

Large volumes of potentially recoverable petroleum in the City of Los Angeles



*View across Salt Lake oil field to the Santa Monica Mountains from Rancho La Brea.
USGS photo by Ralph Arnold. January 26, 1906.*

DonGautier L.L.C. has completed an initial evaluation of the petroleum potential of existing oil fields within the City of Los Angeles and concluded that about 1.6 billion barrels of additional oil could be produced using existing technology. At the same time, California imports more than 1 million barrels of crude oil each day, largely by tanker through the ports of Los Angeles and Long Beach.

Sixty-eight oil fields have been named in the Los Angeles basin; twenty of them are within the City of Los Angeles itself. The southern California oil accumulations, including those in L.A., are extraordinary because: (1) they exhibit what may be the world's highest concentration of crude oil in terms of volume per unit area, and (2) they happen to underlie a modern mega-city with tens of millions of inhabitants.

The exceptionally high concentration of crude oil is the geological result of a nearly ideal natural petroleum system, consisting of organic-rich source rocks, exceedingly high heat flow, abundant sandstone reservoir rocks, and large structural traps, all fortuitously formed over the past 14 million years by the complex tectonic forces that continue to shape southern California. People have used the oil in southern California since time

immemorial, but large-scale commercialization began with the waves of American migrants who arrived with the Southern Pacific Railroad. Tradition points to devel-



opment of Los Angeles City oil field in the early 1890s by Edward Doheny and Charles Canfield as the beginning of the petroleum age in L.A.

In spite of southern California's early and enthusiastic embrace of the gasoline-powered automobile, oil development and urbanization have been in conflict since the beginning. Haphazard early-day town-lot development, competing land use practices, and evolving community

standards have constrained production. As a result, recovery efficiency (the fraction of the original oil in place produced or reported as proved reserves) is low in nearly every field and many fields have been prematurely abandoned, leaving large quantities of recoverable oil behind.

In 2012, as part of a larger national project, the U.S. Geological Survey (USGS) estimated that between 1.4 and 5.6 billion barrels of recoverable oil remain in just ten L.A. basin oil fields; three of them (Inglewood, Torrance, and Wilmington-Belmont) lie partially within the L.A. city limits. The USGS did not estimate what portion of the oil was within the City of Los Angeles, nor did it estimate the volumes of recoverable oil in the other fields in the city.

The new evaluation by DonGautier L.L.C. is done in two steps: First, results of the USGS estimates of additional oil in Inglewood, Torrance, and Wilmington-Belmont fields are allocated to the areas of those fields that are within the City of Los Angeles. Second, the volumes of remaining recoverable oil in the seventeen other L.A. basin fields in the city are estimated with a methodology similar to that used by the USGS.

The original oil in place (OOIP) is calculated with a standard petroleum engineering equation: $OOIP = 7758Ah\phi(1-S_w)/Bo_i$, where A = productive area in acres, h = net thickness of the reservoir in feet, ϕ = decimal porosity, S_w = decimal water saturation, and Bo_i = the formation volume factor for oil at reservoir conditions. Data used in the evaluation are from the California Department of Conservation, the USGS, other published sources, and from DonGautier L.L.C. The potential recovery efficiency (RE-max) is estimated from recovery efficiencies modeled in engineering studies, achieved in similar reservoirs elsewhere, or indicated by laboratory results reported in technical literature. Allocations to the city are based on productive areas within municipal boundaries, modified if necessary by other considerations. Results are listed in Table 1.

