

GIS Analysis



Improving Coverage in LA County

Introduction

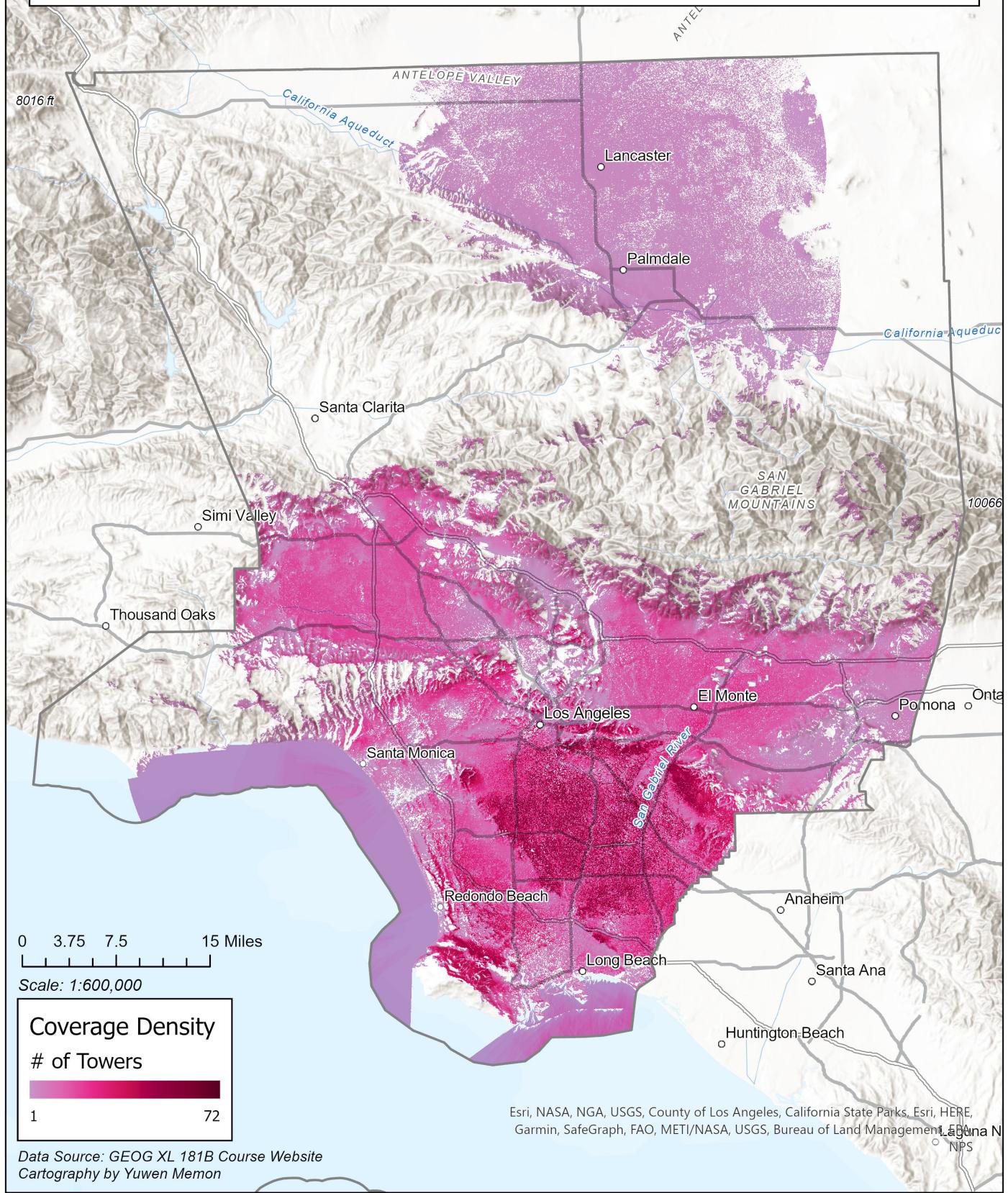
T-Mobile is seeking to expand its cellular coverage in LA County within a budget of \$750,000. Using GIS and viewshed analysis, we'll aim to evaluate how to best apply this budget.

Current Coverage

Below is a map of the estimated footprint of T-Mobile's cell coverage using viewshed analysis based on the current tower infrastructure within LA County. Not pictured are Catalina and San Clemente islands, which belong to LA County but are not in range of any T-Mobile cell towers.

