

# Idaho Society of Professional Land Surveyors

“Preparing For NGS 2022 in Office and field  
Software” with Special Thanks to NGS!

## **Vertical GEODETIC DATUMS**

### **National Geodetic Vertical Datum 1929 (NGVD29)**

- The Result of 66,315 Miles of Levels
- Mean Sea Level Measured at 26 Tide Gauges
- Prior to 1973 Known as the Sea Level Datum 1929

# **Vertical GEODETIC DATUMS**

## **North American Vertical Datum 1988 (NAVD88)**

- Released in 1991 and adopted as Part of the National Spatial Reference System in 1993 to Replace NGVD29
  - Referenced to the International Great Lakes Datum of 1985 at Father Point, Rimouski, Quebec : 6.271 Meters above MSL
  - Unlike NGVD 29, Tidal Bench Marks were NOT Used
    - Too much variation in Sea Floor Surface
  - 1993: NAVD 88 Became the Official Vertical Datum of NSRS
- For the Continental United States and Alaska
- Helmert Orthometric Heights
    - Geoid location calculated relative to local modeled gravity

24.000000	58.000000	-130.000000	-60.000000	0.016667	0.016667
-39.715	-39.737	-39.759	-39.780	-39.801	-39.820
-39.839	-39.856	-39.873	-39.890	-39.909	-39.930
-39.952	-39.974	-39.997	-40.019	-40.041	-40.063
-40.084	-40.106	-40.127	-40.148	-40.170	-40.192
-40.214	-40.235	-40.257	-40.277	-40.297	-40.316
-40.334	-40.352	-40.369	-40.388	-40.407	-40.428
-40.450	-40.472	-40.496	-40.519	-40.542	-40.564
-40.585	-40.605	-40.624	-40.641	-40.659	-40.677
-40.697	-40.720	-40.746	-40.775	-40.806	-40.840
-40.873	-40.906	-40.937	-40.966	-40.993	-41.017
-41.039	-41.060	-41.082	-41.104	-41.127	-41.151
-41.175	-41.199	-41.220	-41.237	-41.251	-41.262
-41.271	-41.280	-41.289	-41.300	-41.314	-41.331
-41.350	-41.371	-41.394	-41.418	-41.443	-41.468
-41.495	-41.523	-41.552	-41.582	-41.613	-41.643
-41.673	-41.701	-41.727	-41.751	-41.773	-41.794
-41.812	-41.830	-41.847	-41.863	-41.879	-41.894
-41.909	-41.923	-41.936	-41.949	-41.962	-41.975
-41.987	-42.001	-42.014	-42.028	-42.041	-42.055
-42.069	-42.083	-42.097	-42.111	-42.126	-42.143
-42.160	-42.179	-42.198	-42.219	-42.239	-42.260
-42.281	-42.300	-42.319	-42.336	-42.352	-42.367
-42.382	-42.396	-42.411	-42.426	-42.441	-42.455
-42.468	-42.481	-42.493	-42.504	-42.515	-42.527

## GRAV-D will mean:

- As the  $H=0$  surface, the geoid will be tracked over time to keep the datum up to date
- The reliance on passive marks will dwindle to:
  - Secondary access to the datum
  - Minimal NGS involvement
    - Maintenance/checking in the hands of users
  - Use at your own risk

## **Which Geoid Model Do I Use?**

**NAD 83(2011)**

**Geoid 18**  
**Geoid 12B**

**NAD 83(2007)**

**Geoid 09**

**NAD 83(1996)**

**Geoid 03**  
**Geoid 99**  
**Geoid 96**

# **NAD83 and WGS 84**

## **Datums and Realizations**

### **NAD 83**

- NAD 83 (1986)
- NAD 83 (1992)
- NAD 83 (1996)
- NAD 83 CORS96(2002)
- NAD 83 (NSRS2007)
- NAD 83 (2011) epoch 2010.00

### **WGS 84**

- WGS 84 (1987)
- WGS 84 (G730)
- WGS 84 (G873)
- WGS 84 (G1150)
- WGS 84 (G1674)
- WGS 84 (G1762)

# **NGS Provided Transformations**

## **NAD 83 conversion to new datum**

- NGS will provide a transformation tool (NCAT)

## **NAVD 88 conversion to new datum**

- A transformation will be provided (VERTCON)

# Quality Control 1

- Number of Satellites During Observation
- PDOP, HDOP and VDOP
- RMS in Millicycles
- Horizontal and Vertical Standard Deviations
- Positions Used
- GPS Week

Base Data Age

# Quality Control 2



## NGS 2022: What Can I do to Prepare? Quality Control (QC2)

ΔX	47079.163 ΔY	36870.159 ΔZ	57200.713
Method	Fixed Type	Observed control point Search class	Normal
Type	Uncorrected Htz Prec	0.020 Vh Prec	0.060
Satellites	12 PDOP	2.2 HDOP	0.91
Base data age	2 RMS	10.450 Positions used	61
VCV xx (m <sup>2</sup> )	0.000039 VCV xy (m <sup>2</sup> )	-0.000003 VCV xz (m <sup>2</sup> )	0.000005
	VCV yy (m <sup>2</sup> )	0.000193 VCV yz (m <sup>2</sup> )	-0.000111
		VCV zz (m <sup>2</sup> )	0.000135

## Variance Covariance (VCV) Matrix

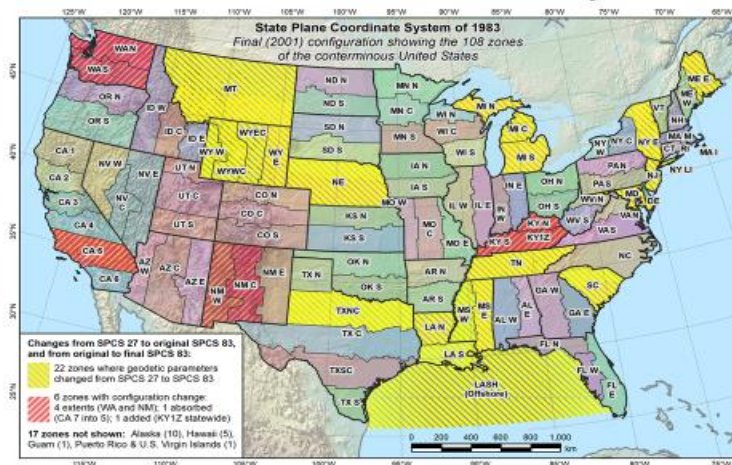
# Quality Control 3

- Local Tangent Plane (Using VcV values)
  - Sigma North
  - Sigma East
  - Sigma Up
- Covariance East – North Error
- Semi Major Axis of Error Ellipse
- Semi Minor Axis of Error Ellipse
- Orientation of Error Ellipse
- Unit Variance of Solution

All at 1 Sigma (68% Confidence)



## US State Plane Coordinate System





## Oregon Coordinate Reference System

