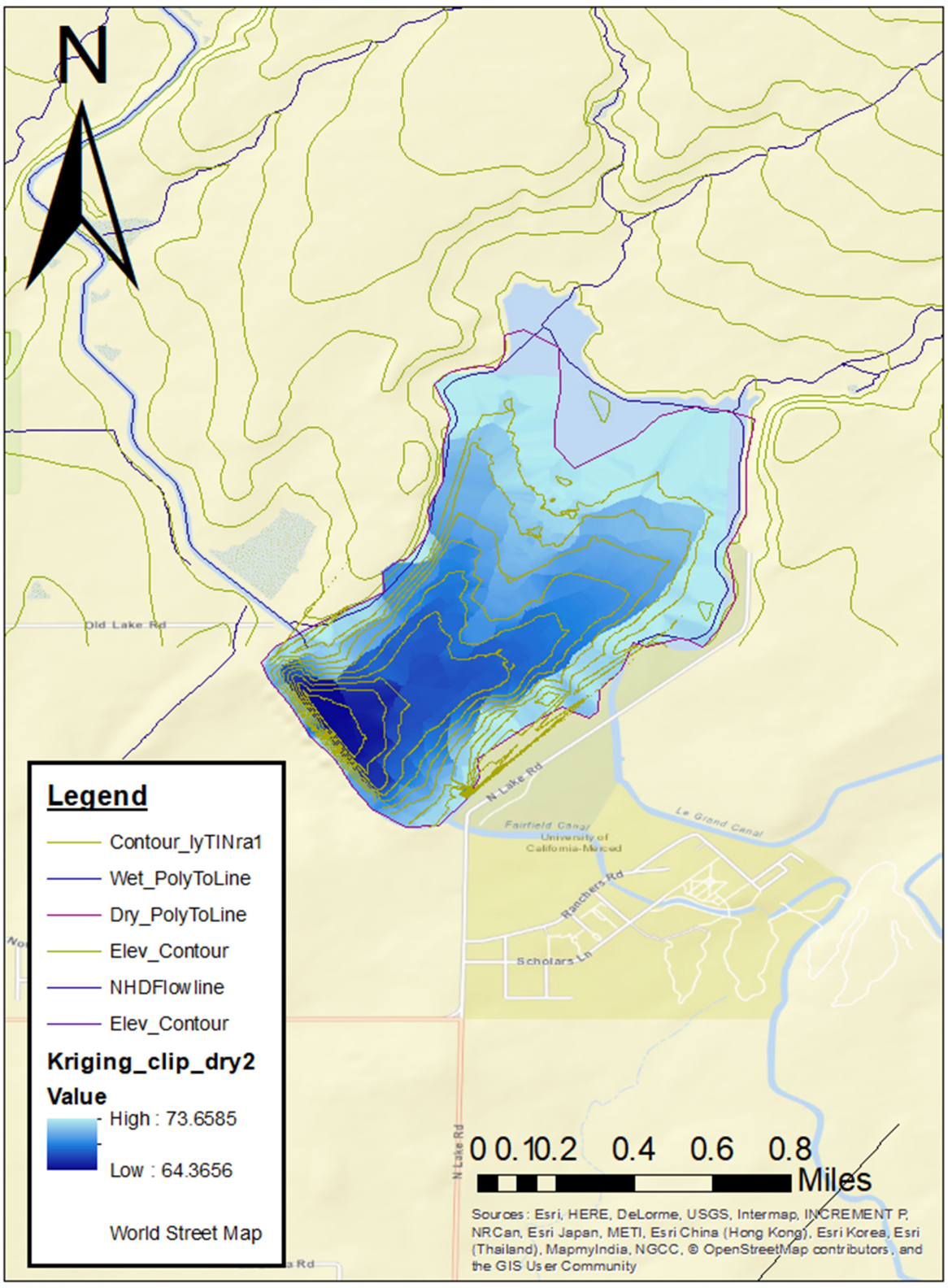
Lake Yosemite Volume Estimation Under Uncertainty

