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Mineral Land Classification

The California Geological Survey (CGS) provides objective economic-geologic expertise to assist in the protection and development of mineral resources through the land-use planning process. This effort is mandated by the Surface Mining and Reclamation Act of 1975 (SMARA). The primary products are mineral land classification maps and reports. Local agencies are required to use the classification information when developing land-use plans and when making land-use decisions.

Publication Index



[Publications of the SMARA Mineral Land Classification Project Dealing with Mineral Resources in California](#) (pdf) - This reference is a chronological index of mineral land classification reports produced by staff of CGS's SMARA Mineral Land Classification Project since 1979. The reports are also indexed by county.

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Aggregate Sustainability in California - Map Sheet 52, Updated 2018

This map and accompanying report provides general information about the current availability of California's permitted aggregate reserves. The map compares projected aggregate demand for the next 50 years with currently permitted aggregate reserves for more than 30 aggregate study areas throughout the state. The map also highlights regions where there are less than 10 years of permitted aggregate supply remaining.

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The State Mining and Geology Board

Attn: Jeffrey Schmidt

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Sacramento, CA 95814

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MINERAL LAND CLASSIFICATION OF VENTURA COUNTY

PART I

DESCRIPTION OF THE
MINERAL LAND CLASSIFICATION PROJECT OF VENTURA COUNTY

PART II

CLASSIFICATION OF
SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS,
SIMI PRODUCTION-CONSUMPTION REGION

PART III

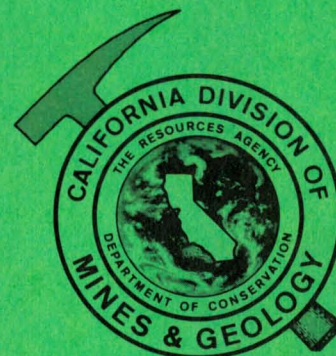
CLASSIFICATION OF
SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS,
WESTERN VENTURA COUNTY PRODUCTION-CONSUMPTION REGION

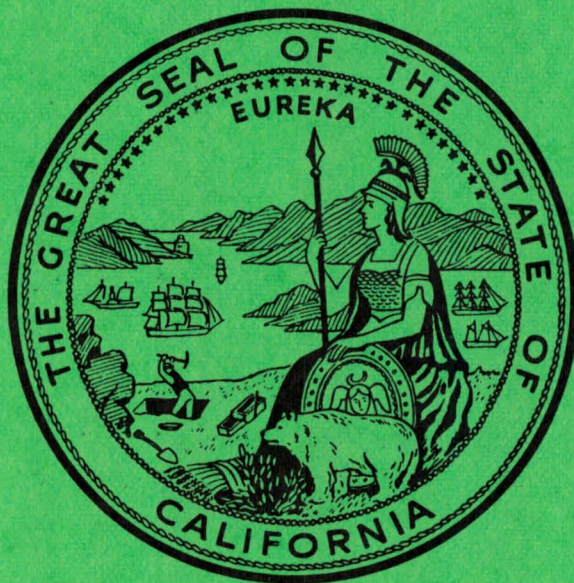
1981

CALIFORNIA DIVISION OF MINES AND GEOLOGY

SPECIAL REPORT 145

PARTS I, II and III





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SPECIAL REPORT 145

MINERAL LAND CLASSIFICATION OF VENTURA COUNTY

PART I

**DESCRIPTION OF THE
MINERAL LAND CLASSIFICATION PROJECT OF VENTURA COUNTY**

PART II

**CLASSIFICATION OF
SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS,
SIMI PRODUCTION-CONSUMPTION REGION**

PART III

**CLASSIFICATION OF
SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS,
WESTERN VENTURA COUNTY PRODUCTION-CONSUMPTION REGION**

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PREFACE

The principal objective of this report is to describe and explain the California Division of Mines and Geology's classification of the Ventura area into Mineral Resource Zones, based on guidelines adopted by the California State Mining and Geology Board and under authority granted by the Surface Mining and Reclamation Act of 1975 (SMARA). Another objective is to assist the State Mining and Geology Board in designating lands that are most needed for their mineral content. The designation process is designed to assist and guide local lead agencies responsible for land-use planning and management.

The Ventura area, which includes the southern part of Ventura County and parts of southwestern Los Angeles County, has a population of nearly half a million people and is one of the most rapidly urbanizing areas in California.

As with any metropolitan or rural region undergoing urban development, it is important that the Ventura area has adequate supplies of readily available mineral commodities. Minerals used in construction, particularly sand, gravel, or stone used in concrete, must be available in large quantities and at reasonable costs. However, it often happens that, as more and more land in a region becomes urbanized, nearby available sand and gravel deposits suitable as sources of aggregate tend to be either depleted by mining or lost to competing land uses. As this happens, more and more distant sources must be used to supply the region's needs for aggregate. Increases in haulage distance bring increases in the cost of aggregate to consumers and also undesirable impacts on the environment. However, appropriate lead agency policies and procedures can extend the life of the local supply of aggregate significantly.

This report consists of three parts covering two production-consumption regions that have been identified in the Ventura area. Part I is an introductory section describing the background, purpose, and scope of the overall project. Part II presents the classification of aggregate resource areas in the Simi Production-Consumption Region. Part III presents the classification of aggregate resource areas in the Western Ventura County Production-Consumption Region. Information in Parts II and III include maps showing the locations of significant sand and gravel deposits of the two production-consumption regions as well as tables, charts, and discussions that present data on population, production, aggregate consumption, future requirements, and estimates of aggregate resources.

Some of the resource volume numbers for the Western Ventura County P-C Region have had minor revisions since the preliminary draft of this report was released. This final version of the report shows the correct figures. None of these changes were substantial in size and they have not altered basic conclusions reached regarding aggregate resources in the County.

The reader may also wish to refer to the California Division of Mines and Geology Special Report 139, "Aggregates in the Greater Los Angeles Area" (Evans and others, 1979). Special Report 139 describes and evaluates the significance, use, prices, marketing, transportation, supply, and other factors that relate to the aggregate industry of the greater Los Angeles metropolitan area, including southern Ventura County. Special Report 143 (Anderson and others, 1979), the first Mineral Lands Classification Study done under the Surface Mining and Reclamation Act, served as a model for the following report.

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EXECUTIVE SUMMARY

The California Division of Mines and Geology (CDMG) has classified land in Ventura County south of the Los Padres National Forest Lands according to the presence or absence of construction aggregate resources. Special attention has been given to aggregate suitable for use in Portland cement concrete, the highest quality use of sand, gravel, and crushed rock. The classification was completed in accordance with guidelines established by the State Mining and Geology Board in compliance with the Surface Mining and Reclamation Act of 1975.

Southern Ventura County was divided into two separate regions on the basis of existing aggregate production and consumption patterns. Each region is discussed as a separate part of this report: the Simi Production-Consumption Region as Part II and the Western Ventura County Production-Consumption Region as Part III (see Figure 1.4 on page 6). These parts present results of the mineral land classification, aggregate resource tonnage estimates, and projected aggregate needs over the next 50 years for their respective areas.

Aggregate resource tonnage estimates for individual sand and gravel deposits were calculated mainly on the basis of limited field observations, analyses of water-well records, and a broad understanding of the geology of the locality in question. Exploratory drilling and rock-quality laboratory testing to generate independent, detailed data could not be done. It should be recognized, therefore, that the figures for resource tonnage, although based on sound geologic reasoning, are *estimates* and, as such, have an inherent degree of uncertainty.

Also, it must be noted that large aggregate resource tonnage figures are presented in the text of this report. These figures represent the total aggregate resource estimated to underly a particular area, sometimes to relatively great depths. The estimates represent the total quantity of aggregate material that is geologically available for mining, but they do not reflect such constraints as current land use (except urban areas) or political, sociological, environmental, economical, and technological factors. Given the above-mentioned constraints, it is unlikely, as a practical matter, that much of the large resource tonnage estimates will ever be translated into processed aggregate. However, the material that might be regarded as unminable because of the above constraints remains available and could meet future needs, were they ever to become great enough to warrant extraction of the material.

Figures for total aggregate needs over the next 50 years were projected on the basis of past per capita consumption rates and projected population increases. As guideline figures for future aggregate needs, these estimates are valid. It is, of course, always possible that unforeseen events—for example, a massive urban-renewal effort or reconstruction after a major disaster—will significantly change the amount of aggregate needed to fulfill future needs.

The Simi Production-Consumption (P-C) Region has a population of over 300,000, which is projected to increase to over 600,000 within the next 50 years. The average annual per capita rate of aggregate consumption within this region is estimated to be 5.5 tons. Western Ventura County, the westernmost of the two P-C regions, has a population of over 350,000, which is expected to increase to over 700,000 within the next 50 years. The average annual per capita rate of aggregate consumption within this region is estimated to be 11.0 tons.

In the Simi P-C Region, aggregate is produced from the Simi Conglomerate and Saugus-San Pedro Formations by six operating companies at six operating sites. In the Western Ventura County P-C Region, aggregate is extracted from the Santa Clara and Ventura River systems by three companies at six operating sites.

Major conclusions regarding aggregate availability for the Simi P-C Region are summarized below:

- 1) Over the next 50 years, the region will need over 130 million tons of aggregate to meet its requirements, 40 million tons of which must be coarse material (particles larger than 4 mm in size).
- 2) Estimates derived from the present study indicate that there are approximately 170 million tons of reserves available, 50 million tons of which represent coarse material suitable for use in Portland cement concrete. Aggregate reserves and resources are present within the Simi Conglomerate and the Saugus-San Pedro Formations. Current mining operations are producing both fine and coarse aggregate from each geologic unit, but in time operations in the Simi Conglomerate will run out of fine material and it will have to be transported from sources in the Saugus-San Pedro Formations. Likewise, operations in the Saugus-San Pedro Formations

in time will run out of coarse material and it will have to be transported from sources in the Simi Conglomerate. The amount of transportation that will then be required will significantly increase the price of Portland cement concrete and have a severe impact on the environment of the region. Nevertheless, for the Simi P-C Region to continue to meet its Portland cement concrete needs from local sources through the next 50 years, its Portland cement concrete will have to be produced from a mix of materials from both the Simi Conglomerate and the Saugus-San Pedro Formations.

- 3) It is estimated that there are over a billion tons of resources available. Of this, over 550 million tons represent coarse material that is suitable for use in Portland cement concrete.
- 4) The current reserves are adequate to cover the projected 50-year needs provided depletion is not accelerated by an increase in local consumption rate, draw-down by adjacent P-C regions, or a loss of reserves as a result of some use of the land that would preclude extraction.
- 5) As a practical matter, much, if not most, of the resources identified in the current study may never translate into reserves for economic, technological, environmental, or political reasons.
- 6) Provisions should be made to designate Sector A and substantial portions of Sectors B and C as having regional significance as sources of aggregate suitable for Portland cement concrete so that these areas will be available for the 50-year requirements for the region. Aggregate reserves and resources must come from sectors A, B, and C in order to ensure that the proper size distribution is available for Portland cement concrete aggregate (see item 2 above).

Major conclusions regarding aggregate availability for the Western Ventura County P-C Region are summarized below:

- 1) Over the next 50 years, the region will need approximately 310 million tons of aggregate to meet its requirements. Of this, 190 million tons must be material suitable for Portland cement concrete aggregate.
- 2) The present study estimates that there are approximately 40 million tons of aggregate reserves suitable for Portland cement concrete, asphaltic concrete, and road base (30 million tons for Portland cement concrete only). Current reserves are adequate for 13 years.
- 3) Resources suitable for use in Portland cement concrete within the Western Ventura County P-C Region are estimated to be 4 billion tons. Of these, 265 million tons occur within company-held lands below allowed mining depths. The remainder of these occur elsewhere within the Santa Clara River system.
- 4) The inhabitants of the Western Ventura County P-C Region have only three options by which they can meet the shortfall of 160 million tons of aggregate suitable for use in Portland cement concrete to satisfy their 50-year requirement. These options are: (1) permit mining to greater depths within the current mining areas and/or extend the lateral size of the existing pits; (2) move mining operations to some new locations within the river systems where resources are known to exist; (3) acquire resources from outside the region. All three options present problems that must be evaluated. These include environmental, safety, and economic problems.
- 5) As a practical matter, much, if not most, of the resources identified in the Western Ventura County P-C Region may never become reserves for economic, technical, environmental, or political reasons.
- 6) It is recommended that the State Mining and Geology Board consider designating areas contained in Sectors A-J as lands containing sand and gravel of regional significance.

GLOSSARY OF GEOLOGICAL TERMS

(adapted from American Geological Institute and from USGS Bulletin 1450- A)

- **aggregate:** Any of several hard, inert, construction materials (such as sand, gravel, shells, slag, crushed stone, or other mineral material), or combinations thereof, used for mixing in specified size distributions with a cementing or bituminous material to form such products as concrete, asphaltic concrete, mortar, and plaster.
- **aggregate reserves:** Aggregate materials concluded to be acceptable for commercial use that exist within property boundaries owned or leased by an aggregate producing company and for which permission allowing extraction and processing has been granted by the proper land-use regulation authorities.
- **aggregate resources:** Resources include reserves as well as all similar potentially usable aggregate materials that may be mined in the future, but for which no use permit allowing extraction has been granted, or for which development has not been definitely established to be feasible based upon current technological or economic conditions.
- **alluvial fan:** A low, outspread, relatively flat to gently sloping deposit of sand and gravel, and shaped in aerial view like an open fan or a segment of a cone, normally deposited by a stream with its apex at the place where the stream issues from a narrow mountain valley upon a plain or broad valley.
- **alluvial terrace:** A stream terrace composed of unconsolidated alluvium (including gravel), produced by renewed downcutting of the flood plain by a rejuvenated stream.
- **alluviation:** The process of deposition or formation of alluvium or alluvial features at places where stream velocity is decreased or streamflow is checked.
- **alluvium:** A general term for clay, silt, sand, gravel or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment.
- **asphaltic concrete:** Mixed asphalt (binder) and crushed stone, gravel, and sand used for paving and roofing.
- **base level:** The lowest level toward which erosion of a region of the Earth's surface constantly progresses but seldom, if ever, reaches; especially the level below which a stream cannot erode its bed. The general, or ultimate base level for the land surface is sea level, but temporary base levels may exist regionally.
- **base material:** Specified material (coarse gravel, crushed stone) used in the construction of the base course, a bottom layer designed for one or more functions such as distributing load, providing drainage, and minimizing frost action.
- **basement rock:** An assemblage of undifferentiated rocks that underlies the younger, sedimentary deposits in the area. The basement rocks are igneous and metamorphic in origin.
- **basin:** A depressed area in which sediments accumulate.
- **bedrock:** A general term for the rock, usually solid, that underlies soil or other unconsolidated material.
- **Cenozoic:** An era of geologic time, from the end of the Mesozoic to present. Considered to have begun about 70 million years ago.
- **coalescing alluvial fans:** A series of alluvial fans forming a broad, continuous, gently inclined surface extending along and from the base of a mountain range out into and around an inland basin.
- **consolidation:** Any process whereby loosely arranged, soft, or liquid earth materials become firm and coherent rock.
- **construction materials:** Natural and manufactured industrial mineral and rock materials used by the construction industry. These materials include: aggregate (crushed stone, sand and gravel, lightweight aggregate, and slag), cement and cement raw materials, dimension and cut stone, granules, gypsum and anhydrite, and insulating materials.

- **crystalline rock:** An igneous or metamorphic rock consisting wholly of interlocking crystals. Igneous rocks develop through cooling from a molten state. Metamorphic rocks have undergone recrystallization as a result of temperature and pressure changes.
- **deposit:** Material of any type or from any source that has accumulated by some natural process or agent, either in the form of consolidated or unconsolidated material.
- **detrital:** Pertaining to or formed from detritus, which is loose rock and material (gravel, sand, silt, and clay) that is worn off or removed from older rocks and moved from its place of origin.
- **deuteric:** A water-associated alteration process that occurs during the late stages of crystallization of an igneous rock. Certain minerals composing the rock may react or be transformed into different minerals.
- **distal:** Formed farthest from the source area.
- **gabbro:** A dense, dark crystalline igneous rock - the intrusive equivalent of basalt.
- **granitic gneiss:** A metamorphic rock that has a mineral composition similar to granite.
- **"hardpan":** A term used loosely to designate any relatively hard layer that is difficult to excavate or drill.
- **indurated:** Term applied to a deposit that has been hardened by the action of pressure, cementation, and heat.
- **intrusion:** The process of emplacement of molten rock in pre-existing rock.
- **lens:** A geologic deposit bounded by converging surfaces (at least one of which is curved), thick in the middle and thinning out toward the edges, resembling a convex lens.
- **market area:** The area in which a commodity is sold and used. For bulky low-unit-price materials like aggregate, the market area is usually a specific geographic region of the state. This is a production-consumption region in the CDMG classification of sand and gravel.
- **massive unit:** Sedimentary rock that occurs in very thick, homogeneous beds; sedimentary rock that is obscurely bedded or seems to be without internal structure.
- **Mesozoic:** An era of time, from the end of the Paleozoic to the beginning of the Cenozoic (about 280 million years ago to 70 million years ago).
- **Paleozoic:** An era of geologic time, from the end of the Precambrian to the beginning of the Mesozoic (about 600 million years ago to 280 million years ago).
- **petrographic analysis:** Description and systematic classification of rocks by means of microscopic examination of thin sections of rocks.
- **Precambrian:** All geologic time before the beginning of the Paleozoic.
- **Quaternary:** The second period of the Cenozoic era (following the Tertiary), thought to cover last two or three million years.
- **rejuvenated:** A stream stimulated to renewed erosive activity, as by uplift or by a drop of sea level; stream that has reverted to the activities and forms of a more youthful stage.
- **source area:** The area from which the constituent materials of a sedimentary rock are derived.
- **tectonism:** General term for all movement of the crust produced by earth forces, including the formation of ocean basins, continents, plateaus, and material ranges.
- **terrace:** A relatively level or gently inclined surface, generally less broad than a plain, that commonly occurs along the margin and above the level of a body of water, marking a former water level.
- **terrane:** Term applied to a rock or group of rocks and to the area in which it outcrops.
- **Tertiary:** The first period of the Cenozoic era, thought to have covered the time span between 65 and three to two million years ago.

- **wash:** A broad, shallow, gravelly, or stony, normally dry bed of an intermittent stream.
- **waste factor:** A numerical factor used to calculate the amount of a mineral deposit that does not meet industrial specifications and therefore is not of economic value. It is given as a percent and largely reflects the amount of silt or clay in a sand and gravel deposit.
- **youthful:** First stage in the development of a stream, characterized by active and rapid downcutting, forming a deep, narrow, steep-walled, V-shaped valley with a steep and irregular gradient.
- **zeolite:** A large group of white or colorless minerals that commonly occur as secondary minerals filling cavities and coating cracks in basaltic lavas and other rocks.
- **zeolitization:** Introduction of, or replacement by, a mineral (or minerals) of the zeolite group.

PART I

DESCRIPTION OF THE MINERAL LAND CLASSIFICATION PROJECT OF VENTURA AREA

BACKGROUND AND PURPOSE

To establish an effective and comprehensive surface mining and reclamation policy, the California Legislature enacted the Surface Mining and Reclamation Act (SMARA) of 1975 (see Appendix A-1). SMARA requires the State Geologist to classify, according to the presence or absence of significant mineral deposits, certain areas of the State subject to urban expansion or other irreversible land uses incompatible with mining. Urbanizing areas in this context are those identified by the State Office of Planning and Research (OPR) or by the State Mining and Geology Board.

The Board, upon receipt of the classification information from the State Geologist, transmits the information to the appropriate lead agencies and other interested parties. Following compliance with California Environmental Quality Administration (CEQA) requirements and after public hearings, the Board may designate identified mineral deposits in classified areas as being of statewide or regional significance. The objective of the classification and designation processes is to ensure, through appropriate lead agency policies and procedures, that mineral deposits of statewide or of regional significance are available when needed.

On January 13, 1978, the State Mining and Geology Board adopted Resolution No. 22, "Priorities for Mineral Lands Classification" (revised November 2, 1978), which scheduled the general order of the work for the State Geologist to classify different areas within the State (Appendix A-2). The priorities for classification were determined by the Board pursuant to a mandate in SMARA. The criterion used by the Board in establishing priorities is the general perception of the urgency of need for mineral resource information and planning assistance by the various lead agencies. Aggregate resources were deemed to be of more immediate concern than other mineral commodities; therefore, the Board reflected this also in setting the priorities.

The "Guidelines for Classification and Designation of Mineral Lands" were adopted by the State Mining and Geology Board on June 30, 1978 (Appendix A-3). The purpose of these guidelines is to provide direction to the State Geologist in carrying out the classification of mineral land, and to establish procedures for the designation process. Section I.1a of the "Guidelines" directs the State Geologist to classify specified areas into *Mineral Resource Zones* (MRZ's) or *Scientific Resource Zones* (SZ's) as defined in Section I.2 of the "Guidelines" (Appendix A-3). In addition, Section I.3 of the "Guidelines" directs that mineral land classification reports identifying areas classified as containing significant deposits of construction material (sand, gravel, and crushed stone) include information about (1) the location and estimated total quantity of construction material that is geologically available for mining, (2) the limits of the market (consumption) region which the potentially producible com-

modity would serve, and (3) an estimate of the total quantity of material that will be needed to supply the requirements of the county and consumption region for the next 50 years. This information assists the State Mining and Geology Board in determining the regional or statewide significance of these types of deposits for purposes of designation.

