Special Report 254

UPDATE OF THE MINERAL LAND CLASSIFICATION FOR PORTLAND CEMENT CONCRETE AGGREGATE RESOURCES IN THE SAN FERNANDO VALLEY AND SAUGUS-NEWHALL PRODUCTION-CONSUMPTION REGIONS

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CALIFORNIA GEOLOGICAL SURVEY
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INDEX OF ACRONYMS AND ABBREVIATIONS

CO_2 – Carbon dioxide

CDIR – California Department of Industrial Relations

CGS – California Geological Survey

CPI – Consumer Price Index

DMR – Division of Mine Reclamation

DWR – Department of Water Resources

MLC – Mineral Land Classification

MRZ – Mineral Resource Zone

OFR – Open File Report

OPR – Office of Planning and Research

P-C – Production-Consumption

PCC – Portland cement concrete

SMARA – Surface Mining and Reclamation Act

SMGB – State Mining and Geology Board

SR – Special Report

EXECUTIVE SUMMARY

California's Surface Mining and Reclamation Act (SMARA) of 1975 requires the State Geologist to classify land based on the known or inferred mineral resource potential of that land. The primary goal of mineral land classification (MLC) is to help ensure essential mineral resources are recognized and considered by local governments in the land-use planning process.

Aggregate (sand, gravel, and crushed stone) is the number one non-fuel mineral commodity produced in California by value. In 2017, aggregate was valued at $1.49 billion and comprises 42 percent of California's $3.6 billion non-fuel mineral economy (Key, 2019). In 2018, cement was valued at $1.37 billion (Marquis, 2020). Construction aggregate is a crucial material for construction and infrastructure maintenance. California's largest aggregate consumption regions are in the Los Angeles and San Francisco Bay metropolitan areas. As urbanization continues, additional strain will be placed on both the land underlain by significant mineral resources and the resource itself.

Transportation plays a significant role in the final cost of aggregate to the consumer. Increased truck haulage distances not only increase the price of aggregate, but also create environmental and societal impacts such as increased fuel consumption, carbon dioxide (CO_2) emissions, air pollution, traffic congestion, and road maintenance. Local sources of aggregate are important in reducing California's carbon footprint.

This report includes: 1) a reevaluation of Portland cement concrete (PCC) aggregate resources within the San Fernando Valley and Saugus-Newhall Production-Consumption (P-C) Regions; 2) estimates for the quantity of resources as of December 2018; and, 3) a 50-year forecast of PCC aggregate demand within the San Fernando Valley and Saugus-Newhall P-C Regions from 2018 to 2068.

This report, Special Report (SR) 254, serves as an update to the findings presented in SR 143 parts I, II (Anderson and others, 1979), and V (Joseph and others, 1987) and Open-File Report (OFR) 94-14 (Miller, 1994). The major findings are:

- No new sectors were added; the four sectors classified in the San Fernando Valley P-C Region and the three sectors classified in the Saugus-Newhall P-C Region were maintained from SR 143 and OFR 94-14.

- The projected 50-year PCC aggregate demand on the San Fernando Valley P-C Region through the year 2068 is estimated to be 959 million tons.
- The projected 50-year PCC aggregate demand on the Saugus-Newhall P-C Region through the year 2068 is estimated to be 80 million tons.
- Reserves are proprietary but will be exhausted in less than 10 years in both regions if the current demand is sustained.
- Approximately 416 million tons of resources underlie the San Fernando Valley P-C Region.
- Approximately 10.5 billion tons of resources underlie the Saugus-Newhall P-C Region.
- If no additional reserves become available, both the San Fernando Valley and Saugus-Newhall P-C Regions will remain dependent on external sources of PCC aggregate.

Table ES-1 compares key data from the previous update report (OFR 94-14) with data from this report:

Table ES-1. Comparison of key data from OFR 94-14 and SR 254

	San Fernando Valley		**Saugus-Newhall**	
	1992 (OFR 94-14)	**2018 (SR 254)**	**1992 (OFR 94-14)**	**2018 (SR 254)**
Population	3,310,093	3,689,156	170,984	296,850
Total Permitted PCC Aggregate Reserves	Confidential	Confidential	158 million tons	Confidential
Total PCC Aggregate Resources	259 million tons	416 million tons	7,439 million tons	10,492 million tons
Average Annual PCC Aggregate Production	9.4 million tons/year (1980-1992)	2.6 million tons/year (1990-2018)	1.2 million tons/year (1982-1992)	530,000 tons/year (1990-2018)
PCC Aggregate Mines	4	4	3	1
Number of PCC Aggregate Mining Companies	2	2	3	1

INTRODUCTION

The California Geological Survey (CGS) is responsible for identifying and presenting information on the significance, availability, and location of mineral resources within California for the benefit of the public and local lead agencies. Land-use planners and decision-makers must balance the need for these mineral resources when planning for a sustainable future for their communities. As California becomes increasingly urbanized, these resources will require development to support sustainable growth and maintenance of communities. Local land-use decisions regarding mineral resources often have regional impacts that go beyond local jurisdictional boundaries as existing permitted reserves are depleted.

Aggregate (sand, gravel, and crushed stone) is the number one non-fuel mineral commodity produced in California by value. In 2017, aggregate was valued at $1.49 billion and comprises 42 percent of California's $3.6 billion non-fuel mineral economy (Key, 2019). In 2018, cement was valued at $1.37 billion (Marquis, 2020). High quality aggregate (sand, gravel, and crushed stone) is required for production of concrete and asphalt. California's largest aggregate consumption regions are in the Los Angeles and San Francisco Bay metropolitan areas.

Transportation plays a significant role in the final cost of aggregate to the consumer, because aggregate is a low unit-value, high bulk-weight commodity. Aggregate must be sourced near its end use to minimize economic and environmental costs associated with transportation. Increased truck haulage distances increase the price of aggregate and amplifies environmental and societal impacts such as increased fuel consumption, carbon dioxide (CO_2) emissions, air pollution, traffic congestion, and road maintenance. Maintaining local sources of aggregate is important in reducing the carbon footprint associated with California's construction projects.

This report contains updated information on high quality aggregate used in Portland cement concrete (PCC) in both the San Fernando Valley and Saugus-Newhall Production-Consumption (P-C) Regions within northwestern Los Angeles County. This report includes: 1) updated information on the geographic distribution and quantity of PCC aggregate resources within these two P-C regions; 2) a discussion of the aggregate market in these two P-C regions

since the last report, Open File Report (OFR) 94-14; and, 3) a 50-year projection of the amount of PCC aggregate needed to meet regional demand within each P-C region.

