

Oregon Coordinate Systems and NATF2022 Update

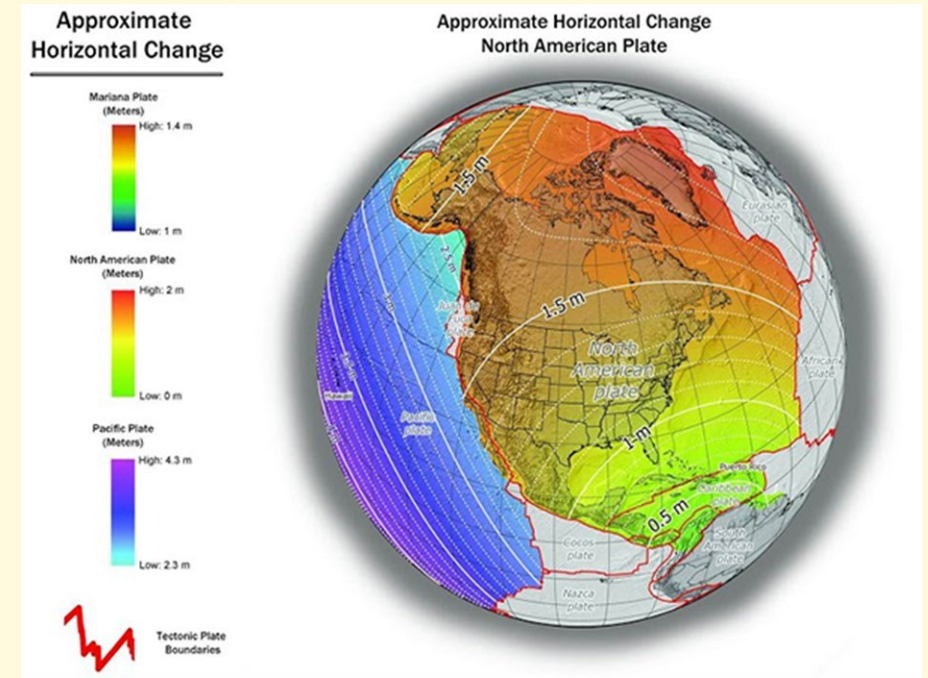
Joint TAC/GPL
June 11, 2024

Brady Callahan, Geospatial Lead
Oregon Parks and Recreation Department

TODAYS TOPICS

MOSTLY REVIEW

- Quick review of what's happening at NGS
- What SPCS2022 looks like for Oregon
- **Two feedback questions**
- Transformations (getting ready)
- Rollout for Oregon




DECADE PLUS IN THE MAKING

- North American Terrestrial Reference Frame of 2022 (NATRF2022)

- North American-Pacific Geopotential Datum of 2022 (NAPGD2022)
- GEOID 2022

National Geodetic Survey Positioning America for the Future

geodesy.noaa.gov



New Datums Are Coming!

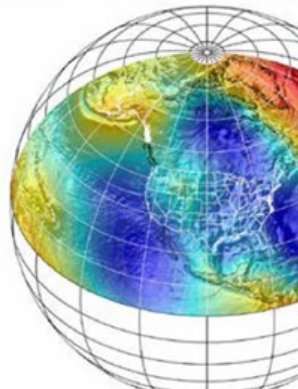
NOAA is Replacing NAD 83 and NAVD 88. NOAA's National Geodetic Survey (NGS) will be replacing the datums of the National Spatial Reference System (NSRS), including the **North American Datum of 1983 (NAD 83)** and the **North American Vertical Datum of 1988 (NAVD 88)**. NGS will provide the tools to easily transform between the new and old datums. Read the NGS Ten-Year Plan and visit the **New Datums Web page** on our site to learn more.

How You Can Prepare

- Learn if **legislation** or other formal documents referencing NAD 83 and NAVD 88 need to be changed in your state.
- Transform existing data** to the latest NSRS datums and realizations; i.e. NAD 83 (2011), GEOID18, and NAVD 88.
- Obtain precise ellipsoidal heights** on NAVD 88 bench marks, and visit the GPS on Bench Marks Web page to learn more.
- Require and provide **complete metadata** on all mapping contracts. See our website for more details.