The Aggregate (Sand and Gravel and Crushed Rock) Mineral Land Classification of Ventura Area was initiated in August 1979 by the State Geologist. The Ventura area was assigned a high priority for classification in response to a request by land planners of Ventura County and in recognition that the Ventura area is undergoing rapid urbanization. The project area includes the southern part of Ventura County and parts of southwestern Los Angeles County (Figure 1.1).

The emphasis in the Ventura County classification is placed on Portland cement concrete aggregate. The material specifications for this commodity are more restrictive than for other aggregate types, so fewer sand and gravel deposits satisfy them. Those deposits that are acceptable for use as PCC aggregate are thus the scarcest aggregate resources in the county and are of the most concern in terms of planning future availability of this commodity.

Classification for other mineral resources will be done following the initial statewide classification of urbanizing areas for aggregate resources.

In keeping with the goal of determining the regional significance of a particular mineral deposit, each major sand and gravel deposit or bedrock deposit in the Ventura area has been evaluated separately. The project area was divided into two production-consumption (P-C) regions on the basis of existing Portland cement concrete aggregate production and consumption patterns. In determining these patterns and, subsequently, in evaluating the significance of deposits within each P-C region, alternative sources, including the possible available resources of adjacent P-C regions, were considered.

REFINING PROJECT BOUNDARIES

Maps supplied by the State Office of Planning and Research (OPR) served to identify urbanized and urbanizing areas within the Ventura area (Figure 1.2). These maps are part of a series of eight issued by the Office of Planning and Research in July 1975 as the "Urban Expansion Map of California." The maps were published at a scale of 1:500,000 (1 inch approximately equal to 8 miles), and show "Existing Urban - 1970" and "Projected Urban - 1990" areas.

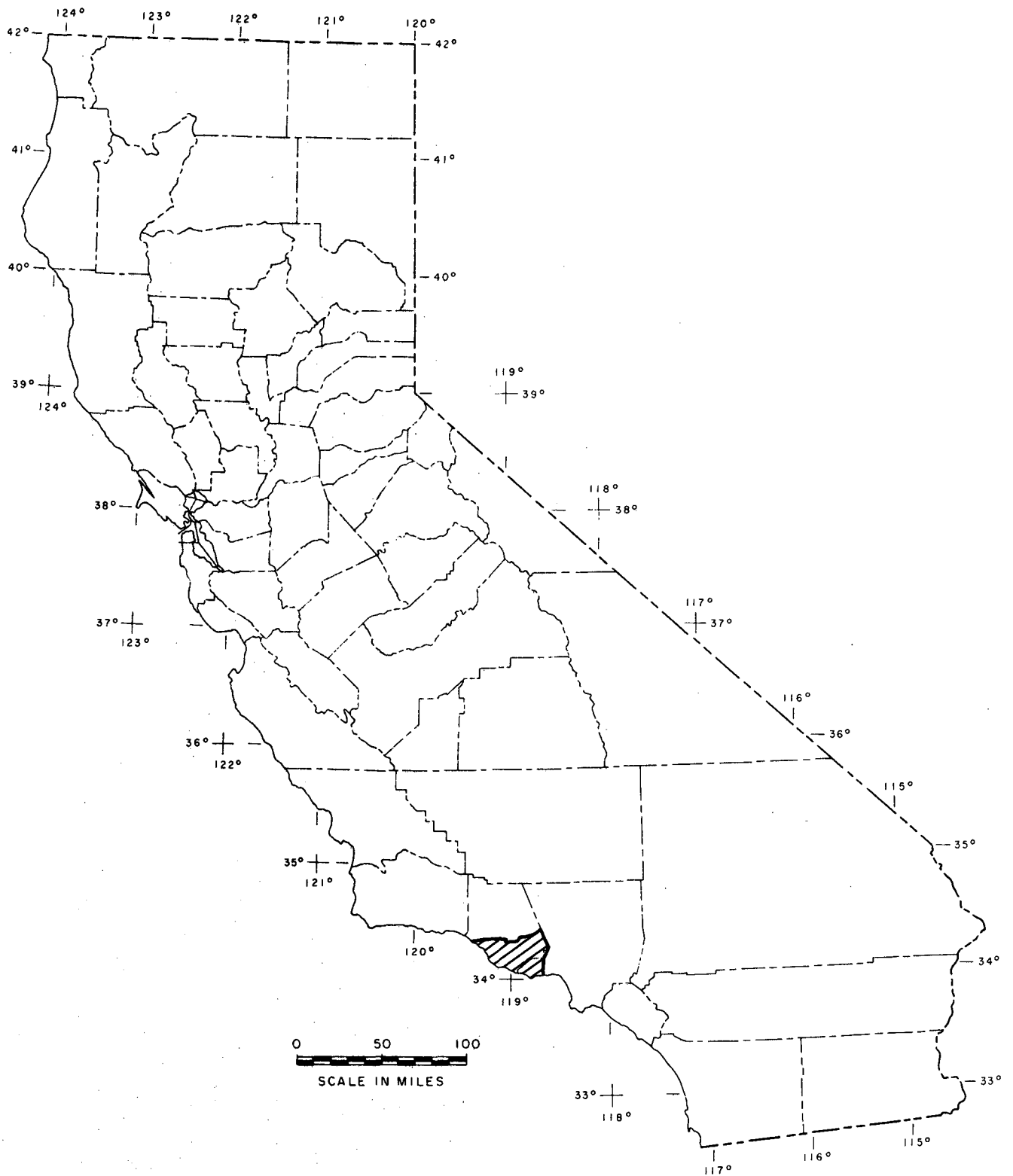


Figure 1.1 Project boundaries: Mineral Land Classification of Ventura County.

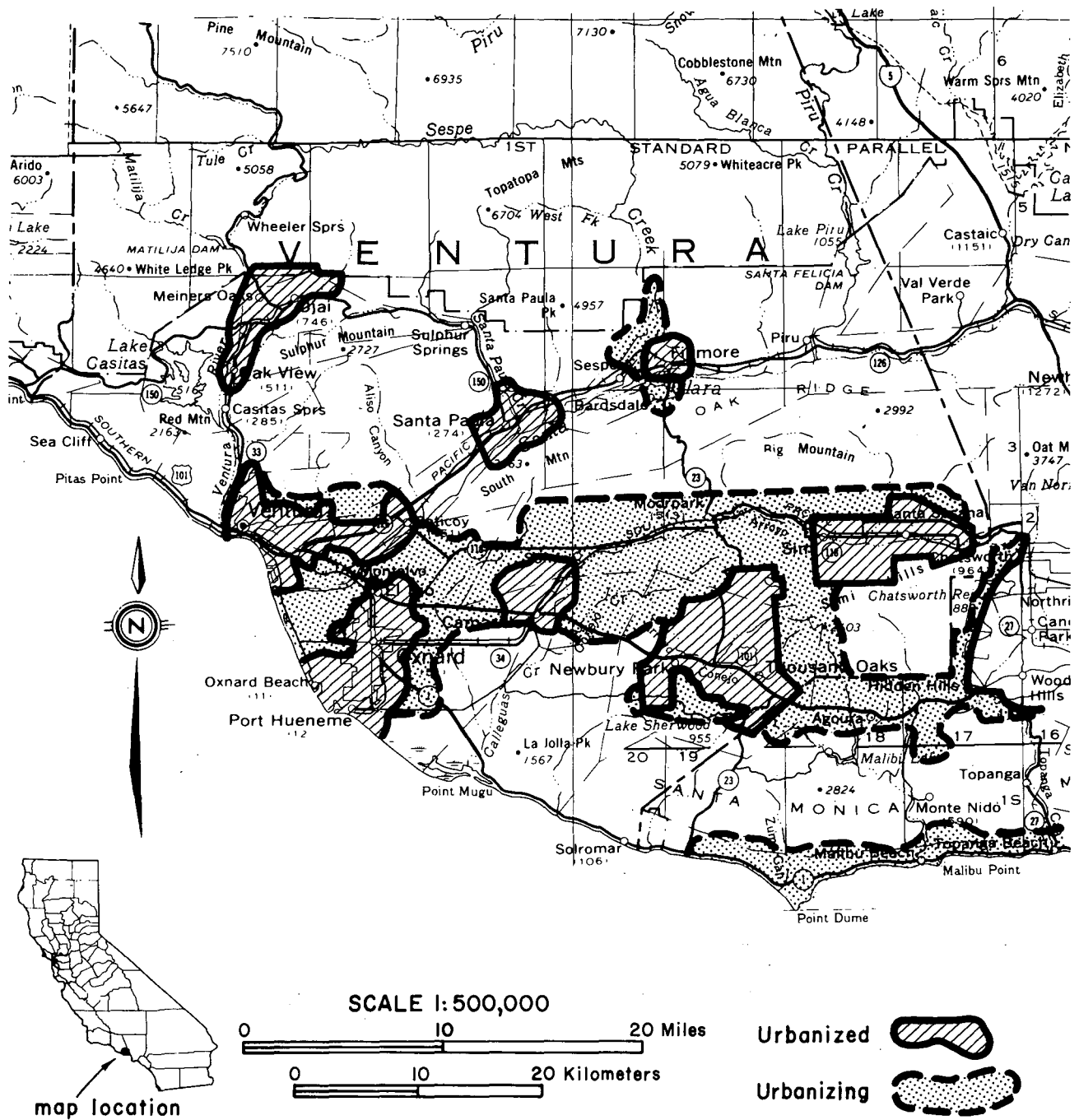


Figure 1.2 Urbanized and urbanizing areas of Ventura County as identified by the Office of Planning and Research, July 1975.

The "existing urban" areas shown on the OPR maps are the basis for the *unmodified urbanized* areas used for the land classification maps developed during the present study; similarly, the "projected urban" areas are the *unmodified OPR urbanizing* areas. Because the OPR maps were produced several years ago, those boundaries were modified at the Board's request to reflect current conditions. This was accomplished by obtaining information from local lead agencies (usually planning departments), by interpreting recent aerial photographs, and by on-site examination to determine where urbanization is occurring and anticipated to occur ("urbanized") in the next 10 to 30 years.

DETERMINATION OF PRODUCTION-CONSUMPTION REGIONS

Marketing Regions

To evaluate the significance of a mineral commodity, it is necessary to know where the commodity is produced and where it is consumed. Some mineral commodities, such as the borate deposits of Death Valley, have a worldwide market area and, therefore, have worldwide significance. However, low-value bulk commodities such as sand and gravel are marketed regionally, and their significance should therefore be measured on a regional level.

Large metropolitan areas usually obtain sand and gravel or crushed stone for construction purposes from several sources within their region. The Ventura area meets its aggregate needs from 12 aggregate plants clustered in two major aggregate production districts (Figure 1.3). The plants operate within the jurisdictional boundaries of 11 lead agencies (nine city governments and two county governments) (Table 1.1). Producers within a major production district generally share a common market region. Because each of the two major production districts in the Ventura area has its own characteristic marketing areas, it was possible to divide the Ventura area into two separate aggregate "Production-Consumption" (P-C) regions: the Simi Production-Consumption Region and the Western Ventura County Production-Consumption Region.

Transportation Rates

The boundaries for these P-C regions were based upon a comparative analysis of the haulage costs for the different production districts in the area. These costs generally follow minimum transportation rates that are reported and periodically updated by the California Public Utilities Commission (PUC, 1972), which fixes minimum transportation rates for the delivery of aggregate products by independent trucking firms in southern

California. Although the PUC minimum rates do not apply to aggregate producers who transport their own product, the producers use the PUC minimum rates as guidelines for haulage rates. The schedule of rates contained in MRT 17A is based on both the mileage and time involved for delivery. MRT 17A is accompanied by a series of maps that divide the Ventura area into numerous rock product delivery zones keyed to the MRT listing by code number.

The minimum transportation rates set by MRT 17A and the appropriate "Rock Products Delivery Zones" maps were used in the present study to aid in the determination of preliminary P-C region boundaries. First, the minimum transportation rates for all production localities were plotted on the delivery zones maps. Next, preliminary P-C region boundaries were drawn along the rock product delivery zones according to the production district which could deliver aggregate at the least fixed minimum rate.

The resulting P-C region boundaries (see Figure 1.4), though by necessity generalized, are reasonably accurate delineations of the respective marketing areas for the two major production districts in the Ventura area. An index map showing P-C region boundary lines in relation to the 7 1/2-minute U.S. Geological Survey quadrangle maps covered in this project area is presented in Figure 1.5. A list of quadrangles is presented in Table 1.2.

MINERAL RESOURCE ZONE CATEGORIES

Mineral Resource Zones (MRZ-1, MRZ-2, MRZ-3, MRZ-4) and Scientific Zones (SZ) that appear on quadrangles that accompany each P-C region report are determined on the basis of guidelines set forth in SMARA and in the "Guidelines for Classification and Designation of Mineral Lands" (Appendix A-3).

The guidelines for establishing the Mineral Resource Zones are also set forth below:

The State Geologist shall classify, on the basis solely of geologic factors, and without regard to existing land use and land ownership, certain areas as one of the following:

- (a) MRZ-1 Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence. This zone shall be applied where well-developed lines of reasoning, based upon economic-geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is nil or slight.
- (b) MRZ-2 Areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists.

Table 1.1 List of lead agencies (county and incorporated city governments) located within or adjacent to the project boundaries of the Mineral Land Classification (Sand and Gravel) of Ventura County. (Cities that have active aggregate operations within their jurisdictional boundaries are denoted by asterisks.)

| LOS ANGELES COUNTY | VENTURA COUNTY | | |
|-----------------------|---|----------------------------------|--------------------------------------|
| Los Angeles | *Santa Paula Ventura Port Hueneme | Oxnard Carmarillo Fillmore | Ojai Thousand Oaks Simi Valley |

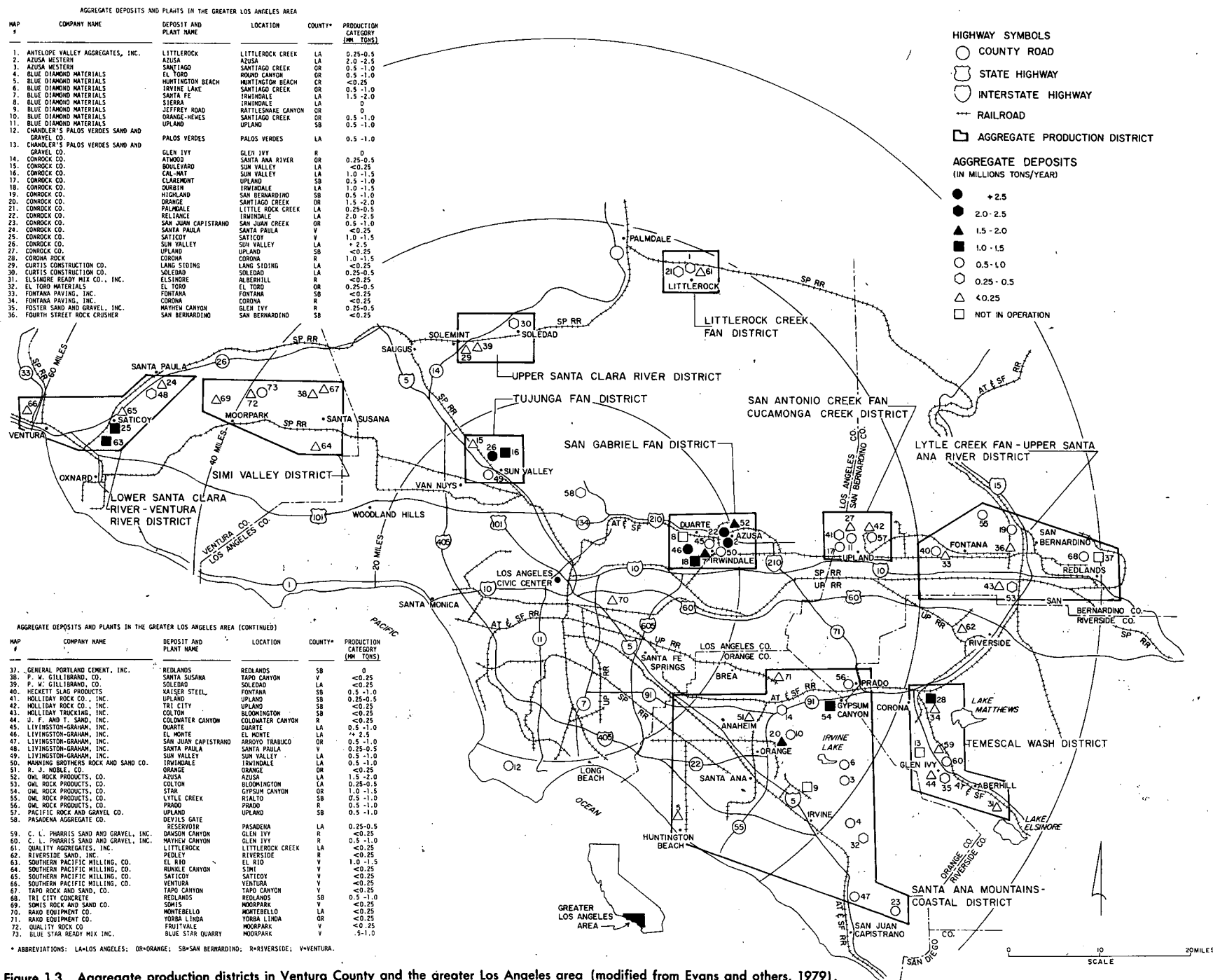


Figure 1.3 Aggregate production districts in Ventura County and the greater Los Angeles area (modified from Evans and others, 1979).

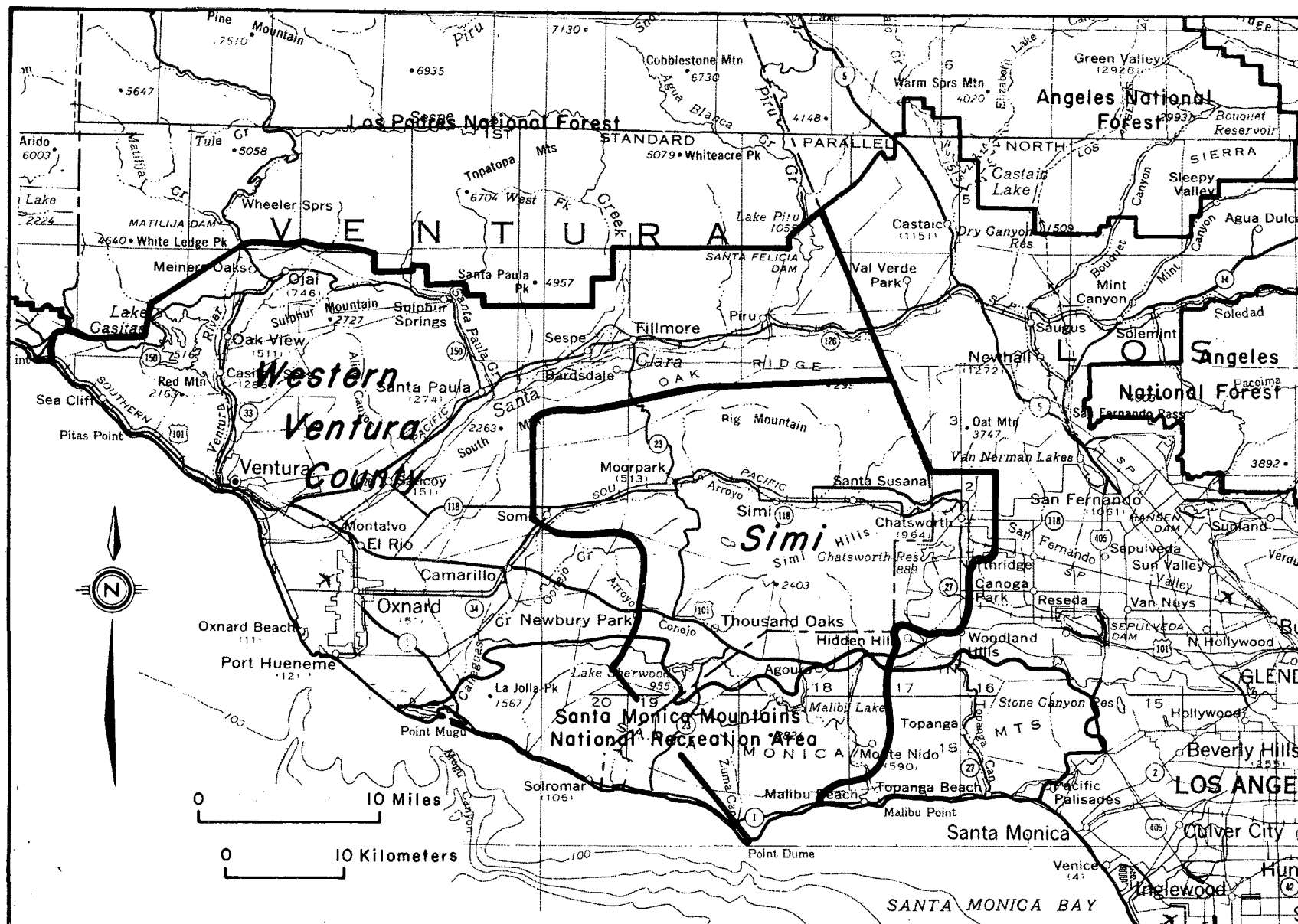


Figure 1.4 Aggregate production-consumption regions of Ventura County.

