

**ADA Compliant Industrialization Project At Yosemite  
National Park**

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# FINAL PROJECT DELIVERABLE

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## **Introduction**

The mission statement for this industrial project is to construct an American Disability Association compliant parking space within the Yosemite National Park. The guideline for this project is to analyze a specific region of Yosemite's hiking trail - this data is given by the University of Merced, and defines a specific region in which the placement of an accessibility compliant parking space would most be appropriate. Furthermore, the scope of distance for this project has to cover at least one kilometer of trail to the location of which the parking space will be constructed. The construction of this project will abide by the standard code of 2010 ADA article title two and three published by the U.S department of Justice in regards to public accommodation of commercial facilities and minimum accessibility mandates for individuals who are qualified in accordance with the ADA standard.

Yosemite National Park is a public institution accessible by everyone offering scenic view, adventure and therapy to those who may wish for an escape from the mundane, stressful routine of life. Yosemite National Park climate may experience temperatures up to ninety-degree Fahrenheit in summer seasons, and an average of low temperatures in the forties within the winter months. The park is located on the west-slope of the Nevada Sierra which means the geographic landscape of Yosemite is of glaciated origin. This specific landscape composition derives from the megalithic sediments of granites at the base of the mountain interacting with the slopes of snow from the Nevada Sierra mountain range. Hence, the terrain of Yosemite comprises a variety of slopes and plains suites for hiking and camping alike. As per this factor,

analysis of Yosemeti's terrain has a direct correlation with ADA compliance code which should be considered an imperative aspect of this project during construction.

Before commencement of data analysis or development, keep in mind that Yosemite National Park is more than a national forest, but also a sanctioned tribal ground for the Southern Sierra Miwuk Nation. Evidently, the inhabitants within this park and their property should utmost be respected without hesitation. Construction of institutions shall never be on tribal ground without consulting with an ambassador seeking for consent . The objective of this project is to offer convenience for those who qualify for accessibility aids; thereby, the nobility of our cause should also be our moral code of conduct on all levels when carrying out this project.

### **ADA Specification**

Within the American Disabled Association standard code of 2010 in article titles two and three revised and published by the U.S department of Justice focused on accommodation of commercial facilities and minimum accessibility mandates for individuals who qualify for aid by the ADA standard. Evidently, individuals who qualify according to the honor code will have access to parking areas closest and most convenient closest to the entrance of a facility. For the construction of this project, consider that the 1991 safe harbor honor system insists that all parking space must include seven accessible lots and one van space. Any lot restriped and resurfaced must oblige to the 2010 safe harbor honor code of having seven accessible lots with two van accessible spaces. Accessibility spaces may be grouped together for a building if it is of the same operational facility with color scheme to identify accessibility. Accessibility space must be identified with the international symbol and specific variables need to be assigned to indicate van-only accessibility. Note that during the construction of the individual parking spaces,

consider eight feet wide for cars, and eleven feet wide for vans, and the access aisle, which is the loading zone, is five feet wide according to ADA standard code in article two three.

### **Dataset Integration**

Within this project, there will be a number of external sources integrated besides the data that was already provided by the University of Merced. These layers will be gathered from the ArcGis Online database for the purpose of refining and informing the viewers about details within the map. Ergo, there will be a layer of all the hiking routes within Yosemite National Park. Another layer depicting various terrains within roads of the park via it may be dirt, gravel or bridge - these factors greatly affect the mobility of accessible individuals which would greatly aid in determining the appropriate displacement for the route construction leading to the parking lot. Lastly, there will be a number of other layers generated by ArcGis tool features serving as convenience for the viewer to have a vivid understanding of this project's mission statement.

### **Data Integration Methods**

The procedural methods taken to generate the final quality map product depicted within this industrial project is achieved by first importing the given shape and '.tif' file given to us into ArcGis. The program will displace a boundary of Yosemite Park along with a raster projection of a specific hiking trail region. Next we will run a slope-analysis spatial tool to compute the data within the raster to display slope values and projection; the output of this computation should be projected to the default projection of the original base map - 'NAD 1983 UTM Zone 11N'. Note that since this projection is our default projection, the rest of our data projection will also be applied to this method for the most precise data interpretation and presentation. The next step in