Overall, T-mobile cell service is accessible from **40.05%** of the area within LA County using county towers. We can see dense coverage in the central Los Angeles urban areas, where most residents live.

Current T-Mobile Cell Coverage in LA County



Improvement Scenarios

Within a budget of \$750,000 we've identified three separate ways to improve tower network infrastructure and thus cellular coverage:

1. Raise all towers by 10 meters
2. Increase the maximum range for all towers by 5km
3. Add 3 new towers in under-served areas

We'll visualize the estimated improvements to cell coverage that would result from pursuing each scenario. We'll also compare the results and evaluate which one will be the most beneficial.

Raise All Towers By 10 Meters

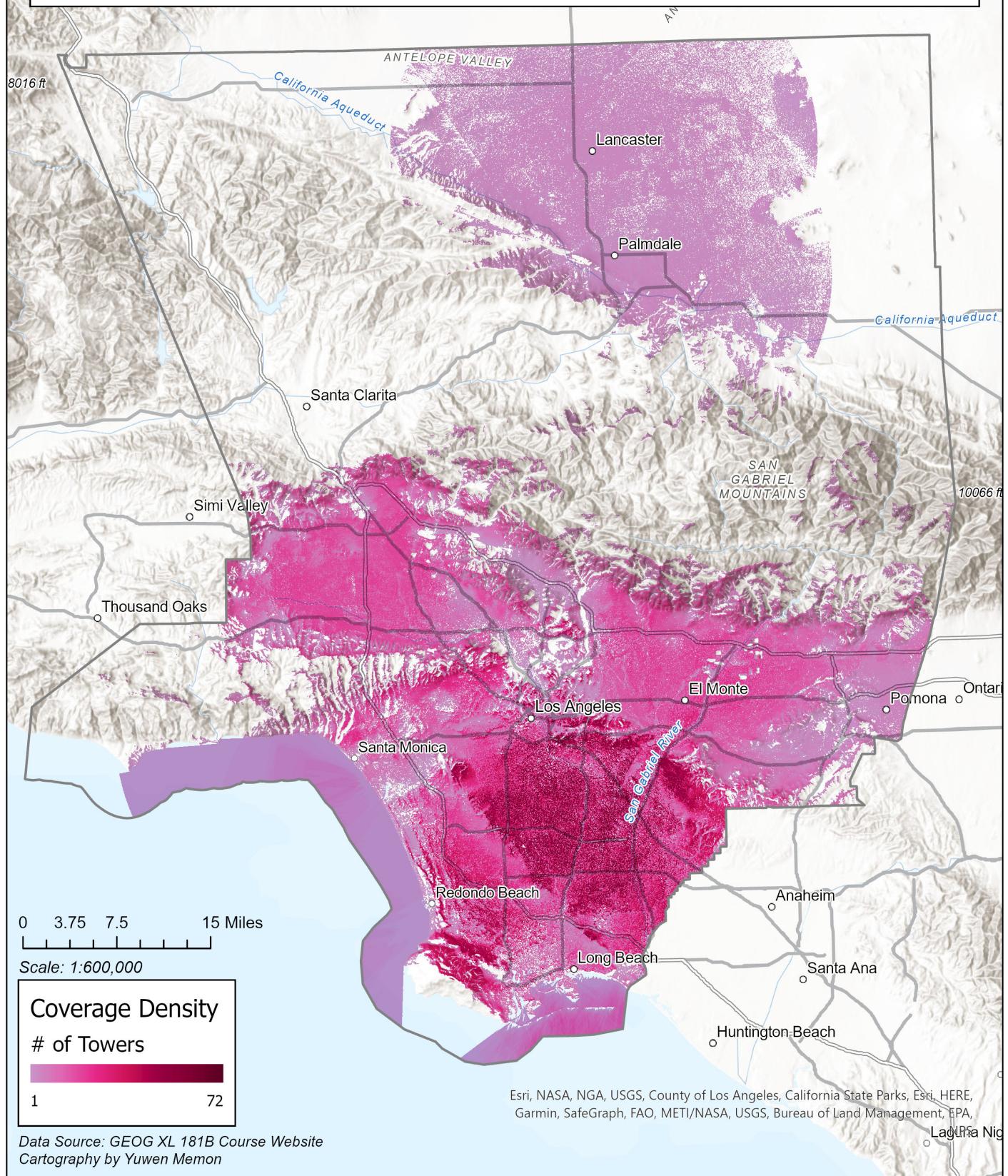
One way to possibly add more coverage area is to raise all towers. This will give them better sight-lines across terrain that may be blocking their wave paths.