Benefits

The new reference frames (geometric and geopotential) will rely primarily on **Global Navigation Satellite Systems (GNSS)**, such as the Global Positioning System (GPS), as well as on a gravimetric geoid model resulting from NGS' **Gravity for the Redefinition of the American Vertical Datum (GRAV-D)** Project.



The target accuracy of differential orthometric heights (heights relative to sea level) in the geopotential reference frame will be 2 centimeters over any distance, where possible.

What You Can Expect

The magnitude of change with the new datums will vary depending on the datum you are using and your geographic location. The new geometric datum will change latitude, longitude, and ellipsoid height between 1 and 4 meters. In the conterminous United States (CONUS), the new vertical datum will change heights on average 50 centimeters, with approximately a 1-meter tilt towards the Pacific Northwest.

The new datums will extend across CONUS and U.S. territories. The terrestrial reference frames replacing NAD 83 will be consistent with geocentric global reference frames defining latitude and longitude. The geopotential datum replacing NAVD 88 will be based on a gravimetric geoid model, enhanced by data from NGS' Gravity for the Redefinition of the American Vertical Datum (GRAV-D) Project.

National Oceanic and Atmospheric Administration • National Geodetic Survey

STATE PLANE UPDATE

NEW DATUM = NEW SPCS

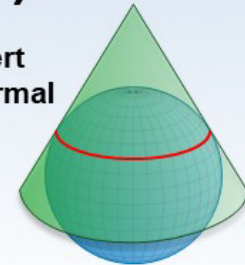
NOAA's **National Geodetic Survey** Positioning America for the Future

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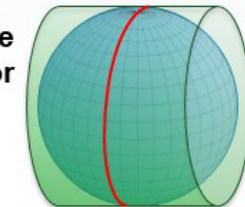
State Plane Coordinate System of 2022 (SPCS2022)

- Part of modernizing the *National Spatial Reference System (NSRS)*
- Third generation of State Plane
 - First in 1930s (SPCS 27), second in 1980s (SPCS 83)
 - Same 3 map projection types
 - Same ellipsoid as SPCS 83 (GRS 80)
- Same as existing State Plane, *but different...*
 - Based on new terrestrial reference frames instead of NAD 83
 - More zones, most designed by state stakeholders
 - Designed to reduce linear distortion at topographic surface (i.e., reduce difference between “grid” and “ground” distances)

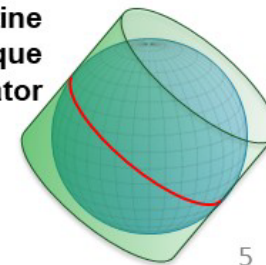
Lambert
Conformal
Conic



Transverse
Mercator



Hotine
Oblique
Mercator



NSRS MODERNIZATION TIMING

We're well past 2022...

Phased rollout and testing

- Alpha GEOID2022 **out now**
- Alpha values for ITRF transformation parameters **out now**
- State Plane 2022 parameters **out now**

Over the next 12 months:

- NATRF2022 (horizontal datum)
- NAPGD2022 (vertical datum)
- Transformation parameters for NAD83


Federal Geodetic Control Subcommittee

- Vote for adoption as official NSRS (likely early 2026)

National Geodetic Survey

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Issue 36 April 2024

NSRS Modernization News

For all issues of **NSRS Modernization News**, visit:
geodesy.noaa.gov/datums/newdatums/TrackOurProgress.shtml

Farewell to NGS Director Blackwell

The Modernization of the NSRS has been underway for 17 years, and for 15 of those years, NGS has been led by Ms. Juliana Blackwell. As Director, she supported, encouraged, and facilitated Modernization in so many ways small and large. It is impossible to quantify how important she has been to this ongoing effort. On March 29, Director Blackwell retired from NGS. We wish her well in her retirement. She will truly be missed.

Clarifying Roll-out and Testing of the Modernized NSRS

NGS operates three websites. The official website is geodesy.noaa.gov. This website holds the official NSRS data and tools. This will remain true through the phased roll-out and testing of the Modernized NSRS.