Table 1.2 List of U.S. Geological Survey 7-1/2 minute quadrangles included in the Mineral Land Classification (Sand and Gravel) of Ventura County. Quadrangles show existing urbanized areas, urbanizing areas, Mineral Resource Zones (MRZ), and well log locations. Quadrangles are indexed on Figure 1.5 by the following number list.

- | | | |
|---------------------|------------------|-------------------|
| 1. Matilija | 9. Saticoy | 17. Newbury Park |
| 2. Ojai | 10. Santa Paula | 18. Thousand Oaks |
| 3. Santa Paula Peak | 11. Moorpark | 19. Calabasas |
| 4. Fillmore | 12. Simi | 20. Canoga Park |
| 5. Piru | 13. Santa Susana | 21. Point Mugu |
| 6. Val Verde | 14. Oat Mtn. | 22. Triunfo Pass |
| 7. Pitas Point | 15. Oxnard | 23. Point Dume |
| 8. Ventura | 16. Camarillo | 24. Malibu Beach |

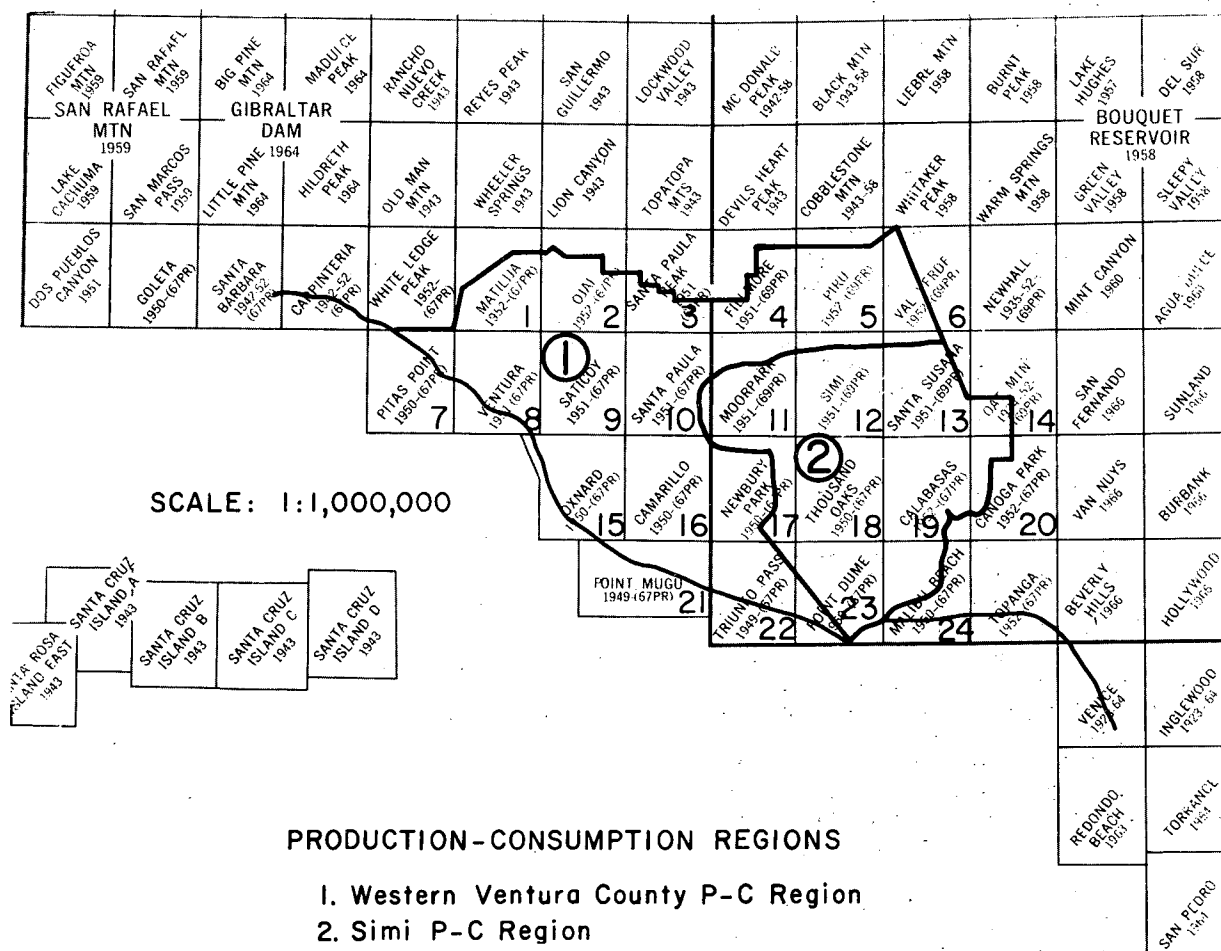


Figure 1.5 Index map of U.S. Geological Survey 7-1/2 minute quadrangles showing aggregate production-consumption regions of the Mineral Land Classification (Sand and Gravel) of Ventura County.

This zone shall be applied to known mineral deposits or where well-developed lines of reasoning, based upon economic-geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.

- (c) MRZ-3 Areas containing mineral deposits, the significance of which cannot be evaluated from available data.
- (d) MRZ-4 Areas where available information is inadequate for assignment to any other MRZ zone.
- (e) SZ Areas containing unique or rare occurrence of rocks, minerals, or fossils that are of outstanding scientific significance shall be classified in this zone.

50-YEAR FORECASTS

Basis of 50-Year Forecasts

An estimate of the total quantity of sand and gravel required to supply the needs of each P-C region for the next 50 years will be presented in this report in accordance with the requirements set forth in the "Guidelines for Classification and Designation of Mineral Lands" (Appendix A-3, Section I.3.c.2).

Fifty-year forecasts of aggregate needs are made on the basis of aggregate that was consumed during the years 1960-1978. For the purposes of these calculations, it is assumed that all aggregate produced in a particular P-C region was also consumed within the same P-C region.

Aggregate Consumption Indicators

Factors such as the number of new residential and non-residential building permits issued, miles of new highway constructed, number of non-agricultural employees, and population data were compared with aggregate production records to determine whether or not they bore a direct relationship to the aggregate consumed in a P-C region. Simple linear regression analyses showed that population is the only factor that correlates closely with the amount of aggregate consumed in a given P-C region.

POPULATION AND AGGREGATE PRODUCTION DATA

A 19-year population record (1960-1978) was compiled for each of the P-C regions established within the project area. The historical population data for this period was obtained from statistical bulletins that have been published by the counties on a quarterly or an annual basis. These statistics were presented in the form of county-wide census tract maps as shown in the example in Appendix B. Boundary lines for the P-C regions were then transferred to the census tract maps, and the populations of tracts located within each P-C region were totaled on a year-by-year basis. Annual aggregate production data for the years 1960-1978 were obtained from Evans and others (1979) as well as from individual mine operators in Ventura County.

Population projections for the years between 1979 and 2020 were made for each P-C region using area projections furnished by county governments, the State Department of Finance (1977), and the Southern California Association of Governments (1978). Population projections for the 10-year period

between 2020 and 2030 were extrapolated by CDMG staff from previously mentioned data for the preceeding 41 years.

PER CAPITA CONSUMPTION OF AGGREGATE

Simple linear regression analyses of historical data were made to identify basic trends in the per capita consumption rates. The projected per capita consumption rates of each P-C region were then related to respective regional population projections, on a yearly basis, to obtain the total aggregate needs of each P-C region to the year 2030.

Per capita consumption rates vary greatly among different P-C regions, apparently depending upon the degree of urban maturity reached. In the Los Angeles area, high per capita consumption rates were characteristic of P-C regions where the overall population density is relatively low and the rate of urban development is high. High consumption rates will probably be maintained in such P-C regions until growth rates decline with the onset of urban maturity. As indicated by production and population records in the Los Angeles area, per capita consumption then usually decreases, eventually leveling off to a general maintenance level.

Population and dwelling unit densities were computed for the 1960-1976 base period in order (1) to relate and explain differences in per capita consumption rates between the two P-C regions and (2) to estimate when changes might occur in the current per capita consumption trends of urbanizing P-C regions (population statistics furnished by the counties also report the estimated number of dwelling units per census tract; see Appendix B). The statistical compilation of dwelling units is limited to the years 1960, 1965, 1970, and 1976. In order to compute density figures, the acreage of each P-C region was determined by planimeter; larger areas not suited for urban development and areas set aside for other land uses were excluded. Graphical curves depicting the 16-year records of population density, dwelling unit density, and per capita consumption of each P-C region were constructed for comparison purposes. The above data for each P-C region is presented in the "Evaluation of Aggregate Resources" sections of Parts II and III of this report.

REPORT SUMMARIES AND RECOMMENDATIONS

At the end of each of the following P-C region reports (Parts II and III), findings are summarized and recommendations are made to the State Mining and Geology Board. The 50-year forecasts of aggregate needs of a P-C region are compared with aggregate resources estimated to be present and available within the P-C region. (Areas of aggregate "availability" are shown as sectors on Plate 2.3 of this report.) Both the possibility of using resources from adjacent P-C regions and the potential for use of alternative materials (for example, crushed rock) are considered. These facts are brought together by the California Division of Mines and Geology (CDMG) to apprise the Mining and Geology Board of the options that are available to provide for future resource needs and to enable the Board to consider alternative choices for designation. Final determination of the designated areas will be made by the Board after consultation with lead agencies.

OVERVIEW OF AGGREGATES

Uses

Sand, gravel, and crushed rock are included among mineral commodities classed as "Construction Materials." These commodities, collectively referred to as aggregates, provide bulk and strength to Portland cement concrete, asphaltic concrete, and plaster or stucco. Aggregates are also used as road base, subbase, and fill. Aggregates normally provide from 80 to 100 percent of the material by volume in the above uses.

Economic Significance

The economic significance of aggregate arises from its use as a basic building material. It is all but indispensable in modern construction. Developers, building and freeway/road contractors, cement manufacturers, asphalt producers, carpenters, electricians, truck drivers, and mechanics, to name only a few, depend directly or indirectly on the flow of aggregate.

Aggregate production is a major industry in the Ventura area. Between 1971 and 1975, an average of 4 1/2 million tons of aggregate were produced and consumed there each year. Aggregate sells (1979 rates) generally at prices ranging from two to five dollars per ton at the plant site after washing, sizing, and stockpiling. Aggregate delivered to the consumer costs considerably more. The cost of delivered aggregate includes the plant-site cost plus charges for handling, haulage, and mixing. The haulage charge is the most influential factor determining the cost of the final product at delivery point. The availability of aggregate from local sources is therefore critical—not only to the construction industry, but to the general economic strength of the Ventura area.

Development and Production

In past years, as mentioned above, the population centers in the Ventura area have been served from local deposits of aggregate materials. However, deposits are rapidly being depleted and some of the potential sources have been lost to irreversible land uses incompatible with mining, such as home developments.

QUALITY SPECIFICATIONS

Rarely is aggregate raw material at the pit or quarry site, even from the highest grade deposits, physically or chemically suited for every type of aggregate use. Therefore, every potential deposit must be tested to determine how large a tonnage of its various components can meet specifications for a particular type of use and what processing is required.

Specifications for various uses of aggregate material have been established by several agencies, such as the Water and Power Resources Service (formerly U.S. Bureau of Reclamation), the U.S. Army Corps of Engineers, and the California Department of Transportation (Caltrans), to ensure that aggregate is satisfactory for particular uses. These agencies, as well as other major consumers of concrete, evaluate aggregate for acceptance by using standard test procedures outlined by such organizations as the American Society for Testing Materials and the American Association of State Highway Officials.

Most aggregate specifications have been established to ensure the manufacture of strong, durable concrete that will withstand the physical and chemical effects of weather and use. For example, specifications for concrete and base products prohibit or limit the use of rock materials containing mineral substances such as gypsum, zeolite, pyrite, opal, chalcedony, chert, siliceous shale, volcanic glass, and some acidic volcanic rocks. Gypsum shortens the setting time of cement, pyrite dissociates to yield sulfuric acid and iron oxide stain, and the other substances contain silica in a form that reacts with alkali substances in the cement to cause deterioration of concrete.

Specifications also call for various grain-size ranges and particle-size distributions in the various uses of aggregate. For some uses, such as asphalt paving, particle shape is specified. Specification standards set by the California Department of Transportation in 1975 require that at least 25 percent by weight of coarse aggregate (3/4-inch minus material retained on the No. 4 sieve) used as Class 2 aggregate base material shall be crushed particles. Furthermore, aggregate material (screenings) used with bituminous binder to form sealing coats on road surfaces shall consist of at least 90 percent by weight of crushed particles. Crushed stone is preferable to natural gravel in asphaltic concrete because broken surfaces adhere to asphalt better than rounded surfaces and the interlocking of angular particles strengthens the asphaltic concrete.

Aggregates for asphaltic concrete and Portland cement concrete generally meet the same physical and chemical requirements. In localities where only the one type of aggregate is readily available, that type is ordinarily used in both types of concrete; however, all material from the Ventura area cannot be used in high use categories such as the Portland cement concrete use. Most crushed rock that is produced in the Ventura area for use in asphaltic concrete is obtained from alluvial deposits. At most of the larger sand and gravel plants, oversize rock clasts (usually larger than 1 1/2 inch diameter) are screened from the alluvial raw material and crushed for use as crushed stone.

PRODUCTION COSTS

Production costs include the cost of mining and processing raw materials for use as aggregate and also the ensuing costs when utilizing the finished aggregate material in various final products (Portland cement concrete, asphaltic concrete, etc.). These costs can vary greatly, depending on the type of the deposit, character of the deposit, and the end use of the finished aggregate.

UTILIZATION COSTS

The preferred use of one aggregate material over another in construction practices depends not only on specification standards but also on economics. Alluvial sand and gravel is preferred to crushed stone for Portland cement concrete aggregate because the natural material is less expensive and because a wet mix made with rounded particles of alluvial sand and gravel has better workability than one made with angular particles. The workability of a wet mix consisting of Portland cement with crushed rock aggregate is improved by adding more sand and water. However, this also requires that more cement be added to the mix in order to maintain concrete durability standards. Normally, the additional cement amounts to about a quarter sack per yard of concrete, an additional cost of about \$0.75 per yard of mix (1978 prices).

Crushed rock is commonly used for Portland cement concrete aggregate under geologic conditions where shortages of alluvial sand and gravel exist. Although slightly more care is required in pouring and placing a wet mix that contains crushed rock, Portland cement concrete made with this aggregate is as satisfactory

as that made with sand and gravel of comparable rock quality; however, production costs are considerably greater, and the use of crushed rock in regions such as the Ventura area would involve additional haulage costs, truck traffic, and fuel consumption.

PART II

CLASSIFICATION OF SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS SIMI PRODUCTION-CONSUMPTION REGION

INTRODUCTION

Land in the Simi Production-Consumption (P-C) Region of Ventura County has been classified by the California Division of Mines and Geology (CDMG) according to the presence or absence of significant sand and gravel deposits and crushed rock source areas (Plate 2.1). The land classification is presented in the form of Mineral Resource Zones (MRZ's) that are shown on 12 of the 24 U.S. Geological Survey topographic base maps which accompany this report. Figure 1.5 and Table 2.1 are indexed to the quadrangle maps covering the Simi P-C Region. The lead agencies located within the Simi P-C Region are listed on Table 2.2.

ESTABLISHMENT OF MINERAL RESOURCE ZONES

Mineral Resource Zones within the Simi P-C Region are established on the basis of an aggregate-resource appraisal which includes: an analysis of geologic reports and maps; field investigations and examination of active sand and gravel mining operations; analyses of drill hole data; interpretation of aerial photographs; and evaluation of private company data.

The Mineral Resource Zones depicted on Plates 1.1 through 1.24 were established based on the suitability of the deposits for use as Portland cement concrete (PCC) aggregate. Lower quality aggregate resources, acceptable for use as asphaltic concrete aggregate, construction sub-base, railroad ballast, etc., have not

been zoned independently on the plates, but are evaluated only where they occur in conjunction with PCC aggregate. They are discussed under Resource Sectors A-C and shown on Table 2.3.

Areas Classified MRZ-1

Several areas located within the Simi P-C Region have been classified MRZ-1 (Plate 2.1). These are areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence ("Guidelines for Classification and Designation of Mineral Lands," Appendix A-3, p. 51).

These areas occur mainly within the Simi Valley, Little Simi Valley, and several other small valleys in the eastern part of the county, as well as in mountainous areas underlain by particular bedrock formations. Drill hole data and field observations indicate that these latter areas are underlain by sedimentary deposits composed predominantly of fine-grained material unsuitable for use as or in aggregate.

Areas Classified MRZ-2

Two areas within the Simi P-C Region have been classified MRZ-2 (Plate 2.1). These are areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists ("Guidelines for Classification and Designation of Mineral Lands," Appendix A-3, p. 51).

Table 2.1 List of U.S. Geological Survey 7-1/2 minute quadrangles covering the Simi P-C Region (Plates 1.10-1.14, 1.17-1.20, and 1.22-1.24). Quadrangles show existing urbanized areas, urbanizing areas, Mineral Resources Zones (MRZ), and well log locations. Quadrangles are indexed on Figure 1.4 by the following number list.

| | | |
|------------------|-------------------|------------------|
| 10. Santa Paula | 14. Oat Mtn. | 20. Canoga Park |
| 11. Moorpark | 17. Newbury Park | 22. Triunfo Pass |
| 12. Simi | 18. Thousand Oaks | 23. Point Dume |
| 13. Santa Susana | 19. Calabasas | 24. Malibu Beach |

Table 2.2 List of lead agencies (county and incorporated city governments) located within the Simi P-C Region. (Cities that have active aggregate operations within their jurisdictional boundaries are denoted by asterisks. Cities that have land within their jurisdiction classified MRZ-2 are denoted by .

| VENTURA COUNTY | LOS ANGELES COUNTY |
|------------------------------|--------------------|
| Thousand Oaks Simi Valley | Los Angeles |

The CDMG classified a deposit of sand and gravel or a particular bedrock unit as significant (MRZ-2) if it satisfied the criteria given in the "Guidelines" and met the following requirements:

- 1) The deposit must consist of sound, durable material substantially free of chemically reactive substances that would preclude its use for Portland cement concrete.
- 2) The geologic factors that resulted in the formation of the deposit must be understood clearly enough so that reasonable subsurface interpretation can be made from surface exposure of the material and from drill hole data.

The only deposits within the Simi P-C Region that satisfy these criteria are certain bedrock units of the Simi Conglomerate, the Saugus Formation, and the San Pedro Formation. Portions of these deposits are currently being mined and processed for aggregate uses (Plate 2.1, Figure 2.1).

Several different companies have mined aggregate within these areas for many years. Open-file reports compiled by the California Division of Mines and Geology show that aggregate was extracted as early as 1962 by Canyon Rock and Gravel Company north of the town of Simi. Presently, there are six companies producing aggregate within the P-C area.

About 2 miles southeast of the City of Simi, aggregate is extracted from the Simi conglomerate member of the Santa Susana Formation by S.P. Milling Company. Elsewhere, aggregate is extracted from the Saugus and San Pedro Formations at five separate localities. Approximately 5 miles northwest of the town of Moorpark and just east of Balcom Canyon, aggregate is produced from the San Pedro Formation by Somis Sand and Rock Company. About 3 1/2 miles north of Moorpark, Quality Rock Company and Blue Star Ready Mix, Inc. extract aggregate from the Saugus Formation. Similar material is produced by Tapo

Rock and Sand Company and by P.W. Gillibrand Company at sites located approximately 5 miles northeast of the city of Simi.

SAUGUS FORMATION

The Pliocene-Pleistocene Saugus Formation is distributed along a broad east-west arcuate band extending westward from Los Angeles County to somewhat west of Grimes Canyon, where the Saugus Formation merges into the San Pedro Formation. Outcrops of the Saugus Formation are also present in the southwestern part of the Simi P-C Region and in the eastern part of the adjacent Western Ventura County P-C Region. (See Figure 2.1 and Plates 1.11, 1.12, and 1.13 for MRZ-2 locations.)

Apparent deltaic deposits of sandstone, pebbly sandstone, and conglomerate that make up the Saugus Formation grade downward into fine- to medium-grained, clayey sandstone and siltstone of estuarine origin (Weber and others, 1972). Several exposures in outcrops and mine workings show that there is considerable variability in grain size distribution, both laterally and vertically within the formation. The coarse fraction (pebbles, cobbles, and boulders) is composed of several varieties of granite, gabbro, and anorthosite, while the fine fraction is made up of feldspathic sands. The presence of anorthosite and gabbro particles suggests that a major portion of the coarse-grain particles within the Saugus Formation originated from the San Gabriel Mountains to the east. It is estimated that about 15 percent of the Saugus Formation, where it is currently being mined, is composed of relatively durable coarse particles (pebbles, cobbles, and boulders) suitable for Portland cement aggregate.

The Saugus Formation has been deformed by folding and dislocated by faults over much of its extent. Typically, it displays dips ranging from about 15 to 45 degrees. This characteristic may affect the amount of resources that can be recovered at any specific locality.