this project is to allow editing and modification of the raster elevation map by turning it into a polygon layer- ArcGIS does not support the overlay of external data or the application of tools such as clipping and buffer on raster data tif files; thereby this data must be transformed in order for further modification. First employ the raster calculator to compute the value input of the raster by one-hundred since the rater data value has one-hundredth decimal displacement. The output will be a floating-integer raster data which is still not usable; therefore, the Int operation in ArcGIS will convert this floating - integer raster value into an integer value, and the output layer will be converted into a polygon using raster to polygon spatial analysis tool - for this project, the output data will be named, ‘PolygonOfTrail’. In order to ensure that future external data may be correctly displayed after importation, the values of which the raster calculator has modified earlier should be reverted to its original decimal estimate. Thus, by exploring the attribute of ‘PolygonOfTrail’, employ a field calculator and divide the ‘Geocideid’ by one-hundred reverting back to default decimal values. Next is the construction of the point, line and polygon to identify the route leading to parking space through the creation of new class features for each with default projection as mentioned above - point to indicate starting point, line to show route’s path and polygons representing ADA compliant parking lot. Furthermore, external data gather from ArcGIS Online such as compilation of hiking trails within the park, hiking trails indicators, road’s terrain classification, yosemeti’s road names, and along with various map layer generated through ArcGIS tool such as buffering and clipping all serves the incentive of drawing out details, information delivery, and data interpretation and projection.

### **Data Review and Analysis**

- Yosemite National Park Hiking trails - Alexaccc, A. (2020, January 4). *Yosemite Valley Trails*. ArcGIS Online. Retrieved June 30, 2022, from

<https://ucmerced.maps.arcgis.com/home/item.html?id=c97961ae6e114601944f416129ed>

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- This data published on Jan 2, 2019 demonstrates all the hiking routes representing Yosemite Valley trails which align with the base map layout exactly. The data was recorded using GPS collection tools, but it seems that the arcview related DLG file is corrupted creating new displacement of routes and trails, this could sum to a large margin of error if applied to road map calculation and summarization; however, give the case that this is a construction of a path - this data is deemed permissible.
- Yosemite National Park Campground and trailhead identification - Learn\_ArcGIS. (2019, January 22). *Base Data - Yosemite National Park MED*. ArcGis Online. Retrieved June 28, 2022, from  
<https://ucmerced.maps.arcgis.com/home/item.html?id=0c1bebf618d0425ba3181a5b0fcac821>
  - This data was published on the date of Jan 2, 2019. Such a layer depicts trailheads, rivers, roads along with many other detailed components located within Yosemite park. A histogram creation in reference of this data shows that data distribution is not of normal distribution and should be transformed. Nonetheless, the creators were ArcGIS leaner and was recently updated as of the year 2019 rendering it an appropriate and credible source.
- UC Merced Provide '.tif' file of Yosemite National Park - University Of California Berkeley. (2011, December 1). *OpenTopography - Yosemite National Park, CA: Rockfall*

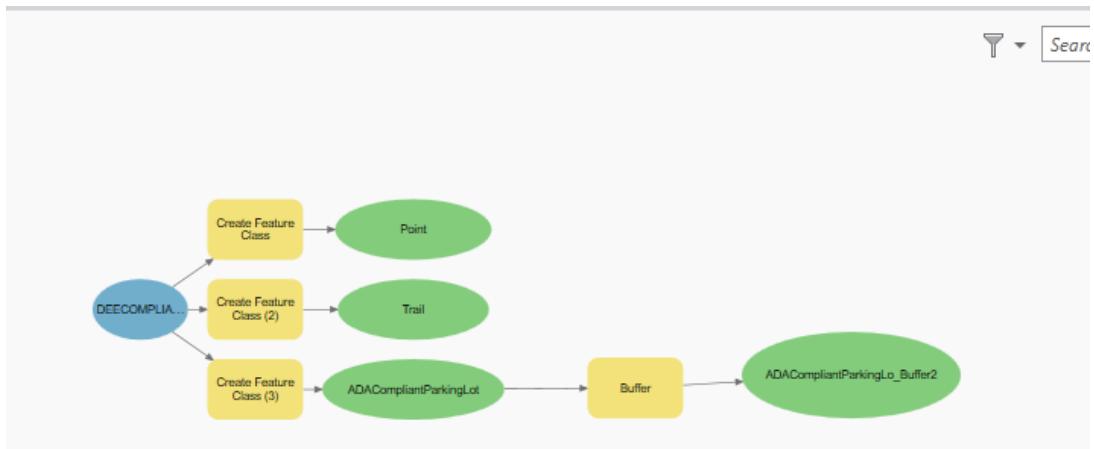
*Studies.* Opentopography. Retrieved June 25, 2022, from