Below is a map of the estimated coverage area produced from raising all cell towers by 10 meters. We've also isolated and mapped the areas of coverage gained to give a better picture of the change in service that would be achieved.

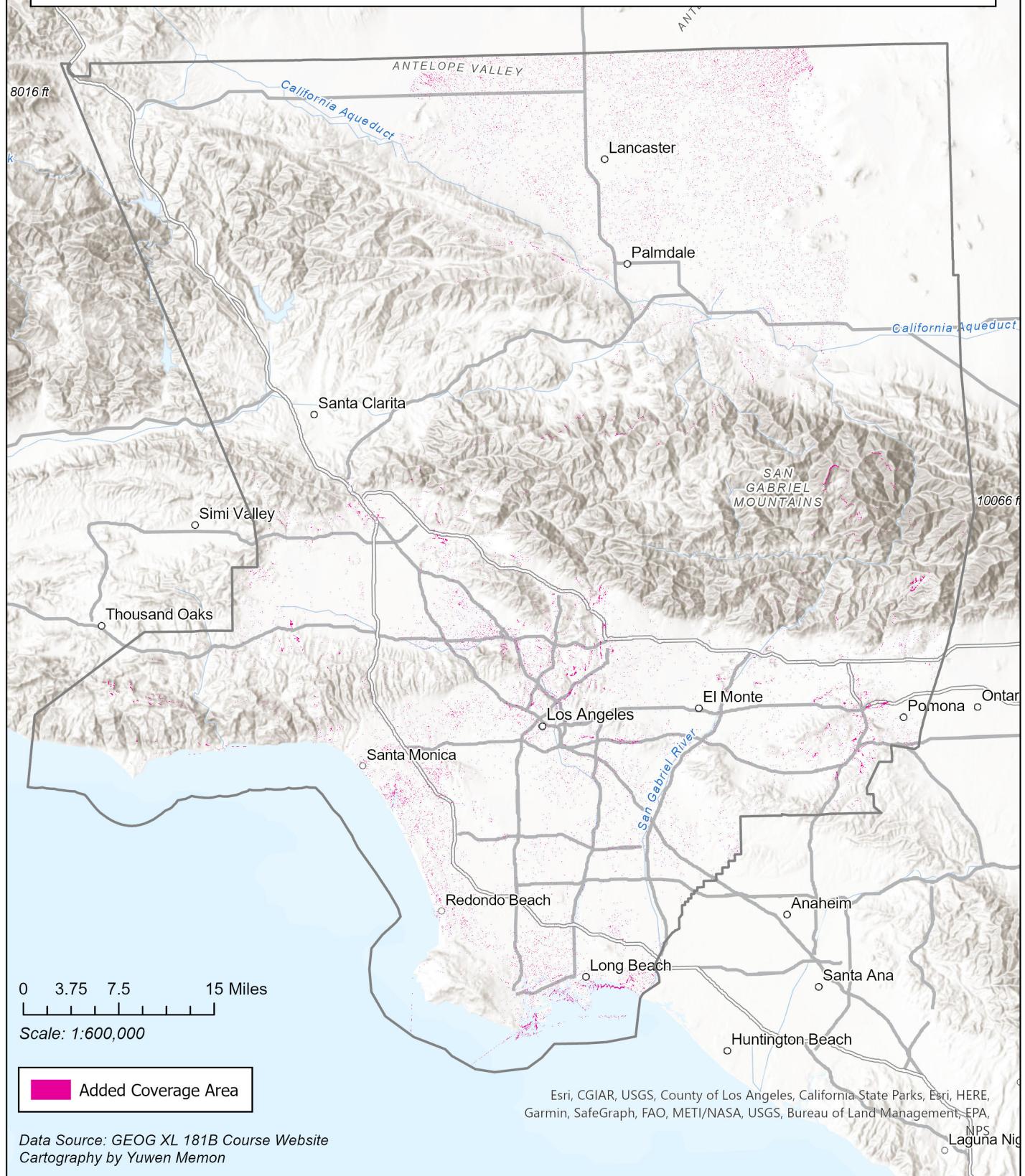
Overall, this will gain us just over **70 million** square meters of cell service (70,002,247 square meters). However that only represents **0.57%** of LA County and only a **1.42%** improvement on current cell coverage.