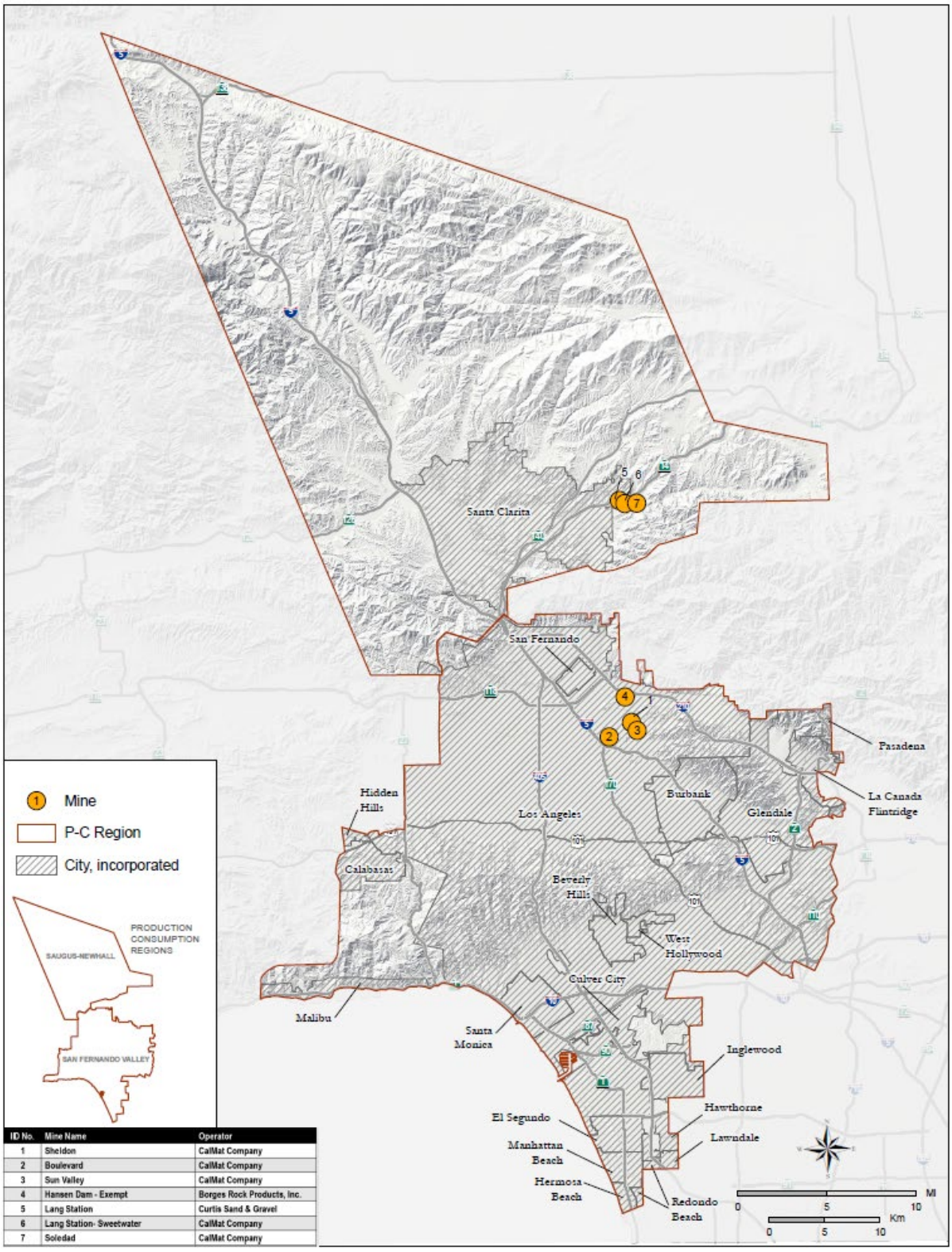
BACKGROUND

The Surface Mining and Reclamation Act (SMARA) of 1975 was passed by the California State Legislature to: 1) ensure reclamation of mined lands; 2) ensure information regarding the location and quantity of mineral resources is updated; and, 3) respond to the loss of significant mineral resources to urban expansion. *Classification-Designation* is the two-phase process mandated by SMARA to address mineral resource loss. *Classification* is the process of identifying lands that contain significant mineral deposits, based solely on geologic factors regardless of land use or ownership. The primary goal of mineral land classification (MLC) is to ensure that the mineral resource potential of lands is recognized and considered in the land-use planning process. The State Geologist is responsible for the classification process, in which specified areas of land are assigned mineral resource zone (MRZ) classifications (MRZ-1 through MRZ-4). *Designation* is the formal recognition of those significant mineral deposits by the State Mining and Geology Board (SMGB) (2000) after consultation with lead agencies and other interested parties. The objective of the classification-designation process is to ensure through local lead-agency policies and procedures, that mineral resources will be available when needed and do not become inaccessible due to inadequate information during the land use decision-making process.

Jurisdictions with lead agency responsibilities are listed in Appendix A and shown on Figure 1. Appendix A also indicates whether the lead agencies contain vested/exempt/permitted mines, lands classified as MRZ-2, and land classified as sectors.

This report is the third MLC report for PCC aggregate in the San Fernando Valley and Saugus-Newhall P-C Regions. The San Fernando Valley and Saugus-Newhall P-C Regions are located in northwestern Los Angeles County (Figure 1). Aggregate resources for the entire Greater Los Angeles area were first assessed but not classified in CGS publication Special Report (SR) 139 (Evans and others, 1979). The San Fernando Valley and Saugus-Newhall P-C Regions were first classified for PCC aggregate in SR 143 parts I, II, and V. The San Fernando Valley P-C Region was first classified in 1979 in SR 143 parts I and II (Anderson and others), and the Saugus-Newhall P-C Region was first classified in 1987 in SR 143 part V (Joseph and

others). Based on the recommendations in SR 143, the SMGB designated parts of the four sectors in the San Fernando Valley P-C Region (California Department of Conservation, 1981), and parts of the three sectors in the Saugus-Newhall P-C Region (California Department of Conservation, 1987). A subsequent update, CGS publication, OFR 94-14 (Miller, 1994), includes updates to sectors based on urbanization in all seven P-C regions located within Los Angeles County. There was only one update made to the MRZs in Saugus-Newhall in OFR 94-14. A 0.1-acre MRZ-4 was reclassified as MRZ-1 (Miller, 1994). No new sectors were presented in OFR 94-14 for either P-C region (Miller, 1994). The SMGB did not take action to address the updated sectors in the San Fernando Valley or the Saugus-Newhall P-C Regions presented in OFR 94-14.



ID No.	Mine Name	Operator
1	Sheldon	CalMat Company
2	Boulevard	CalMat Company
3	Sun Valley	CalMat Company
4	Hansen Dam - Exempt	Borges Rock Products, Inc.
5	Lang Station	Curtis Sand & Gravel
6	Lang Station- Sweetwater	CalMat Company
7	Soledad	CalMat Company

Figure 1. Location map of the San Fernando Valley and Saugus-Newhall Production-Consumption regions. Includes lead agency jurisdictional boundaries (incorporated city limits), and locations of mining operations evaluated in this report.

METHODS

Mineral Land Classification

Mineral land classification is the process of identifying lands containing significant mineral deposits based solely on geologic and economic factors without regard to existing land use and ownership. The major geologic factors that affect the quality of construction aggregate are rock type and weathering; these characteristics affect the hardness, durability, and potential chemical reactivity of aggregate. Geologic maps and California Department of Water Resources (DWR) water well-logs were used to determine the locations of favorable geology in the surface and subsurface.

In addition to the presence of favorable geologic factors, a mineral deposit must meet the marketability and threshold value criteria adopted by the SMGB (2000) to be classified. The SMGB determined the threshold value of the first marketable product in 1998 dollars to be $12,500,000 for construction aggregate deposits. To adjust for inflation and reflect 2018 dollars, the threshold value was multiplied by an inflation factor of 1.66. This factor was determined by dividing the California Department of Industrial Relations' (CDIR) Consumer Price Index (CPI) for 2018 (272.5; CDIR, 2020) by the CPI for 1998 (163.7; CDIR, 2020). The threshold value that a construction aggregate deposit must meet to be classified is approximately **$20,800,000.** Aggregate prices in San Fernando Valley in 2006 were $13-16 per ton (Kohler, 2006). The price of aggregate in the Los Angeles metropolitan area remained consistent at $13-16 per ton through 2012 (Clinkenbeard, 2012), after which data is unavailable. Using $16 per ton, the threshold value tonnage equivalent is approximately 1.3 million tons.

The result of classification is a map of MRZs; this map highlights areas with the potential to host mineral deposits of economic significance (Plate 1). MRZs are divided into four categories:

- **MRZ-1:** Areas where available geologic information indicates that little likelihood exists for the presence of significant PCC aggregate resources.
- **MRZ-2:** Areas where geologic information indicates the presence of significant PCC aggregate resources.

- **MRZ-3:** Areas containing known or inferred PCC aggregate resources of undetermined mineral resource significance.
- **MRZ-4:** Areas where available geologic information is inadequate to assign to any other mineral resource zone category.

The State Geologist also identifies and quantifies areas containing regionally significant mineral deposits, referred to as sectors. A sector is an area classified as MRZ-2 and has a land use compatible with mining. Examples of incompatible land use include high-density residential developments, commercial and industrial developments, and major public infrastructure (SMGB, 2000). Examples of compatible land use include land that is nonurbanized or has very low-density residential development (approximately one unit or less per 10 acres), lands that lack high-cost improvements (including recreational lands), and lands used for agriculture, silviculture, grazing, or open space. The result of this land-use evaluation is a map that displays the sectors identified by the State Geologist (Plate 2).

Reserves and Resources

Aggregate material can either be categorized as resources or reserves. Aggregate reserves are deposits that: 1) have been determined acceptable for commercial use; 2) exist within properties owned or leased by aggregate-producing companies; and 3) have been granted permits to allow mining and processing of material. Aggregate reserves are calculated using the permitted area within a sector. Aggregate resources include reserves, as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted. Aggregate resources are calculated based on the total area, both permitted and unpermitted, within a sector.