<https://portal.opentopography.org/raster?opentopoID=OTSDEM.112011.26911.2>

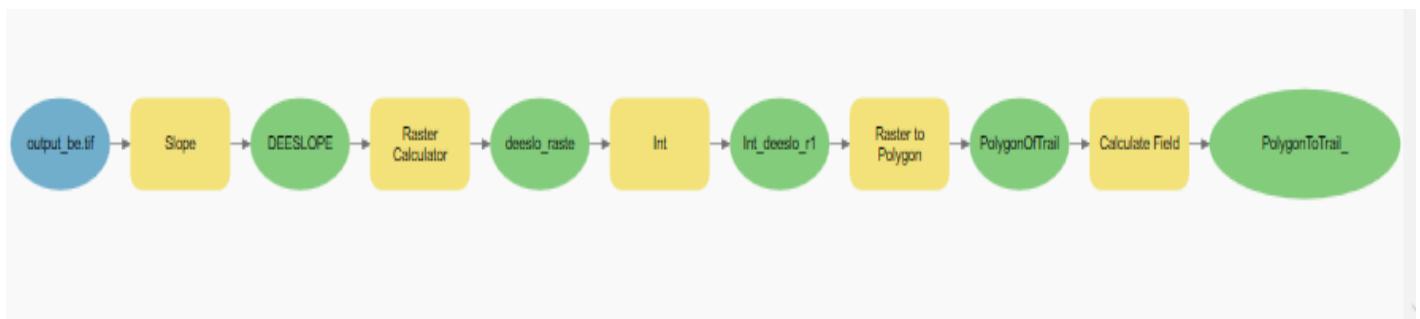
- The file derives from a rockfall study devoted to Yosemite National park. Such is a lidar data format credited to the University of Berkeley. It was published on the date of December 01, 2019. The interpolation analysis for this file through a series of numerical analysis methods formula evidently show that there exists a small percentage of error within the data.
- UC Merced Provided boundary layer of Yosemite National Park - University Of California Berkeley. (2011, December 1). *OpenTopography - Yosemite National Park, CA: Rockfall Studies.* Opentopography. Retrieved June 25, 2022, from  
<https://portal.opentopography.org/raster?opentopoID=OTSDEM.112011.26911.2>
  - Similar to the file description above, this file originated from a rockfall study of Yosemite National forest. Though developed and recorded with lidar file, this data show to have error percentages when performing data analysis using numerical interpolation formula to address and identify errors.

### **Workflow Diagram**

- **Creating new feature class to construct point, line and polygon within project identifying starting point, route path and parking space's destination:**



