	F	F	F
Rufous-sided Towhee	S, R, W, F	C	C	C	C
Brown Towhee	S, R, W	C	C	C	C
Savannah Sparrow	G	C	C	C	C
Grasshopper Sparrow	G	R	R	R	R
Vesper Sparrow	G	R		R	R
Lark Sparrow	G, W, S	C	C	C	F
Rufous-crowned Sparrow	S	F	F	F	F
Slate-colored Junco	S, G, W	R		R	R
Oregon Junco	F, S	C	C	C	C
Chipping Sparrow	F, W		C		
Brewer's Sparrow	S	R		R	R
Harris' Sparrow	S	R		R	R
White-crowned Sparrow	G, S, R	C	C	C	C
Golden-crowned Sparrow	S, R, F, W	C		C	C
White-throated Sparrow	S, R, F, W	R		R	R
Fox Sparrow	S, R	C			C
Lincoln's Sparrow	S, G, R	F		F	F
Song Sparrow	R, S	C	C	C	C
Lapland Longspur	G			R	

APPENDIX B

PLANT MATERIALS CLOSELY RELATED TO THE NATURAL ENVIRONMENT

QUERCUS CHRYSOLEPIS Canyon live oak

Native to mountain slopes and canyons of California and Oregon. Round-headed, somewhat spreading, 20'-60' tall, with smooth whitish bark. The leaves are oval, 1"-2" long, shiny medium green above, and greyish or whitish beneath. Leaf edges are smooth or toothed.
The crown is round topped and sometimes 100' across. Native in mountain canyons, moist ridges, and flats. Very variable in size from low dense chaparral bush to a wide spreading tree. Commonly growing on coves, sheltered depressions, dry, sandy and gravelly soils, exposed slopes, and the rich humous soils of sheltered canyon bottoms. Endures heavy shade in youth but later seeks more light.

● DECIDUOUS TREES

ACER MACROPHYLLUM Bigleaf maple

Native to streambanks and moist canyons. A broad-topped tree that is 30'-90' high. The leaves are large, 3-5 lobed, 6"-15" wide, and turn yellow in the fall.

AESCULUS CALIFORNICA California buckeye

Native to dry slopes and canyons below 4000'. Shrub-like or small tree with several stems that are 10'-20' tall. The compound leaves have 5-7 leaflets that are 3" to 6" long. During drought conditions, the leaves drop in July, but will remain until fall if given water. The bark is smooth gray and the crown is broad and open. Chiefly useful in forming loose cover on exposed dry, rocky foothill slopes, in gulches, and along hill streams where few other trees grow.

ALNUS RHOMBIFOLIA White alder

Native along streams. Very fast growing, 50'-90' tall with a 40' spread. The spreading or ascending branches are often pendulous at the tips. The truck is tall and straight with whitish or gray-brown bark. The broad, open, dome-like crown, endures a great deal of shade, and requires moderate overhead light for best growth.

ALNUS RUBRA Red alder

Native to stream banks and marshes, the tree may grow to 90' high, but usually to 45'-50'. It has attractive, light gray, smooth bark and dark green leaves that are rusty and hairy beneath and 2" to 4" long. The branches are slender, spreading and somewhat pendulous. Leaf blades are ovate to elliptic-ovate, 2-1/2"-6" wide, dark green, and glabrous. The plant can survive a surprising amount of brackish water.

FRAXINUS LATIFOLIA Oregon ash

The leaves are 6"-12" long and divided into 5-7 oblong to oval, light green, hairy or smooth leaflets. The end leaflet is larger than the side leaflets. The tree is shade intolerant, and grown on rich deep humous sandy soils, or moist rocky, gravelly soils. It is fairly fast growing and useful as a street tree, shade tree, or lawn tree.

● EVERGREEN SHRUBS

ARCTOSTAPHYLOS HOOKERI Hooker manzanita

A low erect or almost procumbent shrub, 1/2'-3' tall, with smooth dark-reddish brown or deep purplish bark. Leaf blades are elliptic or ovate, 1/2" to 3/4" long, bright green, and shining and glabrous on both sides. The flowers are pink. It grows on sandy flats and in open pine woods in the Monterey area. Slow growing as mounds that are 1/2'-4' across and spreading to 6'.

ARCTOSTAPHYLOS EDMUNDSII Little Sur manzanita

Native to Hurricane Point, Monterey. Grows 4" to 24" high and 12' wide. The leaves are roundish, light green, 1" long attached to red stems. The pink flowers are evident in December and January. Can be used for border and massed ground cover in full shade, semi-shade, or full sun. Grows on well-drained, rocky loam but where surface drainage is slow, mound the soil for quick runoff.

ARCTOSTAPHYLOS STANFORDIANA Stanford manzanita

Native to Mendocino, Napa, and Sonoma counties. A spreading shrub that grows to about 3' tall. The bark is smooth reddish-brown and the leaves are glossy, deep green and 1" to 1-3/4" long. Pink flowers are in open clusters. Relatively straight and slender stems and branches. Must have rapid drainage to avoid root rot. Grows on heavy or light soil and needs little water.