During the phased-rollout and testing, each component of the Modernized NSRS will be put on the NGS Beta website (beta.ngs.noaa.gov). This will begin with GEOID2022 in the summer of 2024, and will continue into 2025. As each component is rolled-out, users may test it. After all components are rolled-out, a final six-month testing period will commence, at the end of which the Federal Geodetic Control Subcommittee will be asked to vote to make the Modernized NSRS the official NSRS of the nation. When that happens (likely in early 2026), the current NSRS will be moved off of the official NGS website (to some other location, TBD), and the Modernized NSRS will be moved from the Beta website to the official website. There will then be a brief overlap period, after which the current NSRS

data and tools will be formally removed from service. During the roll-out and testing, NGS will occasionally release some data or tool on a third website, the Alpha website (alpha.ngs.noaa.gov). Alpha releases will be incomplete, possibly inaccurate, and are not authoritative. They are purely for an early glimpse into future releases.

GEOID2022 on Alpha

The geoid teams of the USA, Canada, and Mexico have finalized the software which will create GEOID2022, and an alpha version of GEOID2022 has been created from it. This model is an *alpha*, because it was finalized before GRAV-D data collection was completed. Readers interested in this alpha release of GEOID2022 may access it here: <https://alpha.ngs.noaa.gov/GEOID2022/>. Later this year, the official release of GEOID2022 will occur on the NGS Beta website.

Joint NGS/CGS Adoption of GGXF for Gridded Geodetic Products

NGS and the Canadian Geodetic Survey are jointly adopting the Open Geospatial Consortium's [Gridded Geodetic data eXchange Format \(GGXF\)](https://www.opengeospatial.org/standards/ggxf) as our distribution format for gridded geodetic files. For NGS, this will begin with our NSRS Modernization products but will also mean back-translating older files as time allows. This means that every grid NGS releases to the public with the Modernized NSRS will be in GGXF at a minimum, but it does not preclude our distributing grids in additional formats.

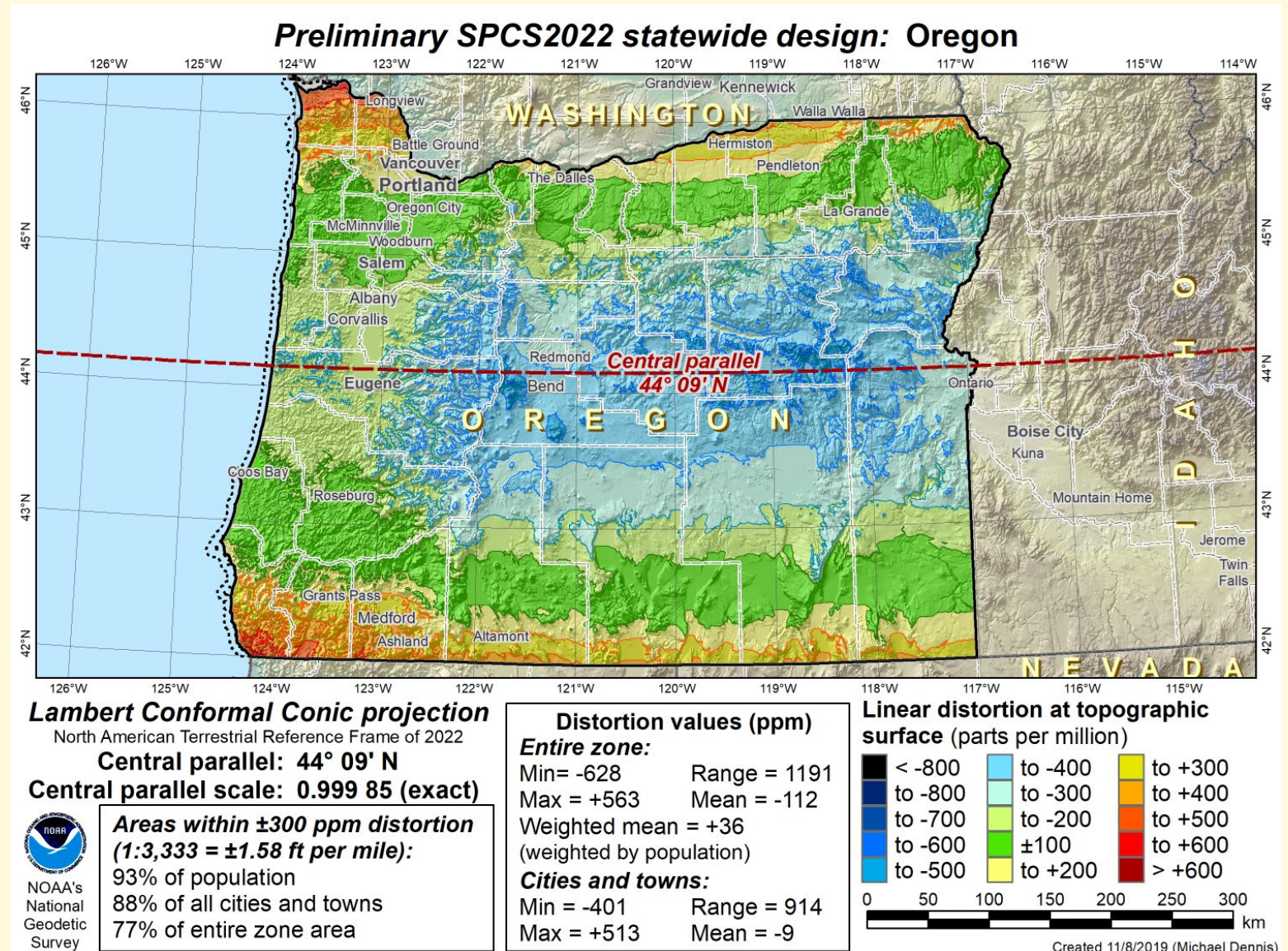
National Oceanic and Atmospheric Administration

