

# GIS Analysis for Identification of Suitable Sites for Solar Plant Installation

Report

Submitted To:

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# Introduction

The assignment of GIS analysis for the identification of suitable sites for solar plant installation was carried out by NAXA for Dolma Advisors. The scope of the assignment was the whole country but with certain criteria to eliminate sites that are unsuitable for the installation.

## Model Development Criteria

The criteria used for the identification are:

1. Proximity of at least 15 kms from sub-stations
2. South facing slope of less than 20 degrees
3. Not more than 3 kms from motorized roads
4. Not forest, agriculture or settlement area
5. Area or a set of areas of at least 1 sq. kms. lying close to one another

## Data

Following datasets were used for the analysis:

1. 30m resolution Digital Elevation Model (DEM) [Data Source: ASTER]
2. Transmission lines, Substation data [Source: Provided by Dolma]
3. Irradiance data [Source: Provided by Dolma]
4. Land use data [Data Source: ICIMOD 2010]
5. Road data [Data Source: OpenStreetMap & Survey Department]

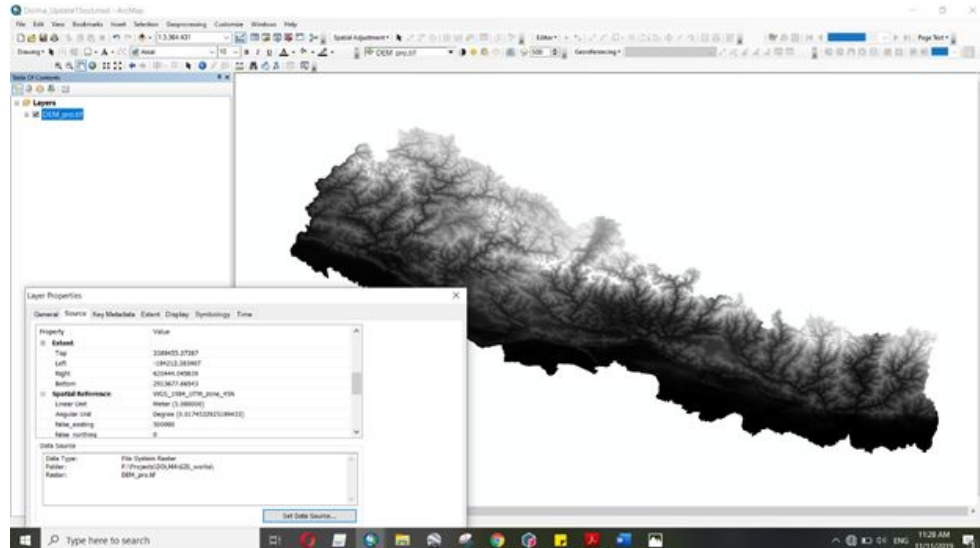
# Methodology

## A. Data Preparation and Analysis in GIS

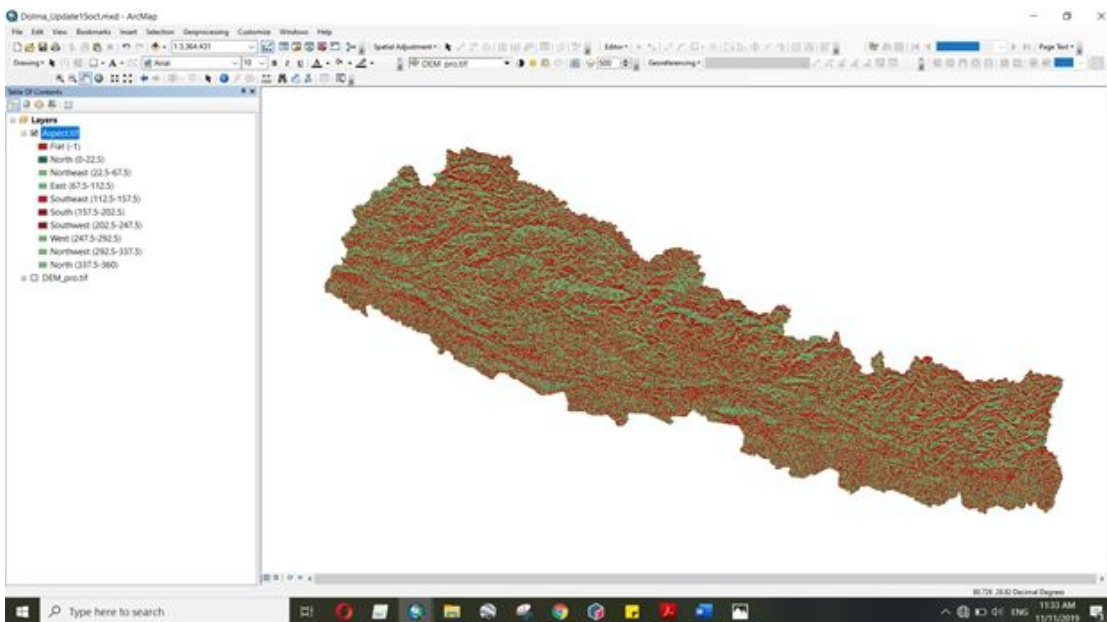
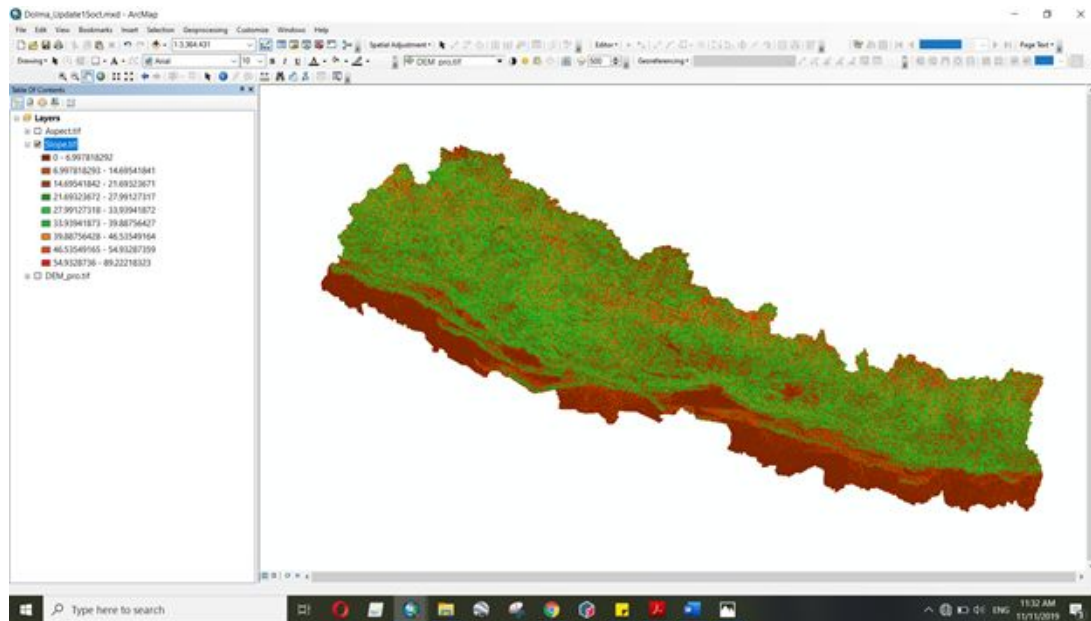
The following methodology was used to prepare data and carry out the required analysis in GIS software:

In this first phase of the assignment, all necessary data required for the analysis was acquired from available relevant sources. Further preparation/formatting/editing of the data (if required) will be done. After a series of operations on the dataset, suitable sites for solar plant installation were identified:

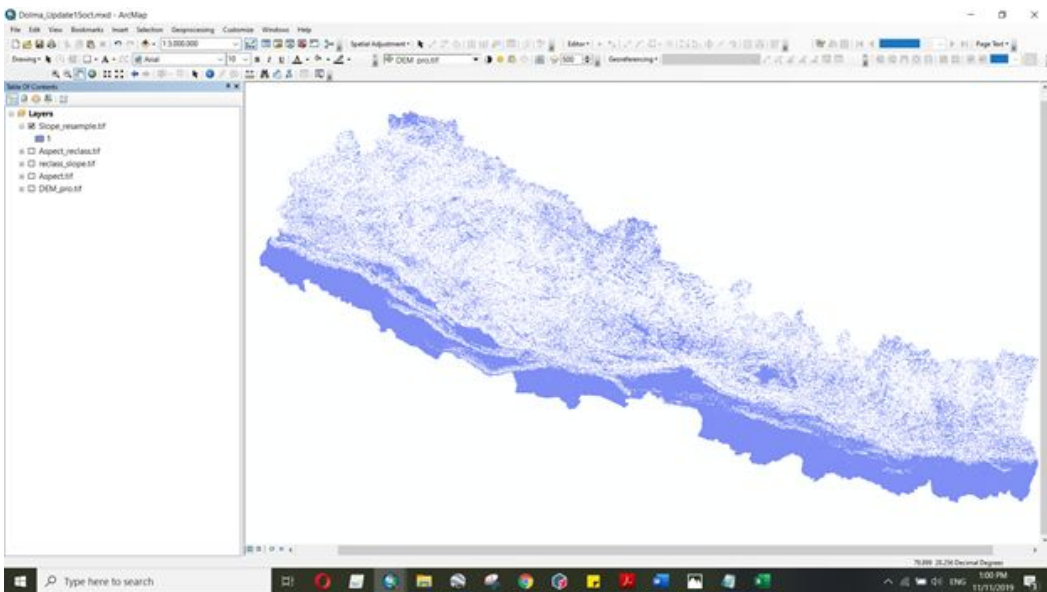
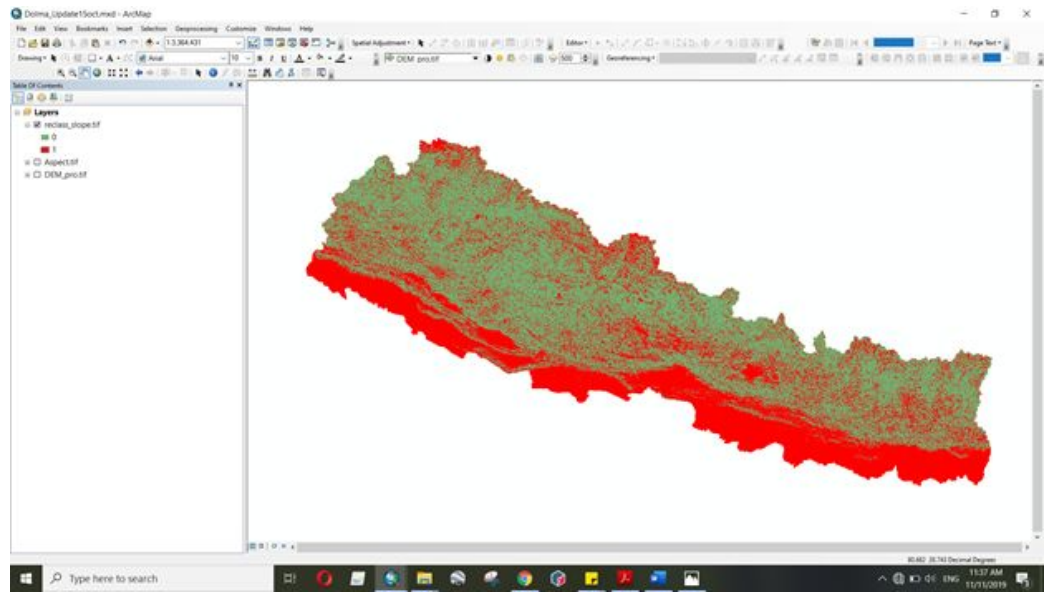
### 1. Project DEM in utm 44/45N to calculate slope