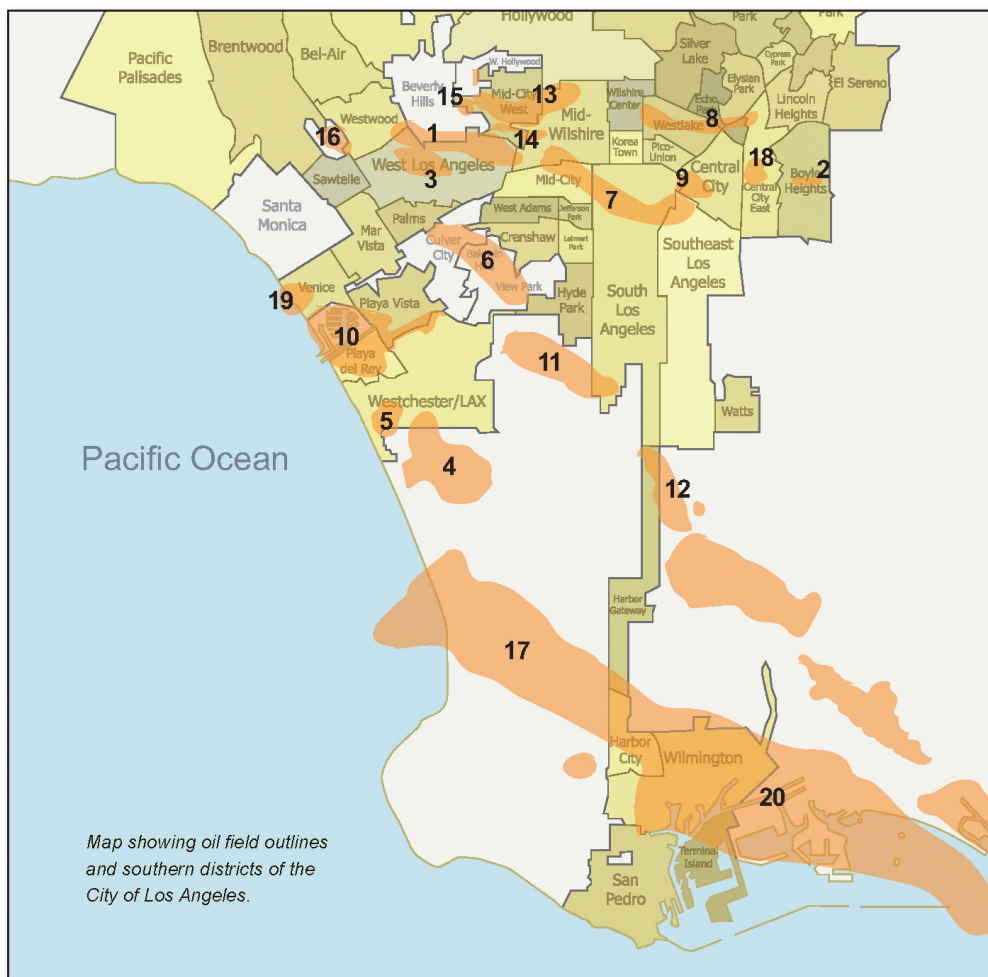


Table 1

Estimated mean volumes of recoverable oil remaining in L.A. basin oil fields located within the City of Los Angeles. (Volumes are in millions of barrels. Known oil is the sum of cumulative production and proved reserves. %RE is recovery efficiency.)

Field Name	Location on map	Known Recoverable Oil	OOIP	Current %RE	Max %RE	Additional oil	Oil in L.A.
BEVERLY HILLS	1	159	1100	14.5	40	287	230
BOYLE HEIGHTS (abd 1973)	2	0.27	22	1.2	35	8	8
CHEVIOT HILLS	3	28.1	620	4.5	35	189	189
EL SEGUNDO	4	15	75	20	35	11	1
HYPERION	5	0.96	7	13.7	30	1	1
INGLEWOOD	6	430	1400	30.7	45	250	13
LAS CIENEGAS	7	73.4	163	45	45	1	1
LOS ANGELES CITY	8	23.2	217	10.6	60	107	107
LOS ANGELES DOWNTOWN	9	15.8	48	33	35	1	1
PLAYA DEL REY (abd 1942)	10	63.5	250	25.6	30	11	10
POTRERO (abd 1996)	11	15.2	367	4.1	35	113	11
ROSECRANS	12	87	475	18.3	35	79	24
SALT LAKE	13	54	439	12.3	60	209	209
SALT LAKE, SOUTH	14	11.5	28	41.1	45	1	1
SAN VICENTE	15	28.5	1000	3	30	272	136
SAWTELLE	16	19.4	97	20	35	15	5
TORRANCE	17	232	1000	23.2	40	227	23
UNION STATION	18	2	570	<1%	30	170	170
VENICE BEACH (abd 1991)	19	3.6	27	13.3	30	5	2
WILMINGTON-BELMONT	20	2984	9000	33.2	40	973	486
Totals		4246.43	16905			2930	1628