National Geodetic Survey

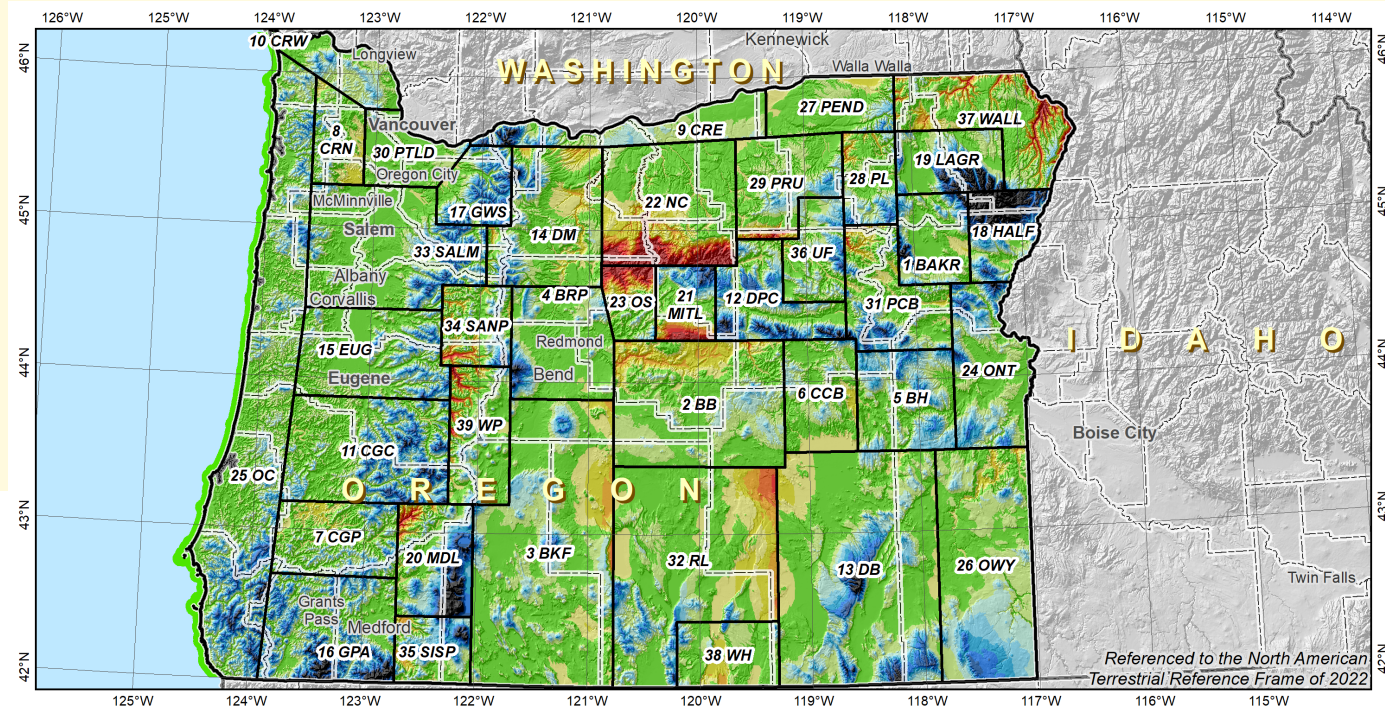
SPCS2022 AND OREGON

STATEWIDE ZONE

- Performance slightly better than Oregon Statewide Lambert
- Performance similar to combined North & South zones