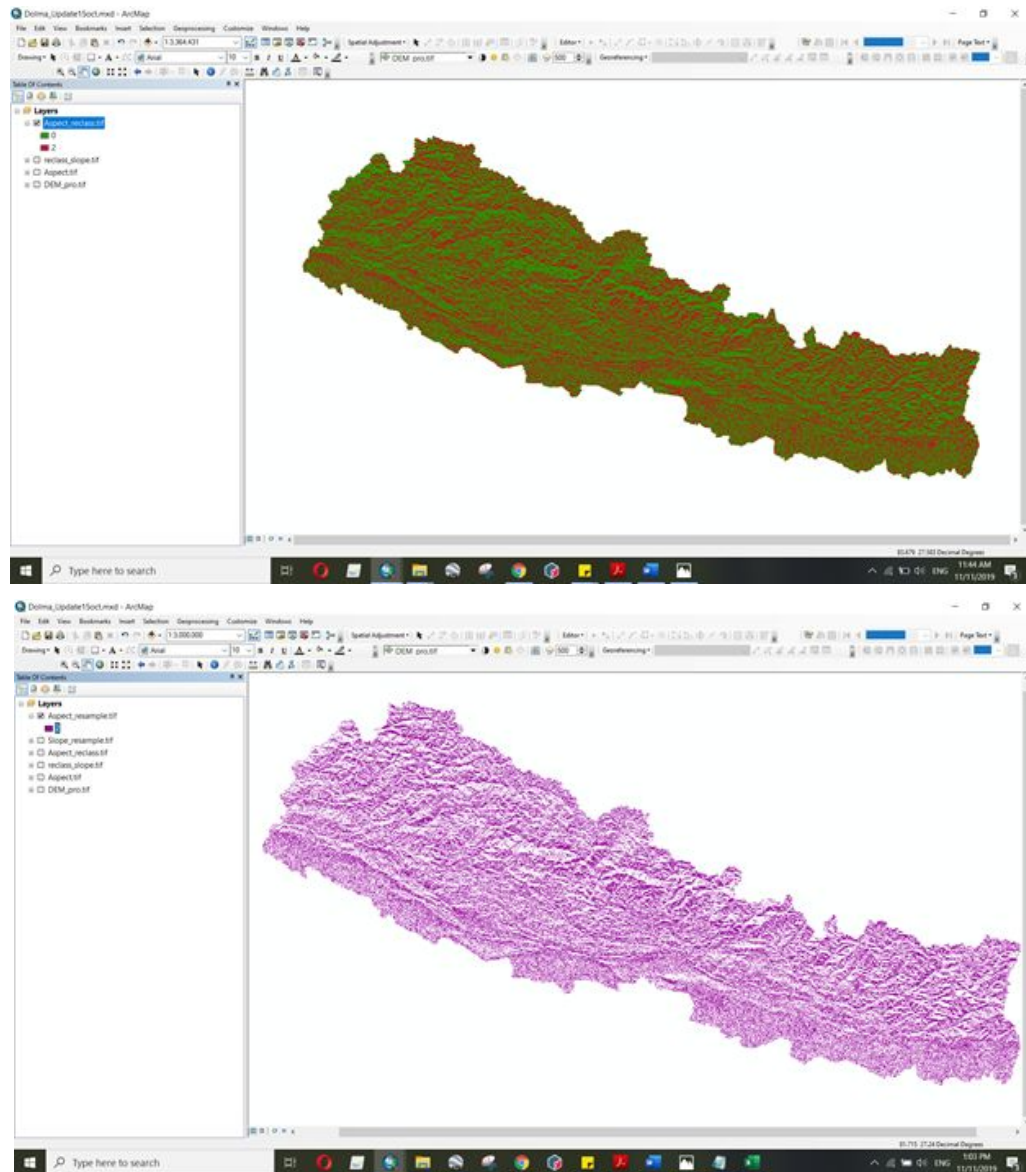
## 2. Calculate Slope and Aspect



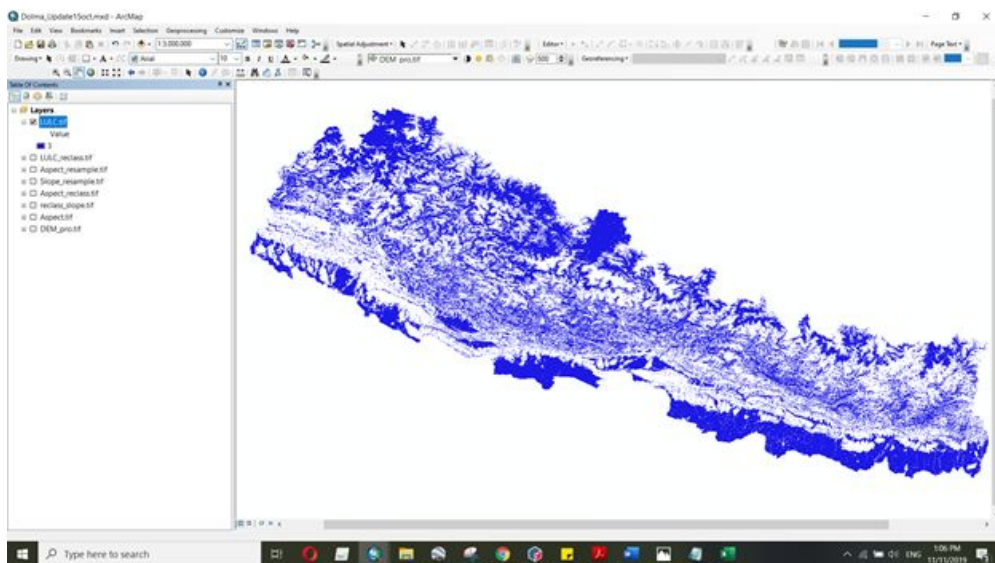
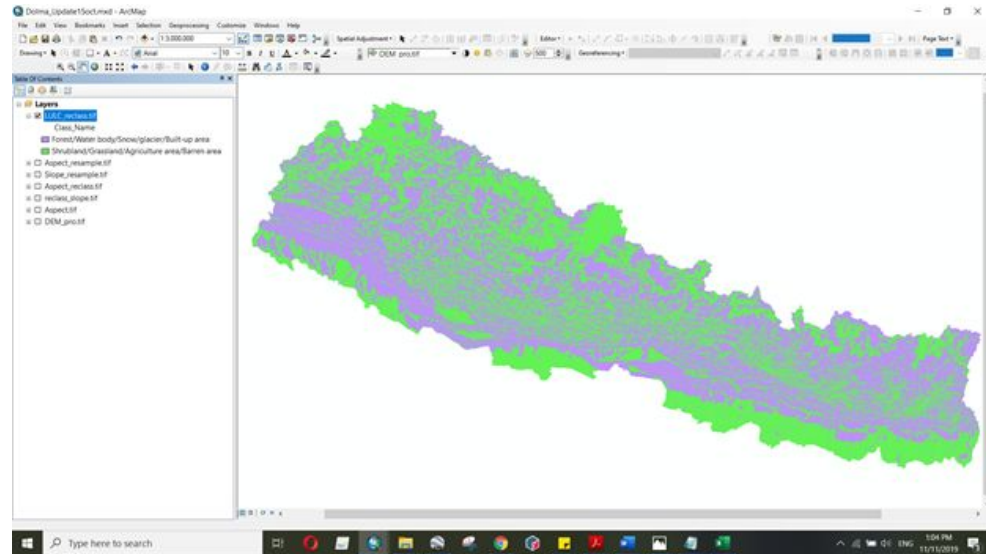
## 3. Reclass slope >20° in class 0 and slope < 20° in class 1 and export class 1



