

1 Summary of Proposed Building and Land Utilization Approach

A critical component of a successful development plan is utilizing resources to create a building and site plan for the overall scope of a project. Systems can be held to different standards and codes depending on their physical location regardless of the system type. To determine appropriate land use and zoning compliance, each subsystem was looked at individually. Location suitability and development attractiveness was then analyzed using placement and aesthetics, respectively. The subsystems were then altered in order to comply with existing zoning to ensure permit eligibility. The systems designed were compared to New Mexico State University’s District Master Plan to ensure compliance over the 20-year time span. Additional land use cases were also taken into consideration to ensure project feasibility.

2 Analysis of Applicable Land Use and Zoning Code Compliance

According to the Dona Ana County UDC Zoning Map, the zoning classification that the University falls into is NMSU. Additionally, the county defines a structure as “anything that is constructed or erected with a fixed location on the ground or attached to something having a fixed location on the ground [1]”. This definition will apply to the ground-mount panels intended for use in the dirt lot. Using this definition, the following relevant codes were analyzed:

Table 1: Dona Ana County Codes [2]

Code	Summary	Compliance
Article I: 324-6	All new structures must connect to the County water system	Because the solar field does not use water, a connection is not needed.
Chapter 150-5	Any proposed structures in unincorporated areas must apply for an address to the County Addressor	The proposed design must attain an address due to its location in an unincorporated location.
Chapter 142-5	Any site where structures are being must constructed must be kept free of waste and construction material scraps.	The company involved in construction will be responsible for meeting this code.
Article VI: 350-603	Drainage designs must meet all NMDOT requirements.	If constructed, drainage will be designed to meet the requirements.
Article V: 350-508	All signs must be maintained.	Any signs designating the solar field will meet all city codes.
Article V: 350-502	Structures must be approved by the Zoning Administrator and the structures cannot be larger than what is reasonable necessary.	The solar field will not be any taller than the standard sizes.

The proposed Geothermal Substation Ground Mount design will be compliant with all these codes and ordinances by ensuring that the proper experts are used in each step of the construction process.

3 Analysis of Location Suitability & Attractiveness for Development

Determining if a site is suitable for solar generation is reliant on four factors, shown in Figure 1A in Appendix A: aspect layer, slope layer, elevation layer, and high radiation layer. Suitable elevation describes the optimal elevation of solar panels—the farther from the ground the better. So, optimally the team must utilize stands for the PV modules to increase energy production as opposed to sitting directly on the ground. Suitable aspect describes the aspect and how modules should be south facing and horizontal [3]. The proposed plan has south facing panels. The slope of most of the dirt lot is negligible. After using the lidar from Aurora Solar, it was determined around 80% of the dirt lot is flat or has a less than 1-degree slope. The radiation of New Mexico is very high, around roughly $6-8.5 \text{ kWh/m}^2 / \text{day}$ as displayed in Figure 1. Las Cruces, the city in which NMSU is located, has an average solar radiation of about $7-8 \text{ kWh/m}^2 / \text{day}$ [4]. This value is extremely good compared to most of the United States and indicates a good amount of power that can be harvested. As for the attractiveness of the solar generation field, the team believes that a field of solar modules will be much more attractive than a large flat desert area and will help advertise the campus's efforts to move towards renewable energy resources. The solar field will add substance to the area and the geometrical pattern of the module placement is an almost artistic testament to a renewable future.