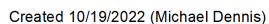
- Performance nearly identical to existing OCRS



	Cities	Area
Min	-129	-365
Max	+186	+241
Range	315	606
Mean	+7	-22

Range	Pop	Cities	Area
±20 ppm	90%	81%	43%
±25 ppm	93%	85%	50%
±30 ppm	95%	88%	56%
±40 ppm	97%	92%	66%
±50 ppm	98.7%	96%	74%
±75 ppm	99.6%	98%	86%
±100 ppm	99.9%	98%	92%
±150 ppm	99.98%	99.6%	98%
±200 ppm	99.996%	100%	99.5%

to -160	to -80	to +60
to -160	to -60	to +80
to -140	to -40	to +100
to -120	±20	to +120
to -100	to +40	>+120



OREGON

PARAMETERS

- Are we OK with the grid origins (false northing and easting)?
- NGS designed to be significantly different than values for current zone

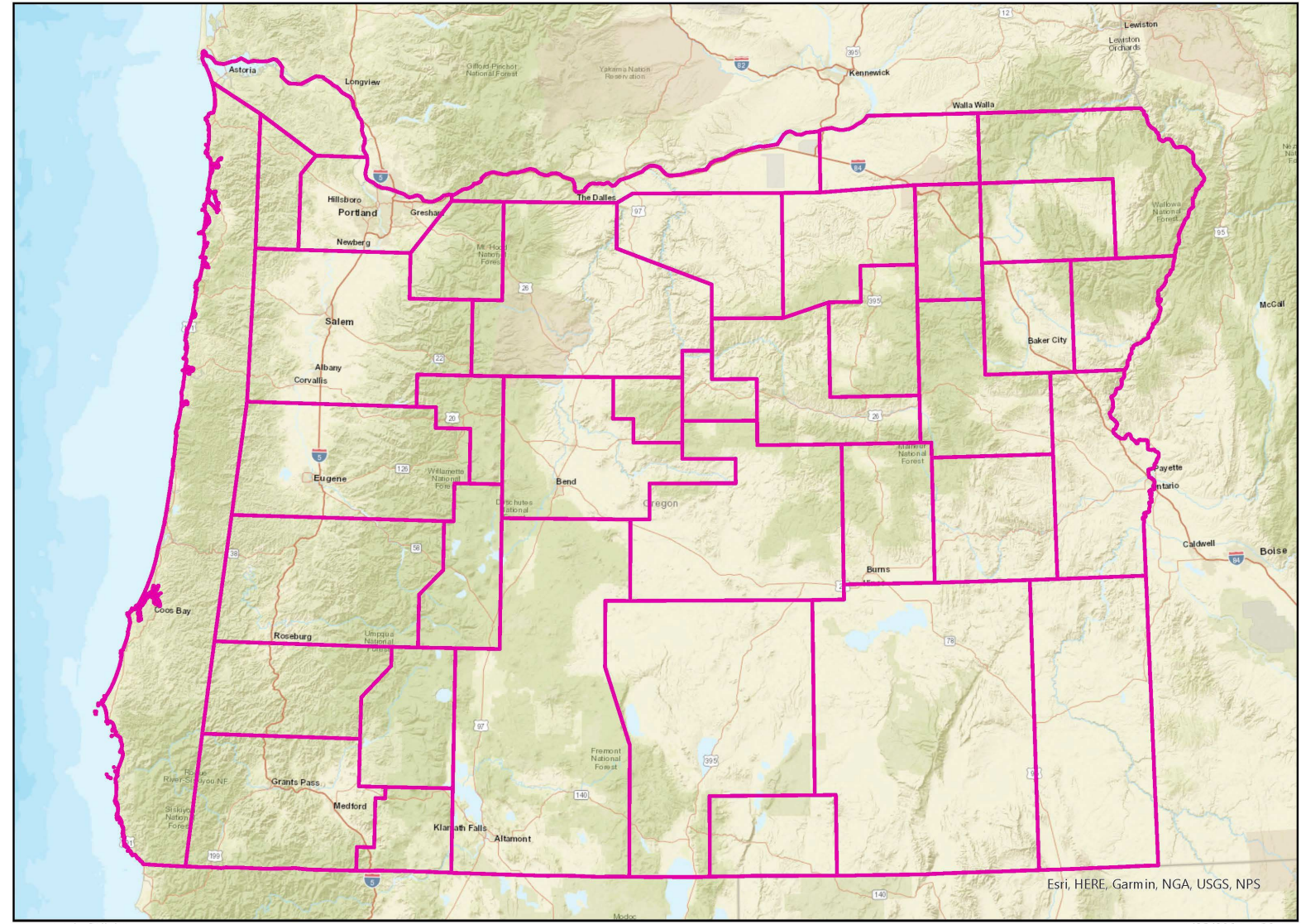
Zone code	Zone abrv	Zone name	Proj type	Origin latitude	Origin longitude	Projection origin	Skew azimuth	False northing	False easting	False northing (ft)	False easting (ft)
					west	scale	(deg)	(m)	(m)		
410001	OR	Statewide	LC1	44°09'N	120°30'W	0.999800		457,200	1,066,800	1,500,000.000	3,500,000.000
411001	OR BAKR	Baker	TM	44°00'N	117°50'W	1.000160		0	190,500	0.000	625,000.000
411002	OR BB	Bend-Burns	LC1	43°40'N	120°00'W	1.000200		76,200	266,700	250,000.000	875,000.000
411003	OR BKF	Bend-Klamath Falls	TM	41°15'N	121°45'W	1.000200		0	342,900	0.000	1,125,000.000
411004	OR BRP	Bend-Redmond-Prineville	LC1	44°40'N	121°15'W	1.000120		152,400	190,500	500,000.000	625,000.000
411005	OR BH	Burns-Harper	TM	42°45'N	117°40'W	1.000140		0	266,700	0.000	875,000.000
411006	OR CCB	Canyon City-Burns	TM	42°45'N	119°00'W	1.000220		0	228,600	0.000	750,000.000
411007	OR CGP	Canyonville-Grants Pass	TM	42°00'N	123°20'W	1.000070		0	190,500	0.000	625,000.000
411008	OR CRN	Coast Range North	LC1	45°35'N	123°21'W	1.000045		76,200	228,600	250,000.000	750,000.000
411009	OR CRE	Columbia River East	LC1	45°40'N	120°45'W	1.000008		76,200	266,700	250,000.000	875,000.000
411010	OR CRW	Columbia River West	OMC	46°00'N	123°15'W	1.000000	-65	76,200	228,600	250,000.000	750,000.000
411011	OR CGC	Cottage Grove-Canyonville	TM	42°30'N	123°20'W	1.000023		0	228,600	0.000	750,000.000
411012	OR DPC	Dayville-Prairie City	TM	43°30'N	119°38'W	1.000120		0	228,600	0.000	750,000.000
411013	OR DB	Denio-Burns	TM	41°15'N	118°25'W	1.000190		0	381,000	0.000	1,250,000.000
411014	OR DM	Dufur-Madras	TM	44°00'N	121°00'W	1.000110		0	266,700	0.000	875,000.000