4. Reclass aspect South, Southeast and Southwest in class 2 and the rest of all in class 0 and export class 2

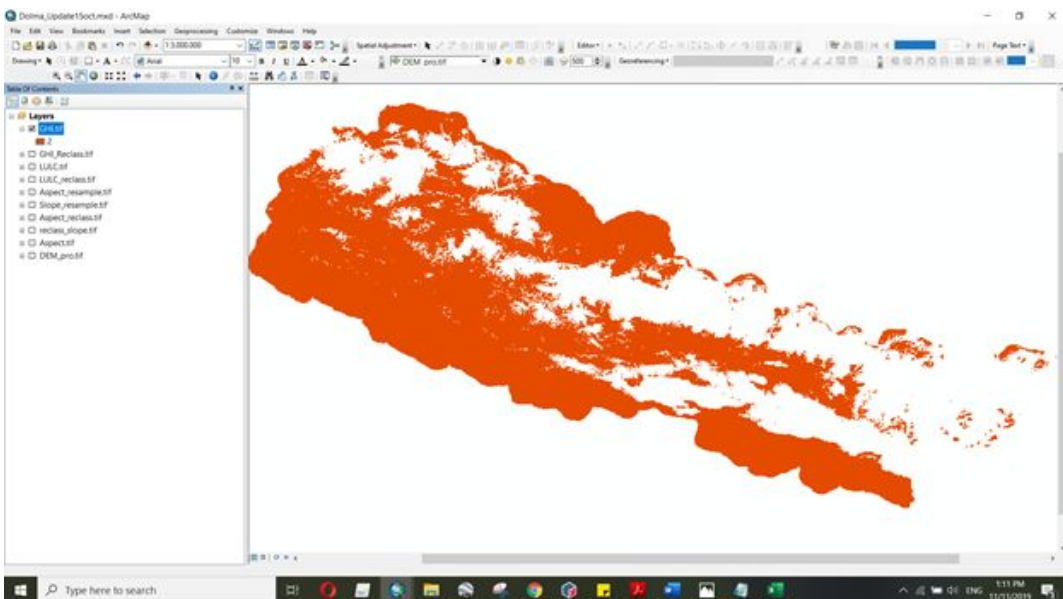
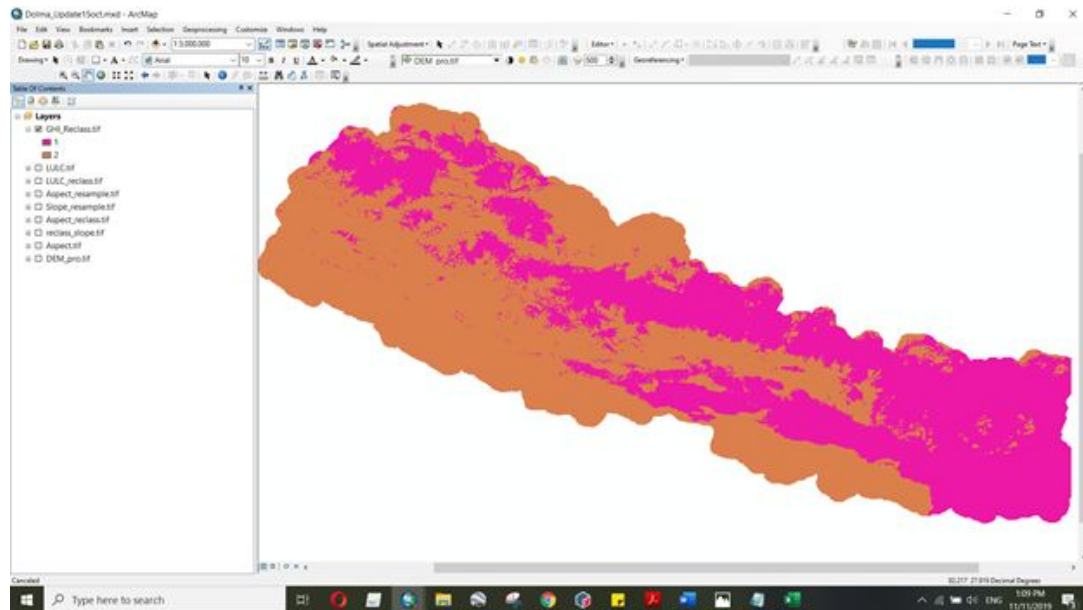


5. Reclass LandUse/LandCover Forest, Water Body, Snow, Glacier and Built-up Area in class 0 and the rest all in class 3 and export class 3



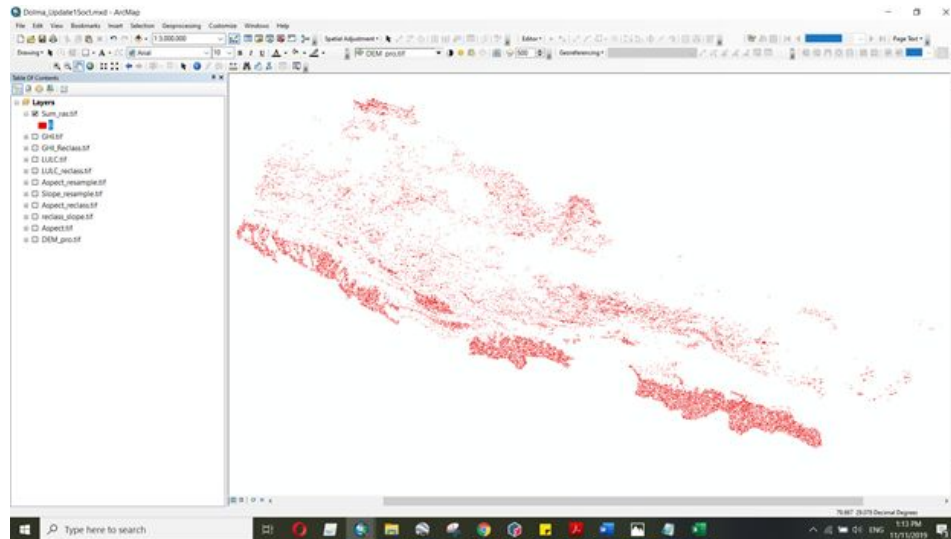
6. Reclass GHI > 4.5 in class 2 and GHI < 4.5 in class 1 export class 2



