ONE half of the United States doesn’t know what the other half is doing. This is greatly to be regretted, because either half might learn much from the experiences and performances of the other. Los Angeles affords a case in point. The city has just completed the greatest aqueduct in the world. Its construction involved a number of unique and daring engineering feats. Its cost has been enormous, but the assured returns from it more than justify the outlay.

It is, however, as an example of municipal independence and efficiency that this great undertaking is chiefly interesting. In a country which is dry nine months in the year and has but a scanty rainfall during the other three, water attains a value that cannot be appreciated by the Easterner. Its availability for irrigation increases the price of land twentyfold. Then again, where fuel is scarce it is a means of materially reducing the otherwise high cost of power by displacing steam with electrical energy. So that, in southern California hardly any price is considered too great to pay for an adequate water service.

The Franciscan friars, versed in the art of irrigation, placed the pueblo of Los Angeles on the banks of a river and based the boundaries of the future town upon a calculation of the area which might be watered by drawing upon the stream. In the course of time this space was occupied by ranches. These in turn were gradually absorbed by the residences and business buildings until, at length, brick and mortar entirely absorbed field and orchard.

Now, it is a curiously convenient fact that the water needed to irrigate a certain area is almost exactly the amount that will be required by the people of a city bounded by the same limits. So that, in the case of Los Angeles, the transition from rural to urban conditions took place without creating a water problem. But the respite was short-lived. The city grew at a prodigious rate, increasing its population thirtyfold in thirty years. The utmost possible draughts upon the river failed to meet the requirements of the population. Recourse to pumping afforded relief for a while, but the constantly increasing demand soon outstripped the new supply. A few years ago it was found that the drain upon the subterranean stores had resulted in markedly lowering their levels. It became necessary to look for an entirely new source of supply, and one which would be equal to the
COTTONWOOD CREEK, ONE OF THE NUMEROUS TRIBUTARIES OF THE OWENS RIVER WHICH SUPPLIES THE GREAT LOS ANGELES AQUEDUCT.
PUTTING THE CONCRETE LINING IN A SECTION OF THE LOS ANGELES TWO-HUNDRED-AND-FIFTY-MILE CONDUIT, THE LONGEST IN THE WORLD.
UPPER DIVISION OF THE POWER PLANT OF THE CALIFORNIA AQUEDUCT: ONE OF THE THREE GREAT PLANTS WHICH FURNISH POWER FOR THE CONSTRUCTION, ALONG WITH FIVE HUNDRED BUILDINGS, A LARGE CEMENT MILL, A TELEPHONE SYSTEM AND A SERIES OF WAGON ROADS.
VIEW OF THE MOUNTAIN SECTION WHICH HAS BEEN PIERCED IN THE JAWBONE DIVISION OF THE LOS ANGELES AQUEDUCT SYSTEM.

OVERHEAD CROSSING IN THE OWENS VALLEY FOR ONE OF THE NUMEROUS MOUNTAIN STREAMS THAT HELP TO FEED THE WATER SUPPLY FOR THE MOST PROFITABLE PUBLIC UTILITY IN THE WORLD.
THE GREATEST AQUEDUCT IN THE WORLD

future necessities of a city already making provision in all its public works for a million inhabitants.

By exercising its right of eminent domain, Los Angeles might have made available some neighboring water courses. This measure, however, would have been no more than a temporary postponement of the difficulty. But, what was of more consequence, extensive fruit lands owed their productivity to the streams in question. Rather than destroy these high-priced properties, the city decided to solve the problem once and for all by seeking water at a distance, where it could be obtained in practically unlimited quantity, and secured without injury to existent or prospective developments.

EXTENSIVE surveys were made and revealed a desirable source in the Owens Valley, lying at an elevation of nearly four thousand feet, on the slope of the Sierra Nevada. This river, fed by the melted mountain snows of summer, flows into a dead lake, more than one hundred square miles in area, from which the annual evaporation is equivalent to seven feet of depth. By intercepting the stream above the lake and diverting it to reservoirs, a vast amount of water, which would otherwise have been wasted, was conserved and turned to beneficial account.

From the point of view of supply this source was satisfactory, but it could only be reached by crossing two hundred miles of lifeless desert and penetrating to the heart of rugged and forbidding mountains, involving the most difficult engineering work. The project would cost twenty-four million dollars, a sum which the city could secure only by straining its bonding resources to the utmost. Despite these deterring conditions, the people of Los Angeles voted nine to one in favor of undertaking the great work. The ground for their confidence is given in the following story that is well worth recital.

In eighteen hundred and sixty-eight, the city of Los Angeles granted a thirty years' franchise to a water company. In eighteen hundred and ninety-eight, the water system of Los Angeles was about as bad as the worst in the country. Some parts of the city had no water and could not get any. The rate was high, the plant in poor condition, and the company losing money.

In nineteen hundred, the municipality secured the corporation's property at a purchase price of two million dollars. At that time the per capita consumption was three hundred gallons daily. A meter system was installed, with the result of diminishing the consumption by half. As this reduction has been accompanied by a decrease of sixty per cent. in the rate, it is safe to assume that measurement of his supply has not induced the consumer to stint himself in the proper use
THE GREATEST AQUEDUCT IN THE WORLD

of the water, and that the curtailment of output represents saving from waste.