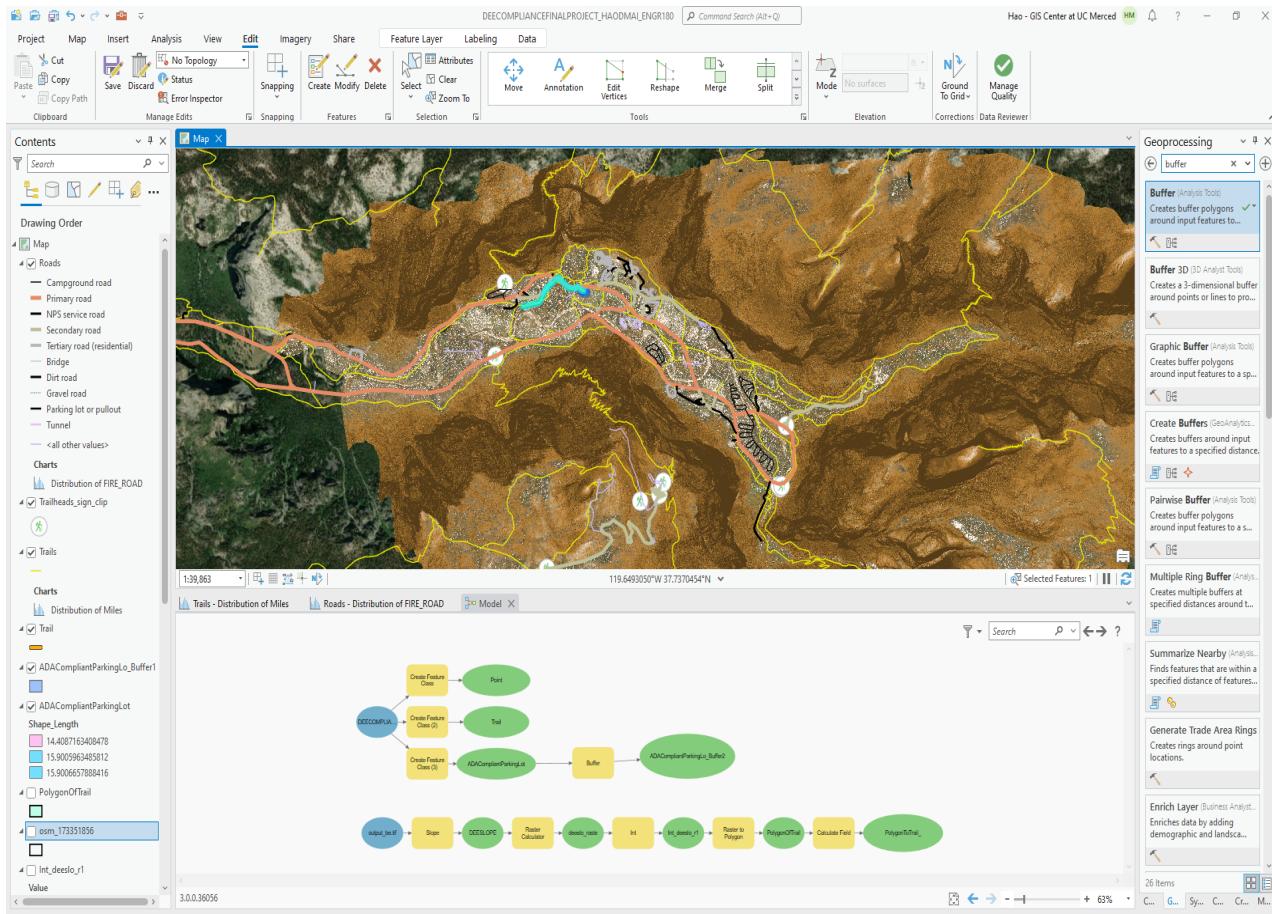
- Procedural method taken to achieve rasterization of elevation raster for further integration of external data source:



- Screenshot of features created and data rasterization for importation of external data source:

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## Uncertainty Discussion

All geospatial data record may serve the purpose of allowing the creation of a visual conceptualization for an area through modification and rescaling of geolocation coordinates of that specific region, and reprojecting it with the ability to edit, summarize and analyzed through a variety of tools within softwares such as ArcGis. However, due to external factors such as frequency pollution from technological conveniences of the twenty-first century, the coordinates recorded for data will always contain a margin of errors. As seen within the analysis of the metadata of Yosemite national park. Looking at the survey report and reviewing the lidar data description shows us that computation for the horizontal and vertical accuracy by applying an analysis formula will give us a better take on determining our margin of error in the data that we

choose to employ and project. Accordingly, for the horizontal accuracy, we shall apply the formula  $1/5,000 * \text{altitude (m AGL)}$ ; 1 sigma. Within the data, since the constant nominal value is set at seven hundred, this value will be multiplied by  $1/5,000$  resulting in our percentage of error. In the case where there are two different values of altitude, recall errors are accounted for within a range, so by finding percentage error for the first value and the second value, the lower value and bigger value will serve as the minimum and maximum for the range of error that will exist. In this scenario, the range will be of 12.07 to 10.9 cm in error range when data was projected and recorded.