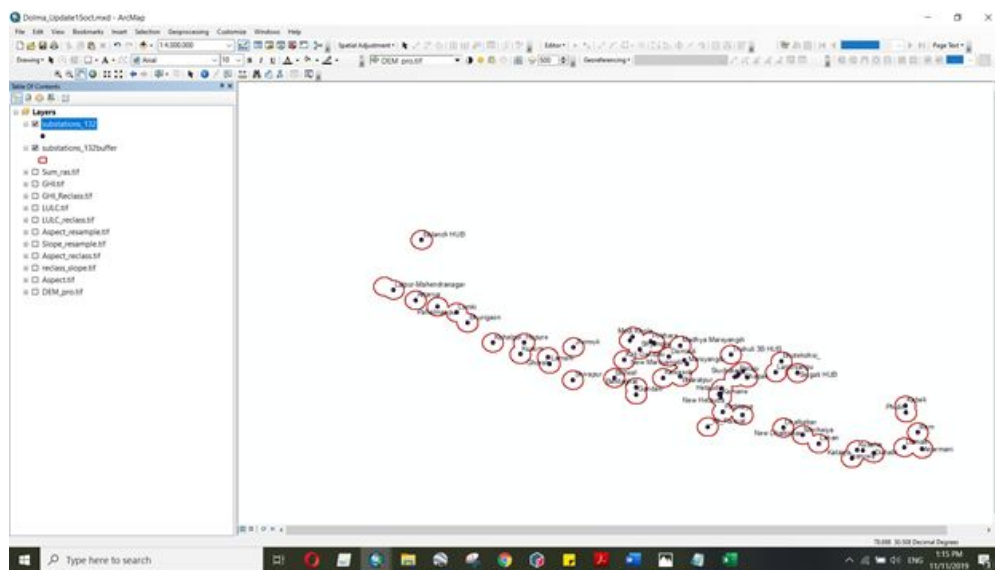


7. Resample rasters to make equal cell size.
8. Add all exported raster to form a single raster called Sum\_ras.tif having value 8  $(1+2+3+2)$