Looking at the Added Coverage Area, we can see that most improvements involve small gains in some “dead spots” around the areas where coverage is already robust.

Resultant Coverage Area From Raising Towers by 10 Meters



Added Coverage Area From Raising Towers by 10 Meters



Increase the Maximum Range for All Towers by 5km

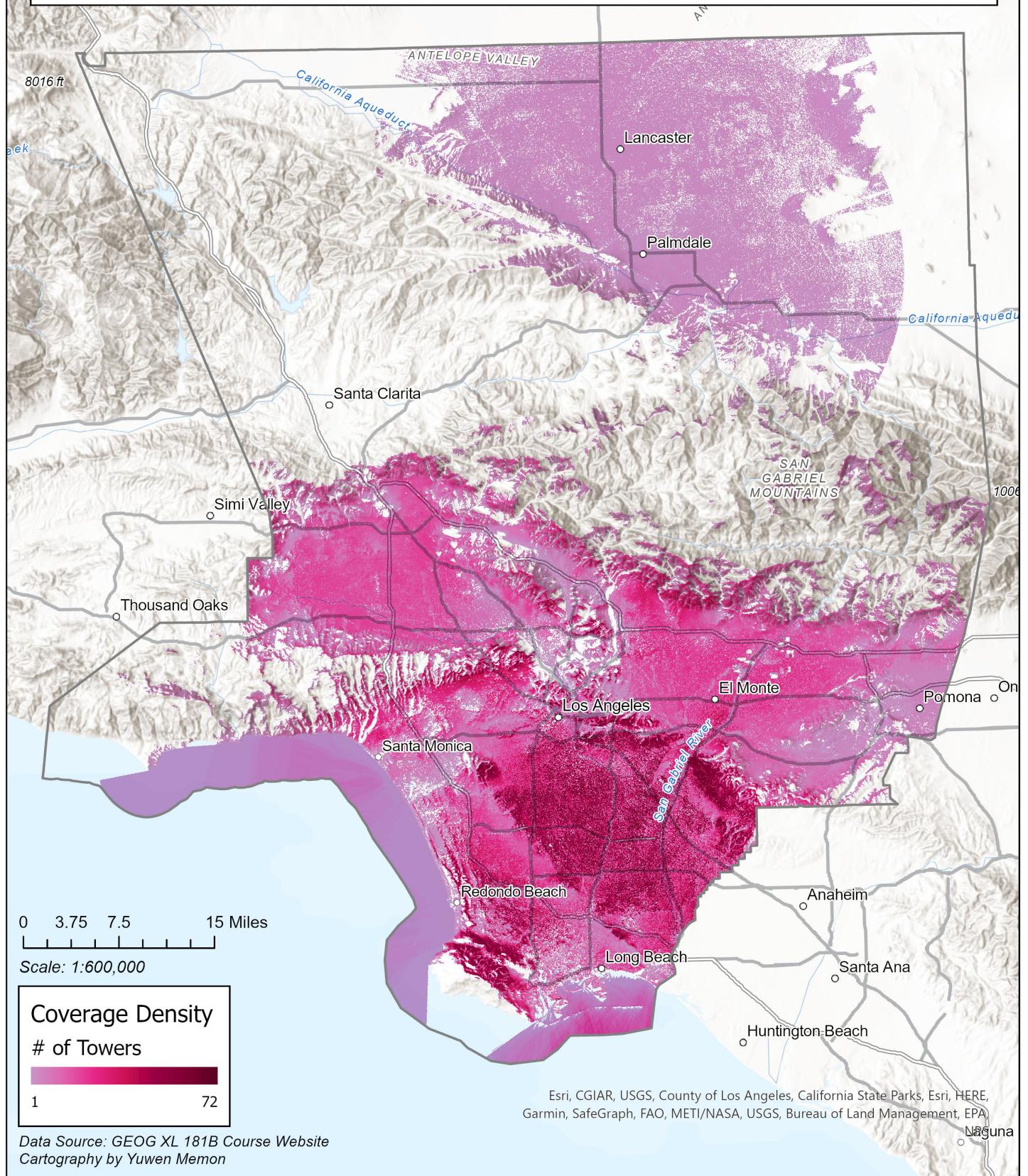
Another way to add more coverage area is to upgrade tower equipment and extend their ranges. This can let tower signal travel 30km instead of the current 25km, which would improve service for areas out of range for current towers.

