

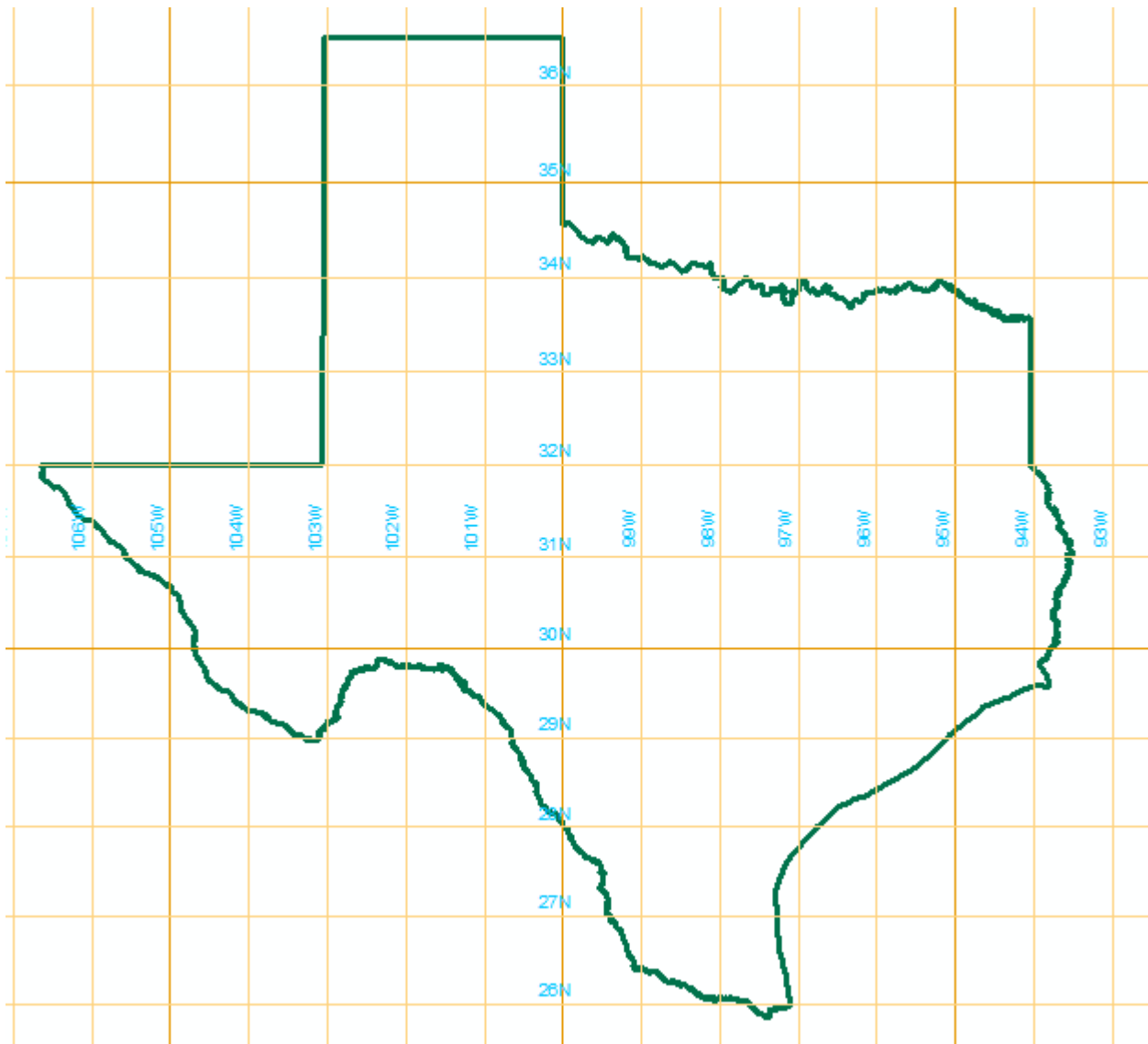
# GIS in Water Resources

Fall 2012

## Homework #1

### 1. Map Projection Parameters

The map below shows Texas and a grid of world latitude and longitude from ArcGIS Online.