411015	OR EUG	Eugene	TM	43°15'N	123°10'W	1.000015		0	190,500	0.000	625,000.000
411016	OR GPA	Grants Pass-Ashland	TM	41°15'N	123°20'W	1.000043		0	228,600	0.000	750,000.000
411017	OR GWS	Gresham-Warm Springs	TM	44°30'N	122°20'W	1.000050		0	190,500	0.000	625,000.000
411018	OR HALF	Halfway	LC1	45°15'N	117°00'W	1.000085		114,300	228,600	375,000.000	750,000.000
411019	OR LAGR	La Grande	TM	44°30'N	118°00'W	1.000130		0	190,500	0.000	625,000.000
411020	OR MDL	Medford-Diamond Lake	LC1	42°00'N	122°15'W	1.000040		0	228,600	0.000	750,000.000
411021	OR MITL	Mitchell	LC1	47°00'N	120°15'W	0.999270		342,900	190,500	1,125,000.000	625,000.000
411022	OR NC	North Central	LC1	46°10'N	120°15'W	1.000000		190,500	266,700	625,000.000	875,000.000
411023	OR OS	Ochoco Summit	LC1	43°30'N	120°45'W	1.000060		0	190,500	0.000	625,000.000
411024	OR ONT	Ontario	TM	42°45'N	117°00'W	1.000100		0	304,800	0.000	1,000,000.000
411025	OR OC	Coast	OMC	44°45'N	124°03'W	1.000000	5	381,000	647,700	1,250,000.000	2,125,000.000
411026	OR OWY	Owyhee	TM	41°15'N	117°35'W	1.000180		0	304,800	0.000	1,000,000.000
411027	OR PEND	Pendleton	TM	45°00'N	119°10'W	1.000045		0	190,500	0.000	625,000.000
411028	OR PL	Pendleton-La Grande	TM	44°15'N	118°20'W	1.000175		0	190,500	0.000	625,000.000
411029	OR PRU	Pilot Rock-Ukiah	LC1	46°10'N	119°15'W	1.000025		190,500	228,600	625,000.000	750,000.000
411030	OR PTLD	Portland	LC1	45°30'N	122°45'W	1.000002		76,200	190,500	250,000.000	625,000.000
411031	OR PCB	Prairie City-Brogan	LC1	44°00'N	118°15'W	1.000170		38,100	228,600	125,000.000	750,000.000
411032	OR RL	Riley-Lakeview	TM	41°15'N	120°20'W	1.000215		0	342,900	0.000	1,125,000.000
411033	OR SALM	Salem	TM	43°45'N	123°05'W	1.000010		0	266,700	0.000	875,000.000
411034	OR SANP	Santiam Pass	TM	43°30'N	122°30'W	1.000155		0	152,400	0.000	500,000.000
411035	OR SISP	Siskiyou Pass	LC1	42°30'N	122°30'W	1.000150		114,300	190,500	375,000.000	625,000.000
411036	OR UF	Ukiah-Fox	LC1	45°15'N	119°00'W	1.000140		152,400	228,600	500,000.000	750,000.000
411037	OR WALL	Wallowa	TM	44°30'N	117°30'W	1.000195		0	266,700	0.000	875,000.000
411038	OR WH	Warner Highway	LC1	42°30'N	119°45'W	1.000245		114,300	190,500	375,000.000	625,000.000
411039	OR WP	Willamette Pass	TM	42°30'N	122°00'W	1.000223		0	228,600	0.000	750,000.000