The factors used to determine the aerial extent and tonnage of aggregate reserves and resources within the sectors are the same as those used in the previous reports for the San Fernando Valley and Saugus-Newhall P-C Regions. They are as follows:

1. Resource and reserve tonnage calculations were based on measurements taken from 1:24,000-scale base maps or maps obtained from aggregate companies with varying scales.
2. A small percentage of every PCC aggregate deposit cannot be used in concrete and is considered waste.

3. Thicknesses of aggregate deposits were determined by analyzing DWR water well-log data, examining active aggregate pits and natural outcrops, and reviewing information provided by persons who have knowledge about aggregate deposits in this region.
4. A standard setback of 100 feet from utility lines, rail lines, and urban developments was used to determine the limits of areas available for mining, unless otherwise stipulated in individual mining plans.
5. In place densities of 0.057 to 0.065 tons per cubic foot were assumed in calculating sand and gravel resources and densities of 0.080 to 0.084 tons per cubic foot were assumed in calculating crushed stone resources.

Mined material was subtracted from the total calculated resources for each sector where an operation existed or currently exists; mined material was calculated using reclamation plans and reported pit depths. Assumptions are outlined in detail in SR 143 and maintained in OFR 94-14; these were updated to reflect more current information from well-log data, communication with operators, and information found in reclamation plans. Previous assumptions from SR 143 and OFR 94-14 and assumptions in this report are discussed in the results section.

Production and Consumption

Production-Consumption regions are defined as market regions in which 95 percent or more of the aggregate produced is also consumed. P-C regions were originally drawn as boundaries for evaluating the significance of aggregate deposits to a specific region (Stinson and others, 1986). Both the San Fernando Valley and Saugus-Newhall P-C Regions no longer meet the definition of a P-C region because of the high volume of imports. However, the P-C region boundaries are maintained to define the areas for direct comparison to previous reports.

Production data prior to 1990, found in previous reports, is inconsistent; thus, only production data from the California Division of Mine Reclamation (DMR) SMARA database is considered in this report. Production data after 1992 is proprietary because of the few active operations located within each region. Because of the discrepancies and proprietary information, production is not reported in this updated report, however, an average annual production for each region is calculated for the years 1990-2018 based on what operators have reported annually.

50-Year Projection of Aggregate Demand

The SMGB recommends the MLC reports include "an estimate of the total quantity of construction aggregate that will be needed to supply the requirements of the county or marketing region in which it occurs for the next 50 years" (SMGB, 2000). In previous reports, the 50-year projection was calculated using a per-capita method, where population is projected over the next 50 years and multiplied by the average historical per-capita consumption. A requirement for this method is that the region is a true P-C region, where 95 percent of the material produced is also consumed within the region, thus equating production and consumption. However, because neither the San Fernando Valley nor the Saugus-Newhall P-C Regions meet this criterion and the production data is inconclusive, the 50-year projection was calculated using a slightly different per-capita method. Population data for both the San Fernando Valley and Saugus-Newhall P-C Regions were projected over the next 50 years. Rather than multiplying the population by average historical per-capita consumption within the regions, population was multiplied by an estimated average historical per-capita consumption for the entire state of California. This accounts for the volume of imports into the regions.

Population data for Los Angeles County was obtained from the California Department of Finance for the years 1970 through 2019. Forecasted population data was also obtained from the California Department of Finance through the year 2060. The forecast for the remaining years from 2061 to 2068 were calculated using the exponential triple smoothing forecasting function within Microsoft Excel®. The percentage of the Los Angeles population in each P-C region was calculated based on Geographic Information System analysis using 2010 US census and census tract data. The San Fernando Valley and Saugus-Newhall P-C Regions account for 36 percent and 3 percent of the total Los Angeles County population respectively. The projected population was multiplied by the 30-year average per-capita aggregate consumption for all of California, which is roughly 5.3 tons per person per year using data from the years 1987-2016 (Clinkenbeard and Gius, 2018).

RESULTS

Production-Consumption Region Boundaries

The P-C region boundaries for both San Fernando Valley and Saugus-Newhall were drawn based on "urbanizing areas" that were periodically updated by the California Office of Planning and Research (OPR). The last maps showing urbanizing areas produced by the OPR were supplied in the early 1970s, several years before the first MLC report for San Fernando Valley and Saugus-Newhall was published. In SR 143, the urbanizing boundaries provided by the OPR were modified to reflect urbanizing conditions at the time the report was written. The original P-C boundary drawn for the Saugus-Newhall P-C Region in SR 143 was maintained in OFR 94-14, as well as this updated report. For this report, the P-C boundary for the San Fernando Valley P-C Region was adjusted slightly to include the north east portion of Sector A (Plate 2), which was not included in past reports. This was the only modification made to the San Fernando Valley P-C Region boundary since it was originally drawn in SR 143.

Mineral Resource Zones

Minor changes were made to the MRZ boundaries within the San Fernando Valley and Saugus-Newhall P-C Regions to reflect more current and accurate geologic mapping. Brief descriptions of the MRZs in the San Fernando Valley and Saugus-Newhall P-C Regions are below.

San Fernando Valley

MRZ-1

The areas classified as MRZ-1 mainly occur in the interior parts of the San Fernando Valley and Los Angeles basin (Plate 1). At the time SR 143 was written, drill hole data indicated that these areas are underlain by sedimentary deposits composed predominantly of fine-grained material unsuitable for use as aggregate (Anderson and others, 1979). Updated geologic mapping indicates that the MRZ-1 areas are predominantly underlain by Holocene and Pleistocene alluvium as well as fine-grained Tertiary sedimentary deposits (Campbell and others, 2014), confirming conclusions from the previous reports.

MRZ-2

There are two areas classified as MRZ-2 within the San Fernando Valley: the Tujunga Wash deposits, and the Pacoima Wash deposits.

The Tujunga alluvial fan deposit is located in the eastern part of the San Fernando Valley P-C Region at the mouth of Big Tujunga Canyon (Plate 1). Material found in the Tujunga Wash varies from clay-size particles to large boulders composed mostly of granitic and metamorphic rock fragments shed from the San Gabriel Mountains (Anderson and others, 1979). Aggregate has been produced from the Tujunga Wash since the early 1900s (Anderson and others, 1979). It is estimated that approximately 70 percent of the material is coarse and approximately 30 percent is fine with a small silt and clay fraction.

The Pacoima Wash extends from Lopez Dam to the mouth of Pacoima Canyon on the southern edge of the San Gabriel Mountains (Plate 1). Material found in the Pacoima Wash varies from clay-sized particles to boulders, and it is estimated that approximately 65 percent of this material is coarse, and approximately 35 percent of material is mostly sand with minor amounts of silt and clay (Anderson and others, 1979). Test data of the material in the Pacoima Wash are not available, however, 400,000 tons of material were mined from Pacoima Wash to construct the Pacoima Dam, a concrete arch dam, in the mid-1920s (Gay and Hoffman, 1954).

MRZ-3

A large portion of the San Fernando Valley P-C Region is classified as MRZ-3 (Plate 1). These areas are underlain by Quaternary and Pleistocene alluvial deposits, Tertiary sedimentary and volcanic deposits, and crystalline basement rock. Little is known about the potential of these rock units for use as PCC aggregate, but pending further evaluation, these deposits could be a potential source of PCC aggregate in the future.

MRZ-4

No land within the San Fernando Valley P-C Region is classified as MRZ-4, because all the land is classified as MRZ-1, MRZ-2, or MRZ-3.

Saugus-Newhall

MRZ-1

The areas classified as MRZ-1 occur in mountainous regions, including parts of the Santa Susana Mountains, hills adjacent to San Martinez Grande Canyon, hills around Castaic Lagoon and Castaic Lake, hills around San Francisquito Canyon near Dry Canyon Reservoir, and hills bounding Bouquet Canyon just south of Dry Canyon Reservoir (Plate 1). These mountainous regions are underlain by bedrock composed of Tertiary sedimentary rocks that are predominantly fine-grained and unsuitable for PCC aggregate (Joseph and others, 1987).

MRZ-2

There are three areas classified as MRZ-2, each with different geology: portions of the Santa Clara River Valley floodplain, bedrock units of the Mint Canyon Formation, and a Proterozoic anorthosite-gabbro body.