ARCTOSTAPHYLOS UVA-URSI Bearberry or Kinnikinnick

Native to San Mateo County. Useful as a ground cover. Prostrate and spreading to 15 feet by stem rooting. The bright, glossy green, leathery leaves grow to 1" in length and turn red in the winter. Useful for slopes too steep for lawn. Slowness in initial growth causes weed problems. Mulch with peat moss or sawdust to keep down the weeds.

ARTEMISIA PYCNOCEPHALA Sandhill sage

A drought resistant, shrubby perennial that grows erect and rounded to about 1'-2' tall. The soft, silvery, white or gray leaves are crowded and divided into narrow lobes. Plant in full sun, do not over water, and replace every two years.

ATRIPLEX LENTIFORMIS Quail bush

A deciduous and densely branched shrub that is 3'-10' high and 6'-12' wide. The oval bluish grey leaves are 1/2" to 2" long. Useful as a hedge or windbreak.

CARPENTERIA CALIFORNICA Carpenteria bush-anemone

An erect shrub, 3'-7' tall with numerous clustered stems and light colored bark that peels into thin shreds. The leaves are opposite, evergreen, thick, oblong-lancerate, 2" to 4-1/2" long, 3/4" to 1-1/4" wide, dark green above and gray beneath. Thrives best in well-drained soils and somewhat protected areas. Suckers freely. Grows in shade or sun, but best in light shade. Unusually susceptible to aphids.

CEANOTHUS GLORIOSUS Point Reyes ceanothus

A low, dense, ground cover growing 4" to 24" high and spreading to 5'. The leaves are leathery, roundish, dark green, and 1/2" to 1-1/2" long with spiny-toothed edges. Excellent tolerance to heavy irrigation. Flowers from March to May. Plants growing beyond oceanic influence have a more upright form.

CEANOTHUS GRISEUS Carmel ceanothus

A ground cover shrub that varies in growth from low and spreading to upright (8' high). Leaves are dark green, 1" to 2", and gray-hairy beneath. Flowers are violet-blue. Fair to good garden tolerance.

CEANOTHUS THYRSIFLORUS Blueblossom

A shrub or small tree that is extremely variable in growth but usually is 4'-8' tall, sometimes to 20'. The glossy dark green leaves are 1" to 2" long. The dense clusters of flowers range in color from deep to washed-out blue. Fair irrigation tolerance.

COMAROSTAPHYLIS DIVERSIFOLIA (ARCTOSTAPHYLOS DIVERSIFOLIA)
Summer-holly (Toothed manzanita)

An evergreen shrub or small tree growing from 6'-18' tall. The bark is gray, and the leaves are leathery, 1" to 3" long, shiny dark green above, and white hairy beneath. Small white manzanita-like flowers show in April to May and are followed by clusters of red berries. Adaptable to many situations, but grows best in half shade with some moisture and good drainage.

MIMULUS SPP. (DIPLACUS SPP.) Shrubby Monkeyflower

Shrubby perennial or evergreen shrub or shrublet that grows erect, 1'-4' high, and branches from base. The glossy leaves are usually dark green. The plant requires sun and well-drained soils. The species can survive with very little water.

ERIOGONUM ARBORESCENS Santa Cruz Island buckwheat

Grows 3'-4' and sometimes 8' tall while spreading 4'-5' or more. The trunk and branches have shreddy gray to reddish bark. The leaves are rather narrow, 1/2'-1-1/2' long, and gray-green in color.

ERIOGONUM GIGANTEUM Saint Catherine's lace

Plant has a freely branching habit with leaves that are grayish-white, broadly oval, and 1" to 2-1/2" long. The trunk is 3'-8' high and often 4" in diameter with rough bark.

FREMONTIA MEXICANA Southern flannel bush

Evergreen shrubs or small trees that are fast growing, 6'-20' tall, with shallow roots. The leathery leaves are dark green above with felt-like covering beneath and are 1-1/4" to 3" long. Flowers are 1-1/2" to 2-1/2" wide. The plants are most suitable on hillsides, needs excellent drainage, are drought resistant, and require summer water.

GARRYA ELLIPTICA Coast silktassel

An evergreen shrub growing 4'-8' tall or a small tree of 20'-30'. The elliptical leaves grow to 2-1/2" long, are dark green above, gray and woolly beneath, have many edges, and densely clothe the branches. Grows very well in sun or part shade and will take summer water. Occurs naturally and usually in small groups.

HETEROMELES ARBUTIFOLIA Toyon or Christmasberry

An evergreen shrub, 6'-10' tall, or small tree 15'-25' tall. The thick glossy, leathery, dark green leaves are 2" to 4" long. The ashy bark is smooth and pale. It is drought tolerant and useful as a traffic barrier.

MYRICA CALIFORNICA Pacific wax myrtle

Grows as a low flattened mass at the beach. When protected from the wind it forms a big shrub or tree to 30' tall, usually with many upright trunks. The glossy dark green leaves are 2" to 4-1/2" long and about 1/2" wide with toothed edges. The bark is smooth, thin, and grayish brown. The plant is very shade tolerant and native in canyons or on moist hill slopes.