### **Ethical Consideration**

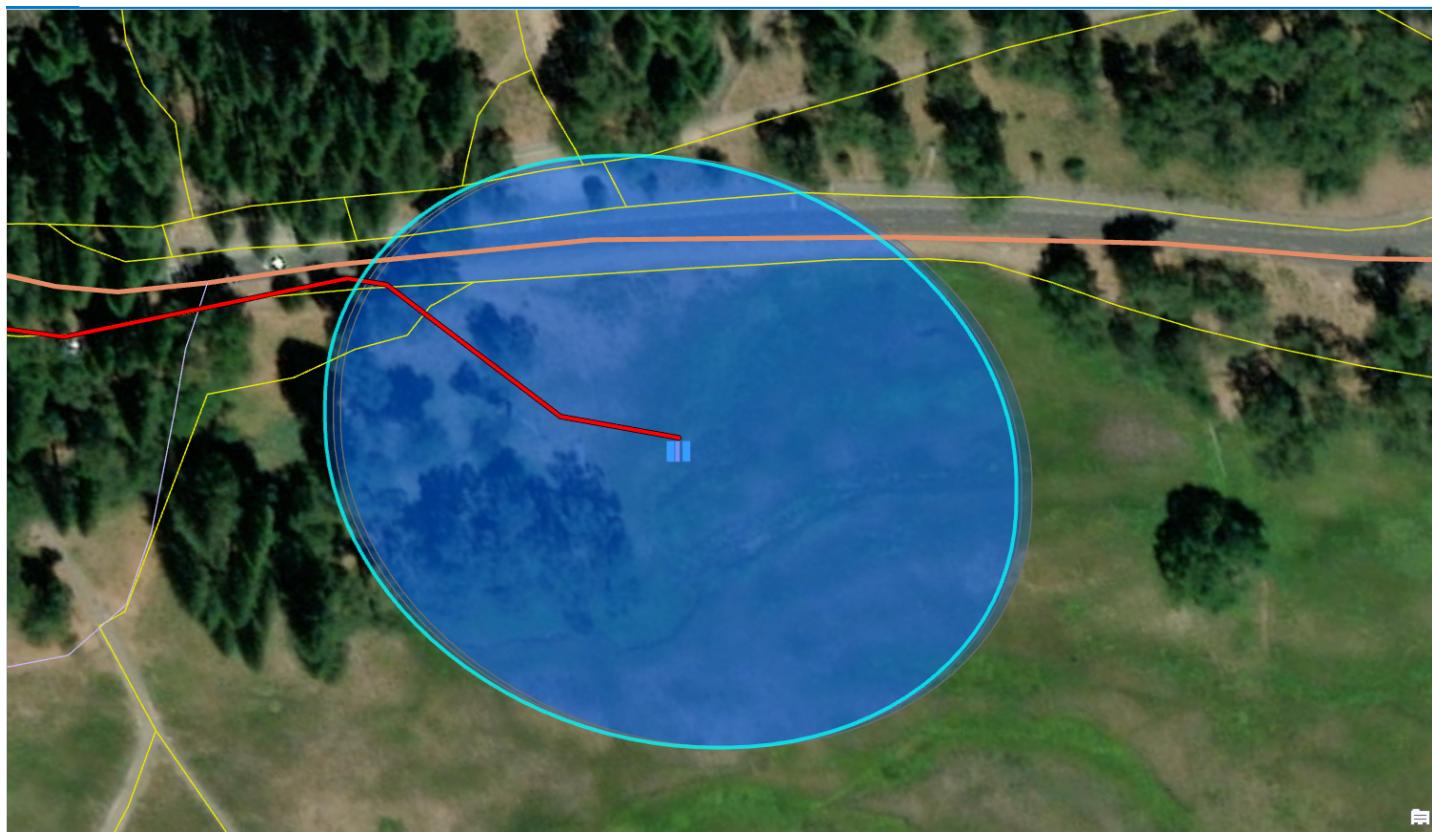
It is promoted that as an engineer, our mission is to use the knowledge through years of academic training and inquisition as foundation to benefit our society is an ideal ethical pursuit adhered to by all participants within this field. The focus on the incentive of our work should strive for the optimization in utility for the good of everybody; the courtesy of our work should not discriminate or benefit any specific group of individuals unproportionately. We shall consider and attempt to pursue what many great philosophers recall as utilitarianism - the ability to maximize relief and good for the sake of a collective society. We shall never use our expertise as leverage to manipulate or exploit circumstances or events for personal agenda and interest. All coworkers and clients should be treated as an end to themselves and not mean to a cause; in other words, we should treat our peers with equal respect because that is simply our professional conduct - not because there is an underlying motive. These obligations ensure the maintenance of an ethical approach when providing a solution, for without ethics, the amount of people we will hurt will far outweigh the numbers in which we helped.

### **Final Recommendation**

As per the guideline of the ADA\_compliant article titles two and three for mandates on public convenience and requirement for those who qualifies for accessibility has all been considered and exemplified with details through the composition of the quality production map of this project. The mandate prompts that public facilities should construct accessible space where there will be the least resistance and requirement of effort for those who qualify. Henceforth, within the slope generated raster layer of the map, the steepness of slope ranges from lowest to highest assigned by color scheme. By creating and incorporating the various class features into the areas with the lightest coloring scheme indicates a trail path with little resistance for individuals who require help traveling through. Additionally, though given a raster data of elevation, we also want to identify trail routes within the park where it is marked so individuals whose destination is at accessible space will not wander off trail and become lost. Safety of those we are trying to help should always be considered first priority. The project has imported a layer representing hiking routes located within Yosemite National Park for better understanding of where to appropriately assign a trail leading into an accessible lot. Lastly, the road's terrain in which ADA qualified individuals who are traveling through to access the constructed lot is another considerable point to note. In many circumstances, individuals with disabilities face challenges with mobility which may require assistance such as wheelchair and crutches. In this light, mobility-assistance devices will not be effective in terrains such as gravel, mud, sand, or creek and rivers - identifying these locations and making these trails around these areas will minimize the risk of injury as well as ensuring these individuals face the least amount of resistance arriving at their destination.