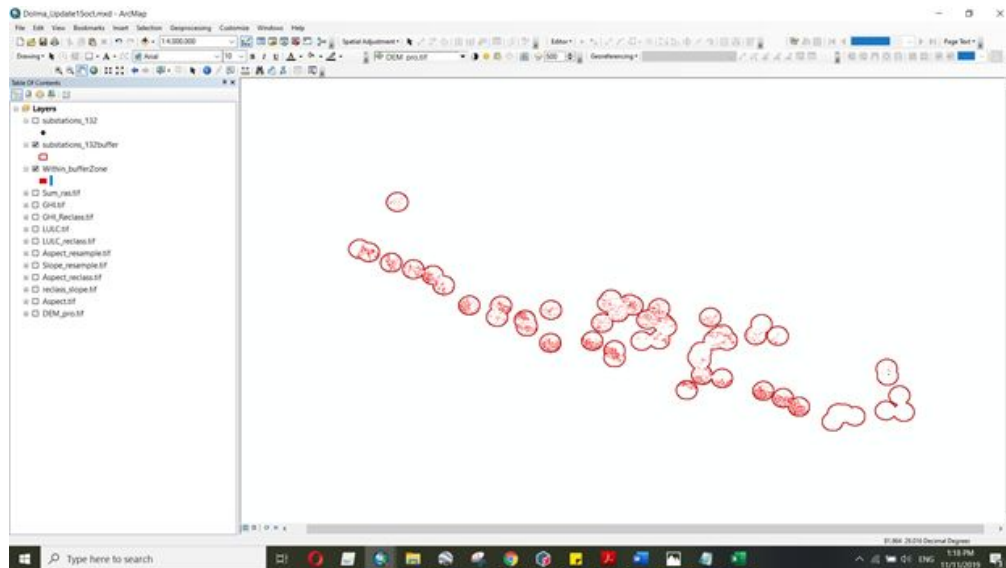




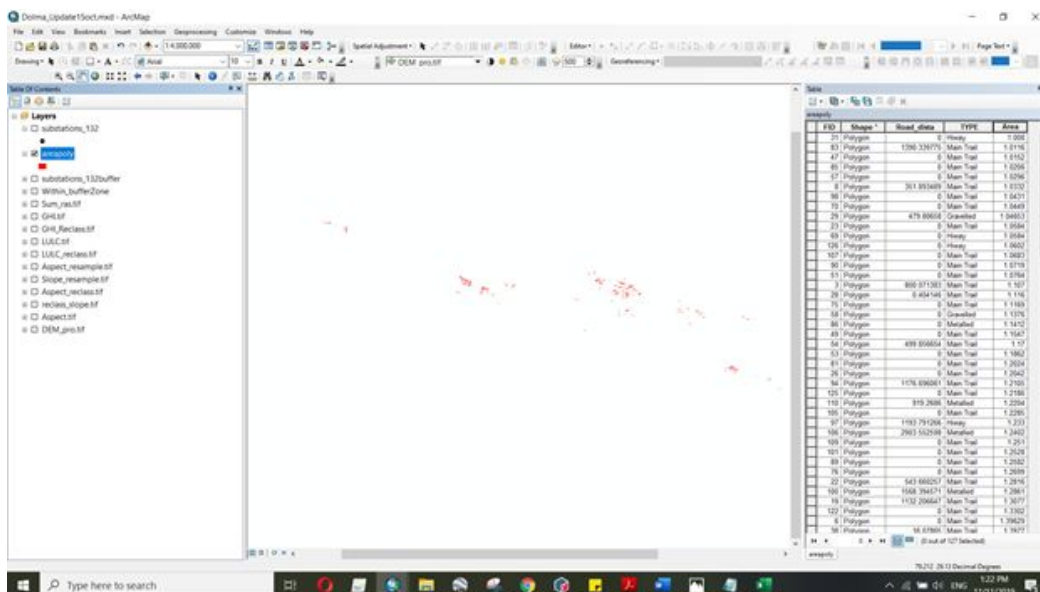
9. Buffer in 15km of existing and under construction substations of power 132kv.



10. Clip Sum\_ras.tif within Buffer\_poly.shp