RHAMNUS CALIFORNICA Coffeeberry

An evergreen shrub that grows low and spreading or upright 3'-15' tall. The leaves are 1" to 3" long, shining dark green to dull green above, and paler beneath. Leaves are usually small and thick on dry habitats and large and thin in moist and shady sites.

RIBES VIBURNIFOLIUM Catalina perfume, Evergreen currant

A low growing shrub to 3' tall and up to 12' wide. The low arching or half trailing wine red stems may root in moist soil. Leaves are leathery, roundish, dark green, and about an inch wide. Useful as ground or bank cover in direct sun or half shade. Drought tolerant when established. Ground cover under oaks.

SOURCES:

McMinn, Howard Earnest, Evelyn Maino McMinn "An Illustrated Manual of Pacific Coast Trees" Berkeley, Calif. University of Calif. Press 1935

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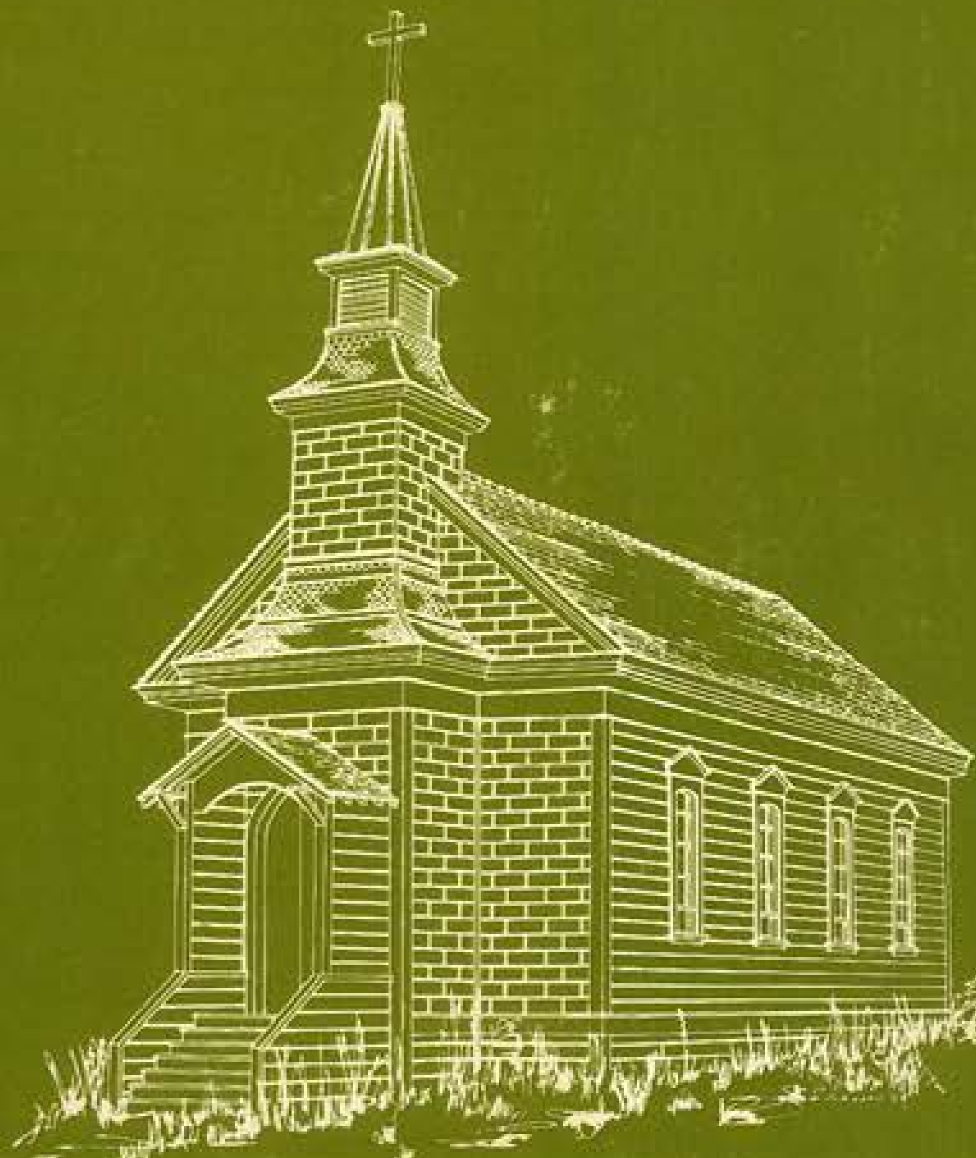
"Sunset Western Garden Book" Menlo Park, Calif. Lane Pub. Co. 1954

Our Lady of Loretto Church faces the Town Square. Dedicated in 1867 it is still in use today.



MARIN COUNTY PLANNING DEPARTMENT


GEOLOGIC HAZARDS
EXISTING LANDSLIDES
TERRACE AND FLOOD PLAIN DEPOSITS
COLLUVIUM
OBSCURING VEGETATION