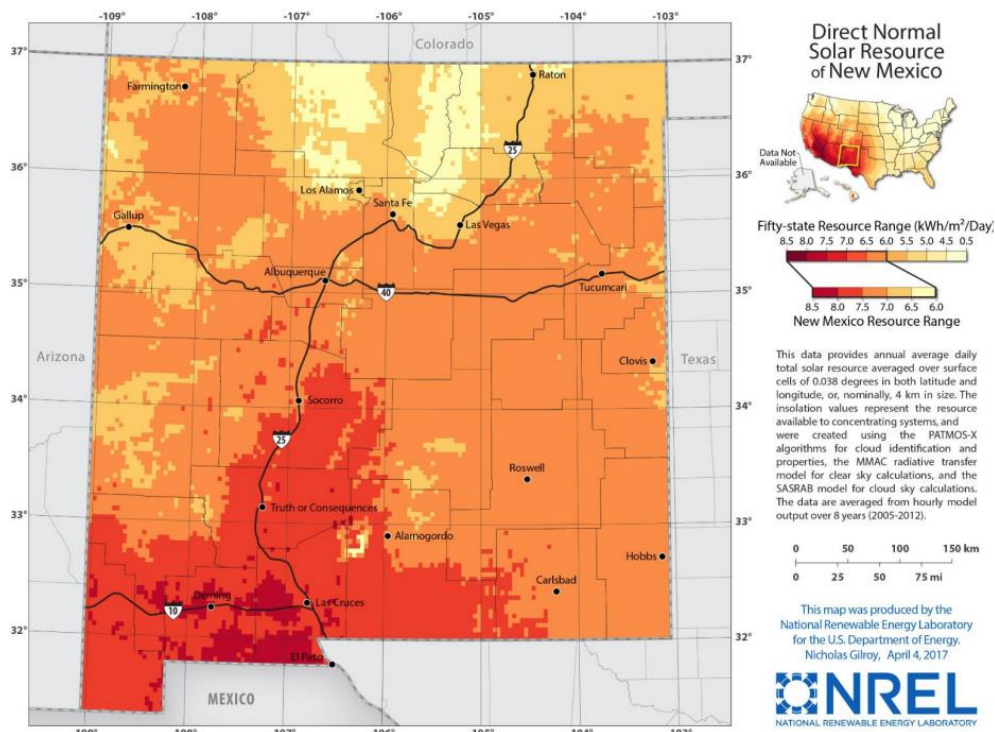


Figure 1: Radiation Profile of New Mexico State

The existing roofing on Hadley Hall is being replaced with modern Spanish Style Tiles that provide renewable energy while maintaining the same aesthetics as before. This location is exhibiting the University striving towards their “zero emissions” goal to a high number of spectators from the dense pedestrian traffic due to campus tours. The team believes this is the most attractive development because it is a creative design that shows the campus’s move to renewable energy that is in a high traffic area of campus, giving the University a significant public relations boost.

NMSU currently has only ten covered parking spots on campus. We believe that creating parking structures over the Pan American Center Parking Lot will demonstrate the University’s commitment to becoming more sustainable while benefiting the faculty, staff, and students as well as generating an additional source of income for the University by increasing the cost of parking permits for the covered spaces. This subsystem is attractive because it is beneficial to both the University and the students.

4 Demonstration of Compliance with Existing Zoning and Proposed Rezoning

New Mexico State University does not fall within Las Cruces city limits as seen in the Figure below. While the land east of campus located next to the Geothermal Substation is in the Dona Ana County zoning, Figure 2.

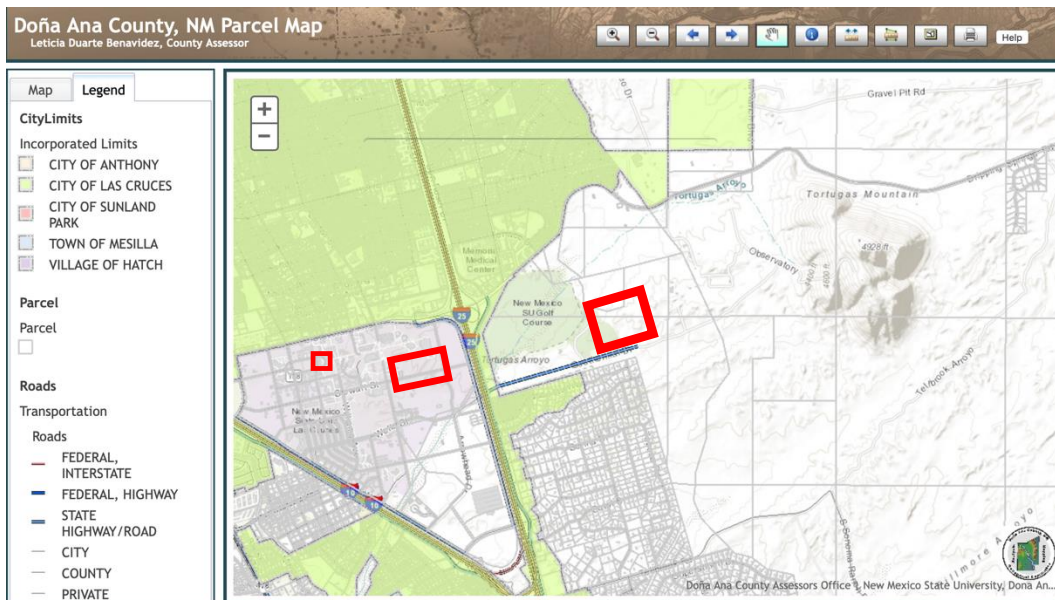


Figure 2: Dona Ana County Parcel Map

No rezoning will be proposed for this project.

5 Demonstration of Compliance with District Master Plan

The goal of this project is to create several solar energy systems that maximize savings over a 20-year time period using photovoltaic solar generation. To do this, our team has created three

systems that utilize the land within the three given use case descriptions. These systems must comply with the University's District Master Plan to ensure that there will not be any interference between our system and the Master Plans.