### Final Visuals

- The informational point (represented by a black point on the red line) within this map is located at longitude: 119.5917985 degrees west, and latitude at: 37.7461355N degrees north.
- **Screenshot of large scale ADACompliant parking lot composition:**



- Quality production of ADA compliant trail in a small scale production, slope based:

**Quality Map Production for ADA  
Compliant Trail of Yosemite**

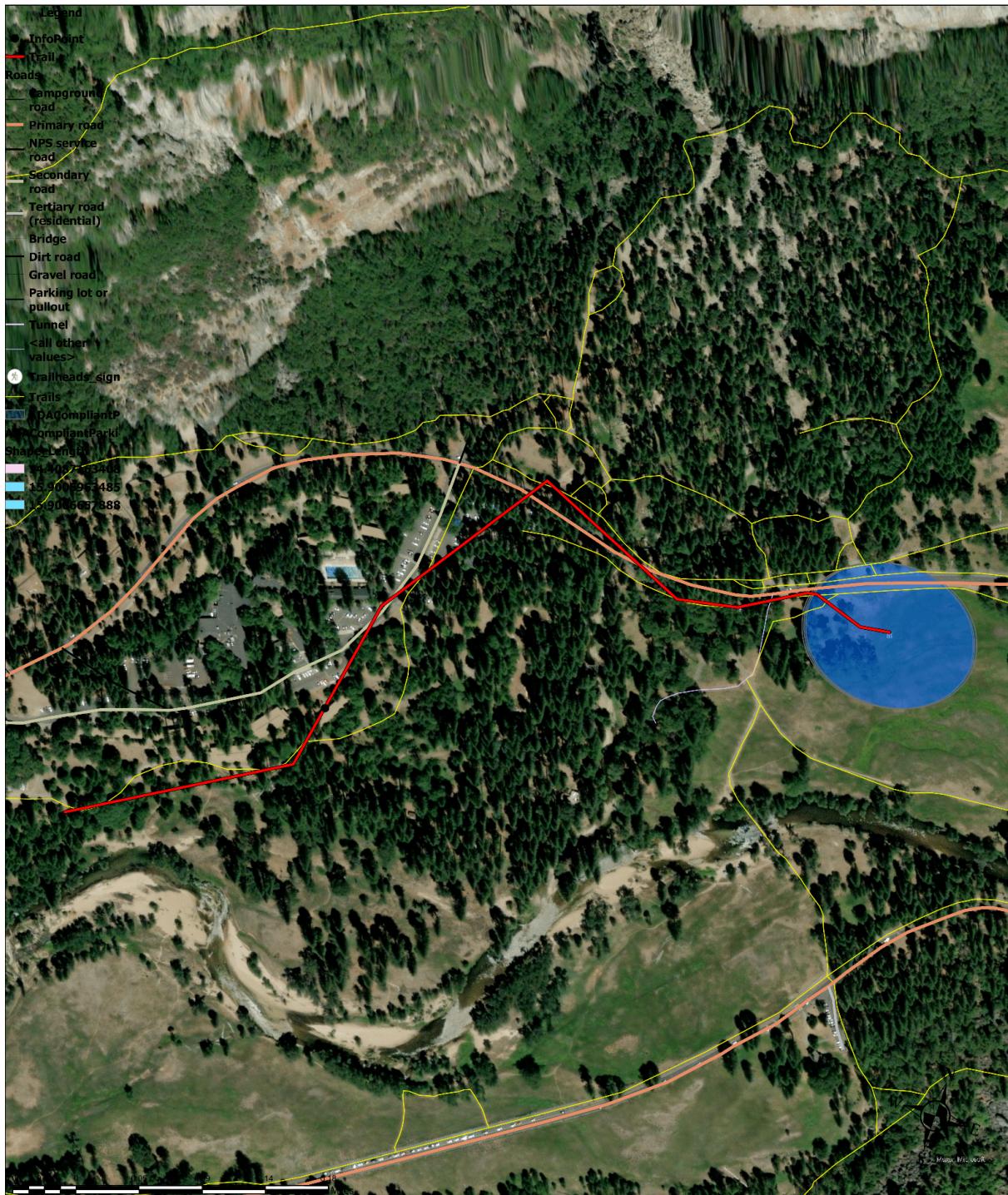
Hao D Mai  
Engr 180  
Professor Madeline  
Final Project Quality Map