The Santa Clara River flows from near Soledad Pass into Ventura County. Several tributaries join the Santa Clara River within the region; most notably are Castaic Creek, Newhall Creek, Bouquet Canyon, and Sand Canyon. The material deposited in the Santa Clara River and its tributaries forms an approximately 18-mile long deposit. At Lang Station, approximately 65 percent of the material is sand, and 35 percent is rock according to operators. Though material varies along the length of a river, the Santa Clara River is 83 miles long, the percentages at Lang Station are a good estimate for approximating the coarse fraction of material along the 18-mile segment within the P-C region. Material being shed from the Mint Canyon Formation into the Santa Clara River contains fragments of the soft, detrimental Pelona Schist; however, the quantity of Pelona Schist is low enough that it does not affect the quality to preclude the mining of PCC aggregate (Joseph and others, 1987).

The Mint Canyon Formation crops out in the eastern part of the Saugus-Newhall P-C Region. The Mint Canyon Formation is approximately 6,000 feet of fine- to coarse-grained, well-consolidated, non-marine sediments (Joseph and others, 1987). The Mint Canyon Formation underlying the areas classified as MRZ-2 is composed of late and middle Miocene lacustrine deltaic facies with interbedded sandstone, conglomeratic sandstone, siltstone, and

claystone (Campbell and others, 2014). The lower portion of the Mint Canyon Formation is approximately 3,100 feet thick and consists of coarse-grained sediments including conglomerate and coarse sand that have been mined to produce PCC aggregate (Joseph and others, 1987). This lower, coarse-grained portion grades upward into finer-grained lacustrine-derived sediment.

Recent geologic mapping shows that portions of the areas classified as MRZ-2 thought to be underlain by Mint Canyon Formation are mapped as units within the Vasquez Formation and Tick Canyon Formation (Campbell and others, 2014). The Vasquez Formation is composed of Oligo-Miocene clast-supported large alluvial conglomerate, fanglomerate, and sandstone with minor lenses of megabreccia sourced from the flank of the San Gabriel Mountains. The Vasquez Formation has a maximum thickness of 12,500 feet (Jahns and Muehlberger, 1954). The Tick Canyon Formation is composed of middle to early Miocene poorly sorted conglomerate. The area underlain by the Tick Canyon Formation has been mapped as both Mint Canyon Formation and Tick Canyon Formation in the past (Oakeshott, 1958; Jahns and Muehlberger, 1954; Dibblee, 1996 a, b). Ehlert (2003) found no lithologic differences or unconformity between the two formations and suggests that units mapped as Tick Canyon Formation should be considered the basal sediments of the Mint Canyon Formation. Regardless, the material is suitable for PCC aggregate. It is estimated that approximately 65 percent of the material is coarse and approximately 35 percent is fine (Joseph and others, 1987) within the Mint Canyon Formation, and approximately 70 percent of the material is coarse, and 30 percent is fine in the Vasquez Formation.

The anorthosite-gabbro body is also located in the eastern part of the Saugus-Newhall P-C Region in the San Gabriel Mountains and is a source of crushed stone aggregate. The anorthosite-gabbro body is comprised of andesine anorthosite, gabbroic anorthosite, anorthositic gabbro, and gabbro, varying only by the proportion of feldspar and mafic minerals (Joseph and others, 1987). However, more recent mapping shows that this Proterozoic anorthosite-gabbro body has several sub-units including syenite and gabbro with lesser leucogabbro, anorthosite inclusion-rich gabbro, and anorthosite (Carter, 1980; Campbell and others, 2014). This anorthosite-gabbro complex is thought to be a result of differentiation of a single parent magma (Oakeshott, 1958) and formed approximately 1,200 million years ago (Barth and others, 1995). After crushing, approximately 80 percent of material is coarse and approximately 20 percent is fine.

MRZ-3

A large portion of the Saugus-Newhall P-C Region is classified as MRZ-3 (Plate 1). In low-lying regions, these areas are underlain by Quaternary alluvial deposits. In mountainous regions where data is lacking, these areas are underlain by Tertiary sedimentary and volcanic deposits as well as portions of the anorthosite-gabbro body. Sedimentary units include the Saugus, Vasquez, Tick Canyon, Towsley, and Pico formations, which contain lenses of sand and conglomerate that may have a potential to yield PCC aggregate.

MRZ-4

There are no areas within the Saugus-Newhall P-C Region classified as MRZ-4, however, there are areas that remain unclassified. This is consistent with the previous report because no new information was available to classify these lands. Additionally, a large portion of the unclassified land in the northern area of the Saugus-Newhall P-C Region is controlled by the U.S. Forest Service; this is a land use incompatible with mining.

Sectors

Four sectors were classified in the San Fernando Valley P-C Region (Anderson and others, 1979), and three sectors, including sub-sectors, were classified in the Saugus-Newhall P-C Region (Joseph and others, 1987) in SR 143 part II and part V, respectively. These sectors were maintained in OFR 94-14 and updated based only on urbanization (Miller and others, 1994). For this report, sectors were adjusted to reflect the changes made to the MRZs and updated to reflect changes in urbanization based on 2018 National Agriculture Imagery Program imagery. No new sectors were added in this report.

The four sectors in the San Fernando Valley P-C Region are underlain by sand and gravel wash deposits. Sectors A, B, and C are located within the Tujunga Wash, and Sector D is located within the Pacoima Wash (Plate 2). Sector A is located from the mouth of Big Tujunga Canyon to the area east of Hansen Dam. Sector B contains the alluvial area north of Hansen Dam. Sector C includes nonurbanized areas south of Hansen Dam. Sector D is located upstream of Lopez Dam to the mouth of Pacoima Canyon.

Some sectors that have been subdivided by highways and other intervening developments have been given sets of sub-sector numbers for ease of identifying individual areas within the Saugus-Newhall P-C Region.

In the Saugus-Newhall P-C Region, each sector is underlain by a different geologic deposit. Sector A is underlain by deposits within the Santa Clara river and floodplain. Sector A includes 12 sub-sectors and spans approximately 18 miles from the county boundary west of Del Valle, through Castaic Junction, then branching north to the Castaic Lagoon and east through Soledad Canyon to Bee Canyon (Plate 2). Sector B is underlain by basal, coarse conglomerates and sandstones of the Mint Canyon, Vasquez, and/or Pico Formations. Sector B includes three sub-sectors; two are located between Bee Canyon and Soledad Canyon and the third is located south of Lang Station (Plate 2). Sector C is underlain by the anorthosite-gabbro group and is located in the western San Gabriel Mountains (Plate 2).

Sub-sector B-1 in the Saugus-Newhall P-C Region was updated to include land which was previously classified as MRZ-2 but excluded from the sub-sector. A 42-acre portion was added to this sub-sector because the area is underlain by PCC aggregate and has a land use compatible with mining.

Each sector is described in detail in Appendix B.

Reserves and Resources

Reserves in both the San Fernando Valley and Saugus-Newhall P-C Regions are proprietary due to the few active operations located within each P-C region. Adjustments were made to the assumptions for resource calculations outlined in SR 143 and maintained in OFR 94-14. These are described below for each region.

<u>San Fernando Valley</u>

The authors of SR 143 assumed the Tujunga Wash and the Pacoima Wash are relatively juvenile alluvial systems, and that the channels form a “V” shaped cross-section (Anderson and others, 1979). However, rivers with a “V” shaped morphology are in the early stage of river development and do not deposit material. A tabular, more mature, river morphology was assumed instead to account for the large amount of deposition which has occurred in the Tujunga and Pacoima Washes. A density of 0.065 tons per cubic foot was maintained for all four sectors

(Anderson and others, 1979). A 0 percent waste factor was used in SR 143 (Anderson and others, 1979); however, this is unrealistic for any type of PCC aggregate deposit. Instead, a waste factor of 10 percent, reported by operators, was used. These assumptions apply to all sectors within the San Fernando Valley P-C Region.