OREGON

ZONE BOUNDARIES

- **Are we OK with the slight modifications?**
- Has no impact on coordinate system performance
- Produces slightly better statistics for reporting

SPCS2022 Zone Boundaries As Revised by NGS May 2024



User: Brady.Callahan

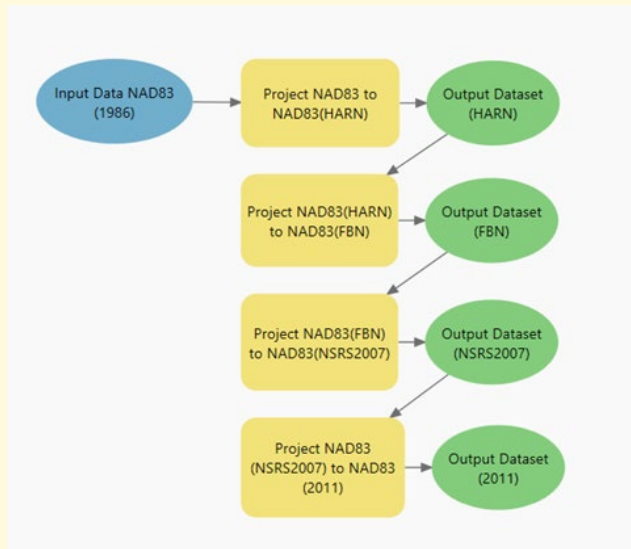
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NEW COORDINATE SYSTEMS/DATUM

NGS RECOMMENDATION

Migrate data to SRS based on NAD83(2011)

- Step through all intermediate realizations (no “jump over transforms”)