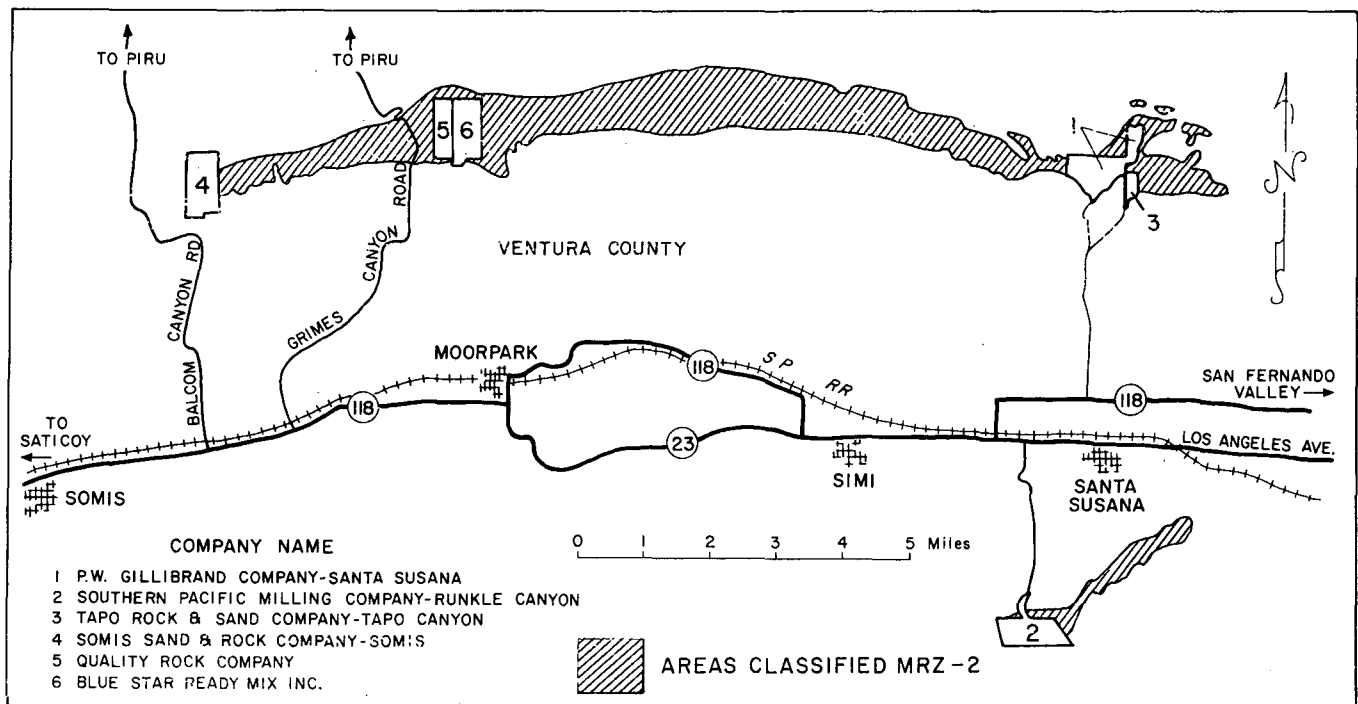


Figure 2.1 Sketch map of the Simi production district showing land owned or leased by aggregate companies as of November 1979 (revised from Evans and others, 1979). (See Plates 2.2 a-d for more detailed maps showing company-owned properties, and Plates 1.11, 1.12, 1.13, and 1.19 for MRZ-2 locations.)

SAN PEDRO FORMATION

The Pliocene-Pleistocene San Pedro Formation merges into the Saugus Formation in the western part of the Simi P-C Region (see Figure 2.1 and Plate 1.11 for MRZ-2 locations). It is composed of silty sands, interbedded sands, pebbly sands, and conglomerate. Field observations of outcrops and mine workings indicate that the formation, as a whole, is probably made up of finer particle sizes than the Saugus Formation. The coarser beds typically occur as discontinuous beds and lenses, which represent about 10 to 15 percent of the formation. Exposures of mine workings show that the coarse fraction is composed of well-rounded durable pebbles, cobbles, and boulders with pebbles predominating. It is made up of particles consisting of dense sandstone, quartz-feldspar schists, and minor amounts of volcanic rocks like the Saugus Formation. Deformation has limited the recoverability of aggregate resources from each of these units also.

SIMI CONGLOMERATE

The Simi Conglomerate is a basal member of the Paleocene-Eocene Santa Susana Formation. Outcrops of the Simi Conglomerate extend northeast from the Thousand Oaks area through Simi Hills to the northeastern side of Simi Valley. The major portion of the unit has been classified as MRZ-2. This zone extends southwest continuously along a 4-mile belt from the southeastern Simi Valley to the Runkle Canyon area, where it is presently being mined. (See Figure 2.1 and Plates 1.11 and 1.19 for MRZ-2 locations.) Beds within the deposit are composed chiefly of fresh durable cobble conglomerate consisting predominately of quartzites and granite clasts. The deposit is moderately to well indurated. Coarse material makes up approximately 60 percent of the deposit, although in the Runkle Canyon area the coarse fraction comprises as much as 70 percent in some parts of the deposit. Cobbles are well rounded, averaging about 3 inches in diameter. The maximum rock size observed was approximately 12 inches in diameter. Finer material (sand, silt, and clay) make up 30 to 40 percent of the deposit. The sandstone is largely feldspathic and is not suitable for use in concrete aggregate.

The apparent thickness of the Simi Conglomerate ranges from 650 feet at Meir Canyon to 1,200 feet at Oak Park Ranch to approximately 20 feet near Lang Ranch. The beds dip north and west from 20 to 50 degrees at the quarry site in Runkle Canyon. This fact has an important bearing on the cost of mining and the recoverability of resources where it is mined.

Aggregate is presently being extracted from the Simi Conglomerate in the vicinity of Runkle Canyon. Extraction began in 1966 by Simi Rock Products Company and was continued by Southern Pacific Milling Company in 1971. Operations have been continuous since that time.

Areas Classified MRZ-3

A substantial part of the Simi P-C Region has been classified MRZ-3 (Plate 2.1). Areas so classified are those containing mineral deposits, the significance of which cannot be evaluated from available data ("Guidelines," Appendix A-3, p.51) MRZ-3 areas located in valley regions within the Simi P-C Region are generally underlain by Quaternary alluvial deposits containing sand and gravel, but resource evaluations of these cannot be

made because of inadequate subsurface data due to the inconclusiveness or unreliability of well-log data.

MRZ-3 areas located in hilly or mountainous terrane within the Simi P-C Region are generally underlain by Tertiary sedimentary/volcanic deposits. Many of these MRZ-3 areas are so classified because they are too small to reach threshold value (5,000,000 dollars FOB at the processing site) or because the suitability of the rock for aggregate could not be determined within the framework of the current study. Several deposits of rock suitable only for fill or base material have been or are being quarried. These deposits are classified MRZ-3 because they do not meet the requirements for MRZ-2 classification.

Some deposits that have been classified MRZ-3 are accompanied by the subscript "a" (see quadrangles). These deposits have been judged, on the basis of the limited available geologic data and field work, to have higher potential as sources of aggregate material suitable for Portland cement concrete than other deposits classified MRZ-3. These deposits, as well as other deposits classified MRZ-3, are discussed below.

SIMI CONGLOMERATE-SAN PEDRO AND SAUGUS FORMATIONS

Parts of the Simi Conglomerate and the San Pedro and Saugus Formations that have not been designated as MRZ-2 offer a high potential for yielding material suitable for concrete aggregate and are particularly worthy of detailed study and subsurface investigation. All three of these bedrock units are currently being mined for their aggregate content within the Simi P-C Region.

SANTA SUSANA, SESPE, TOWSLEY, LLAJAS, COLDWATER, VAQUEROS, AND PICO FORMATIONS

Several other bedrock units are known to contain beds or lenses of sandstone or conglomerate that could possibly yield limited tonnages of aggregate. These include parts of the Santa Susana, Sespe, and Topanga formations.

Other bedrock units that are believed to have a low potential as a source of concrete aggregate could also conceivably yield workable deposits, notably the Llajas, Coldwater, Vaqueros, Towsley, and Pico formations.

CONEJO VOLCANICS

The Conejo Volcanics have served as a source of crushed rock in the past, and could very likely serve as a source in the future. However, the presence of zeolites within many of the volcanic members would preclude their use as a source of crushed rock suitable for concrete aggregate. A systematic study would have to be made to determine which of the volcanic members might be suitable for Portland cement concrete aggregate.

ARROYO SIMI ALLUVIUM

Limited subsurface information has shown that parts of the Arroyo Simi alluvium between Moorpark and the City of Simi contain sand and gravel to depths as great as 135 feet. Considerable subsurface investigation and material testing is required before an assessment can be made of whether or not a suitable source of concrete aggregate is present within this area.

Areas Classified MRZ-4

Areas classified MRZ-4 are those areas where available information is inadequate for assignment to any other MRZ category ("Guidelines," Appendix A-3, p. 51).

EVALUATION OF AGGREGATE RESOURCES IN THE SIMI P-C REGION

Introduction

An analysis of aggregate supply in the Simi P-C Region is presented in this section of the report. It was conducted on the basis of a quantitative evaluation of the aggregate resources contained within the P-C region. A similar evaluation was made of aggregate resources in the adjacent P-C regions (the San Fernando Valley P-C Region in Los Angeles County and the Western Ventura County P-C Region in Ventura County) in order to determine what effects these regions might have on the availability of aggregate in the Simi P-C Region. A less detailed preliminary evaluation was made for the adjacent Saugus-Newhall P-C Region as well. These latter evaluations are presented in the "Alternative Sources of Aggregate" section, beginning on page 20.

Data Base

For any appraisal of a resource to have credibility, it must be based upon sound data. If the data base is weak, the resource appraisal must indicate this fact and, conversely, if it is strong this should also be noted. For this project, the terminology used to reflect the confidence level of the data base has been adapted from U.S. Geological Survey Bulletin 1450-A, which is included herein as Appendix C. The two most important terms used are *reserves* and *resources*. Reserves are aggregate materials believed to be acceptable for commercial use that exist within property boundaries owned or leased by an aggregate producing company and for which permission allowing extraction and processing has been granted by the proper authorities. Resources include reserves as well as all similar potentially useable aggregate materials that may be mined in the future, but for which no use permit allowing extraction has been granted, or for which development has not been definitely established to be feasible based upon current technological or economic conditions.

Regulatory Constraints on Mining

The majority of regulatory constraints on sand and gravel mining that limit the available resources in Ventura County are site specific. The restrictions are written in each conditional use permit issued to quarry operators by the County of Ventura Planning Department. In drafting a permit, the Planning Department must take into account many federal, state, and local agency regulations and consider any recommendations that those agencies make concerning their areas of authority.

The present constraints fall under the following general categories: restraints on final grading configurations; limits on water course alterations; biota habitat preservation measures; limitations to prevent damage to adjoining property; incompatible land-use planning designations; pollution controls; and reclamation requirements.

The following is a list of the various written codes and regulatory agencies that the Planning Department must address:

- 1) Uniform Building Code as adopted by the Ventura County Board of Supervisors. Limits the final grade on cut and fill slopes.
- 2) Ventura County Ordinance No. FC-18. Requires the approval of the Ventura County Flood Control Department to alter any water course.
- 3) Ventura County Ordinance Code, Division 8 - Planning, Chapter 5, Article 1, Section 8163-3. Presents a set of general standards with which all permitted operations on county land must comply. These standards deal with the compatibility of the operation with surrounding land uses, the possible effects on public safety, adjacent property values, and any other detrimental effects that the proposed activity might have on the environment or public health.
- 4) California State Department of Fish and Game Code. Authorizes Fish and Game personnel to require sand and gravel operations to minimize mining impact on fish and wildlife habitats.

The above requirements and agency policies have general applications and must be tailored to each site.

Factors Considered in Calculating Reserves and Resources

In determining which areas, if any, should be classified MRZ-2 (significant deposits present) and in calculating reserves and resources within areas so classified, the following parameters were used:

- 1) Material must meet the criteria given in the "Guidelines for Classification and Designation of Mineral Lands" (Appendix A-3).
- 2) The deposit must consist of sound, durable material substantially free of chemically reactive substances that would preclude its use as Portland cement concrete (PCC) aggregate.
- 3) The basic geologic aspects of the deposit must be understood clearly enough to permit interpretation of the lateral and vertical distribution of the material.
- 4) It is assumed that there is an average of 0.07 short tons of aggregate per cubic foot of material.

Resource Sectors

All the aggregate resources in the Simi P-C Region identified as MRZ-2 occur within the Simi Conglomerate, the Saugus Formation, and the San Pedro Formation. Resource areas in which aggregate is currently being mined are placed into Sector A. Those portions of the Simi Conglomerate for which there is no permit allowing extraction and which are likely to contain aggregate resources of regional significance are included in Sector B. Sector C includes those portions of the Saugus-San Pedro Formations where it is likely that aggregate resources of regional significance are present.

SECTOR A

Sector A outlines all those areas within the Simi P-C Region from which aggregate is currently being extracted (Plate 2.2). This includes areas where aggregate is produced from the Simi

Conglomerate and the Saugus-San Pedro Formations by Blue Star Ready Mix, Inc., P.W. Gillibrand Co., Tapo Rock and Sand Co., Somis Sand and Rock, S.P. Milling Co., and Quality Rock Company (see Figure 2.1).

Before the amounts of aggregate reserves and resources within Sector A could be calculated, it was first necessary (1) to deduce the configurations of aggregate-bearing geologic units from knowledge of the geologic processes responsible for their formation, (2) to evaluate the history of mining operations in the Simi Conglomerate and the Saugus-San Pedro Formations, and (3) to learn both the effects of folding and faulting and the effects of technological constraints (slope requirements, drainage, etc.) on the recovery of reserves.

There is very little known about the source region for the Simi Conglomerate. The composition of the clasts within this formation bears little resemblance to that of any local source beds. Recent paleomagnetic studies by Kammerling and Lyendyk (1979) suggest that the entire Transverse Ranges, which would include all the Simi P-C Region, was rifted, rotated, and tectonically transported several hundred kilometers during Tertiary time. This would suggest that the source of the Simi Conglomerate lies at a considerable distance from the Simi P-C Region and that, therefore, any assessment of continuity for the conglomerate must be based purely on its present position and structural configuration.

The Simi Conglomerate is situated on a north-sloping hillside, and the unit displays a general northerly dip that ranges from slightly in excess of 20 degrees to over 50 degrees. These dips show that substantial amounts of the conglomerate descend beneath the overlying rocks to depths at which aggregate mining becomes economically unfeasible. Those portions are therefore unavailable as a resource.

Within the Simi Conglomerate, there are beds of feldspathic sandstone. This sandstone is not suitable for use in Portland cement concrete aggregate because it loses its cohesiveness when mixed with water. Consequently, it is not included in the resource evaluation. About 50 percent of the conglomerate beds are composed of fine particles unsuitable for concrete aggregate and, for this reason, are not included in the reserve figures. A density factor of 0.07 tons per cubic foot (14.3 cubic feet/ton) is used for calculations.

The Saugus and San Pedro Formations are of different geologic origin and therefore display a different pattern of distribution in both grain size and composition. A substantial portion, if not most of the sediments that are present within the Saugus Formation, originated from the San Gabriel Mountains as an alluvial deposit with the consequence that the coarser particles are more widely distributed in the eastern portions of the formation and the finer ones are more prevalent at its western extremity.

The San Pedro Formation is of marine origin, and it is quite likely that sediments within the formation were carried to the depositional site by long shore currents and, perhaps, in part from the nearby highland to the west and north. Local high and low energy regimes at the time of deposition, in conjunction with shifting of the original shorelines by eustatic sea level changes and tectonism, have very likely played a major role in sediment distribution. Such a mode of deposition would help account for the considerable variability of sediment sizes distributed laterally and vertically. This variability can now be observed in mine workings and outcrops.

Both the Saugus and San Pedro Formations have been folded and faulted. Because of this folding and faulting, portions of these formations are locally unrecoverable. Thus, portions of these formations that would otherwise be considered reserves or resources should not be so considered. However, because of the highly variable grain size distribution and the complications that folding and faulting have introduced on the local level, it is difficult to make an accurate evaluation of available resources in these formations. To do so would require fairly detailed drilling and grain size analysis. Such an undertaking was not possible, given the scope of the present study. Therefore, resource determinations were made based on assumptions of continuity of the individual formations and on estimations of overall grain size distribution based on field observations of outcrops and mine exposures.

Reserve calculations for Sector A are based on the following assumptions:

- 1) A slope requirement of 2:1 is used down to the local drainage level of the operating properties in the Saugus and San Pedro Formations, and a slope of 1:1 down to the pit wall convergence depth is used for the operating property in the Santa Susana Formation (Simi Conglomerate).
- 2) A waste factor of 15 percent is used for resource calculation.
- 3) The in-place density of the resource is assumed to be 0.07 tons per cubic foot (14.3 ft³ per ton).

Based upon these factors, there are an estimated 170 million tons (Table 2.3) of inferred reserves and 2 million tons of indicated reserves within Sector A. The inferred reserves figure is subdivided into three categories: fine aggregate suitable for Portland cement concrete (80 million tons); coarse aggregate suitable for Portland cement concrete aggregate (50 million tons); and fine aggregate suitable for base and asphaltic concrete (40 million tons).

SECTOR B

Sector B includes a major portion of the Simi Conglomerate which lies outside the areas currently held for extraction of sand and gravel. This sector extends southwesterly for a distance of approximately 4 miles from southeastern Simi Valley to the Runkle Canyon area.

Subsurface data was unavailable for the area; consequently, geologic map interpretation and field investigations were performed to identify the material underlying Sector B. Outcrops along the sector area are minimal, but close examination of these exposures shows that the major portion of Sector B contains fresh, durable, cobble conglomerate that appears to be similar to the conglomerate currently being mined in the Runkle Canyon area of Sector A.

Resource calculations for Sector B are based upon the following assumptions:

- 1) There is an overall continuity of the Simi Conglomerate in the area shown as Sector B (Plate 2.2). This area encompasses approximately 1.6 square miles.
- 2) A 50 percent waste factor is used for resource calculation. Of this waste, an estimated 65 to 70 percent consists of discrete beds of sandstone and 30 to 35 percent consist of sands, silts, and clays within the conglomerate beds.

Table 2.3 Aggregate resources of the Simi P-C region (all numbers in million short tons). See Appendix C for definitions of terms used in this table.

| SECTOR | RESOURCES | | | | | | TOTAL |
|--------|--|---------------------------------|-----------------------------------|---|---------------------------------|-----------------------------------|--------|
| | RESOURCES COVERED BY USE PERMIT (Inferred Reserves) | | | RESOURCES NOT COVERED BY USE PERMIT (Inferred Resources) | | | |
| | Fine aggregate suitable for base & asphaltic concrete | Fine aggregate suitable for PCC | Coarse aggregate suitable for PCC | Fine aggregate suitable for base & asphaltic concrete | Fine aggregate suitable for PCC | Coarse aggregate suitable for PCC | |
| A | 40 | 80 | 50 | none | none | 10 | 180 |
| B | none | none | none | 80 | none | 430 | 510 |
| C | none | none | none | 140 | 290 | 110 | 540 |
| TOTAL | 40 | 80 | 50 | 200* | 300* | 550* | 1200** |

* Figures rounded off to nearest 50 million.

** Figures rounded off to nearest 100 million.

PCC Portland Cement Concrete.

- 3) Approximately 85 percent of the resource can be used for Portland cement concrete aggregate.
- 4) The in-place density of the resource is assumed to be 0.07 tons per cubic foot (approximately 14.3 ft³ per ton).
- 5) The conglomerate can be mined to a depth at which the pit walls converge.
- 6) A 1:1 slope is used for the hanging wall (north side) of the deposit.
- 7) The foot wall (south side) is controlled by the angle of dip, which averages approximately 25 percent.

Based upon the above parameters, there are approximately 510 million tons of inferred resources underlying Sector B (see Table 2.3). This figure is subdivided into two categories: coarse aggregate suitable for Portland cement concrete (430 million tons) and fine aggregate suitable for base and asphaltic concrete (80 million ton).

SECTOR C

Sector C includes all those portions of the Saugus-San Pedro Formations outside of the areas currently held for extraction of sand and gravel which are deemed likely to contain deposits suitable for concrete aggregate. Resource calculations are based upon the following assumptions:

- 1) There is an overall continuity of the Saugus-San Pedro Formations, representing about 14 square miles, as shown on Plate 2.2.
- 2) Based upon the evaluation of exposures of aggregate that were viewed in the field and at mine sites, it is estimated that about 25 percent of the 14 square miles contain a workable deposit.

- 3) Silt and clay size particles are considered to be waste; they amount to 20 percent of the mineable area.
- 4) Processed material would yield 80 percent sand and 20 percent coarse aggregate (pebbles, cobbles, and boulders).
- 5) The in-place density of the resource is assumed to be 0.07 tons per cubic foot (approximately 14.3 ft³ per ton).
- 6) It is assumed that material can be mined to a minimum depth of 100 feet without causing undue harm to the land such as disruption of major drainage systems.

Based upon the above parameters, there are 3.5 square miles of area from which aggregate would be available to a depth of 100 feet. This yields 154 million tons of aggregate per square mile or a total of approximately 540 million tons after allowing 20 percent for waste. This total reserve figure of 540 million is subdivided into three categories on Table 2.3: coarse aggregate suitable for Portland cement concrete (110 million tons); fine aggregate suitable for Portland cement concrete aggregate (290 million tons); and fine aggregate suitable for base and asphaltic concrete (140 million tons).