The depths of PCC material were modified for sectors where adequate well-log data strongly suggests suitable material at greater depths. In Sector A, sufficient well-log data west of Interstate 210 suggests PCC material depths of 100 feet. Resource calculations for Sector A were split into two parts; one calculation using a depth of 80 feet for the area east of Interstate 210, and one calculation using a depth of 100 feet for the area west of Interstate 210. There are no new well-logs for Sector B, so the depth of 100 feet used in SR 143 was maintained (Anderson and others, 1979). In SR 143, a depth of 300 feet was used for permitted land in Sector C, and a depth of 250 feet was used for nonpermitted land (Anderson and others, 1979). However, well-logs indicate gravel extends up to 600-800 feet below the surface in Sector C and operators reported material depths up to 1,000 feet within the Tujunga Wash within Sector C. Additionally, depths of 500 feet about two miles south of Hansen Dam are reported in SR 143 (Anderson and others, 1979). Because the quality of material at depth remains uncertain, a conservative estimate of 300 feet was used for this report. A depth of 25 feet was used in SR 143 (Anderson and others, 1979) for Sector D within the Pacoima Wash. Well-logs suggest the depth of gravel extends 175-260 feet below the surface. Because little is known about this deposit, and there are no records to indicate the quality of the material throughout this gravel column (Anderson and others, 1979), a conservative depth estimate of 50 feet was used for this report.

Saugus-Newhall

Sector A

The authors of SR 143 assumed the deposits within the Santa Clara River floodplain are tabular (Joseph and others, 1987). The authors also assumed a waste factor of 5 percent (Joseph and others, 1987) and a material density of 0.065 tons per cubic foot (Evans and others, 1977). No new information suggests that these assumptions should be different, thus, these assumptions were maintained in this report. However, the authors of SR 143 assumed a consistent material thickness of 80 feet for the entire approximately 18 miles of the deposit underlying Sector A

(Joseph and others, 1987). Well-logs indicate that the PCC material of Sector A varies in thickness from 90 to 130 feet, with sand and gravel recorded to depths of 180-200 feet below the surface. A conservative average of 115 feet was used to calculate a resource estimate for Sector A in this report. This average was cross-checked with well-logs from each sector to ensure that 115 feet was a representative average of deposit thickness.

Sector B

Assumptions of the Mint Canyon Formation from SR 143 include: 1) a silt and clay fraction of 15-20 percent, which was used as the waste factor (Joseph and others, 1987); and 2) in-place material density is 0.063 tons per cubic foot (Evans and others, 1977). Both operators that have historically mined the Mint Canyon Formation in Sector B-1 have reported a waste factor of 20 percent. This number is more conservative than the 15 percent waste factor used in previous reports, so a waste factor of 20 percent was used in this report. Sub-sector B-2 is underlain by the Vasquez Tick Canyon/Mint Canyon Formations. Sub-sector B-3 is underlain by the Vasquez Formation. A much lower percentage of material from the Vasquez Formation can be sold as product, thus a waste factor of 40 percent, as reported by operators, was used for areas underlain by this formation. Though no density information is available for the Vasquez Formation, a material density of 0.063 tons per cubic foot is reasonable.

The material thickness used in previous calculations was not included in SR 143 or OFR 94-14 and is difficult to accurately estimate. The coarse conglomerates and sandstones of the Mint Canyon Formation underlying portions of Sector B are reported to be 3,100 feet thick (Joseph and others, 1987). Additionally, the historical Soledad Canyon mine operated by Curtis Construction Company, has reported material at a depth of 2,000 feet. Previous authors estimate that approximately 35 percent of the resource could be unviable due to faulting and folding. Geologic mapping (Campbell and others, 2014; Dibblee, 1996a; 1996b) indicates bedrock underneath Sector B is bound by faults, but the bedrock is not faulted locally within each sub-sector. Additionally, the bedrock orientations are fairly consistent within each subsector (Dibblee, 1996a; 1996b), indicating that folding is not locally pervasive. Because faulting and folding is not locally pervasive, the 35 percent subtracted in previous reports was not subtracted in this report. Using the assumptions outlined in SR 143, a thickness of 400 feet was back calculated. However, mining depths stated in a proposed mining plan are between 600 and 700

feet in the area of Sector B underlain by the Vasquez and Mint Canyon/Tick Canyon Formations. A conservative thickness of 600 feet was used for all of Sector B for this report.

Sector C

Assumptions for the anorthosite-gabbro body in SR 143 (Joseph and others, 1987) include: 1) a material density of 0.08 tons per cubic foot; and, 2) a waste factor of 5 percent. These assumptions were maintained in this report. Like Sector B, the depth used in the previous calculations was not stated in previous reports. Using the assumptions from SR 143, a depth of approximately 450 feet was back calculated. Because the nature of this igneous body is not well-constrained, a conservative depth of 450 feet was used in this report.

Resource Estimates

There are approximately 416 million tons of PCC aggregate resources in the San Fernando Valley P-C Region, where 290 million tons of the material is coarse, and 126 million tons of the material is fine. There are approximately 10,492 million tons of PCC aggregate resources in the Saugus-Newhall P-C Region, where 7,518 million tons is coarse, and 2,974 million tons is fine. Resource tonnage for each sector is summarized in Appendix B.

Production and Consumption

The average annual production was only calculated for the years 1990-2018, because historical production data presented in previous reports is inconsistent. The average annual production in the San Fernando Valley P-C Region from 1990 to 2018 was approximately 2.6 million tons per year (Table 1). The average annual production in the Saugus-Newhall region from 1990-2018 was approximately 530,000 tons per year (Table 1). Production has decreased in both regions with very little production since 2008. Based on conversations with operators most of the PCC aggregate is imported into the regions making consumption very difficult to accurately calculate.

50-Year Projection of Aggregate Demand

The populations for the San Fernando Valley and Saugus-Newhall P-C Regions were projected over the next 50 years (Figure 2; Appendix C). This projected population was multiplied by the average per capita aggregate consumption across all of California. Using 5.3

tons per person per year, the San Fernando Valley P-C Region is projected to need 959 million tons from the years 2018 to 2068, and the Saugus-Newhall P-C Region is projected to need 80 million tons from the years 2018 to 2068. Land use planners should not rely solely on this projection when making decisions for future aggregate needs, as it does not incorporate variables better accounted for by planners.

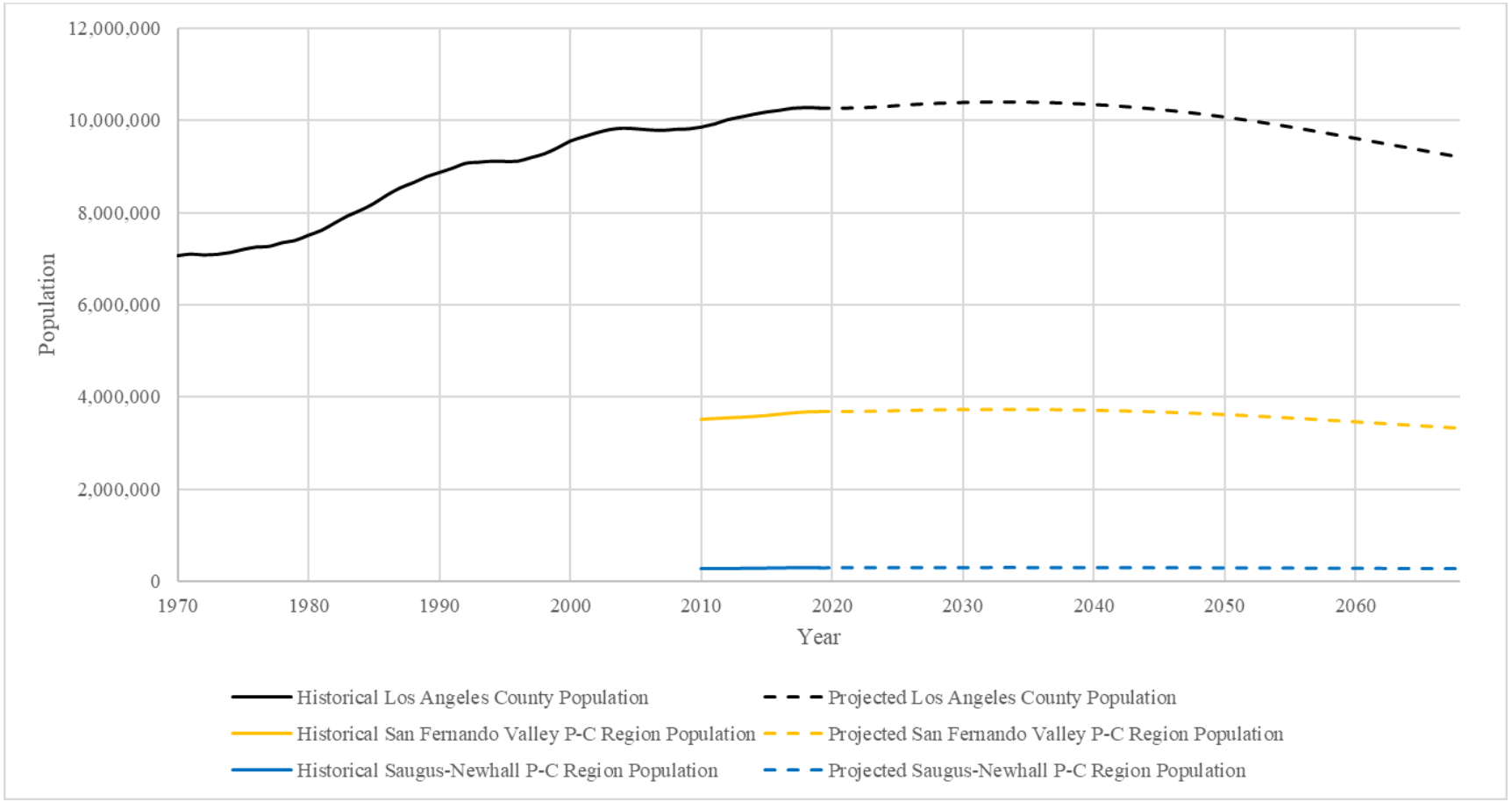


Figure 2. Graph of historical population and projected population for Los Angeles County and the San Fernando Valley and Saugus-Newhall P-C Regions.