11. Convert raster to polygon calculate area and filter out area < 1sqm.

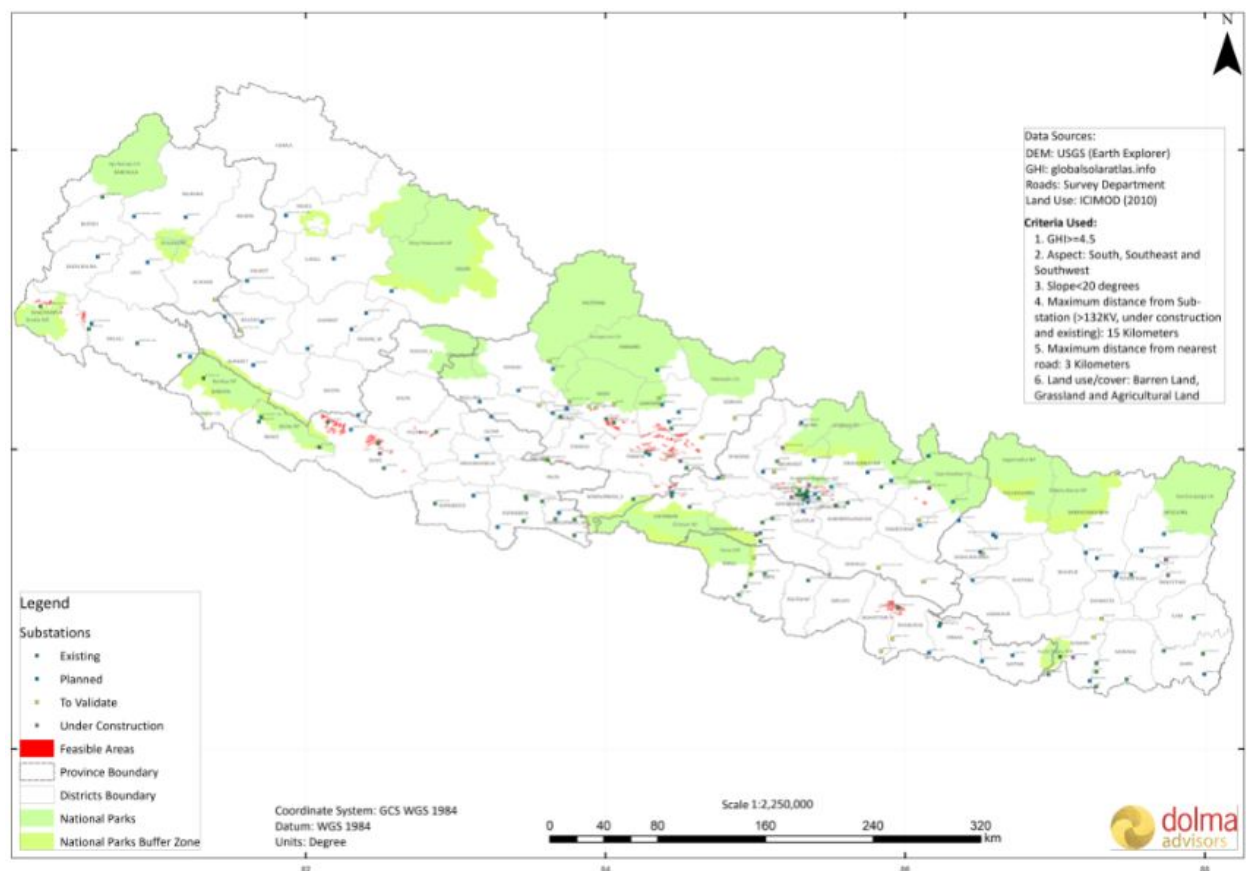


12. Perform spatial join to Road (with search radius 5km) and Substations (with search radius 15km) to get the distance from the sub-stations and road.