San Francisco charges twenty-four cents per thousand gallons for water; Alameda, thirty cents; Berkeley, thirty-five cents; Oakland, forty cents. In each of these instances, the water system is operated by a commercial corporation. The people of Los Angeles are getting water for less than ten cents, the lowest rate in the United States, and that from the most profitable municipal water works in the country. It has never cost the citizens one cent of taxes. It has taken care of its own sinking fund, principal and interest. It not only pays for its maintenance and operation, but also for all improvements. And its net earnings exceed six hundred thousand dollars a year.

Officials and citizens are unanimous in the opinion that this wonderful success is attributable to the splendid management of William Mulholland, Chief Engineer, under whose direction the Aqueduct was constructed, and to the fact that the Water Bureau has been kept free from politics and its employees have been subjected to civil service regulations.

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THEIR experience with the municipal water system warranted the taxpayers of Los Angeles in embarking on the audacious enterprise of bringing their water from a source two hundred and fifty miles distant, which is as though New York should pipe from the Potomac at Washington, but in the latter case the physical obstructions would not be as great as those which have been overcome in carrying out the Los Angeles project.

The work was offered to contractors throughout the country. The lowest bid received was considerably higher than the estimate of the city’s engineers. To them the task was entrusted, and it has been carried on for four years by day labor without any contracts. The aqueduct has been completed within the time and cost limits of the estimate, a remarkable illustration of municipal efficiency.

This experience appears to furnish a refutation of the common statement that a municipality cannot perform work as cheaply as a contractor can. The only essential advantage that the latter has is the possession of a plant, and that advantage disappears when the operation is sufficiently great to justify the purchase by the municipality of a special equipment, and the establishment of an organization on a business basis.

A competitive and bonus system has had much to do with the economy and rapidity attained in the work. Different sections of the line were inspected and a time set for the completion of each. Whenever a crew was able to accomplish its task in less than the given time
a bonus was paid to each member of it. Monthly reports of unit costs and progress in all parts of the work made public the credit, or otherwise, due to the men in charge. These rewards and records stimulated a keen rivalry among the various divisions and gangs. Men voluntarily worked overtime, and on one occasion a number of them and their foreman labored waist-deep in water in the effort to pierce a rock wall before a force that was attacking it from the other side. In the course of the operation American records for both hard and soft rock-tunneling were established. The Elizabeth Tunnel, which is five miles in length and, after the Gunnison Tunnel, the longest duct of its kind in the United States, occupied forty months of twenty-four-hour working days. It was lighted and ventilated by electricity, and the men and their supplies were transported by trolley.

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An Act of Congress was necessary to empower the municipality to purchase certain public lands and to grant it right of way through two national forest reserves. This Act provides that: "The City of Los Angeles is prohibited from ever selling or letting to any corporation or individual, except a municipality, the right for such corporation or individual to sell or sublet the water sold or given to it or him by the city." The charter of the city has been modified so as to provide against the sale of water or power to any but actual consumers, except by vote of the taxpayers. Thus has been precluded the possibility of graft or abuse in the distribution of the precious fluid.

The operation has been carried across two hundred miles of desert, and was possible only after an enormous amount of preliminary work had been done. A large cement mill, three power plants, upward of five hundred buildings, a telephone system two hundred and forty miles in length, and wagon roads of nearly the same extent, were built as auxiliaries to the main construction.

The system consists of six storage reservoirs and two hundred and fifty-five miles of conduit. The largest of the former is situated at the head of the system, seven thousand feet above sea level. Its capacity is two hundred and forty thousand acre feet, which is only about eight per cent. less than that of New York's Ashokan reservoir. This vast store will be held in reserve against a succession of years of drought, such as occur but three or four times in a century. Fifty miles below this reservoir, the main canal, with a capacity of four hundred cubic feet per second, diverts the river into the Hauwee Basin, from which a supply of two hundred and eighty-five million gallons daily may be drawn.

Much of the work is of a spectacular character. The immense cement-lined and covered conduit, sixty-five feet at bottom, carries a
RAIN AT TWILIGHT

volume of water equal to that of a good-sized river. The largest concrete pipe ever constructed is used in places. Canyons are crossed by steel pressure tubes, ten feet in diameter. For forty miles the line forces its way along the rugged face of the Sierra. Tunnel follows tunnel, totaling forty-three miles.

Several drops in the course of the aqueduct make feasible the generation of one hundred and twenty thousand horse-power of electrical energy without interfering with the constant delivery of four hundred second-feet of water. The sale of this power and of the surplus water will make the Los Angeles aqueduct the most profitable public utility in the world. A large demand exists and is constantly growing. The city's power consumption has been doubling yearly for some time past. It is paying two hundred and forty thousand dollars annually for lighting. In the vicinity is four times as much irrigable land as that at present supplied with water, only awaiting a supply to be put into cultivation.

RAIN AT TWILIGHT

THERE was a softness in the wind
Like sweetness of the tongue
When care is hushed and grief is kind,
And plaintive songs are sung.

The grassy valleys and the fells
Beneath the misty skies
Grew full of dreams like asphodels
In meads of paradise.

And gently as the thoughts of love
Come homing to the breast,
The swallow and the mourning dove
Each sought its sheltering nest.

Then like the finger of a friend
Soft tapping on the pane
The swift drops fell, and day had end
In mystery and rain.

Edward Wilbur Mason.