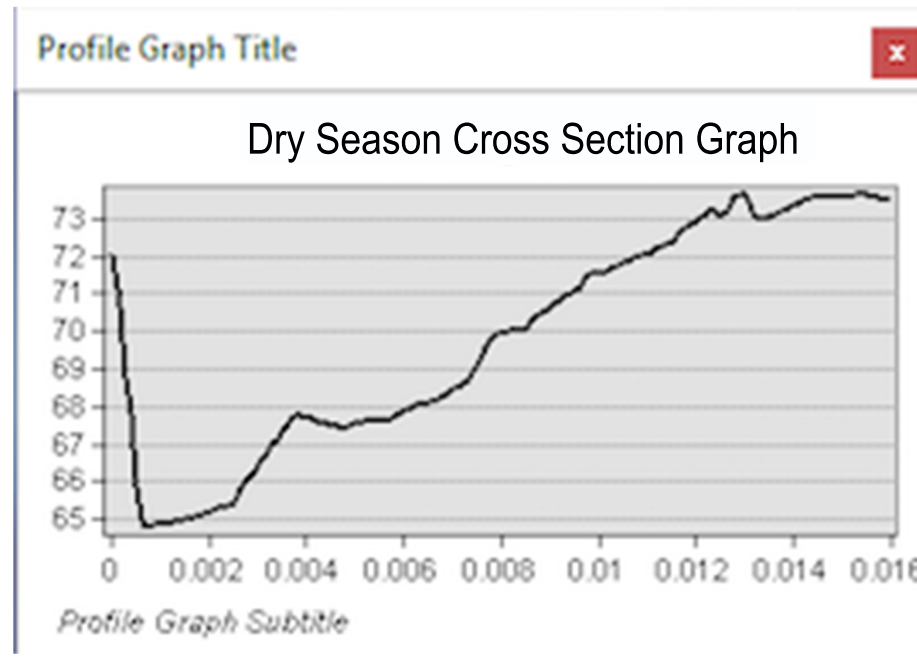


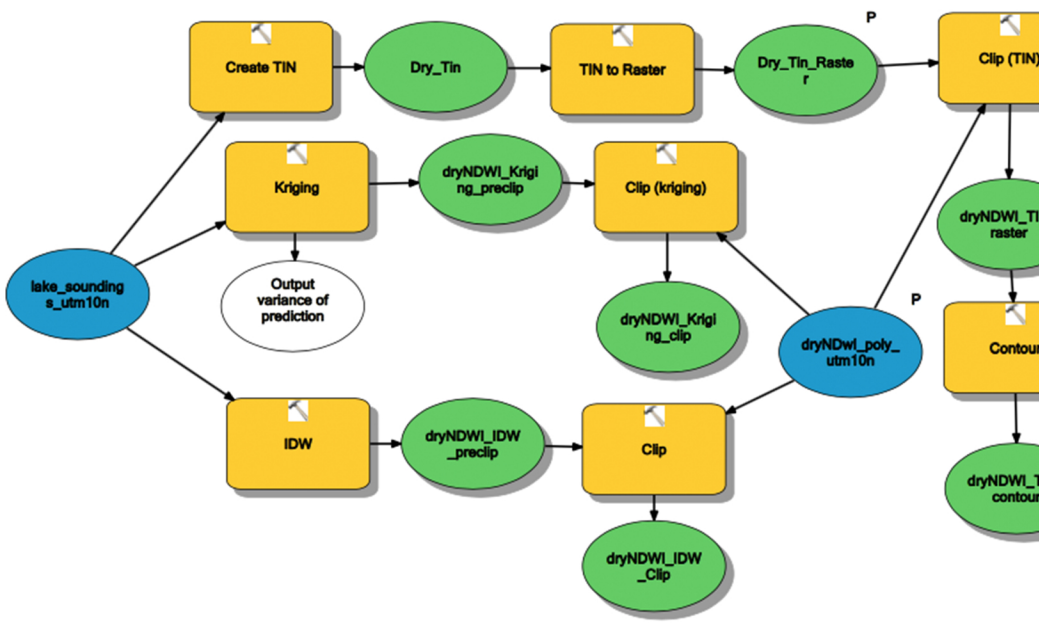
Objective: Our engineering firm is working on a project for the Merced Irrigation District in order to gather the storage capacity of Lake Yosemite. This lake provides irrigation water to the Merced County. Lake Yosemite is a reservoir that was built in 1888 for irrigation purposes. It's a freshwater lake that is approximately 8 km east of Merced and sits right behind the University of California. The MID will use the information that we gather to create an embankment berm to increase the capacity of the lake during wet years. Using sonar measurements our team has collected, we will create a terrain map of the lake floor as well as the depth. In addition, we calculated the quantity of water in the lake during the wet and dry years. We have used three different 3D interpolation techniques: TIN, IDW, and Kriging. With the data that was collected and computed, the final product shown includes: a quality bathymetric map, a report of the results, and discussion on the outcomes. A plan for future implementations of the data collected and the interpolation techniques has also been done. Finally, using the three 3D interpolation techniques, we conclude a profile with the difference and a cross section of the water elevation for the different scenarios.