Here are the parameters of the State Plane Coordinate system of Texas, Central Zone:

NAD\_1983\_StatePlane\_Texas\_Central\_FIPS\_4203\_Feet  
WKID: 2277 Authority: EPSG

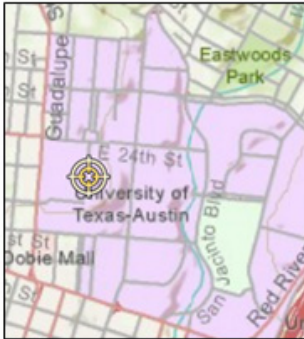
Projection: Lambert\_Conformal\_Conic  
False\_Easting: 2296583.3333333333  
False\_Northing: 9842500.0  
Central\_Meridian: -100.33333333333333  
Standard\_Parallel\_1: 30.116666666666667  
Standard\_Parallel\_2: 31.883333333333333  
Latitude\_Of\_Origin: 29.666666666666667  
Linear Unit: Foot\_US (0.3048006096012192)

Geographic Coordinate System: GCS\_North\_American\_1983  
Angular Unit: Degree (0.0174532925199433)  
Prime Meridian: Greenwich (0.0)  
Datum: D\_North\_American\_1983  
Spheroid: GRS\_1980  
Semimajor Axis: 6378137.0  
Semiminor Axis: 6356752.314140356  
Inverse Flattening: 298.257222101

- (a) What earth datum is used in this coordinate system?
- (b) What map projection is used in this coordinate system?
- (c) Sketch on the map the standard parallels, the central meridian and the latitude of origin of this projection.
- (d) For this projection, what are the coordinates of the origin ( $\phi_o, \lambda_o$ ) (in units of degrees minutes and seconds) and the corresponding ( $X_o, Y_o$ ) (in units of feet)?

## 2. Locations on the Earth

Using ArcGIS Explorer Online and zooming to Austin, Logan and Lincoln reveals the following designated locations for these universities. Convert these locations into decimal degrees. Find the great circle distances between Austin and Logan, Logan and Lincoln, and Lincoln and Austin in km if the radius of an equivalent spherical earth is 6371.0 km. Elevations for these locations were determined using Google Earth. 1 ft = 0.3048 m. Compute the slope along the great circle distance between each pair of universities and indicate the direction that water would flow along this path.



University of Texas at Austin

**30°17'10"N, 97°44'22"W**

Elevation 693 ft



Utah State University

**41°44'54"N, 111°48'30"W**

Elevation 4789 ft



University of Nebraska – Lincoln

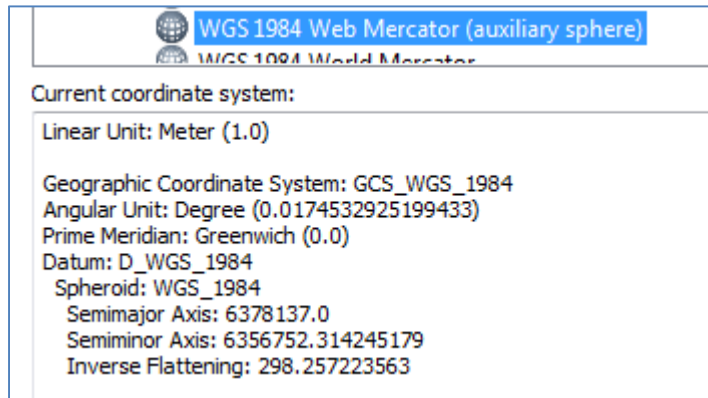
**40°49'09"N, 96°41'55"W**

Elevation 1174 ft

### 3. Web Mercator Coordinates

The location of the Blanco River at Wimberley gage in Geographic Coordinates (in decimal degrees) and in Web Mercator Coordinates (in meters) is given below:

LongDD	LatDD	WebMercatorX	WebMercatorY
98.0886	29.9942	-10919174.24	3502800.045



For one of these pairs of values there is a simple relationship between its geographic and projected coordinates while for the other pair, this relationship does not hold. Show which pair of values have a simple relationship and discuss what this tells you about how the Mercator projection has been applied to develop the Web Mercator coordinate system.

### 4. Sizes of DEM Cells

The National Land Data Assimilation System is a dataset produced by NASA to show describe the time variation of the land surface hydrology of the United States. Data from this system are produced using  $1/8^\circ$  cells. When applied, they are projected to a coordinate system in which the (X,Y) coordinates are in meters. A spherical earth that has the same volume and surface area as a reference ellipsoid has a radius of 6371.0 km. Calculate the corresponding distances AB and AC in kilometers, and the area ABCD in square kilometers, for this cell on a spherical earth, at Austin, Logan and Lincoln.