The approximate nature of these resource estimates needs to be emphasized. It must be born in mind that, although it is estimated that about 25 percent of the 14 square miles contains a workable aggregate deposit, this figure is based upon visual estimates of suitable materials that were seen in exposures at outcrops and mine workings. More detailed evaluation and measurements may well show this estimate to be in error. Furthermore, there are no provisions for giving quantitative expression to the tons of resources affected by structural dislocations that would preclude mining at specific localities. Finally, it must be born in mind that the minimum depth of mining could easily exceed 100 feet at any given locality. In other words, there is considerable uncertainty inherent in these resource estimates.

ESTIMATED 50-YEAR CONSUMPTION OF AGGREGATE

The total projected consumption of aggregate in the Simi P-C Region for the next 50 years is estimated to be 130 million tons (Table 2.4).

Population and Aggregate Production Records

Population and aggregate production records were compiled for the years 1960-1978 for the Simi P-C Region (Figure 2.2). Records for the years prior to 1960 are in most cases incomplete. Records of population and aggregate production from 1960 to 1976 were also compiled for the adjacent P-C regions (Figures 2.3-2.5). Population projections to the year 2030 are presented in Figure 2.6.

Per Capita Consumption Rates

Annual per capita consumption of aggregate in the Simi P-C Region averaged 5.5 tons between 1961 and 1977 (Figure 2.7). The per capita consumption rate was correlated with the population projections for the Simi P-C Region in order to estimate aggregate consumption needs to the year 2030 (Table 2.4). Similar estimates were made for the adjacent P-C regions (Figure 2.8-2.10).

POPULATION AND DWELLING UNIT DENSITIES

Population and dwelling unit densities of the Simi P-C Region are relatively low when compared to those of the adjacent San Fernando Valley P-C Region (Figures 2.11 and 2.12). The relatively high densities of the San Fernando Valley P-C Region reflect the more mature urban area conditions (limited growth space) of the western Los Angeles basin-San Fernando Valley metropolitan areas. The relatively low per capita consumption rates of 1.6 tons per year in the San Fernando Valley P-C Region

(Figure 2.9), compared to the per capita consumption rates of the other P-C regions, apparently indicates the establishment of normal (urban maturity) maintenance levels in that P-C region. This conclusion is based on comparisons of data from six P-C regions in the greater Los Angeles area. The relatively low population and dwelling unit densities of the Simi P-C Region thus suggest high growth potential in the forthcoming years. Based on data obtained from the Ventura County Planning Department, the Southern California Association of Governments (1978), and the California State Department of Finance and CDMG extrapolation for the period between 2020 and 2030, population in the Simi P-C Region is expected to increase from about 315,000 in 1980 to over 645,000 in the year 2030, an increase of 105 percent. According to Ventura County (1978), the fastest growing cities in Ventura County are projected to be Thousand Oaks (89.9 percent increase by year 2000) and Oxnard (72.4 percent by year 2000). Within the unincorporated areas, Oak Park and Moorpark will absorb most of the new development. Generally, the greatest growth is expected to occur in the eastern parts of the county and in the larger cities. Except for Oak Park and Moorpark, virtually all future growth will occur within or adjacent to existing cities.

FACTORS AFFECTING PER CAPITA CONSUMPTION RATES

Per capita consumption of aggregate has varied with time and is different in each P-C region (Figures 2.7-2.10). Several factors, such as changes in urban growth with time, relative degrees of urban maturity, and major construction projects (for example, freeways) could account for the variations and differences.

The 1961-1967 per capita consumption record for the Simi P-C Region is marked by several distinguishable trends. These trends can be related directly to population growth rates over the 16-year time interval. From 1961 to 1968, population in the Simi P-C Region increased from about 92,000 to 194,882 (Figure 2.2), an increase of 112 percent during that 8-year period. Per

Table 2.4 Projected aggregate consumption (in million short tons) for the Simi, Western Ventura County, San Fernando Valley, and Saugus-Newhall P-C regions.

| YEARS | SIMI P-C REGION | | WESTERN VENTURA COUNTY P-C REGION | | SAN FERNANDO VALLEY P-C REGION | | SAUGUS NEWHALL P-C REGION | |
|-----------|---|---|---|--|--|--|---|--|
| | 5 yr per capita consumption = 27.5 tons/person | | 5 yr per capita consumption = 55 tons/person | | 5 yr per capita consumption = 8 tons/person | | 5 yr per capita consumption = 29.3 tons/person | |
| | Average Population (millions) | Aggregate Consumption* (million tons) | Average Population (millions) | Aggregate Consumption (million tons) | Average Population (millions) | Aggregate Consumption (million tons) | Average Population (millions) | Aggregate Consumption (million tons) |
| 1980-1985 | 0.34** | 9 | 0.36 | 21 | 2.74 | 22 | .080 | 5 |
| 1985-1990 | 0.37 | 10 | 0.40 | 23 | 2.80 | 22 | .087 | 5 |
| 1990-1995 | 0.41 | 11 | 0.44 | 25 | 2.86 | 23 | .092 | 6 |
| 1995-2000 | 0.44 | 12 | 0.48 | 27 | 2.91 | 23 | .095 | 6 |
| 2000-2005 | 0.47 | 13 | 0.52 | 30 | 2.95 | 24 | .098 | 6 |
| 2005-2010 | 0.51 | 14 | 0.57 | 32 | 2.97 | 24 | .104 | 6 |
| 2010-2015 | 0.54 | 15 | 0.61 | 35 | 2.99 | 24 | .110 | 7 |
| 2015-2020 | 0.57 | 16 | 0.65 | 37 | 3.01 | 24 | .117 | 7 |
| 2020-2025 | 0.60 | 17 | 0.70 | 40 | 3.03 | 24 | .122 | 8 |
| 2025-2030 | 0.63 | 17 | 0.73 | 41 | 3.05 | 24 | .127 | 8 |
| TOTAL | | 130 (80)**** | | 310 (190)*** | | 230 (140)*** | | 60 (40)*** |

*Aggregate Consumption = population (5 years average) x 5 year per capita consumption. (Western Ventura County aggregate consumption includes an every five year export of one million tons to Santa Barbara County: for example, for the 1980-1985 period, (.36)(55) = 20 million tons + 1 million tons = 21 million tons.)

**Population projections based on data from Ventura County, the State Department of Finance (1977), and the Southern California Association of Governments (1978).

***Approximately 60% of the total aggregate demand will be for Portland cement concrete.

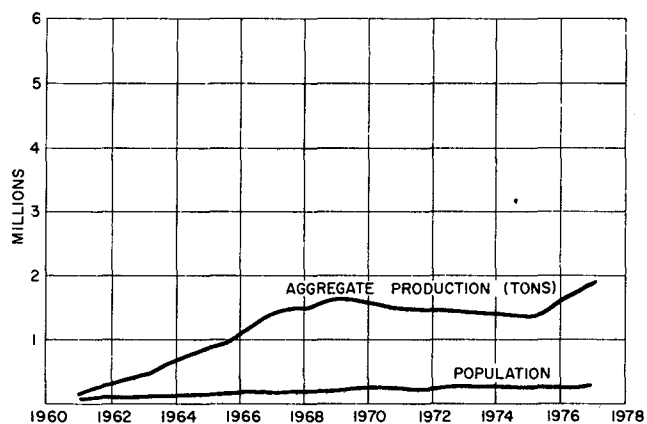


Figure 2.2 Simi P-C Region: population and aggregate production records for years 1960-1976.

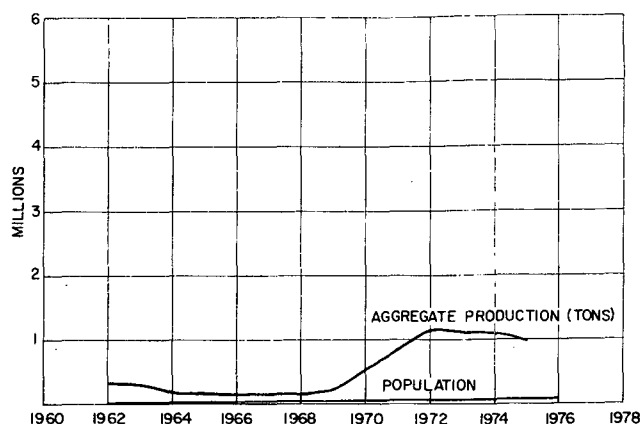


Figure 2.5 Saugus-Newhall P-C Region: population and aggregate records for years 1960-1976.

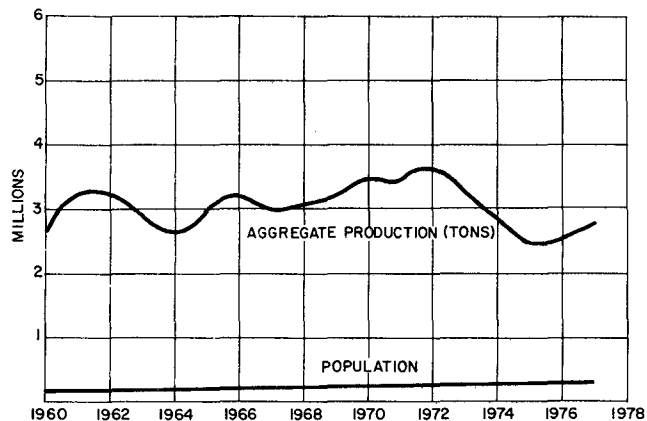


Figure 2.3 Western Ventura County P-C Region: population and aggregate production record for years 1960-1977.

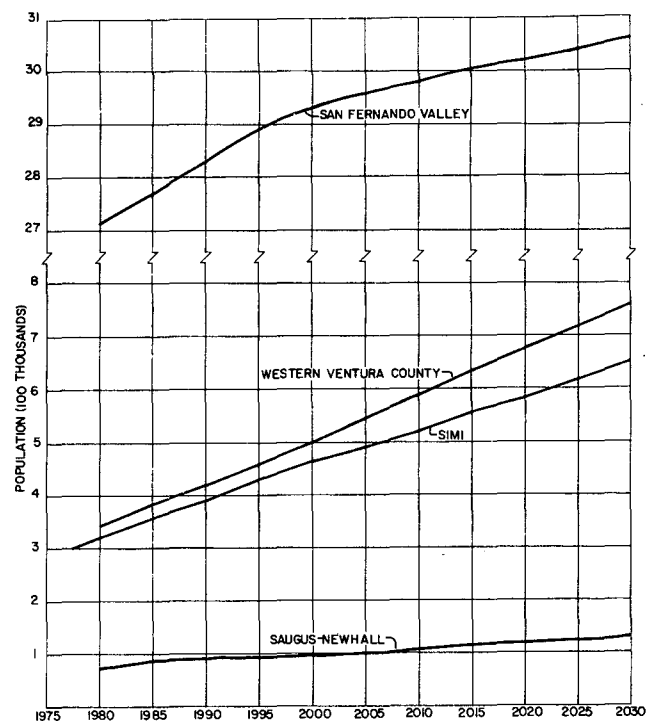


Figure 2.6 Projected populations of the Simi, Western Ventura County, Saugus-Newhall, and San Fernando Valley P-C regions to the year 2030.

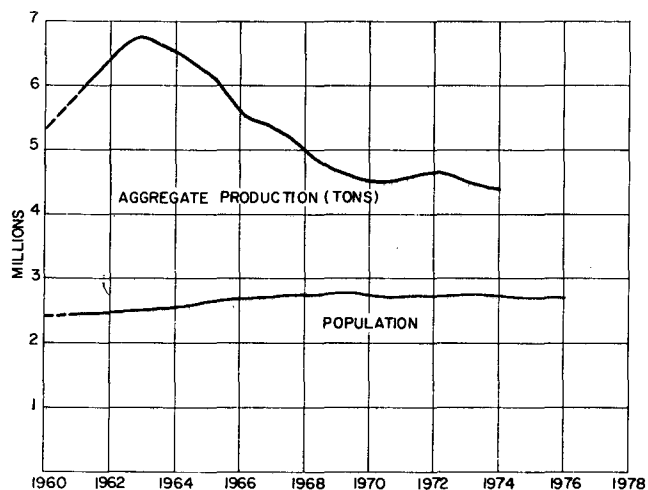


Figure 2.4 San Fernando P-C Region: population and aggregate production record for years 1960-1976.

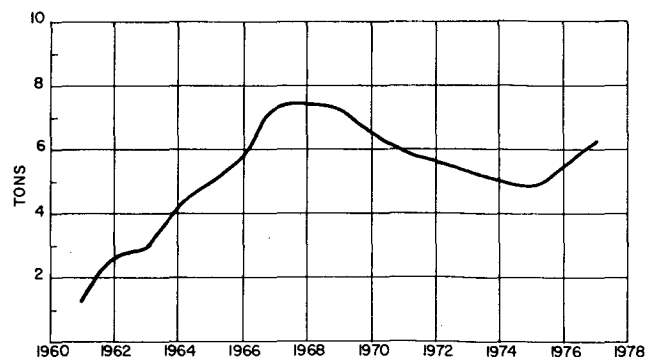


Figure 2.7 Annual per capita consumption in the Simi P-C Region for years 1961-1977.

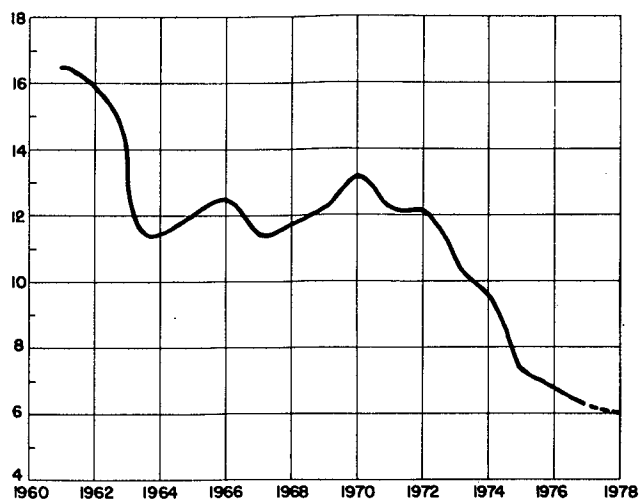


Figure 2.8 Annual per capita consumption in the Western Ventura County P-C Region for years 1961-1977.

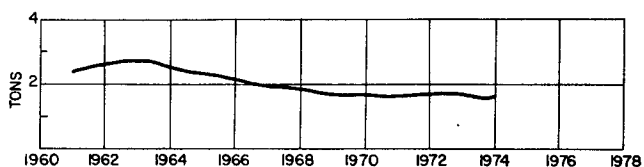


Figure 2.9 Annual per capita consumption of aggregate in the San Fernando Valley P-C Region for years 1961-1976.

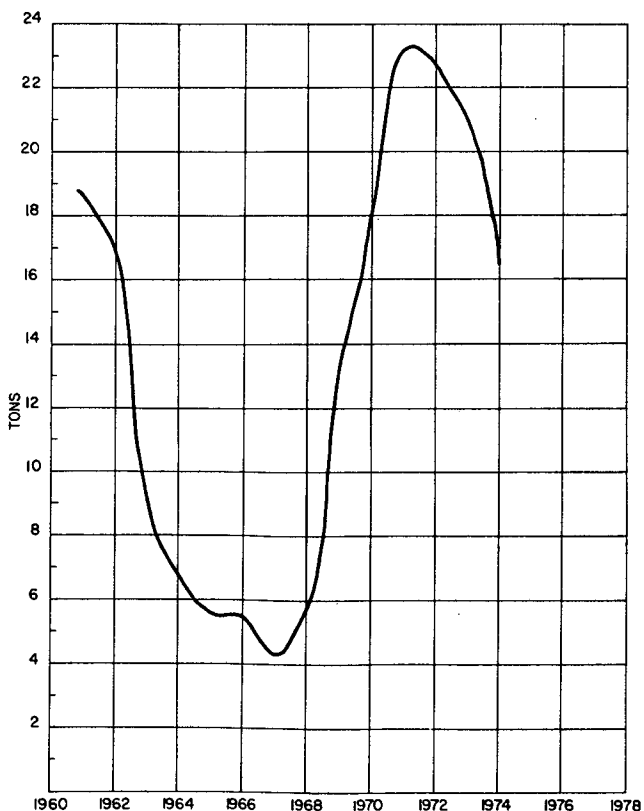


Figure 2.10 Annual per capita consumption of aggregate in the Saugus-Newhall P-C Region for years 1961-1974.

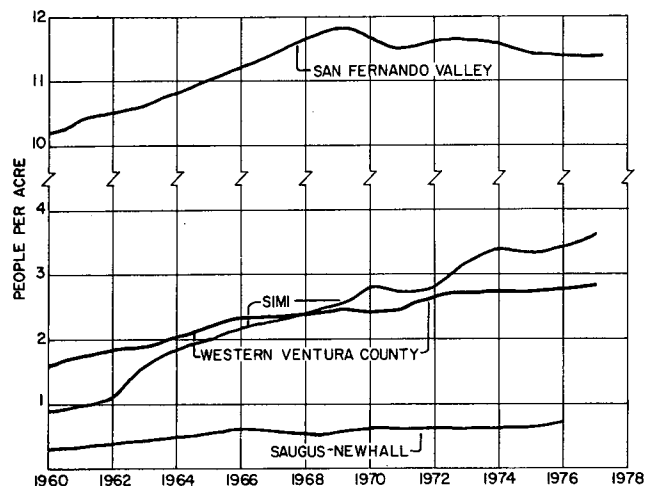


Figure 2.11 Comparison of population densities for Simi, Western Ventura County, Saugus-Newhall, and San Fernando Valley P-C regions for years 1960-1977.

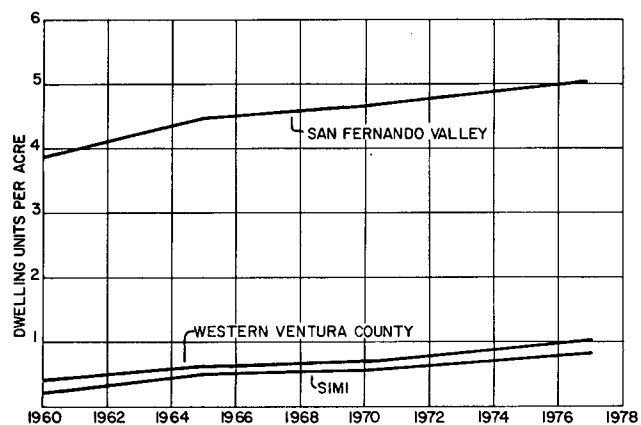


Figure 2.12 Comparison of dwelling unit densities for Simi, Western Ventura County, and San Fernando Valley P-C regions for years 1960-1977. (Data unavailable for the Saugus-Newhall P-C Region.)

capita consumption of aggregate during this 8-year interval steadily rose from 1.34 to 7.41 tons per person per year (Figure 2.7). From 1968 to 1975, also an 8-year period, population in the Simi P-C Region increased from 194,882 to 274,653 (Figure 2.2), an increase of 41 percent, which, in being far less than the percentage increase of the first interval, indicates a decline in the rate of population growth. During the more recent 8-year interval, per capita consumption of aggregate steadily decreased from 7.41 to 4.89 tons per year. During this period, while population continued to grow (but at a much slower rate than previously), yearly aggregate production levels remained relatively constant.

During the 3-year period of 1973 through 1975, population in the Simi P-C Region was increasing at about 5,000 persons per year. Between 1975 and 1977, the population growth rate increased to about 10,000 persons per year. This increase is also reflected in the sudden reverse in the yearly trend of average per capita consumption of aggregate, which climbed from 4.89 tons in 1975 to 5.52 in 1976 and finally to 6.24 in 1977. If population continues to grow at the present rate, it can be assumed that the per capita consumption rate will increase accordingly—at least until the rate of population growth declines.

The above discussion points out the general relationship that exists between population growth rates and the consumption of aggregate. On that basis, it is possible to forecast the total amount of aggregate that will be required to fill the needs of a particular consumption area within a specified time interval if projected per capita consumption rates are related to population growth rates for each year during the time interval. However, it is very difficult to forecast variances in annual growth rates and accompanying changes in per capita consumption rates into the future. Population projections are normally calculated on the basis of relatively steady growth rates which will have the effect of averaging out the future variances in annual population increases. Accordingly, the 16-year average annual per capita consumption of aggregate of 5.5 tons per person per year is used as the projected per capita consumption figure to calculate total aggregate needs of the Simi P-C Region to the year 2030.

Whether or not the annual per capita rate of aggregate consumption in the Simi P-C Region over the next fifty years will prove to be the same as the rate for this 16-year period cannot, of course, be said with certainty. A massive reconstruction project necessitated by an unforeseen disaster such as a major earthquake could increase the average annual consumption rate by as much as 100 percent. However, all known factors make the 5.5 tons per person per year rate the most likely probability.

Results based on the correlation between this figure and projected population growth for the region are shown on Table 2.4. The Simi P-C Region will require about 130 million tons of aggregate to satisfy its 50 year future requirements based upon an annual per capita consumption rate of 5.5 tons. About 60 percent of this would go into making Portland cement concrete aggregate as indicated by examination of private company data. In light of this, it can be anticipated that 80 million of the 130 million ton figure will be used as Portland cement concrete aggregate, of which about 50 percent or 40 million tons would be made up of coarse particles larger than 4 millimeters and about 40 million tons would be fine aggregate.