METHODS:

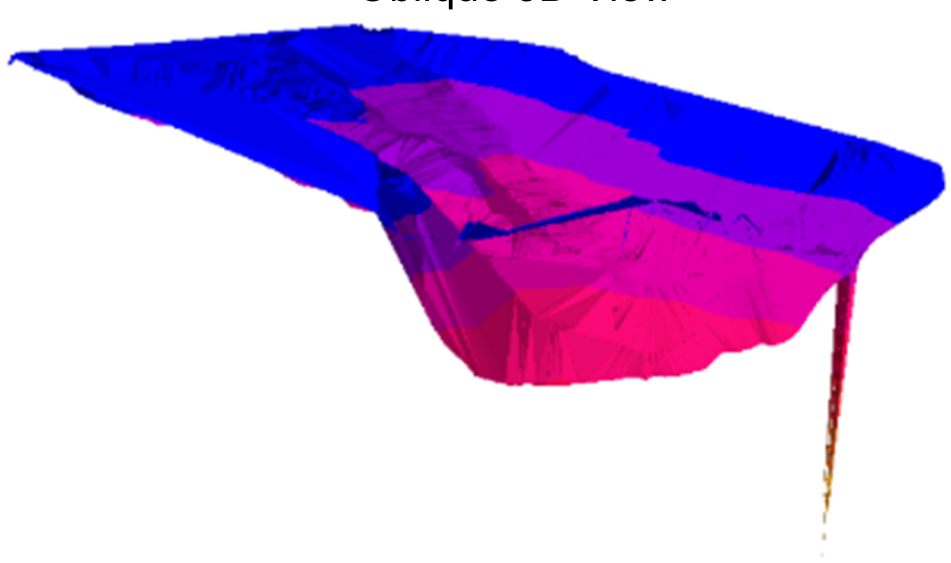
To start off, I uploaded all the shapefiles provided to us onto our blank map. I looked up in the search tools for TIN to raster and created the raster shapefile. The first set of data that I used is the coordinate system, "WGS_1984_utm_Zone_10z". Using this coordinate system and setting our input "LAKE SURROUNDINGS_UTM10" we created the TIN. I then created a clip with the input "lytinraster" and named the output llyTinRasLy in order to clip the TIN raster to the lake yosemite boundary. Next, using the surface volume tool, we calculate the volume based on the plane height (low: 74.1 high: 77.1), reference plane (below), and the input being the clipped TIN Raster. The output of the surface volume tool is a text file containing the 2D and 3D area and volume values of the low and high years of the water elevations. After we use a Profile Graph Tool provided by AcrMaps which provides an interactive toolbar which is used to derive a graphic representation of one or many profiles, for instance, below is a dry season cross section graph produced by this tool and using the TINs we generated. The next step is where we merge all the UTM10n files (lake_surroundings_utm10n, tb_utm10n, and elev_utm10n) into one and save it as a shapefile instead of a geodatabase the output (allmerged_utm10n) should be a shapefile containing all the points. Afterwards, with the field calculator we input the all merged shapefile, field name is selected as elevation, the expression is in python (!elevation! +!z!). We then create another TIN but this time using the all merged shapefile as the input and output a high TIN and low TIN. After we need to convert these into rasters. Using the Create Feature Class we are making a dry and wet season polygon in order to make the IDW and Kriging interpolation techniques. I started with the IDW tool first and used the lake surroundings utm10n file as the input, the z value was elevation since we are gathering data of how filled the lake is in a dry or wet season, and finally the barrier is the polygon line of lake yosemite. For Kriging we take a similar approach, instead we are using a Kriging tool. Finally, we clip the shapefiles with the lake yosemite polygon and we have our final results. In ArcScene, we can visualize a 3D version of this data by inputting the clipped TIN raster shapefiles for the wet and dry season.

	TIN	IDW	Kriging	Mean	STD
Low Year	9023598.84 m	9679594.96 m	9673615.97	9458936.59	377025.40300576
High Year	4547140.96 m	4606717.57 m	4607110.23 m	4586989.5866667	34510.481464092





Oblique 3D View



Discussion:

The Kriging Method produced the largest volume value for the low and high seasons. Whereas the least volume was produced by the TIN Method. In comparision to the published data of the volume of Lake Yosemite, our calculations are more precise, whereas the published data is an estimate. A limitation that was encountered is the amount of data that is provided to determine the volumes, as well as the fixed methods. Secondly, would be the accuracy of the data since the water elevation can vary in each season and year. For future data using various methods and data collected over a longer time period may result in a precise result that the clients needs.

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MID MERCED IRRIGATION DISTRICT WATER & POWER
Water Resources Management Plan

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Prepared for: Merced Irrigation District
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Data Sources: UCM180, Esri, USGS, Google, Tiger