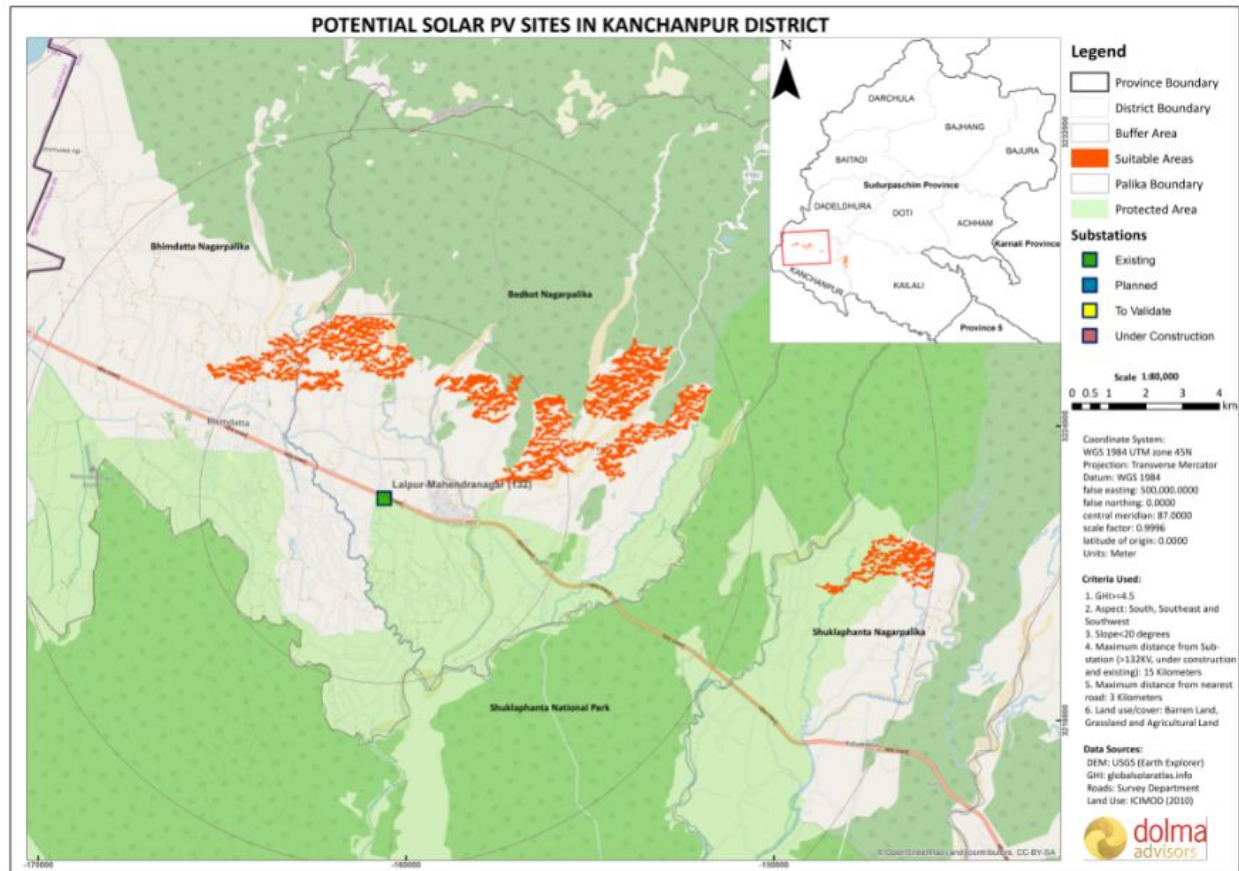
## B. Map Preparation and Export

Preparation of KML/KMZ files for the identified suitable areas were prepared in this phase. Furthermore, digital and print ready maps for the areas that are most suitable (selected by Dolma) were prepared. These maps will have available data like surrounding features, hydropower stations, transmission lines, substations, contour lines, settlements, etc. as well as a base layer of OpenStreetMaps or Google Maps.

### Output Maps



Overall map of potential sites along with sub-stations and administrative boundaries



Sample map of one of potential sites in Kanchanpur District

## Conclusion

The final outputs of the project have been in the form of maps and data. Both these outputs are by-products of different kinds of spatial and attribute data along with their accuracies in the source. Hence, the products also tend to have the accuracy as a cumulative function output from the datasets used. While field based verification and validation is encouraged, we assure that the output is accurate as per the criteria used.

Naxa is pleased to have carried out the assignment and is willing to make necessary revisions in criteria, parameters or the process in order to get better outputs in future. We also want to encourage involvement of the company's technical resource to carry out similar assignments on a bigger geography or different context in future.