The NMSU Master Plan established a goal to achieve "zero emissions" by 2050 in 2007 when President Michael Martin signed the American College and University Presidents' Climate Commitment [1]. The Master Plan also discusses sustainable design guidelines that mentions implementing solar and renewable energy systems when economically feasible.

Our designed systems will provide a huge steppingstone towards this goal and will showcase the University's dedication towards it. The Spanish Style Solar Tiles will provide talking points, promote innovative and renewable energy, and aesthetically please a wide range of individuals passing through the quad including faculty, students, and most importantly the people that are considering attending the University.

Since the land east of campus is not owned by New Mexico State University, but for the competition it is assumed it is, there is no discussion regarding this property in the University's Master Plan. Therefore, the team assumed that it does not have any intentions of being used over the next 20 years. This provided the team with a significant region of land to implement a large-scale photovoltaic ground-mounted system.

The Solar Parking Awning system is in the Pan American Center parking lot. The only discussion in the Master Plan around this area is renovating the Pan American Center as it is a major attraction on campus. This system complies with the Master Plan because it will be fully functioning years before this renovation begins and even if these renovations obstructed the parking lot or restricted parking the solar panels will still generate the same energy.

6 Demonstration of Compliance with Other Land Use or Building Restrictions or Regulations

Using the U.S. Fish and Wildlife Critical Habitat for Threatened & Endangered Species it was determined that the greater area of Las Cruces, NM does not inhibit any threatened or endangered species, Figure 3.

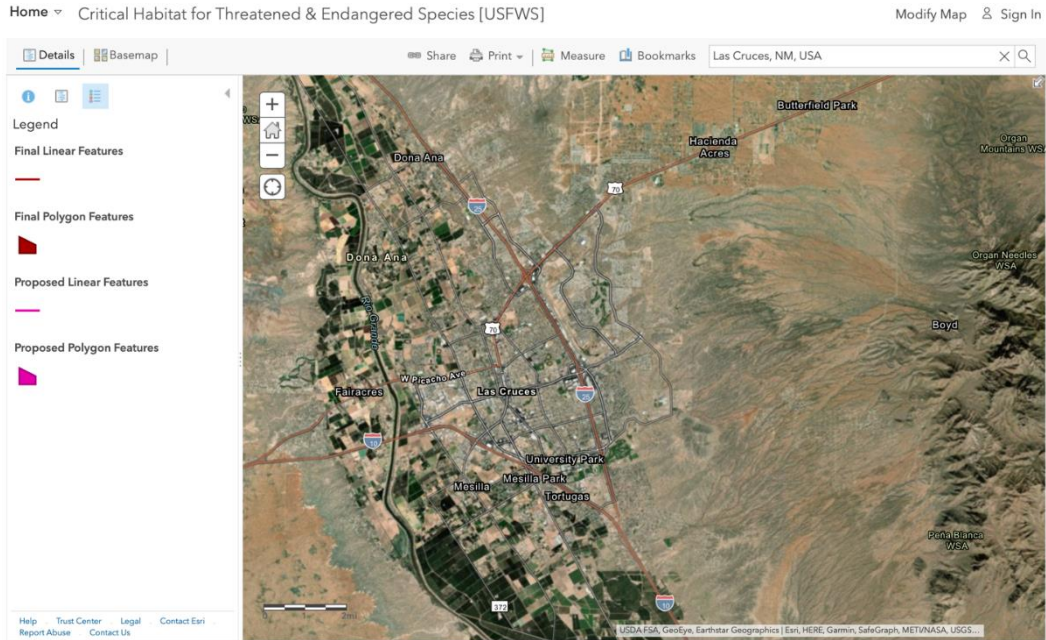


Figure 3: Critical Habitat for Threatened and Endangered Species: Las Cruces, NM

A primary restriction is the land given for construction east of NMSU next to the Geothermal substation. This land is owned by the State of New Mexico and therefore calls for a Letter of Intent, but this may be neglected due to the rules of the competition. The dirt lot is assumed to have no cost to use.

Using google maps the team noted that the NMSU Golf Course is located Northwest of the system, the Aggie corrals are Northeast of the system, and there is a residential area Southwest of the system.