Below is a map of the estimated coverage area produced from extending the range for all towers from 25km to 30km. Again, we've isolated and mapped the areas of coverage gained to give a better picture of the change in service that would be achieved.

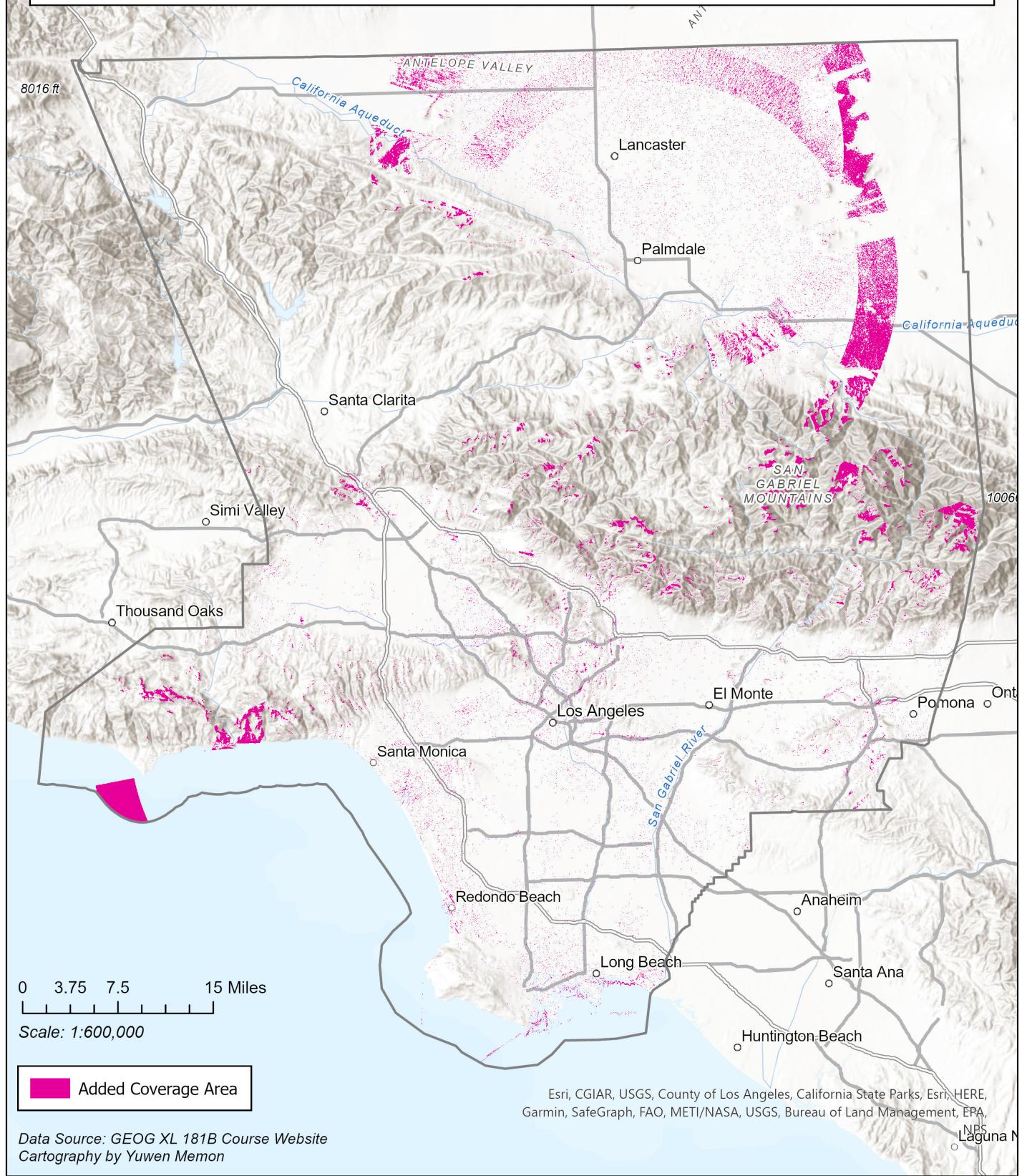
This improvement sees much higher gains than the previous scenario of raising towers. We will net just under **350 million** square meters of cell service (348,519,390 square meters). That represents **2.83%** of LA County and a **7.07%** improvement in current coverage. That's a five-fold increase.