Although inspection of Table 2.4 would suggest that adequate reserves are available for the region based upon projected demand, this conclusion needs to be qualified. The distribution of coarse and fine aggregate is not uniform throughout Sector A. The Simi Conglomerate is deficient in fine aggregate; the Saugus-San Pedro Formations are deficient in coarse aggregate. However, both fine and coarse aggregate are needed to obtain the proper size mix for Portland cement concrete. Current mining operations are producing both fine and coarse aggregate from one geologic unit, but in time operations in the Simi Conglomerate will run out of fine material and have to transport it from sources in the Saugus-San Pedro Formations. Likewise, operations in the Saugus-San Pedro Formations in time will run out of coarse material and have to transport it from sources in the Simi Conglomerate. Neither of these sources alone is capable of supplying the necessary size distribution for Portland cement concrete over the next fifty years without causing major disruptive environmental and engineering problems at an excessive cost to the consuming public.

As indicated on Table 2.3, within the Simi P-C Region there are an estimated 50 million tons of coarse aggregate reserves and an estimated 120 million tons of fine aggregate reserves, 50 million tons of which is suitable for making Portland cement concrete. Therefore, it can be concluded that, if the per capita consumption remains constant for the region and if no new demands are made on reserves from adjacent regions, there is

about 25 percent *more* coarse aggregate and about 25 percent *more* fine material than is needed for making Portland cement concrete. If, however, the consumption rate *increases* or experiences an accelerated rate of depletion through a draw down of reserves by adjacent P-C regions, then a short fall could easily occur. Furthermore, no account has been taken of the possibility that some of the reserves could be lost as a result of land in reserve areas being used in ways that preclude mining.

As shown in Table 2.3, there are over a billion tons of non-permitted resources (in areas not covered by a use permit allowing mining of aggregate) in the Simi P-C Region. Approximately 550 million tons of this represents coarse material suitable as a source of Portland cement concrete aggregate. It may be advisable for local agencies of the region to make provisions to set aside some, if not all, of these non-reserve resources as a contingency reserve. Such a reserve could meet future needs should existing reserves be depleted as a result of massive reconstruction following a major disaster.

ALTERNATIVE SOURCES OF AGGREGATE

Introduction

Potential sources of aggregate, in addition to those described in Sectors A, B, and C (Plate 2.2), occur in areas within and near the Simi P-C Region. These include resources in adjacent P-C regions, areas underlain by crystalline rocks, older Cenozoic sedimentary deposits, and offshore sand and gravel deposits (see Plate 2.3).

Except for the resources in adjacent P-C regions, too little is known about the physical and chemical properties (see Part I, "Overview of Aggregate") of alternative sources of aggregate to permit even crude resource estimates. However, a general discussion about the potential resources, their occurrence, and factors controlling their utilization is presented in the following section.

Sand and Gravel Resources of Adjacent P-C Regions

RESOURCE ESTIMATES

The resource estimates given in this report for the adjacent Saugus-Newhall P-C Region (Table 2.5 and Plate 2.1) represent a modification of data taken from California Division of Mines and Geology Special Report 139 (Evans and others, 1979). The *reserve* estimate is current to January 1979. The *resource* estimate was made using published geologic maps with reconnaissance field checking, including visits to sand and gravel plants operating in 1978. The following parameters were assumed in making these estimates:

- 1) Material density ranges from .060 to .065 short tons per cubic foot.
- 2) Waste does not exceed 25 percent.
- 3) Technology is presently available for economic extraction.
- 4) Estimates are limited to areas which are not urbanized and for which mining is still a possible interim land use.
- 5) In bedrock areas, the lowest depth of extraction would be such as to permit drainage of the mined area.

Table 2.5 Aggregate resources of the Simi, Western Ventura County, San Fernando Valley, and Saugus-Newhall P-C regions.

| PRODUCTION-CONSUMPTION REGION | RESERVES (Million Tons) | RESOURCES (Million Tons) | TOTAL (Million Tons) |
|---|----------------------------|-----------------------------|-------------------------|
| Simi | 170 | 1000* | 1200* |
| Western Ventura County | 40 | 4900* | 4900* |
| San Fernando Valley | 40 | 720 | 760 |
| Saugus-Newhall | 200 | 230 | 430 |
| CATEGORY TOTAL | 450 | 6900* | |
| TOTAL RESERVES-RESOURCES Simi, Western Ventura County, San Fernando Valley and Saugus-Newhall: 7300* | | | |

*Figure rounded off to the nearest 100 million tons.

The *reserve* and *non-permitted resource* figures for the adjacent San Fernando Valley P-C Region are taken from California Division of Mines and Geology Special Report 143, Part II (Anderson and others, 1979). The *reserve* and *non-permitted resource* figures for the Western Ventura County P-C Region are taken from Part III herein. The estimated resources of the adjacent P-C regions are presented on Table 2.5:

Localities marked as PRZ-2 (Preliminary Resource Zone) on Plate 2.1 contain all of the known tentative MRZ-2 resource areas in the Saugus-Newhall P-C Region. Changes will most likely be made both in the resource estimations and the outlines of the zones after a more detailed study is completed at a later date.

ESTIMATED 50-YEAR CONSUMPTION OF AGGREGATE IN ADJACENT P-C REGIONS

Estimated 50-year aggregate needs for adjacent P-C regions are presented on Table 2.4. Comparison of Tables 2.4 and 2.5 shows that the projected 50-year total consumption of aggregate for each of the three adjacent P-C regions is less than their respective total *resource* estimates. However, the *reserves* alone in the Western Ventura County and San Fernando Valley P-C regions are not sufficient to supply the 50-year projected needs for aggregate. Consequently, these two P-C regions will be forced to acquire aggregate from their non-permitted resources or from supplies outside their regions. Either course is likely to have a major negative impact upon the Simi P-C Region's supply of aggregate.

Production from present sources in the adjacent P-C regions—San Fernando Valley, Western Ventura County, and Saugus-Newhall—represents the most immediate alternative source of aggregate. The disadvantages of increasing dependency on these sources in the future are increases in haulage costs, added air pollution attendant to longer haulages, and lack of control of those sources by the market population of the Simi P-C Region. The last disadvantage may become important when present reserves in adjacent P-C regions are depleted, which is projected to happen in the Western Ventura County and San Fernando Valley P-C regions within the 50-year projection period. Future aggregate supply from these regions, and perhaps the Saugus-Newhall P-C region as well, may depend on land-use decisions made without consideration of the aggregate needs of the Simi P-C Region.

Sedimentary Rocks as Alternative

Much of the Simi P-C Region is underlain by Tertiary sedimentary rocks (Plate 2.3). Oak Ridge, the Santa Susana Mountains, and the Las Posas, Camarillo, and Simi Hills are all composed primarily of Tertiary sedimentary rocks. Some of these sedimentary units are possible alternative sources of aggregate material.

Three Tertiary sedimentary formations—the Simi Conglomerate, the San Pedro Formation, and the Saugus Formation—are presently being mined for sand and gravel. They have sections that are classified as MRZ-3a in addition to the areas classified as MRZ-2. The subscript "a" has been added to these MRZ-3 areas to indicate their high potential. Suitable sources of aggregate may exist in those areas.

The Sespe Formation (classified as MRZ-3 in this report) is also a potential alternative aggregate source. Although in many areas the Sespe Formation contains an abundance of clayey silt and clayey sandstone layers, particularly within the Thousand Oaks-western Simi Valley area, there are localities where it consists of relatively clean sandstone and conglomerate. The conglomerate clasts are generally composed of well-rounded volcanic rock and granitic rock, along with minor shale and metamorphic rock. The conglomerate sections are weakly indurated and could probably be excavated with heavy equipment. It is noteworthy that about 70 miles to the southeast of the Simi P-C Region, in Orange County, a lens of Sespe Formation conglomerate is being mined for aggregate material.

The Topanga Formation (classified as MRZ-3 in this report) is a potential alternative source of aggregate, especially in the Thousand Oaks-Bell Canyon area where it is known to contain beds of conglomerate. A detailed evaluation would have to be made to determine its suitability as a source of Portland cement concrete aggregate. It is reported that a significant percentage of the conglomerate is derived from the Conejo Volcanics, parts of which are suspected of being reactive with Portland cement and therefore, of being unsuitable for use in Portland cement concrete.

The Santa Susana Formation (classified as MRZ-3 in this report) is exposed in the Simi Hills and in an area northeast of Simi Valley. It may contain lenses of conglomerate of acceptable quality and extent for use as aggregate.

The Simi P-C Region is unique among the greater Los Angeles-Ventura County area P-C regions in that the only sources of aggregate within the region are bedrock sedimentary formations. In view of the very limited potential of stream bed deposits in the Simi P-C Region, the Tertiary sedimentary formations mentioned in this section are likely to become important alternative sources of local aggregate. Also, Tertiary sedimentary formations are located in areas not likely to feel the pressures of urbanization in the future.

Alluvial Sediments as Alternative

The creek bed of Arroyo Simi between the communities of Simi Valley and Moorpark is a potential limited source of aggregate (MRZ-3 in this report). The deposit is generally confined to the existing channel and may be as deep as 135 feet. There is no information on the quality of this sand and gravel, and its suitability for use in Portland cement concrete is in question.

Sources of Crushed Rock as Alternative

Tertiary volcanic rocks—the Conejo Volcanics—are exposed over large parts of the western and central Santa Monica Mountains area, and as far north as the west end of Simi Valley. This large deposit of middle Miocene volcanics is made up chiefly of basaltic and andesitic flows, breccias, tuffs and shallow intrusives. It is possible that some of this material might be crushed and processed into aggregate material if the rock is of acceptable quality.

These volcanic rocks have not been thoroughly evaluated for use as aggregate material; however, brief field examination and petrographic analysis of several rock samples indicate that rocks in this area have undergone widespread zeolitization. Volcanic rocks with high zeolite content are potentially reactive in concrete and, therefore, unsuitable for use as aggregate. Deuteric rock alteration could also affect the durability of the material. Exploration and testing is necessary to identify and delineate any resource suitable for crushed rock in this terrane.

LAND-USE FACTORS

Most of the volcanic rock exposed in the Santa Monica Mountains lies within the proposed boundaries of the Santa Monica Mountains National Recreation Area (NRA), which was established November 10, 1978, with passage of Public Law 95-625, Section 507 (Plate 1.1). The NRA is administered by the U.S. Department of the Interior through the National Park Service. Public Law 95-625 mandates that "The Secretary shall manage the recreation area in a manner which will preserve and enhance its scenic, natural and historical setting and its public health value as an airshed for the southern California metropolitan area while providing for the recreational and educational needs of the visiting public." Although the enabling legislation does not address mining activity specifically, Section 507(i) states: "In the administration of the recreation area, the Secretary may utilize such statutory authority available for the conservation and management of wildlife and natural resources as appropriate to carry out the purpose of this section. The fragile resource areas of the recreation area shall be administered on a low-intensity basis, as determined by the Secretary." Opportunities for future mining activity in this area seem uncertain at best.

ENVIRONMENTAL FACTORS

Major environmental factors that must be addressed when evaluating mining and processing of crushed rock for aggregate material are water and air quality, operational noise level, reclamation of mined land, and esthetics. The aggregate industry must meet rigorous city, county, state, and federal requirements to abate and mitigate degradation of the environment. Specific environmental concerns can vary from locality to locality depending on the nature of the surrounding environment. For instance, environmental issues regarding crushed rock aggregate operations in the western Simi Valley area that might be raised by the people in the surrounding residential sections would be related to dust, noise (blasting), and truck traffic resulting from plant operations. In unpopulated, undeveloped areas of the Santa Monica Mountains, esthetic quality, noise, water pollution, and disturbance of surrounding biota might be of greatest concern.

CONCLUSIONS AND RECOMMENDATIONS

Current reserves within the Simi P-C Region are adequate for supplying construction aggregate for the existing population of over 300,000 inhabitants and an anticipated population increase to over 600,000 by the year 2030. Based upon the projected population figures and using an average annual consumption rate of 5.5 tons per capita, approximately 130 million tons of aggregate will be required to satisfy the local demand. Current reserves are in excess of 170 million tons, which is an adequate amount to fulfill local requirements, provided reserves are made available from both the Simi Conglomerate and the Saugus-San Pedro Formations in order to obtain the proper balance of coarse and fine aggregate for Portland cement concrete. However, if consumption were to return to the 1968 high annual rate of consumption of 7.41 tons per capita, 180 million tons of aggregate would be required. This represents a shortfall of about 10 million tons.

As noted previously in this report, there are 170 million tons of aggregate reserves in Sector A, of which 50 million tons are coarse material suitable for Portland cement concrete and the balance of 120 million tons is fine aggregate (essentially sand), 50 million tons of which is suitable for making Portland cement concrete.

It is anticipated that over the next 50 years, about 130 million tons of aggregate will be needed to satisfy a per capita consumption of 5.5 tons per year for the projected population. About 60 percent of this will most likely be needed to make Portland cement concrete, which represents approximately 80 million tons. About 50 percent of the 80 million tons (40 million tons) would represent coarse aggregate. Therefore, it can be considered that Sector A contains an adequate amount of aggregate for its projected needs. However, because the material within this sector will be needed to meet the region's projected requirements for aggregate of a proper sizes distribution for Portland cement concrete, the CDMG recommends that the State Mining and Geology Board consider all of this sector for designation.

Consideration also needs to be given to the advisability of providing sufficient aggregate resources to allow for unforeseen circumstances, such as reconstruction in the wake of a major earthquake or similar disaster. In addition, it can be anticipated

that, if residents of the adjacent San Fernando Valley P-C Region fail to find a local source of aggregate to replace their region's rapidly depleting reserves (anticipated to be depleted in about 10 years), they are likely to use aggregate from the Simi P-C Region to meet much of their requirements. With the substantially higher population in the San Fernando P-C Region (about 2.5 million inhabitants compared to about 340,000 inhabitants of the Simi P-C Region) this development could lead to a significantly accelerated depletion rate for the Simi P-C Region.

Sector A contains a reasonable balance between coarse and fine aggregate. Sector B is well endowed with coarse aggregate, while Sector C is generally deficient in coarse material. Therefore, if measures are to be taken to provide for emergency contingencies alluded to earlier or to provide for a draw down of reserves as a result of consumption by the adjacent San Fernando P-C Region, then particular consideration should be given to designating portions of both Sectors B and C. Neither of these two sectors alone can supply the proper balance between coarse and fine aggregate needed for making Portland cement concrete.

PART III

CLASSIFICATION OF SAND, GRAVEL, AND CRUSHED ROCK RESOURCE AREAS WESTERN VENTURA COUNTY PRODUCTION-CONSUMPTION REGION

INTRODUCTION

Land in the Western Ventura County Production-Consumption (P-C) Region has been classified by the California Division of Mines and Geology (CDMG) according to the presence or absence of significant sand and gravel deposits and crushed rock source areas (Plate 2.1). The land classification is presented in the form of Mineral Resource Zones (MRZ's) on 18 of 24 U.S. Geological Survey topographic quadrangle base maps which accompany this report (Plates 1.1-1.24). Figure 1.3 and Table 3.1 are indexed to the quadrangle maps covering the Western Ventura County P-C Region. A list of lead agencies located within the Western Ventura County P-C Region is presented on Table 3.2.

ESTABLISHMENT OF MINERAL RESOURCE ZONES

Mineral Resource Zones within the Western Ventura County P-C Region were established on the basis of an aggregate resource appraisal which includes study of pertinent geologic reports and maps, field investigations, visits to active sand and gravel mining operations, analyses of drill hole data collected from the past 75 years, and inspection of aerial photographs and private company documents.

The Mineral Resource Zones depicted on Plates 1.1 through 1.24 were established based on the suitability of the deposits for use as Portland cement concrete (PCC) aggregate. Lower quality aggregate resources, acceptable for use as asphaltic concrete aggregate, construction sub-base, railroad ballast, etc., have not

been zoned independently on the plates, but are evaluated only where they occur in conjunction with PCC aggregate. They are discussed under Resource Sectors A-J, and shown on Table 3.3.

Areas Classified MRZ-1

Several areas located within the Western Ventura County P-C Region have been classified MRZ-1. These are areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence ("Guidelines for Classification and Designation of Mineral Lands," Appendix A-3, p. 51).

These areas occur mainly within the interior parts of the Oxnard plain, Santa Rosa Valley, other small valley areas, and in mountainous areas underlain by particular bedrock formations (Plate 2.1). Drill hole data and field observation indicate that these areas are underlain by sedimentary deposits composed predominantly of fine-grained material unsuitable for use as aggregate.

Areas Classified MRZ-2

One area within the Western Ventura County P-C Region has been classified MRZ-2. In this area, adequate information indicates that significant material deposits are present or that a high likelihood for their presence exists ("Guidelines," Appendix A-3, p.51). The area mainly occurs within the Santa Clara River Valley, an elongate area about 27 miles long (Plate 2.1).

For a deposit of sand and gravel or a particular bedrock unit to be categorized as significant (MRZ-2), it must satisfy the

Table 3.1 List of U.S. Geological Survey 7-1/2 minute quadrangles covering the Western Ventura County P-C Region (Plates 1.1-1.13, 1.15-1.17, and 1.21-1.23). Quadrangles show existing urbanized areas urbanizing areas, Mineral Resource Zones (MRZ), and well log locations. Quadrangles are indexed on Figure 1.4 by the following list.

| | | |
|---------------------|-----------------|------------------|
| 1. Matilija | 7. Pitas Point | 13. Santa Susana |
| 2. Ojai | 8. Ventura | 15. Oxnard |
| 3. Santa Paula Peak | 9. Saticoy | 16. Camarillo |
| 4. Fillmore | 10. Santa Paula | 17. Newbury Park |
| 5. Piru | 11. Moorpark | 21. Point Mugu |
| 6. Val Verde | 12. Simi | 22. Triunfo Pass |
| | | 23. Point Dume |

Table 3.2 List of lead agencies (county and incorporated city governments) located within the Western Ventura County P-C Region. (Cities that have active aggregate operations within their jurisdictional boundaries are denoted by asterisks. Cities that have land within their jurisdiction classified MRZ-2 are denoted by ▲).

| | |
|----------------|------------|
| Santa Paula* ▲ | Camarillo |
| Ventura ▲ | Fillmore ▲ |
| Port Hueneme | Ojai |
| Oxnard ▲ | |

criteria given in the "Guidelines for Classification and Designation of Mineral Lands" (Appendix A-3) as well as the following:

- 1) The deposit must consist of sound, durable material substantially free of chemically reactive substances that would preclude its use in Portland cement concrete.
- 2) The geologic factors that resulted in the formation of the deposit must be understood clearly enough so that reasonable subsurface interpretation can be made from surface exposures of the material and from drill hole data.
- 3) The particle grain size distribution required in Portland cement concrete must be present.

The only deposits within the Western Ventura County P-C Region that satisfy these criteria occur within the Santa Clara River Valley and within a small portion of the Oxnard Plain (Plate 2.1).

The Santa Clara River flows westerly from its headwaters in the San Gabriel Mountains near Soledad Pass, six miles south of Palmdale, California. The river flows through Ventura County in a westerly and southwesterly direction for a distance of about 36 miles. Numerous tributary streams join the Santa Clara River within Ventura County; the most significant of these are Piru Creek, Sespe Creek, and Santa Paul Creek. Detritus that has been transported by the river and its tributaries has been deposited along the Santa Clara River channel and on the adjacent floodplain to form a linear deposit ranging from 1 to 5 miles in width and up to 500 feet deep.

The coarse fraction of the deposit (particles greater than one quarter inch) decreases downstream with distance from the river's source. At Santa Paula, this fraction is estimated to be 40 to 45 percent coarse material, and it contains boulders that measure up to 3 feet in diameter. The aggregate is composed of approximately 40 percent reworked sandstones, 40 percent granitic rock, 10 percent Modelo or Monterey Formation shales,* and 10 percent metamorphic and volcanic rocks. Most of the reactive Monterey Shale has been introduced into the Santa Clara River deposits by the above mentioned major tributaries draining the mountainous area to the north. As a result, the amount of reactive material in the deposits theoretically decreases upstream. Records of aggregate production show that two companies were producing aggregate from three plants in the lower Santa Clara River-Ventura production district prior to 1925 (Tucker, 1925, p. 223-245). At present there are four companies operating from six properties within the district (Figure 3.1). The district includes the Santa Clara River between Santa Paula and El Rio, a distance of seven miles.

The plants market their products in southern Santa Barbara, Ventura, and western Los Angeles counties. All of the aggregate is hauled in trucks owned by the producing companies or by independent operators.

*These contain reactive opaline chert and soft, light diatomaceous shales; see aggregate specifications, Part I, "Overview of Aggregates."