DISCUSSION

Mineral Resource Zones and Sectors

Mineral resource zones were maintained from previous reports and were only revised to reflect updated geologic mapping and current aerial imagery. Likewise, sectors were updated to reflect changes made to the MRZs, as well as accounting for urbanization that would preclude mining. Acreage for each individual sector is shown in Appendix B. The total acreage lost to incompatible land uses such as urbanization is 126 acres and 1,630 acres in the San Fernando Valley and Saugus-Newhall P-C Regions respectively.

Reserves and Resources

A comparison of reserves and resources in OFR 94-14 and this report is presented in Table 1. The 161 percent and 141 percent increase in resources in the San Fernando Valley and Saugus-Newhall P-C Regions respectively since OFR 94-14 was published is attributed to the changes in assumptions for the calculations, as outlined in the results section.

Table 1. Reserves and Resources Comparison from OFR 94-14 and SR 254

San Fernando Valley		
	OFR 94-14	**SR 254**
Reserves	Confidential	Confidential
Resources	259 million tons	416 million tons
Average Annual Production	9.4 million tons/year	2.6 million tons/year
Saugus-Newhall		
	OFR 94-14	**SR 254**
Reserves	158 million tons	Confidential
Resources	7,439 million tons	10,492 million tons
Average Annual Production	1.2 million tons/year	530,000 tons/year

Operations

Understanding the history of aggregate production is crucial to fully understand the complexity of production and consumption within the San Fernando Valley and Saugus-Newhall P-C Regions. Additionally, this information is hard to glean and piece together from previous reports, thus a concise summary of historical and present-day operations is described below for each region.

San Fernando Valley Operations

At the time SR 143 part II was written in 1979, there were four active operations located within sectors in the San Fernando Valley P-C Region: Conrock Company's Sun Valley, CalMat, and Boulevard operations, and Livingston-Graham's Sun Valley operation. All four of these operations were located in Sector C.

At the time OFR 94-14 was written in 1994, Conrock had changed their name to CalMat, who operated the Boulevard and Sun Valley/Sheldon pits within the San Fernando Valley P-C Region. Two pits, Conrock's CalMat pit and Livingston-Graham Company's Sun Valley pit ceased production between 1976 and 1994. Channel and Basin Reclamation Company started mining material north of Hansen Dam in 1984 in Sector B.

There are currently four active operations within the San Fernando Valley P-C Region: CalMat d.b.a Vulcan's Sheldon, Boulevard, and Sun Valley operations, and Borges Rock Products' Hansen Dam operation (Plate 1; Plate 2; Figure 1). Calmat's three operations have vested rights, and the operation behind Hansen Dam is exempt from SMARA.

Saugus-Newhall Operations

At the time SR 143 part V was written in 1987, there were three active operations located within the Saugus-Newhall P-C Region: Curtis Construction Company's Lang Siding and Soledad operations, and P.W. Gillibrand's Lang Siding operation. Curtis Construction Company mined sand and gravel from the Santa Clara River Valley at Lang Siding, now referred to as Lang Station and mixed it with the coarser conglomeritic unit of the Mint Canyon Formation. P.W. Gillibrand mined the finer grained unit within the Mint Canyon Formation and mixed this material with crushed stone from the anorthosite-gabbro body.

At the time OFR 94-14 was written in 1994, there were also three active operations located within the Saugus-Newhall P-C Region: P.W. Gillibrand's Soledad operation (formerly known as Lang Siding), CalMat's Sweetwater Aggregates operation, and Curtis Sand and Gravel Company's Lang Station operation. CalMat's Sweetwater Aggregates operation was in production from 1990-1992 and produced PCC aggregate from the Santa Clara River Valley and the Mint Canyon Formation. Curtis Sand and Gravel Company, formerly known as Curtis Construction Company, continued mining sand and gravel from the Santa Clara River Valley. P.W. Gillibrand continued mining the Mint Canyon Formation and the anorthosite-gabbro body at their Pole Canyon site. P.W. Gillibrand also produced PCC aggregate from sub-sector A-12 at their Oak Spring and Rabbit Canyon sites.

There is currently one operation within the Saugus-Newhall P-C Region with an active permit: Curtis Sand and Gravel Company's Lang Station operation (Plate 1; Plate 2; Figure 1). Curtis Sand and Gravel Company continues to mine sand and gravel within the Santa Clara River Valley but relies on flood events to replenish the resource. The permits for both the CalMat (d.b.a Vulcan) Lang Station – Sweetwater (formerly known as Sweetwater Aggregates) operation and the CalMat (d.b.a. Vulcan) Soledad operation (formerly P.W. Gillibrand's Soledad operation) expired in the 2010s.

Production

Production and consumption are not correlated in either the San Fernando Valley or Saugus-Newhall P-C Regions. Production has been declining steadily even though the populations in both regions are still growing and urbanization continues to increase. The number of active operations has decreased over the past several decades. In the Saugus-Newhall P-C Region, only one mine currently has an active permit, and this operation is a surface mine that is limited in the amount of PCC aggregate it can produce because it is dependent on flood events to bring material into the Santa Clara River Valley. In the San Fernando Valley, there are three operations with vested rights and one exempt operation; however, these operations have been producing material since the mid-1950s, and reserves are running low. Production has decreased steadily over the past two decades, and neither region is producing enough material locally to sustain their populations. Thus, the majority of the PCC aggregate consumed in both regions

must be imported by rail and truck from neighboring regions, such as Palmdale or the Mojave Desert to meet the demand of the rapidly urbanizing regions in north Los Angeles County.

50-Year Projection of Aggregate Demand

The 50-year projected demand presented in this report could not be compared to the 50-year projected demand presented in OFR 94-14. In OFR 94-14, Los Angeles County was analyzed as a whole county and includes several different P-C regions within Los Angeles County for the projection; thus, a direct comparison could not be made. However, the 50-year projected aggregate demand for both the San Fernando Valley and Saugus-Newhall P-C Regions is discussed below.

Both P-C regions have shifted dependence to external sources of PCC aggregate, because there are not enough permitted reserves in either region to meet the demand with local resources. Unless new mines are permitted, the San Fernando Valley and Saugus-Newhall P-C Regions will continue to import the majority of the PCC aggregate to meet the demands of the regions. There are plenty of PCC aggregate resources in both the San Fernando Valley and Saugus-Newhall P-C Regions, but the permitting process is especially difficult in a heavily urbanized region like Los Angeles County compared to more rural regions, because the public and county are hesitant to allow additional mining which may impact the communities.

CONCLUSIONS

This report serves as an update to the findings from OFR 94-14 (1994). The following is a summary of the findings from this report:

- No new sectors were added; the four sectors classified in the San Fernando Valley P-C Region and the three sectors classified in the Saugus-Newhall P-C Region were maintained from OFR 94-14.
- The projected 50-year demand on the San Fernando Valley P-C Region through the year 2068 is estimated to be 959 million tons of PCC quality aggregate.
- The projected 50-year demand on the Saugus-Newhall P-C Region through the year 2068 is estimated to be 80 million tons of PCC quality aggregate.
- Reserves are proprietary but will be exhausted well before 10 years in both regions if the current demand is sustained.