Looking at the Added Coverage Area, we can see that we make similar gains in the "dead-zones" as before. We also add wider geographic coverage in the San Gabriel Mountains, areas around rural Lancaster and Palmdale, and parts of the Malibu hills. One thing to note is that with the exception of the last, these areas are quite remote.

Resultant Coverage Area From Extending Tower Range by 5 Kilometers



Added Coverage Area From Extending Tower Range by 5 Kilometers



Add Three New Towers in Under-Served Areas

Our final scenario for improving cell coverage is to simply add three new cell towers to the existing network. These towers would go in areas identified as gaps in our current coverage. For this scenario, we proposed adding towers in the following locations:

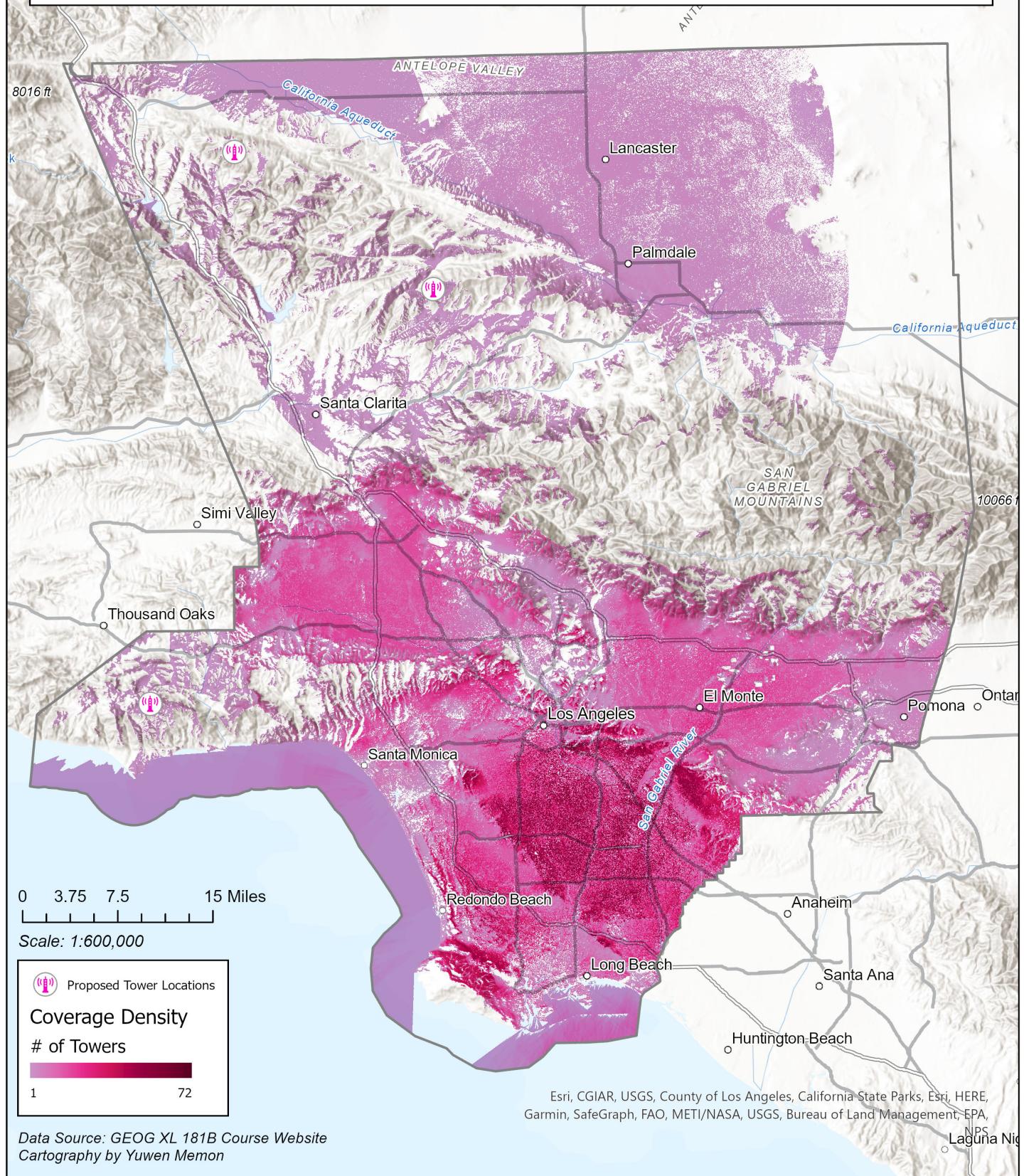
1. Atop a high point in the Malibu Hills
2. On a mountain overlooking the Santa Clarita Valley
3. On top of a mountain range just south of Three Points in the northwestern end of the County.