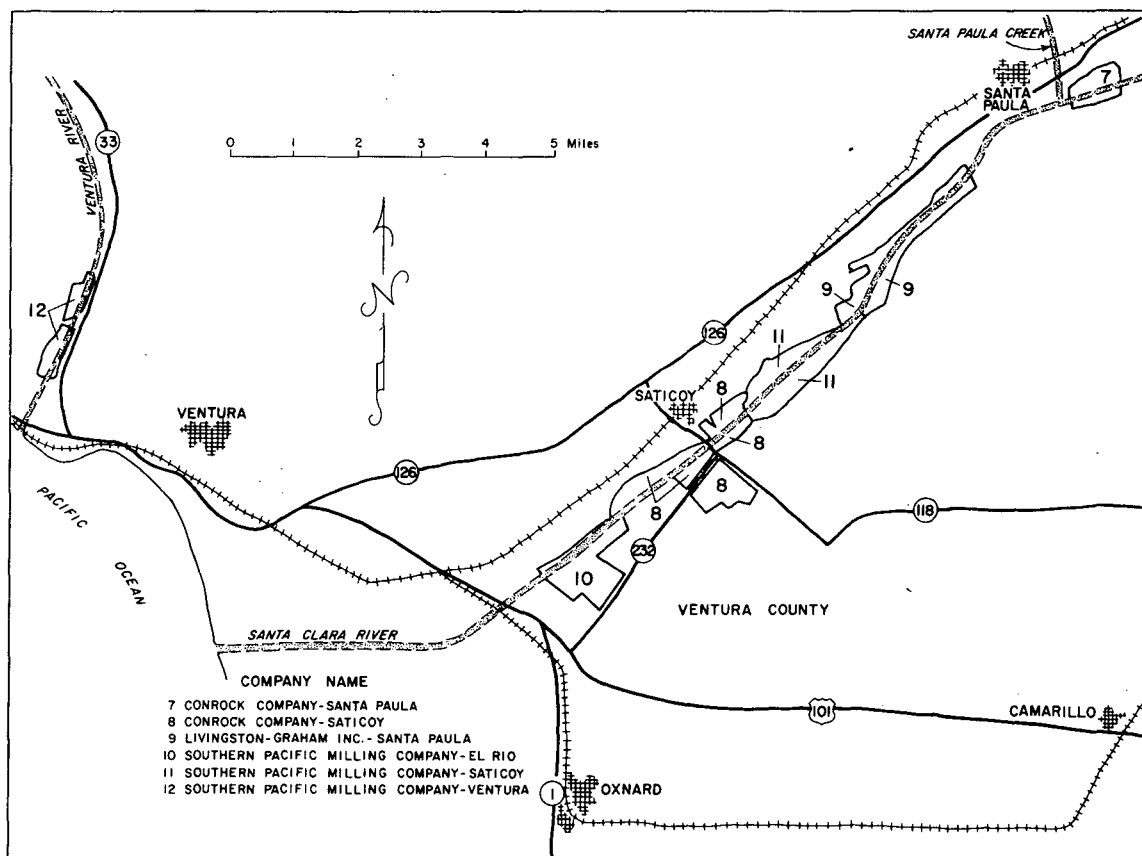


Figure 3.1 Sketch map of the lower Santa Clara River production district showing land owned or leased by aggregate companies as of November 1979 (from Evans and others, 1979). (See Plates 1.9, 1.10, and 1.15 for MRZ-2 locations.)

Areas Classified MRZ-3

A substantial portion of the Western Ventura County P-C Region has been classified MRZ-3. Areas classified MRZ-3 are those areas containing mineral deposits, the significance of which cannot be evaluated from available data ("Guidelines," Appendix A-3, p. 51). MRZ-3 areas located in valley regions are generally underlain by Quaternary age alluvial deposits containing sand and gravel. Resource evaluations cannot be made because of inadequate subsurface data (well-log data is unavailable or available data is inconclusive or unreliable). MRZ-3 areas located in hilly or mountainous terrane are generally underlain by Tertiary sedimentary volcanic deposits.

Some deposits that have been classified MRZ-3 are shown by the subscript "a" (see quadrangles). Based upon the limited available geologic data and limited field work, these deposits have been judged to have relatively higher potential as sources of aggregate material suitable for use in Portland cement concrete. Areas within the Western Ventura County P-C Region that are classified MRZ-3 or MRZ-3(a) are discussed in the "Alternative Sources of Aggregate" section below.

Areas Classified MRZ-4

Several areas within the Western Ventura County P-C Region have been classified MRZ-4 (Plate 2.1). Areas about which available information is inadequate for assignment to any other MRZ zone are classified MRZ-4 ("Guidelines," Appendix A-3, p. 51).

EVALUATION OF AGGREGATE RESOURCES IN THE WESTERN VENTURA COUNTY P-C REGION

Introduction

An analysis of aggregate supply in the Western Ventura County P-C Region was conducted on the basis of a quantitative evaluation of aggregate resources there. A similar evaluation was made of aggregate resources of the adjacent Simi P-C Region. A similar, but less detailed evaluation was made in the adjacent Saugus-Newhall P-C Region, which will be classified at a later date (Plate 2.1). The adjacent P-C regions were evaluated to determine the effects that these regions might have on the availability of aggregate from sources in the Western Ventura County P-C Region. These latter evaluations are presented in the "Alternative Sources of Aggregate" section, beginning on page 35.

Data Base

For any appraisal of a resource to have credibility, it must be based upon sound data. If the data base is weak, the resource appraisal must indicate this fact and, conversely, if it is strong this should also be noted. Terminology used to reflect the confidence level of the data base for this project has been adapted from U.S. Geological Survey Bulletin 1450-A (Appendix C). The terms *measured*, *indicated*, and *inferred*, as used in the discussion that follows, refer to both reserves and resources, as well as hypothetical resources. For this project, *reserves* represent material believed to be acceptable for commercial use that exists within property boundaries owned or leased by an aggregate

producing company and for which permission allowing extraction and processing has been granted by the proper authorities. *Resources* include *reserves* as well as all potentially useable aggregate materials (non-permitted resources) which may be mined in the future, but for which no use permit allowing extraction has been granted, or for which development has not been definitely established to be feasible based upon current technological or economic conditions.

Much of the resource evaluation that follows is based on drill hole records. These drill holes were made over a time span extending back to the early part of this century. They describe the types of earth material (silt, sand, gravel, and bedrock types) encountered at various depths. The quality of drill hole descriptions range from poor to very good. Only drill hole records that contain descriptions judged to be acceptable for analysis were used in the present study.

Regulatory Constraints on Mining

The majority of regulatory constraints on sand and gravel mining that limit the available resources in Ventura County are site specific. The restrictions are written in each conditional use permit issued to quarry operators by the County of Ventura Planning Department. In drafting a permit, the Planning Department must take into account many federal, state, and local agency regulations and consider any recommendations that those agencies make concerning their areas of authority.

The present constraints fall under the following general categories: restraints on final grading configurations, limits on water course alterations, biota habitat preservation measures, limitations to prevent damage to adjoining property, incompatible land-use planning designations, pollution controls, and reclamation requirements.

The following is a list of the various codes, regulations, and directives that the Planning Department must address:

- 1) Ventura County Board of Supervisors Resolution FC-1. This is a set of requirements—adopted from the U.S. Army Corps of Engineers—that set the grading limits for excavations adjacent to the lower Santa Clara River levee.
- 2) Uniform Building Code as adopted by the Ventura County Board of Supervisors. This limits the final grade on cut and fill slopes.
- 3) Ventura County Ordinance No. FC-18. Requires the approval of the Ventura County Flood Control Department to alter any water course.
- 4) City of Oxnard Resolution 5007. Prohibits sand and gravel quarrying east of Vineyard Avenue within the city limits of Oxnard.
- 5) U.S. Environmental Protection Agency, 1972 Act (PL92-500), Section 208 as amended in 1977. Affects mining below the ground water level in the Oxnard Plain.
- 6) Ventura County Ordinance Code, Division 8 - Planning, Chapter 5, Article 1, Section 8163-3. Presents a set of general standards with which all permitted operations on county land must comply. These standards deal with the compatibility of the operation with surrounding land uses, the possible effects on public safety, effects on values of adjacent property, and any other detrimental effects that the proposed activity might have on the environment or public health.

- 7) California State Department of Fish and Game Code. Authorizes Fish and Game personnel to require sand and gravel operations to minimize mining impact on fish and wildlife habitats.
- 8) State of California Water Resources Control Board. Authorized by the State Water Code to regulate the water resources of the State. Presently the sea water intrusion of the Oxnard Plain aquifers is of major concern and may affect mining in the lower Santa Clara River by requiring mitigating measures that would severely limit sand and gravel extractions.
- 9) California Coastal Commission Shoreline Erosion Protection Policy to be administered by the County of Ventura. Requires the county to restrain any operation from reducing the transport of sediments to the beach unless counter measures are provided.

The adopted requirements of U.S. Army Corps of Engineers (FC-1) and the City of Oxnard's Resolution 5007 are the most explicit. The remaining requirements provide general policy which must be tailored to each site in the form of permit stipulations.

Factors Considered in Calculating Reserves and Resources

In determining which areas, if any, should be classified as MRZ-2 (significant deposits present) and in calculating reserves and resources within areas so classified, the following parameters were used:

- 1) Material meets the criteria given in the "Guidelines for Classification and Designation of Mineral Lands" (Appendix A-3).
- 2) The deposit consists of sound, durable material substantially free of chemically reactive substances that would preclude its use as a construction material.

In alluvial areas:

- 3) Combined clay and silt fraction does not exceed 25 percent by volume as determined from drill hole data.
- 4) The geologic factors that resulted in the formation of the deposit are understood clearly enough so that reasonable subsurface interpretation can be made from surface exposures of the material and from drill hole data. Furthermore, it is assumed that there is an average of .065 short tons of sand and gravel per cubic foot (15.4 ft³/ton).

In bedrock areas:

- 5) The basic geologic structures of the deposit must be understood clearly enough to make a reasonable interpretation of the lateral and vertical distribution of the material. Furthermore, it is assumed that there is an average of .070 short tons per cubic foot of material (14.5 ft³/ton).

Resource Sectors

All extractable sand and gravel deposits suitable for aggregate within the Western Ventura County P-C Region have been divided into ten sectors (A-J) for the purpose of making resource calculations.

SECTOR A

Sector A encompasses 1,447 acres of land lying within the Santa Clara River channel sector. It extends from the United Water Conservation District's proposed diversion dam, located

about 1¼ miles upstream from Los Angeles Avenue, to a point approximately 1 mile west of Highway 101 (Plate 3.1). The 6½ mile stretch of river is bordered on the south by a man-made levee and on the north by higher ground of an alluvial fan deposit along the base of the mountains to the north.

Drill hole records of several water wells located in Sector A indicate that sand and gravel extends from the surface downward to a depth of 30 to 130 feet. The deepest deposits occur along the southern margin and to the east. The northern margin of the river channel deposit appears to consist of overly fine-grained deposits of the adjacent alluvial fan at about 30 feet in depth.

A 20 percent waste factor is used for calculating the amount of total sand and gravel which can be used as various aggregate products (Portland cement concrete aggregate, asphaltic concrete aggregate, road base material, and railroad ballast). This factor is based on well-log evaluation, field investigation, including sampling by CDMG geologists, and company supplied information. However, deposits underlying Sector A have demonstrated a very high sand-to-gravel ratio, mainly because of the long distance from the rock sources and the low stream gradient to this depositional area. An overall average waste factor of 40 percent is used to calculate the amount of aggregate available for use in Portland cement concrete alone.

On this basis, it is estimated that a total of 240 million tons of aggregate underlies Sector A. Of this amount, 180 million tons of aggregate is suitable for use in Portland cement concrete (Table 3.3). These are classified as inferred resources and are in addition to reserves.

Two companies presently control property located within Sector A. However, recently instituted mining regulations limiting excavation to above the low-water flow line have severely restricted mining activity within those properties in the river channel.

SECTOR B

Sector B covers an area of 1,080 acres situated south of the river levee, north of Vineyard Avenue, and between Highway 101 and Los Angeles Avenue (Plate 3.1). The resource in Sector B extends from the surface to 130 feet in depth and possibly more in some places. A general depth of 130 feet below the surface is used in resource calculation because a thick clay layer is present at that depth in drill holes throughout the sector. The upper surface of the clay layer appears to be parallel or subparallel to the present day surface over most of the area of the section. Elevation in Sector B ranges from 125 feet above sea level at Los Angeles Avenue to about 75 feet above sea level at Highway 101.

As in Sector A, a 20 percent waste factor is used for calculating total aggregate resources. The waste factor is based on well-log evaluation, field investigation, including sampling done by CDMG geologists, and company supplied information. Also, as in Sector A, there is an abundance of sand in the deposits underlying Sector B. Therefore, a waste factor of 40 percent was assigned to these sand and gravel deposits for a second resource calculation to estimate the amount of material suitable for use in Portland cement concrete. The factor is based upon information from drill records and historical mining data.

Excluding company reserves and mined out areas, total inferred resources contained in Sector B to an average depth of 130

Table 3.3 Estimated aggregate resources of the Western Ventura County P-C Region. (Numbers shown in this table have been modified slightly from those shown in earlier drafts of this report.) (See Appendix C for definitions of terms used in this table.)

| RESOURCES COVERED BY USE PERMIT (Indicated Reserves) | | | RESOURCES NOT COVERED BY USE PERMIT (Inferred Resources) | | | | | | | | | | | | |
|---|----------------------------------|------|---|------|---|------|---|------|--|------|---|------|--|----------|--------------------|
| RESOURCE DEPTH INTERVAL | REGULATED EXTRACTION LIMIT | | RESOURCES CONTAINED BETWEEN SURFACE AND BOTTOM OF DEPOSIT | | RESOURCES CONTAINED BETWEEN SURFACE AND 30' BELOW SURFACE | | RESOURCES CONTAINED IN DEPTH INTERVAL BELOW 30' DEPTH | | RESOURCES CONTAINED BETWEEN SURFACE AND 0 FEET ELEVATION (sea level) | | RESOURCES CONTAINED IN DEPTH INTERVAL BELOW SEA LEVEL | | RESOURCES CONTAINED IN TOTAL DEPTH INTERVAL | | TOTAL RESOURCES |
| HIGHEST AGGREGATE USE** | PCC | MISC | PCC | MISC | PCC | MISC | PCC | MISC | PCC | MISC | PCC | MISC | PCC | MISC | PCC + MISC |
| SECTOR | | | | | | | | | | | | | | | |
| A | * | * | 180 | 60 | | | | | | | | | 180 | 60 | 240 |
| B | * | * | | | | | | | 140 | 50 | 50 | 20 | 190 | 70 | 260 |
| C | | | | | | | | | 270 | 90 | 30 | 10 | 300 | 100 | 400 |
| D | | | 70 | 20 | | | | | | | | | 70 | 20 | 90 |
| E | * | * | | | 90 | 50 | 220 | 110 | | | | | 310 | 160 | 470 |
| F | | | | | 190 | 60 | 730 | 210 | | | | | 920 | 270 | 1190 |
| G | | | | | 160 | 20 | 480 | 60 | | | | | 640 | 80 | 720 |
| H | | | | | 120 | 20 | 830 | 100 | | | | | 950 | 120 | 1070 |
| I | | | | | 70 | — | 340 | — | | | | | 410 | — | 410 |
| J | | | | | 10 | — | — | — | | | | | 10 | — | 10 |
| COLUMN TOTAL | 30 | 10 | 250 | 80 | 640 | 150 | 2600 | 480 | 410 | 140 | 80 | 30 | 3980 *** | 880 **** | 4860 |

* Cannot be shown due to confidentiality of producer data.

** Aggregate is divided into amount of material suitable for use in Portland Cement Concrete (PCC) and remaining material useable only in miscellaneous aggregate products (Misc) - asphaltic concrete, road base, and railroad ballast. Normally material suitable for use in Portland Cement Concrete is also used in miscellaneous aggregate products.

*** Includes 265 million tons located under producer properties.

**** Includes 100 million tons located under producer properties.

feet are estimated to be 260 million tons, 190 million tons of which are believed suitable for use in Portland cement concrete. Between ground surface and zero elevation (sea level), there are, exclusive of reserves and mined out areas, an estimated 190 million tons of aggregate material, 140 million tons of which are believed suitable for use in Portland cement concrete (Table 3.3).

SECTOR C

Sector C covers an area of 1,915 acres south of Vineyard Avenue extending from Los Angeles Avenue southwest to a point about 1 mile south of Highway 101 (Plate 3.1). Although a portion of land in Sector C is owned or leased by the aggregate industry, no permit to mine here has been granted.

Well log evaluation indicates that the depth of the sand and gravel deposit in Sector C ranges from 30 to 130 feet. As in Sector B, the top of a thick clay lens is recorded in many of the well logs at about 130 foot depth. Elevation of the surface in Sector C ranges from about 140 feet at the eastern margin to about 65 feet at the southern margin.

Waste factors used to calculate total aggregate resources and that portion of the resources suitable for use as Portland cement aggregate are the same as those for Sectors A and B (20 percent and 40 percent respectively).

An estimated 400 million tons of total resources, 300 million tons of which are believed suitable for use in Portland cement concrete, underly the area covered by Sector C. Of the 400 million tons, 360 million tons are calculated to lie between the surface and a maximum depth of 140 feet (sea level). 270 million tons of this is suitable for use in Portland cement concrete. These deposits are classified as inferred resources (Table 3.3). Forty million tons of aggregate are estimated to exist in the resource interval between sea level and the bottom of the deposit. Thirty million tons of this material is believed suitable for use in Portland cement concrete. This part of the deposit is also classified as inferred resources (Table 3.3).

SECTOR D

Sector D contains 390 acres occupied by the percolation basin east of Los Angeles Avenue (Plate 3.1). Depth to the bottom of the sand and gravel deposit in this sector, as recorded in well logs, ranges from 88 feet to 140 feet. An average depth of 120 feet was assigned to the deposit. As in Sectors A, B, and C, a waste factor of 20 percent was used to calculate total aggregate resources, while a 40 percent waste factor was used to calculate that portion of the deposit suitable for use in Portland cement concrete. A total of 90 million tons of aggregate, 70 million of which is suitable for Portland cement concrete aggregate, is calculated to lie beneath Sector D. This deposit is classified as an inferred resource (Table 3.3).

SECTOR E

Sector E encompasses 2,221 acres along and adjacent to the Santa Clara River and extending from the Ventura County Flood Control diversion structure northeast to the east boundary line of the land covered by Ventura County's Conditional Use Permit 3390 (Glacier Site), a distance of about 6 1/2 miles (Plate 3.1). Approximately 39 percent of the total area (872

acres) lies within the normal river channel while 61 percent (1,349 acres) lies on adjacent land.

For calculating aggregate resources, a 10 percent waste factor is assigned to the deposits underlying Sector E. This figure is lower than the 20 percent waste factor assigned to sectors to the west because there is a higher percentage of coarse material in these deposits. Thus, there is more coarse material available for road base and asphaltic concrete.

However, as with all sectors located below the Santa Paula Creek confluence, a waste factor of 40 percent is assigned to the deposits in order to estimate that portion of the material suitable for use as Portland cement concrete aggregate. This is because some of the coarse-grained rock clasts consist of unsuitable material (Monterey Shale). Based on well-log evaluation, depth of the deposit in Sector E ranges from a low of 36 feet along the north margin to a maximum of 160 feet in the mid region of the sector. An average resource depth of 90 feet was assigned to the entire length of the sector.

Two sets of resource figures are presented for Sector E, one for that portion of the deposit extending from the surface to 30 feet below the surface and the other for that portion of the deposit extending from 30 feet below the surface to the bottom of the resource interval. In the first depth interval (surface to 30 feet), there are an estimated 140 million tons of aggregate, 90 million tons of which are suitable for use in Portland cement concrete. In the lower depth interval, there are an estimated 330 million tons of aggregate, 220 million tons of which are suitable for use in Portland cement concrete. The combined total of each category is shown on Table 3.3. These deposits are placed in the inferred resource category.

SECTOR F

Sector F is composed of 3,348 acres of land within and adjacent to the Santa Clara River between the east boundary of the Glacier operation site (C.U.P. 3390) to the eastern margin of the confluence of Sespe Creek and the Santa Clara River at Sespe Street (Plate 3.1). Approximately 38 percent (1,258 acres) of the sector is within the Santa Clara River bed while 62 percent (2,090 acres) is on agricultural and other land outside of the river bed. No aggregate production is currently taking place in this sector.

Based on well-log examination, sand and gravel deposits contained in Sector F range in depth from 37 feet along the outer margins to 365 feet in the mid region of the sector. For resource calculation purposes, the sector was separated into four subsectors, and each was assigned an average resource depth figure based on well-log data. As in Sector E, a 10 percent waste factor was used for making resource calculations. However, a waste factor of 30 percent was assigned the deposits contained in Sector F to calculate the amount of material suitable for use in Portland cement concrete. This figure is lower than the counterpart 40 percent waste factor assigned Sectors A, B, C, D, and E because the deposits in Sector F are closer to the durable rock source in the San Gabriel Mountains (higher percentage of coarse material) and, since the confluence of the Santa Paula Creek and Santa Clara River is downstream from the sector, less undesirable rock material (Monterey Shale) has been contributed to the deposits.

Two sets of resource figures are presented for Sector F, one for that portion of the deposit extending from the surface to 30 feet

below the surface and the other for that portion of the deposit extending from 30 feet below the surface to the bottom of the resource interval. In the first depth interval (surface to 30 feet), there are an estimated 250 million tons of aggregate, 190 million tons of which are suitable for use in Portland cement concrete. In the lower depth interval, there are an estimated 940 million tons of aggregate, 730 million tons of which are suitable for use in Portland cement concrete. These deposits are categorized as inferred resources (Table 3.3).