- Approximately 416 million tons of resources underlie the San Fernando Valley P-C Region.
- Approximately 10.5 billion tons of resources underlie the Saugus-Newhall P-C Region.
- There are three vested operations and one exempt operation in the San Fernando Valley P-C Region.
- There is one permitted operation in the Saugus-Newhall P-C Region.
- Average annual production has declined in both regions over the past two decades.
- If no additional resources are permitted, both the San Fernando Valley and Saugus-Newhall P-C Regions will remain dependent on external sources of PCC aggregate.

Land-use planners should consider the findings from this report in their future land-use decisions. Urbanization in north Los Angeles County will continue to put strain on the demand for PCC aggregate resources. Continued dependence on external sources of PCC aggregate comes with consequences such as longer haulage distances which increase transportation costs, cost of aggregate, CO_2 emissions, and the frequency of necessary road maintenance.

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REFERENCES

Anderson, T. P., Loyd, R. C., Clark, W. B., Miller, R. V., Corbaley, R., Kohler, S., Bushnell., M. M., 1979, Mineral Land Classification of the Greater Los Angeles Area; Part I, Description of the Mineral Land Classification Project of the Greater Los Angeles Area; Part II, Classification of Sand and Gravel Resources Areas, San Fernando Valley Production-Consumption Region: California Division of Mines and Geology Special Report 143, Parts I and II, 79 p.

Barth, A.P, Wooden, J.L., Tosdal, R.M., Morrison, J., Dawson, D.L., and Hernly, B.M., 1995, Origin of gneisses in the aureole of the San Gabriel anorthosite complex and implications for the Proterozoic crustal evolution of Southern California: Tectonics, v.14, no.3, p. 736-752.

California Department of Conservation, 1981, Designation of Sand and Gravel Resources of Regional Significance in the San Fernando Valley Region, Los Angeles County, California: SMARA Designation Report No. 1.

California Department of Conservation, 1987, Designation of Regionally Significant Construction Aggregate Resource Area in the Saugus-Newhall and Palmdale Production-Consumption Regions: SMARA Designation Report No. 6.

California Department of Industrial Relations , 2020, California Consumer Price Index, 1955-2020 [Time series].

Campbell, R.H., Wills, C.J., Irvine, P.J., and Swanson, B.J., 2014, Preliminary geologic map of the Los Angeles 30' x 60' quadrangle, California: Version 2.1: California Geological Survey, Preliminary Geologic Maps, scale 1:100,000.

Carter, B., 1980, Structure and petrology of the San Gabriel anorthosite-syenite body, Los Angeles County, California: California Institute of Technology Ph.D. thesis, 393 p., scale 1:31,250.

Clinkenbeard, J. P., 2012, Aggregate Sustainability in California: California Department of Conservation, California Geological Survey Map Sheet 52.

Clinkenbeard, J. P., and Gius, F. W., 2018, Aggregate Sustainability in California: California Department of Conservation, California Geological Survey Map Sheet 52.

Evans, J. R., Anderson, T. P., Manson, M. W., Maud, R. L., Clark, W. B., Fife, D. L., 1979, Aggregates in the Greater Los Angeles Area, California: California Division of Mines and Geology Special Report 139.

Dibblee, T.W. Jr., 1996a, Geologic map of the Agua Dulce Quadrangle, Los Angeles County, California: Dibblee Geological Foundation Map DF-58, Santa Barbara, California, scale 1:24,000.

Dibblee, T.W. Jr., 1996b, Geologic map of the Mint Canyon Quadrangle, Los Angeles County, California: Dibblee Geological Foundation Map DF-57, Santa Barbara, California, scale 1:24,000.

Ehlert, K.W., 2003, Tectonic significance of the middle Miocene Mint Canyon and Caliente Formations, southern California, in Crowell, J.C. ed., Evolution of Ridge Basin, southern California: an interplay of sedimentation and tectonics: Geological Society of America Special Paper, 367, p. 113-130.

Evans, J. R., Anderson, T. P., Manson, M. W., Maud, R. L., Clark, W. B., and Fife, D. L., 1979, Aggregates in the Greater Los Angeles Area, California: California Division of Mines and Geology Special Report 139, 79 p.

Gay, T. E., Jr., and Hoffman, S. R., 1954, Mines and Mineral Deposits of Los Angeles County, California: California Journal of Mines and Geology, v. 50, p. 468-609.

Jahns, R.H., and Muehlberger, W.R., 1954, Geology of the Soledad basin, Los Angeles County, in Jahns, R.H., ed., 1954, Geology of southern California: California Division of Mines Bulletin 170, Map Sheet No. 6, map, scale approximately 1:76,000.

Joseph, S. E., Miller, R. V., Tan, S. S., and Goodman, R. W., 1987, Mineral Land Classification of the Greater Los Angeles Area; Part V, Classification of Sand and Gravel Resource Areas, Saugus-Newhall Production-Consumption Region, and Palmdale Production-Consumption Region: California Department of Conservation, Division of Mines and Geology Special Report 143, Part V, 52 p.

Key, T.B., 2019, California Non-Fuel Mineral Production 2017: California Department of Conservation, California Geological Survey.

Kohler, Susan, 2006, Aggregate Availability in California: California Department of Conservation, California Geological Survey Map Sheet 52.

Marquis, Greg, 2020, California Non-Fuel Mineral Production 2018: California Department of Conservation, California Geological Survey.

Miller, R V., 1994, Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: California Department of Conservation, Division of Mines and Geology Open File Report 94-14, 59 p.

Oakeshott, G.B., 1958, Geology and mineral deposits of San Fernando Quadrangle, Los Angeles County, California. California Division of Mines and Geology Bulletin, v.172, 147 p., plate 1, 1:62,500.

State Mining and Geology Board, 2000, Guidelines for Classification and Designation of Mineral Lands: California Department of Conservation, Division of Mines and Geology, Special Publication 51.

Stinson, M.C., Manson, M.W., and Plappert, J.J., 1986, Mineral Land Classification: Aggregate Materials in the San Francisco-Monterey Bay Area, Part I Project Description: Mineral Land Classification for Construction Aggregate in the San Francisco-Monterey Bay Area: California Department of Conservation, Division of Mine and Geology Special Report 146, 44 p.

APPENDIX A – LEAD AGENCIES

This table lists the lead agencies in the San Fernando Valley and Saugus-Newhall P-C Regions and indicates whether or not they contain vested/exempt/permitted mines, land classified as MRZ-2, and land classified as sectors.

Lead Agency	MRZ-2	Sector	Vested/Exempt/Permitted Mine
County of Los Angeles	Yes	Yes	Yes
Beverly Hills	No	No	No
Burbank	Yes	No	No
Calabasas	No	No	No
Culver City	No	No	No
El Segundo	No	No	No
Glendale	Yes	No	No
Hawthorne	No	No	No
Hermosa Beach	No	No	No
Hidden hills	No	No	No
Inglewood	No	No	No
La Canada Flintridge	No	No	No
Lawndale	No	No	No
Los Angeles	Yes	Yes	Yes
Malibu	No	No	No
Manhattan Beach	No	No	No
Pasadena	No	No	No
Redondo Beach	No	No	No
San Fernando	Yes	No	No
Santa Clarita	Yes	Yes	No
Santa Monica	No	No	No
West Hollywood	No	No	No

APPENDIX B – SECTOR DESCRIPTIONS

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
San Fernando Valley	A	None	Partially	806	185,240,000	Holocene to Pleistocene alluvial fan deposits of the Tujunga Wash containing material composed of granitic and metamorphic rock fragments from the San Gabriel Mountains. Extends east from Hansen Dam to the mouth of Big Tujunga Canyon.
San Fernando Valley	B	Borges Rock Products - Hansen Dam	Yes	191	48,628,000	Holocene to Pleistocene alluvial fan deposits of the Tujunga Wash containing material composed of granitic and metamorphic rock fragments from the San Gabriel Mountains. Located around the Hansen Dam.
San Fernando Valley	C	CalMat d.b.a. Vulcan - Boulevard; Sheldon; and Sun Valley	Yes	451	162,177,000	Holocene to Pleistocene alluvial fan deposits of the Tujunga Wash containing material composed of granitic and metamorphic rock fragments from the San Gabriel Mountains. Located southwest of Hansen Dam.
San Fernando Valley	D	None	Yes	159	20,247,000	Late Holocene alluvial fan deposits of the Pacoima Wash. Extends from north of Lopez Dam to the mouth of Pacoima Canyon.
Saugus-Newhall	A-1	None	Yes	1522	470,670,000	Holocene to late Pleistocene alluvial deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from the Los Angeles County line to southeast of Castaic Junction.