We've included the locations of the three new towers in the resultant coverage area map below. Again, we've also mapped the areas of coverage gained to give a better picture of the change in service that would be achieved.

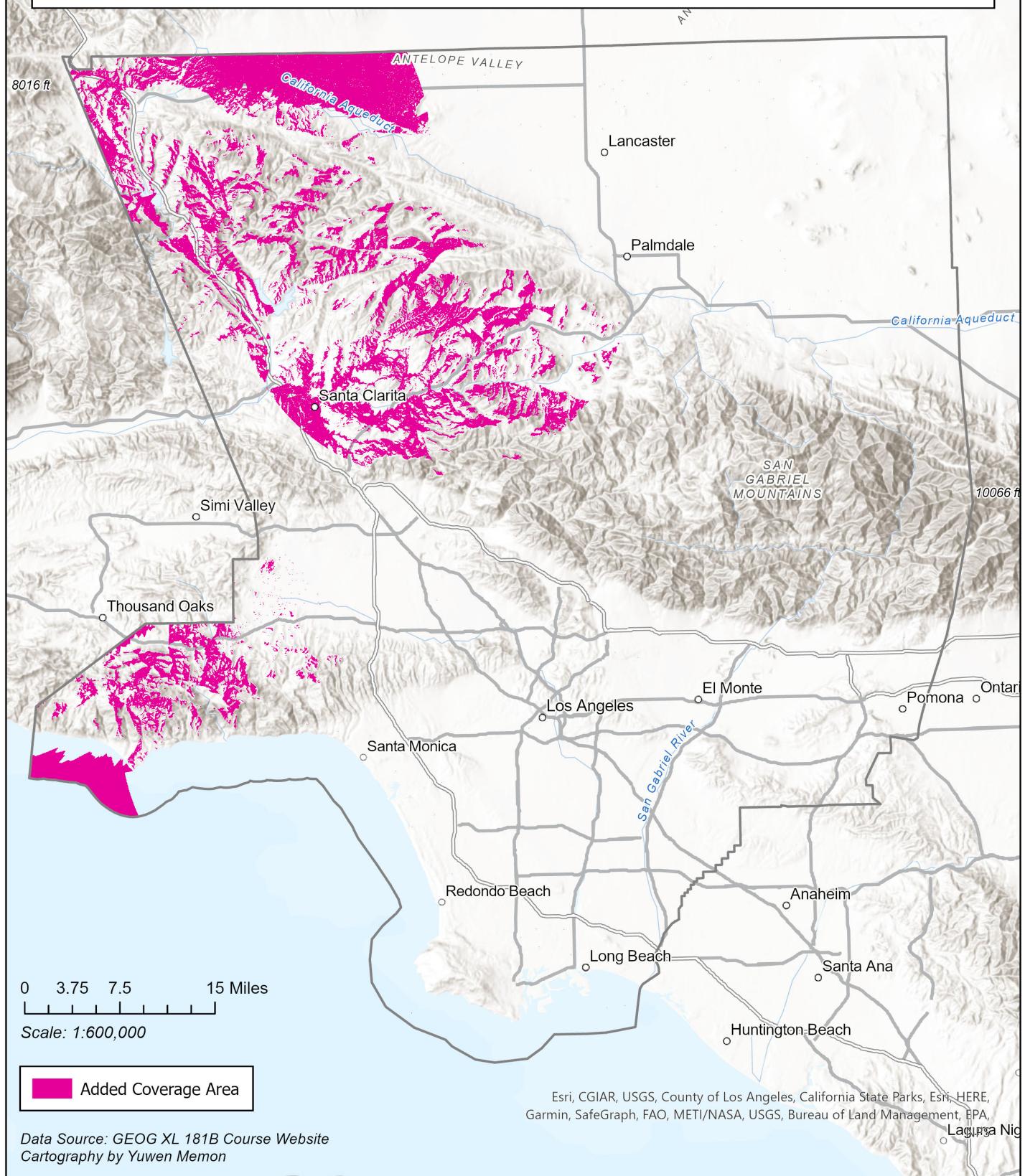
Overall this will gain us the most additional coverage. Just over **870 million** square meters of service area would be added (873,530,965 square meters). That is **7.1%** of LA County and a **17.73%** improvement in our current cell coverage.