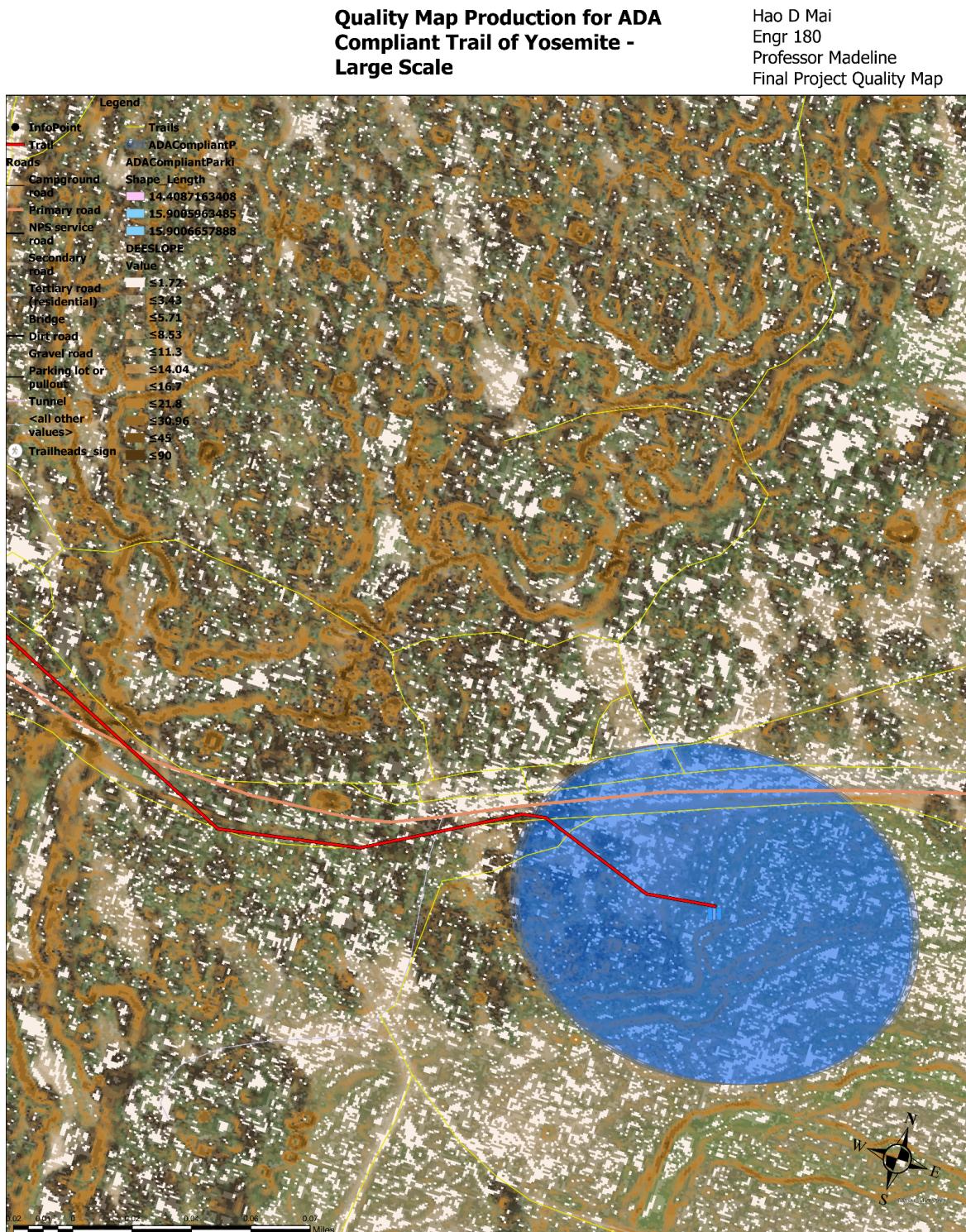
- Quality map production of ADA compliant trail in a small scale production, imagery based:

### Quality Map Production for ADA Compliant Trail of Yosemite

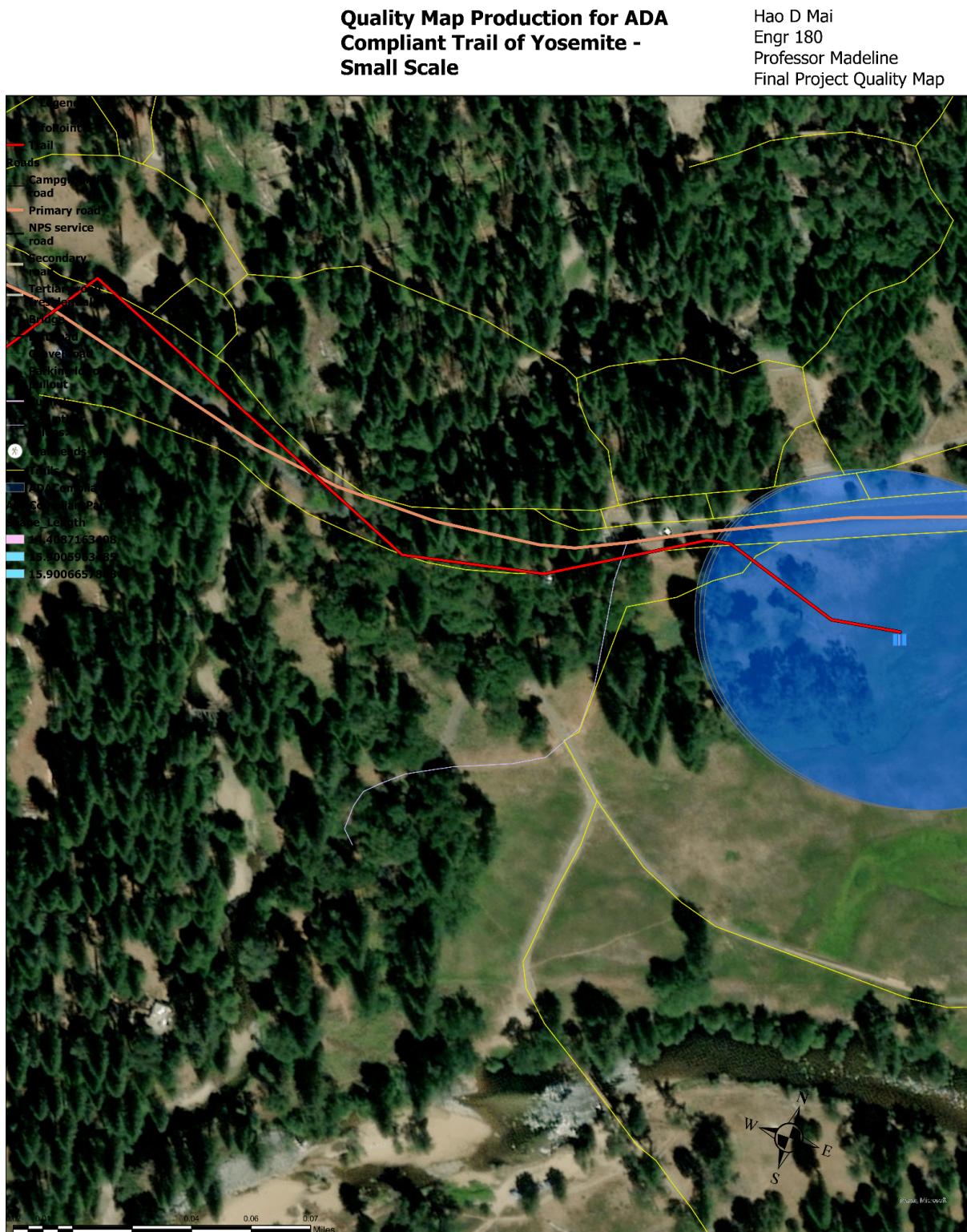
Hao D Mai  
Engr 180  
Professor Madeline  
Final Project Quality Map



- Quality production map of ADA compliant trail on a large scale, slope based :



- Quality production map of ADA compliant trail on a large scale, imagery based:



## Reference

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<https://portal.opentopography.org/raster?opentopoID=OTSDEM.112011.26911.2>
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- *Code of Ethics | National Society of Professional Engineers*. (2019). NSPE Code of Ethics for Engineers. Retrieved June 24, 2022, from  
<https://www.nspe.org/resources/ethics/code-ethics>

- L. (2022, February 15). *A guide to Indigenous land acknowledgment*. Native Governance Center. Retrieved June 25, 2022, from <https://nativegov.org/news/a-guide-to-indigenous-land-acknowledgment/>