SECTOR G

Sector G covers a total of 2,386 acres within an area extending from Sespe Avenue to Cavin Road (Plate 3.1). The sector consists of about 58 percent (1,395 acres) of river bed land and 42 percent (991 acres) of land located outside the river bed. Based on well-log evaluation, sand and gravel deposits contained in Sector B range in depth from 34 feet along the outer margins of the sector to 390 feet in the mid region of the sector. For resource calculation purposes, the sector was separated into four subsectors, and each was assigned an average resource depth based on well-log data. For calculating total aggregate resources, a 10 percent waste factor was used. However, the waste factor used for calculating the amount of material suitable for use in Portland cement concrete is 20 percent. This figure is lower than the counterpart waste-factor percentages for Sectors E and F because these deposits are closer to the durable rock sources in the San Gabriel Mountains (higher percentage of coarse material) and because the Santa Paula and Sespe Creeks have contributed less of the undesirable material (Monterey Shale) that is exposed within their drainage areas to the north to the Santa Clara River deposits in Sector G. However, because Piru Creek and several smaller streams transport the same undesirable material, also exposed within their drainage areas, a waste factor of 20 percent was assigned to the deposits.

Two sets of resource figures are presented for Sector G, one for that portion of the deposit extending from the surface to 30 feet below the surface and the other for that portion of the deposit extending from 30 feet below the surface to the bottom of the resource interval. In the first depth interval (surface to 30 feet), there are an estimated 180 million tons of aggregate, 160 million tons of which are suitable for use in Portland cement concrete. In the lower depth interval, there are an estimated 540 million tons of aggregate, 480 million tons of which are suitable for use in Portland cement concrete. These deposits are placed in the inferred resource category (Table 3.3).

SECTOR H

Sector H contains 1,827 acres along and adjacent to the Santa Clara River between Cavin Road on the west and at the east margin of the confluence of Piru Creek and Santa Clara River, a distance of 3.8 miles (Plate 3.1). Fifty-three percent (973 acres) of the area lies within the river bed of the Santa Clara River while 47 percent (854 acres) lies outside the river on mainly agricultural land. Based on well-log evaluation, sand and gravel deposits contained in Sector H range in depth from 74 feet along the outer margins to 515 feet in the mid region of the sector. For resource calculation purposes, the sector was divided into three subsectors, and each was assigned an average resource-depth figure based on well-log data. Deposits in Sector H are assigned waste factors of 10 percent for calculating total resources and 20 percent for calculating Portland cement concrete aggregate resources. The waste factors for Sector H deposits

are the same as those for Sector G deposits because both sectors are situated between Piru Creek and Sespe Creek and are conditioned by the same depositional factors (see Sector G analysis).

Two resource figures are presented for Sector H, one for that portion of the deposit extending from the surface to 30 feet below the surface and the other for that portion of the deposit extending from 30 feet below the surface to the bottom of the resource interval. In the first depth interval (surface to 30 feet), there are an estimated 140 million tons of aggregate, 120 million tons of which are suitable to be Portland concrete aggregate. In the lower depth interval, there are an estimated 930 million tons of aggregate, 830 million tons of which are suitable for use in Portland cement concrete. These deposits are placed in the category of inferred resources (Table 3.3).

SECTOR I

Sector I covers an area of 983 acres along and adjacent to the Santa Clara River extending 2 1/2 miles east from the confluence of Piru Creek and the Santa Clara River to the gaging station shown on the U.S. Geological Survey quadrangle base map (Plate 3.1). Approximately 48 percent (468 acres) of the sector lies within the bed of the Santa Clara River, while 52 percent (515 acres) is composed of off-river lands. The few well logs available for Sector I record resource depths ranging from 31 feet near the outer margins of the sector to 318 feet in the mid region of the sector. An average depth of 184 feet was assigned for the resource interval.

Sector I is located upstream from the last of the significant streams draining areas to the north underlain by Monterey Shale and other undesirable material. Therefore, the introduction of unsuitable material into the deposit has not been as high as those deposits downstream. Also, the deposit is closer to the source of durable rock material in the San Gabriel Mountains. Consequently, a waste factor of 10 percent is assigned the deposits contained in Sector I. One hundred percent of the remaining portion of the deposit is believed to be suitable for use in Portland cement concrete. Two sets of resource figures are presented for Sector I, one for that portion of the deposit extending from the surface to 30 feet below the surface and the other for that portion of the deposit extending from 30 feet below the surface to the bottom of the resource interval. The two resource figures amount to 70 million tons and 340 million tons respectively, for a combined total of 410 million tons of aggregate. These deposits are placed in the category of inferred resources (Table 3.3).

SECTOR J

Sector J encompasses an area of about 216 acres between the gaging station, 2 1/2 miles east of the confluence of Piru Creek and Santa Clara River, and the Ventura-Los Angeles County line (Plate 3.1). Almost 100 percent of the area is within the channel of the Santa Clara River. No well data is available for Sector J, but it can be reasonably presumed that at least 30 feet of resources underlie the channel length of Sector J. These deposits have been assigned a waste factor of 10 percent for the same reasons discussed in Sector I. If the deposit extends to an average depth of 30 feet and contains about 10 percent in waste material, there are about 10 million tons contained in Sector J (Table 3.3). As in Sector I, 100 percent of the resources are believed to be suitable for use in Portland cement concrete.

ESTIMATED 50-YEAR CONSUMPTION OF AGGREGATE

The total projected consumption of aggregate in the Western Ventura County P-C Region for the next 50 years is estimated to be 310 million tons (Table 3.4). An additional 10 million tons of aggregate is expected to be exported to the south coast region of Santa Barbara County during the 50-year period. It is estimated that about 60 percent of the total amount, or approximately 190 million tons, will be used in the manufacture of Portland cement concrete.

Population and Aggregate Production Records

Population and aggregate production records were compiled for the years 1960-1978 for the Western Ventura County P-C Region (Figure 3.2). Records for the years prior to 1960 are in most cases incomplete. Records of population and aggregate production from 1960 to 1976 were also compiled for the adjacent P-C regions (Figures 3.3 and 3.4). Population projections to the year 2030 are presented in Figure 3.5.

Per Capita Consumption Rates

The Western Ventura County P-C Region averaged a per capita consumption rate of about 11.0 tons of aggregate per year between 1961 and 1977 (Figure 3.6). The per capita consumption rate was correlated with the population projections to determine aggregate consumption needs to the year 2030 (Table 3.4). Included in the calculations for the 50-year aggregate needs is a

200,000-tons-per-year export of sand and gravel into Santa Barbara County. The export figure is based on individual company sales records. The 200,000 tons per year is expected to continue unchanged in the future due to the no-growth policy of Santa Barbara County's south coast region. Similar estimates were made for the adjacent P-C regions (Figures 3.6 - 3.8).

POPULATION AND DWELLING UNIT DENSITIES

Population and dwelling unit densities of the Western Ventura County P-C Region and adjacent P-C regions are presented in Figures 3.9 and 3.10. The population and dwelling unit densities of the Western Ventura County, Simi, and Saugus-Newhall P-C regions are all relatively low compared to those of P-C regions in metropolitan Los Angeles (see corresponding section in Part II of this report). The relatively low population and dwelling unit densities of the Western Ventura County P-C Region suggest high urban growth potential in the coming years. Based on data obtained from the Ventura County Planning Department, the Southern California Association of Governments (1978), and the California State Department of Finance, population in the Western Ventura County P-C Region is expected to increase from about 340,000 in 1980 to over 750,000 in the year 2030, an increase of 120 percent. According to Ventura County (1978), the fastest growing cities in Ventura County are projected to be Thousand Oaks (89.9 percent increase by year 2000) and Oxnard (72.4 percent by year 2000). Within the unincorporated areas, Oak Park and Moorpark will absorb most of the new development. Generally, the greatest growth is expected to occur in the eastern parts of the county and in the larger cities. Except for Oak Park and Moorpark, virtually all future growth will occur within or adjacent to existing cities.

Table 3.4 Projected aggregate consumption (in million short tons) for the Western Ventura County, Simi, and Saugus-Newhall P-C regions.

| | WESTERN VENTURA COUNTY P-C REGION | | SIMI P-C REGION | | SAUGUS NEWHALL P-C REGION | |
|-----------|---|---|---|--|---|--|
| | 5 yr per capita consumption = 55 tons/person | | 5 yr per capita consumption = 27.5 tons/person | | 5 yr per capita consumption = 29.3 tons/person | |
| YEARS | Average Population (millions) | Aggregate Consumption* (million tons) | Average Population (millions) | Aggregate Consumption (million tons) | Average Population (millions) | Aggregate Consumption (million tons) |
| 1980-1985 | 0.36** | 21 | 0.34 | 9 | .080 | 5 |
| 1985-1990 | 0.40 | 23 | 0.37 | 10 | .087 | 5 |
| 1990-1995 | 0.44 | 25 | 0.41 | 11 | .092 | 6 |
| 1995-2000 | 0.48 | 27 | 0.44 | 12 | .095 | 6 |
| 2000-2005 | 0.52 | 30 | 0.47 | 13 | .098 | 6 |
| 2005-2010 | 0.57 | 32 | 0.51 | 14 | .104 | 6 |
| 2010-2015 | 0.61 | 35 | 0.54 | 15 | .110 | 7 |
| 2015-2020 | 0.65 | 37 | 0.57 | 16 | .117 | 7 |
| 2020-2025 | 0.70 | 40 | 0.60 | 17 | .122 | 8 |
| 2025-2030 | 0.73 | 41 | 0.63 | 17 | .127 | 8 |
| TOTAL | | 310 (190)*** | | 130 (80) | | 60 (40) |

*Aggregate Consumption = population (5 years average) x 5 year per capita consumption. (Western Ventura County aggregate consumption includes an every five year export of one million tons to Santa Barbara County: for example, for the 1980-1985 period, (.36)(55) = 20 million tons + 1 million tons = 21 million tons.)

**Population projections based on data from Ventura County, the State Department of Finance (1977), and the Southern California Association of Governments (1978).

***Approximately 60% of the total aggregate demand will be for Portland cement concrete.

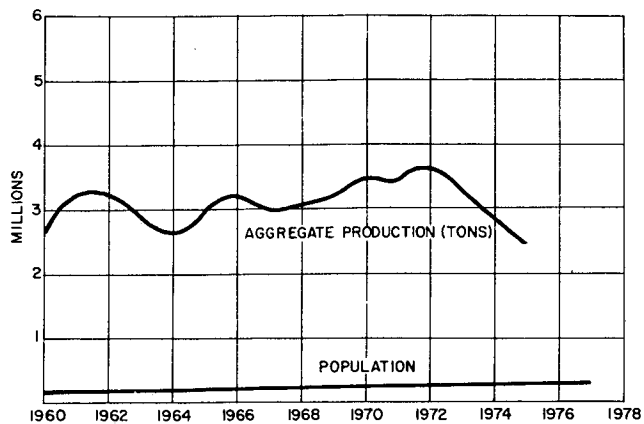


Figure 3.2 Western Ventura County P-C Region: population and aggregate production record for years 1960-1977.

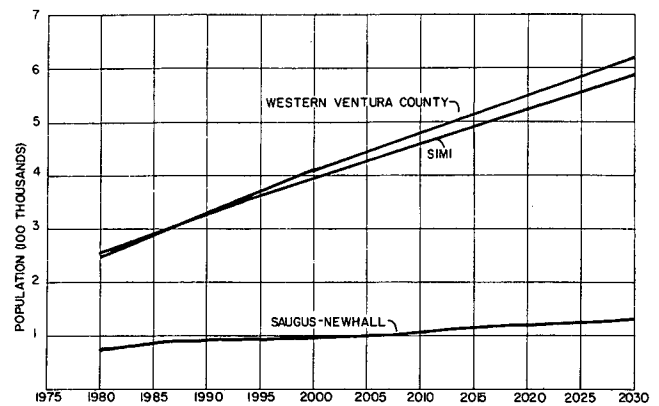


Figure 3.5 Projected populations of the Western Ventura County, Simi, and Saugus-Newhall P-C regions to the year 2030.

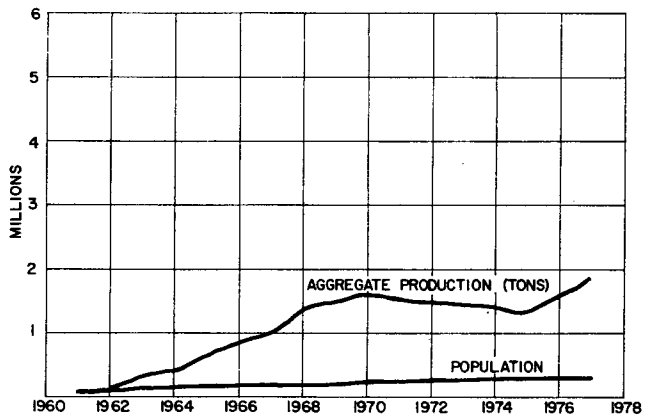


Figure 3.3 Simi P-C Region: population and aggregate production records for years 1960-1976.

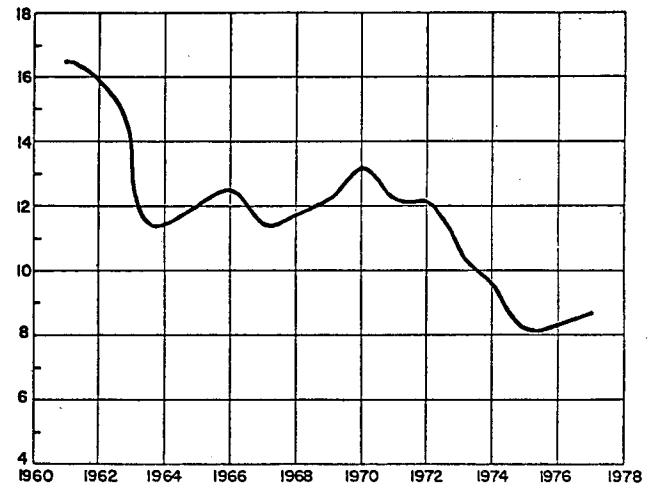


Figure 3.6 Annual per capita consumption in the Western Ventura County P-C Region for years 1961-1977.

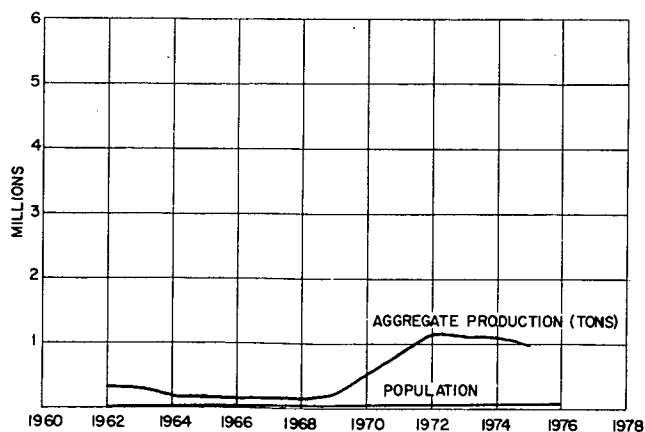


Figure 3.4 Saugus-Newhall P-C Region: population and aggregate production records for years 1960-1976.

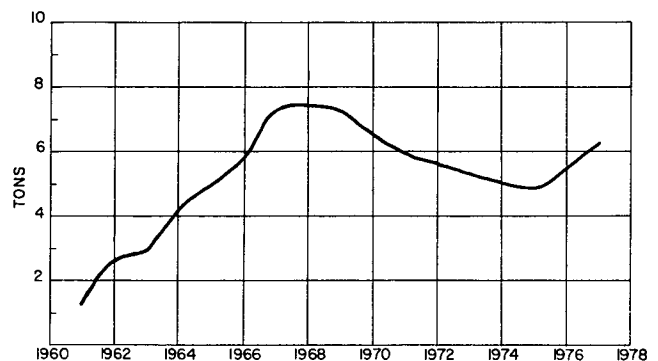


Figure 3.7 Annual per capita consumption in the Simi P-C Region for years 1961-1977.

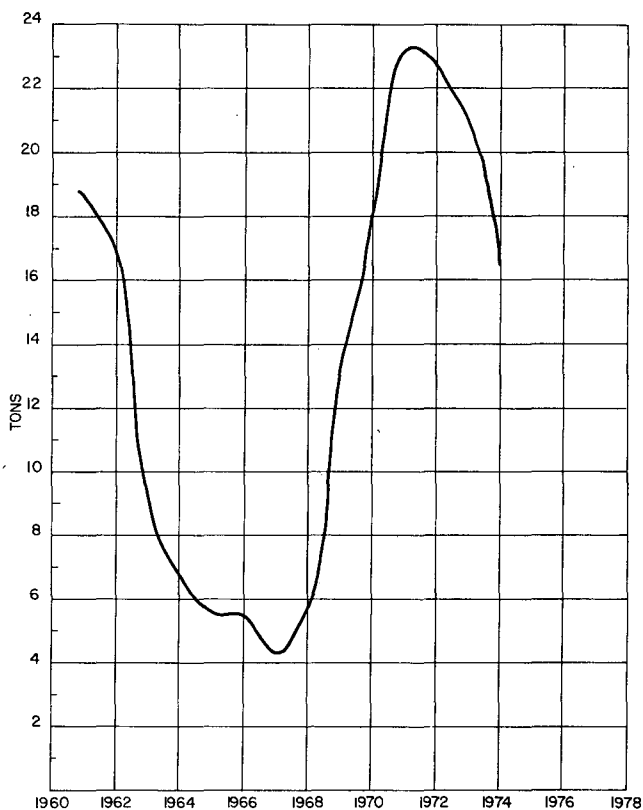


Figure 3.8 Annual per capita consumption of aggregate in the Saugus-Newhall P-C Region for years 1961-1974.

FACTORS AFFECTING PER CAPITA CONSUMPTION RATES

Per capita consumption of aggregate has varied with time and is different in each P-C region (Figures 3.6-3.8). Factors such as changes in urban growth with time, relative degrees of urban maturity, and major construction projects (for example, freeways) could account for the variations and differences.

Figure 3.6 shows a general decrease in per capita consumption of aggregate in the Western Ventura County P-C Region between 1961 and 1977. However, there is a remarkable consistency in annual per capita consumption between the years 1964 and 1972, ranging between 10.6 and 11.6 tons per person per year. This can be explained by the fact that population increases in the Western Ventura County P-C Region amounted to only 27 percent during that 9-year period. This is compared to the 112 percent population increase in the Simi P-C Region between 1961 and 1968 when per capita consumption rates there were steadily increasing each year until population growth rates began to level off (Figure 3.7). Population growth rates in the Western Ventura County P-C Region declined even more after 1972, amounting to about 1,000 persons a year between 1972 and 1975. As an apparent consequence, annual per capita consumption rates fell to 7.4 tons by 1975 (Figure 3.6). However, the annual population increase jumped to about 4,000 persons per year in 1976 and 1977 (Figure 3.2), and per capita consumption also showed a renewed upward trend.

The above discussion points out the general relation that exists between population rates and the consumption of aggregate. On the basis of that relation, it is possible to forecast the total

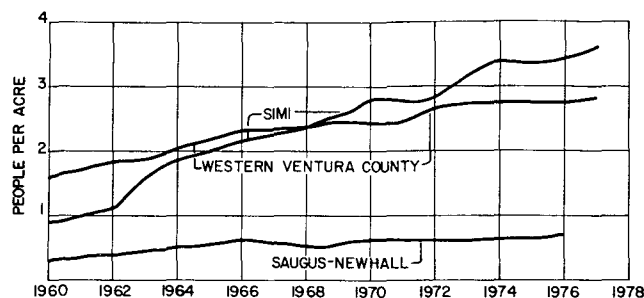


Figure 3.9 Comparison of population densities for Western Ventura County, Simi, and Saugus-Newhall P-C regions for years 1960-1976.

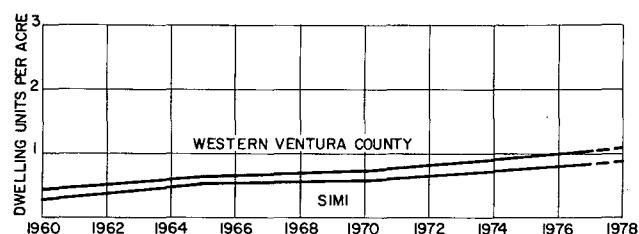


Figure 3.10 Comparison of dwelling unit densities for the Western Ventura County and Simi P-C regions for years 1960-1976. (Data unavailable for the Saugus-Newhall P-C Region.)

amount of aggregate that will be required to fill the needs of a particular consumption area within a specified time interval if projected per capita consumption rates are related to population growth rates for each year during the time interval. However, it is very difficult to forecast variances in annual growth rates and accompanying changes in per capita consumption rates into the future. Population projections are normally calculated on the basis of relatively steady growth rates which will have the effect of averaging out the future variances in the annual population increases. Accordingly, total aggregate needs of the Western Ventura County P-C Region to the year 2030 were calculated on the basis of three factors: (1) a projected annual per capita aggregate consumption rate of 11.0 tons; (2) an annual aggregate export of 200,000 tons into Santa Barbara County; and (3) the projected population growth for the region over the 50-year period. The results of these calculations are presented on Table 3.4.

The average Western Ventura County P-C Region per capita consumption rate of 11.0 is believed valid for forecasting future needs unless unforeseen events occur, such as massive urban renewal or disaster reconstruction. The average per capita consumption rate over the next 50-year period in the Western Ventura County P-C Region could increase as much as 100 percent as a result of extensive earthquake damage or other unforeseen circumstances that would necessitate massive reconstruction. Such events would result in a sharp increase in per capita consumption of aggregate during the period of active reconstruction. The amount of aggregate needed in addition to the steady state consumption of 11.0 tons per person per year would depend upon the extent and duration of reconstruction. Per capita consumption would probably then gradually return to an annual rate equivalent to that which existed before reconstruction began.