The areas of added coverage are a mix of the suburban areas of Santa Clarita, Calabasas, and Malibu, as well as the rural areas near I-5 at the northwestern end of the county. So, not only do we get the largest extension in coverage, but we also add service to the most potential customers living in places not receiving service before.

Resultant Coverage Area From Extending Tower Range by 5 Kilometers



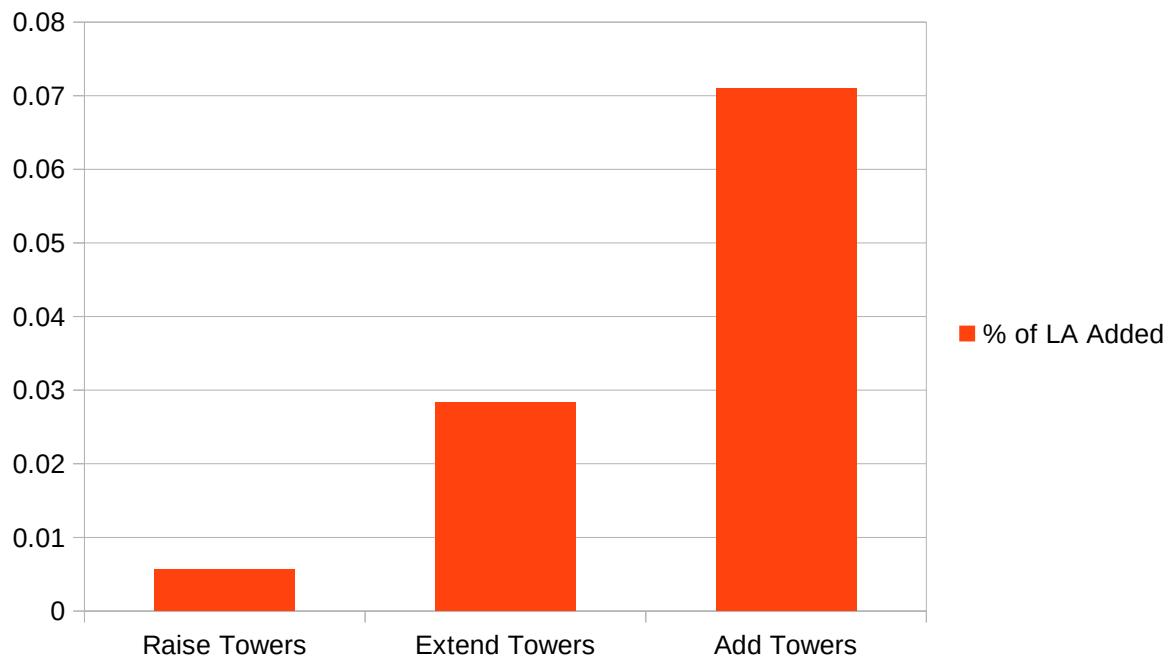
Added Coverage Area From Constructing Three Additional Cell Towers



Conclusion

Since we're looking to maximize coverage, adding additional cell towers stands out as the best path to pursue for upgrades. The full data of our estimates is summarized below.

Improvement	Total Coverage Area (sqm)	Total Coverage Area (%)	Total Added Area (sqm)	Total Added Area (%)	Improvement (%)
Raise Towers	4,996,565,107	40.62%	70,002,247	0.57%	1.42%
Extend Towers	5,275,082,250	42.89%	348,519,390	2.83%	7.07%
Add Towers	5,800,093,825	47.16%	873,530,965	7.10%	17.73%



Additionally, this scenario gives us flexibility with placement. This could allow us to further maximize cell coverage. A follow-up study could evaluate *where* to place the towers in order to best maximize their coverage area.