NGS NADCON 5 Technical Report

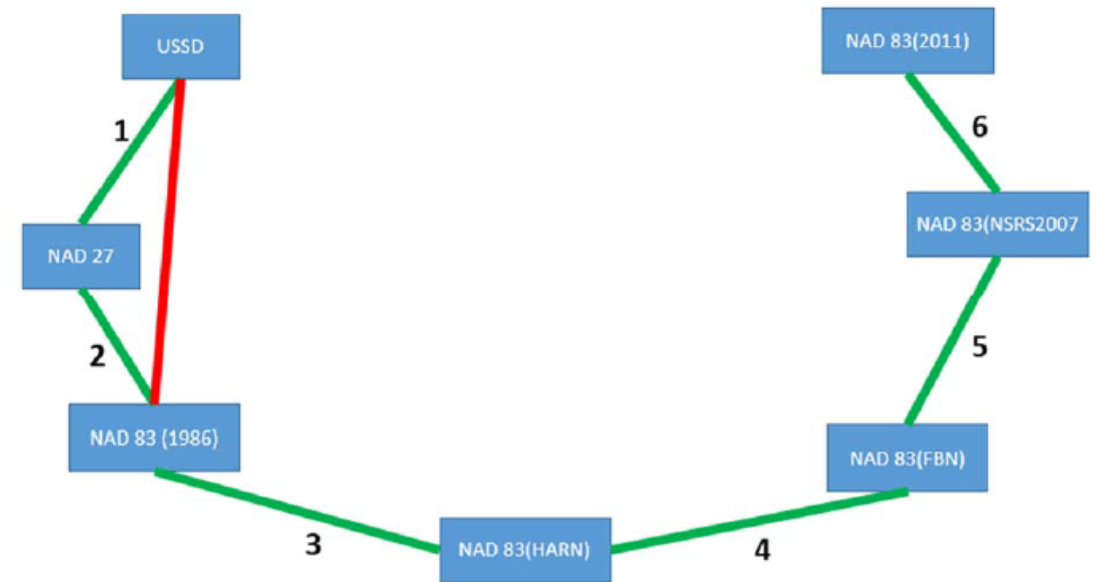


Figure 3-1: Chronological chain of transformations in CONUS (green), with potential realization skipping transformation (red)

Consider a potential transformation from USSD to NAD 83(1986), shown as a red line. Because each transformation is built by pairs of coordinates, there is absolutely no way to ensure (in fact, it's a ridiculous assumption) that the points with USSD/NAD 27 pairs, and the points with NAD 27/NAD 83(1986) pairs are the same, or that either one would align with the points with USSD/NAD 83(1986) pairs. As such, knowing the very data itself can not be identical, it is a simple matter to predict that a grid created along the red line will not be identical to that created by going through the two green lines (1 and 2). Therefore, with non-uniqueness being an issue, NGS chose not to create

NEW COORDINATE SYSTEMS/DATUM

TRANSFORM REQUIREMENTS

Esri software users need to install the supplemental **ArcGIS Coordinate Systems Data** available from My Esri

ESRI Transformation Names for CONUS

- NAD_1927_To_NAD_1983_7 (WKID::8555)
- NAD_1983_To_NAD_1983_HARN_47 (WKID::8556)
- NAD_1983_HARN_To_FBN_NADCON5_3D_CONUS_1 (WKID::8861)
- NAD_1983_FBN_To_NSRS2007_NADCON5_3D_CONUS_1 (WKID::8862)
- NAD_1983_NSRS2007_To_2011_NADCON5_3D_CONUS_1 (WKID::8559)

SPCS2022 AND OREGON

ROLLOUT FOR OREGON

- Adoption of Statewide zone by OGIC – **mid 2026**
 - *Post official NSRS adoption*
 - Recommendation by TAC
- Addition of new 39+1 zones to OAR – **end 2027**
 - Advisory committee meeting July 2024
 - Anticipated rulemaking early 2027



SPCS2022 AND OREGON

ROLLOUT FOR OREGON



What support does our community need?

Has your agency/org started talking about new datums/SPCS2022?

- GEO plans to host Webpage to share content and communications
 - Links to NGS pages
 - Proposed Oregon SPCS2022 parameters, graphics
 - General guidelines
 - Oregon specific guidelines when ready