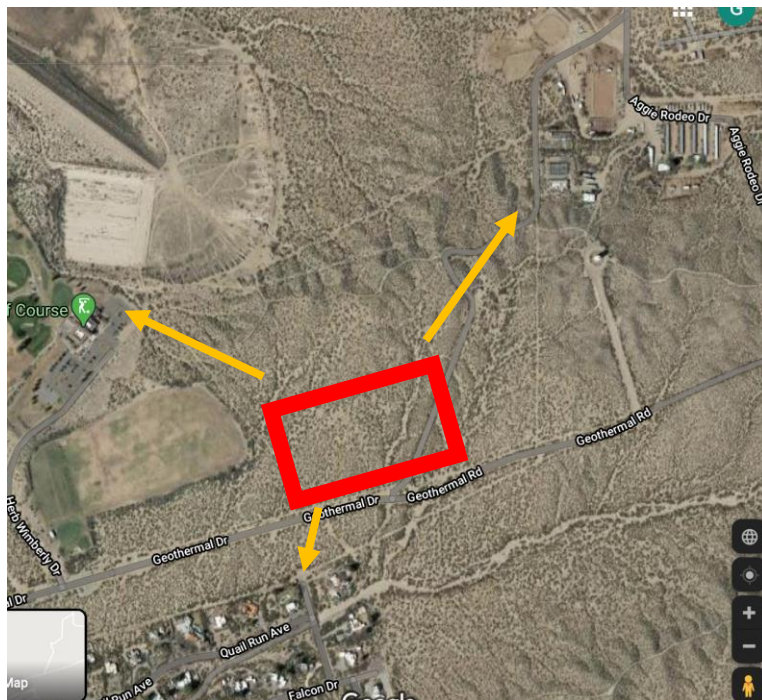


Figure 4: Geothermal Substation Overview

Given that the golf course and corrals are so far from the system we decided that they will not have any effect on the project. While on the other hand the residential area may pose a risk to successful development. This is discussed in deliverable 4B.

Works Cited

- [1] New Mexico State University, "New Mexico State University Master Plan," New Mexico State University, [Online]. Available: <https://hr.nmsu.edu/architect/wp-content/uploads/sites/85/2017/10/NMSU-Master-Plan-9-27-17-RF.pdf>. [Accessed 13 April 2020].
- [2] Dona Ana County, "community development maps," Dona Ana County, [Online]. Available: <https://donaanacounty.org/community-development-maps/county-codes>. [Accessed 13 April 2020].
- [3] A. Chaves and T. Bahill, "Locating Sites for Photovoltaic Solar," ArcUser, [Online]. Available: <https://www.esri.com/news/arcuser/1010/solarsiting.html>. [Accessed 13 April 2020].
- [4] National Renewable Energy Laboratory, "Solar Resource Data, Tools, and Maps," National Renewable Energy Laboratory, [Online]. Available: <https://www.nrel.gov/gis/solar.html>. [Accessed 13 April 2020].

Appendix A

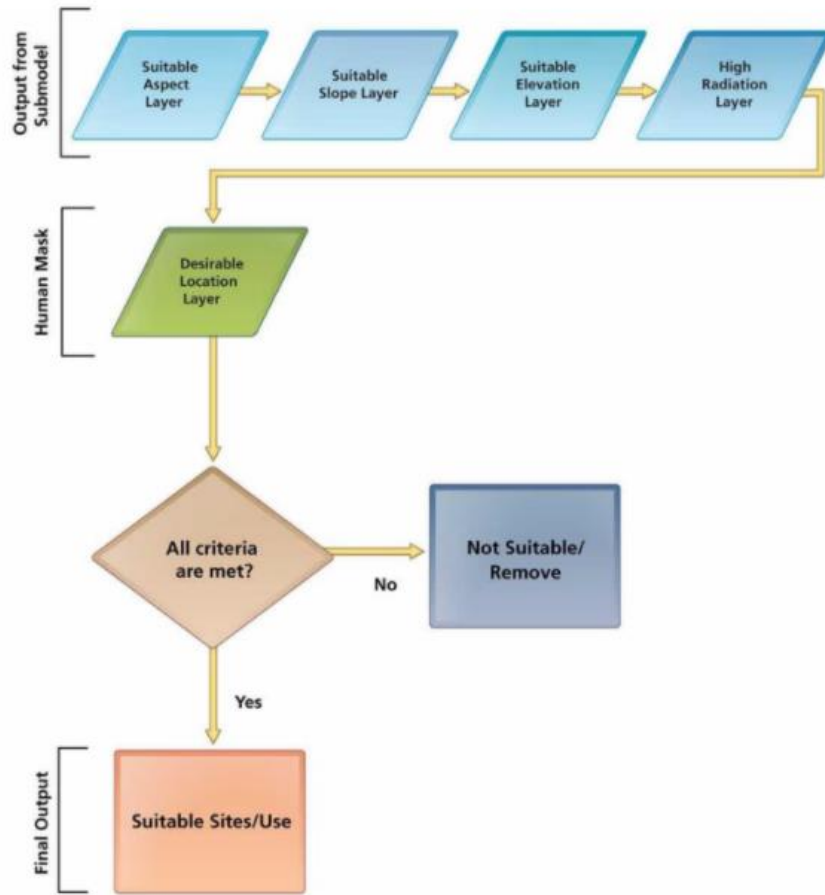


Figure 1A: Site Suitability Flow Chart [2]