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
Saugus-Newhall	A-2	None	Yes	232	71,916,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Located west of Castaic Junction.
Saugus-Newhall	A-3	None	Yes	485	150,092,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from Castaic Junction north to Castaic Lagoon.
Saugus-Newhall	A-4	None	Yes	31	9,731,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Located in a small area southeast of Castaic Junction.
Saugus-Newhall	A-5	None	Yes	236	73,150,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends east of Castaic Junction to Bouquet Junction.

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
Saugus-Newhall	A-6	None	No	0	0	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from Bouquet Junction south to Newhall Creek. The land in this sector is incompatible with mining due to urbanization and powerline right-of-ways.
Saugus-Newhall	A-7	None	Yes	363	112,390,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from Bouquet Junction southeast ~3.6 miles to where Soledad Canyon Road crosses the Santa Clara River.
Saugus-Newhall	A-8	None	Yes	88	27,182,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Located in the area between Soledad Canyon Road and Sierra Highway south of Canyon Country.

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
Saugus-Newhall	A-9	None	Yes	34	10,389,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Located in the area between Sierra Highway and the Antelope Valley Freeway south of Solemint.
Saugus-Newhall	A-10	None	Yes	210	64,999,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends east from the Antelope Valley Freeway ~1.3 miles to north of Sand Canyon.
Saugus-Newhall	A-11	Curtis Sand and Gravel Company - Lang Station	Yes	344	106,285,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from north of Sand Canyon east to Bee Canyon.

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
Saugus-Newhall	A-12	None	Yes	181	31,668,000	Holocene to late Pleistocene alluvial valley deposits of the Santa Clara River Valley containing unconsolidated material composed of granitic rock and lesser reworked conglomerate, sandstone, and metamorphic and volcanic rock. Extends from southeast of Oak Spring Canyon and continues southeast 1 and two-thirds mile.
Saugus-Newhall	B-1	CalMat d.b.a. Vulcan - Lang Station - Sweetwater; Soledad	Yes	971	1,240,466,000	Middle to late Miocene Mint Canyon Formation composed of lacustrine facies including interbedded sandstone, conglomeratic sandstone, siltstone, and claystone (Campbell and others, 2014). Located in a triangular area extending from Pole Canyon southwest 2.5 miles, north-northwest 1.7 miles to the railroad, then east-northeast to Pole Canyon.
Saugus-Newhall	B-2	None	Yes	1007	985,333,000	Oligo-Miocene Vasquez Formation composed of alluvial conglomerate, fanglomerate, and sandstone, with minor lenses of megabreccia as well as the middle to early Miocene Tick Canyon Formation composed of poorly sorted conglomerate (Campbell and others, 2014). Located in a triangular area extending from Bee Canyon northeast, bound by Agua Dulce Canyon on the east and the Santa Clara River to the south.

P-C Region	Sector	Permitted/exempt/ vested mine	Designated?	Acreage	Resources (tons)	Description
Saugus-Newhall	B-3	None	Yes	842	831,968,000	Oligo-Miocene Vasquez Formation composed of alluvial conglomerate, fanglomerate, and sandstone, with minor lenses of megabreccia (Campbell and others, 2014). Area bound by Agua Dulce Canyon to the east and the Santa Clara River to the south. Extends ~1.15 miles to the east of Agua Dulce Canyon and 1.25 miles north of the Santa Clara River.
Saugus-Newhall	C-1	None	Partially	4270	6,306,133,000	Proterozoic anorthosite-gabbro complex including sub-units: syenite, gabbro, leucogabbro, anorthosite inclusion-rich gabbro, and anorthosite (Campbell and others, 2014). Located in a triangular area extending from Pole Canyon southeast 2.5 miles to the P-C region boundary, continuing southwest for 4.25 miles along the P-C region boundary, then northeast back to Pole Canyon.

APPENDIX C – HISTORICAL AND PROJECTED POPULATION

This table shows the historical and 50-year projected population of Los Angeles County and the San Fernando Valley and Saugus-Newhall P-C Regions. As described in the methods section, historical population for each P-C region was only available for the years 2010-2019 due the methodology used to calculate these populations in previous reports.

Year	Los Angeles County	San Fernando Valley P-C Region	Saugus-Newhall P-C Region
1970	7,055,800		
1971	7,092,000		
1972	7,072,100		
1973	7,083,800		
1974	7,124,500		
1975	7,191,300		
1976	7,243,400		
1977	7,258,200		
1978	7,338,600		
1979	7,389,600		
1980	7,500,300		
1981	7,607,100		
1982	7,766,300		
1983	7,921,900		
1984	8,044,400		
1985	8,190,900		
1986	8,373,100		
1987	8,527,400		
1988	8,639,400		
1989	8,768,700		
1990	8,860,281		
1991	8,955,322		
1992	9,060,246		
1993	9,083,691		
1994	9,106,489		
1995	9,101,122		
1996	9,108,050		
1997	9,185,584		
1998	9,265,811		

Year	Los Angeles County	San Fernando Valley P-C Region	Saugus-Newhall P-C Region
1999	9,394,293		
2000	9,543,983		
2001	9,635,795		
2002	9,722,444		
2003	9,791,022		
2004	9,822,508		
2005	9,809,557		
2006	9,787,327		
2007	9,773,894		
2008	9,796,812		
2009	9,805,233		
2010	9,846,651	3,516,495	276,309
2011	9,913,481	3,536,991	277,939
2012	10,006,227	3,551,552	279,857
2013	10,064,909	3,566,524	282,052
2014	10,124,206	3,583,937	284,892
2015	10,176,031	3,606,174	287,935
2016	10,211,351	3,636,975	291,499
2017	10,255,733	3,668,182	294,634
2018	10,269,935	3,689,156	296,850
2019	10,260,237	3,694,994	297,837
2020	10,257,557	3,692,721	307,727
2021	10,259,169	3,693,301	307,775
2022	10,265,369	3,695,533	307,961
2023	10,276,394	3,699,502	308,292
2024	10,292,478	3,705,292	308,774
2025	10,314,467	3,713,208	309,434
2026	10,333,153	3,719,935	309,995
2027	10,348,712	3,725,536	310,461
2028	10,361,734	3,730,224	310,852
2029	10,372,273	3,734,018	311,168
2030	10,380,446	3,736,961	311,413
2031	10,385,674	3,738,843	311,570
2032	10,389,125	3,740,085	311,674
2033	10,390,380	3,740,537	311,711
2034	10,389,542	3,740,235	311,686

Year	Los Angeles County	San Fernando Valley P-C Region	Saugus-Newhall P-C Region
2035	10,386,380	3,739,097	311,591
2036	10,380,661	3,737,038	311,420
2037	10,372,928	3,734,254	311,188
2038	10,362,785	3,730,603	310,884
2039	10,350,160	3,726,058	310,505
2040	10,335,448	3,720,761	310,063
2041	10,318,608	3,714,699	309,558
2042	10,299,425	3,707,793	308,983
2043	10,278,371	3,700,214	308,351
2044	10,254,795	3,691,726	307,644
2045	10,229,233	3,682,524	306,877
2046	10,201,041	3,672,375	306,031
2047	10,170,912	3,661,528	305,127
2048	10,138,208	3,649,755	304,146
2049	10,103,362	3,637,210	303,101
2050	10,066,589	3,623,972	301,998
2051	10,027,268	3,609,816	300,818
2052	9,986,354	3,595,087	299,591
2053	9,943,672	3,579,722	298,310
2054	9,899,334	3,563,760	296,980
2055	9,853,434	3,547,236	295,603
2056	9,805,885	3,530,119	294,177
2057	9,757,362	3,512,650	292,721
2058	9,708,277	3,494,980	291,248
2059	9,658,213	3,476,957	289,746
2060	9,607,708	3,458,775	288,231
2061	9,557,221	3,440,599	286,717
2062	9,506,675	3,422,403	285,200
2063	9,456,130	3,404,207	283,684
2064	9,405,585	3,386,011	282,168
2065	9,355,040	3,367,814	280,651
2066	9,304,494	3,349,618	279,135
2067	9,253,949	3,331,422	277,618
2068	9,203,404	3,313,225	276,102