Digital Elevation Model of the Central Oregon Coast V2: Procedures, Data Sources and Analysis

Prepared for the Pacific Marine Environmental Laboratory (PMEL), NOAA Center for Tsunami Research Program by the NOAA, National Centers for Environmental Information (NCEI)
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Summary

In January of 2016, NOAA's National Centers for Environmental Information (NCEI) updated an integrated bathymetric–topographic digital elevation model (DEM) of the Central Oregon Coast for the Pacific Marine Environmental Laboratory (PMEL), NOAA Center for Tsunami Research Program. The DEM will be used to support modeling tsunami generation, propagation, and inundation. The DEM covers the Central Oregon Coast including communities of the Yaquina Bay, Newport, Siletz Bay and Depoe Bay. Extents of this DEM, procedures, data sources, and analysis are described below. The methodologies used by NCEI in developing DEM's are described in the NOAA Technical Memorandum-52 for Central California and San Francisco Bay (Carignan et al., 2011).

DEM Specifications

The Central Oregon DEM was built to the specifications listed in Table 1. Figure 1 shows this 1/3 arc-second Central Oregon Coast DEM integrated topographic–bathymetric DEM boundary in red.

Table 1. Specifications for the nested Central Oregon Coast DEM.

	Coverage
Cell Size	1/3 arc seconds
Extents	-124.63° to -123.81° W, 43.70° to 45.14° N
Coordinate System	Geographic decimal degrees
Horizontal Datum	World Geodetic System 1984 (WGS 84)
Vertical Datum	Mean High Water (MHW)
Vertical Units	Meters
Grid Format	ASCII raster grid

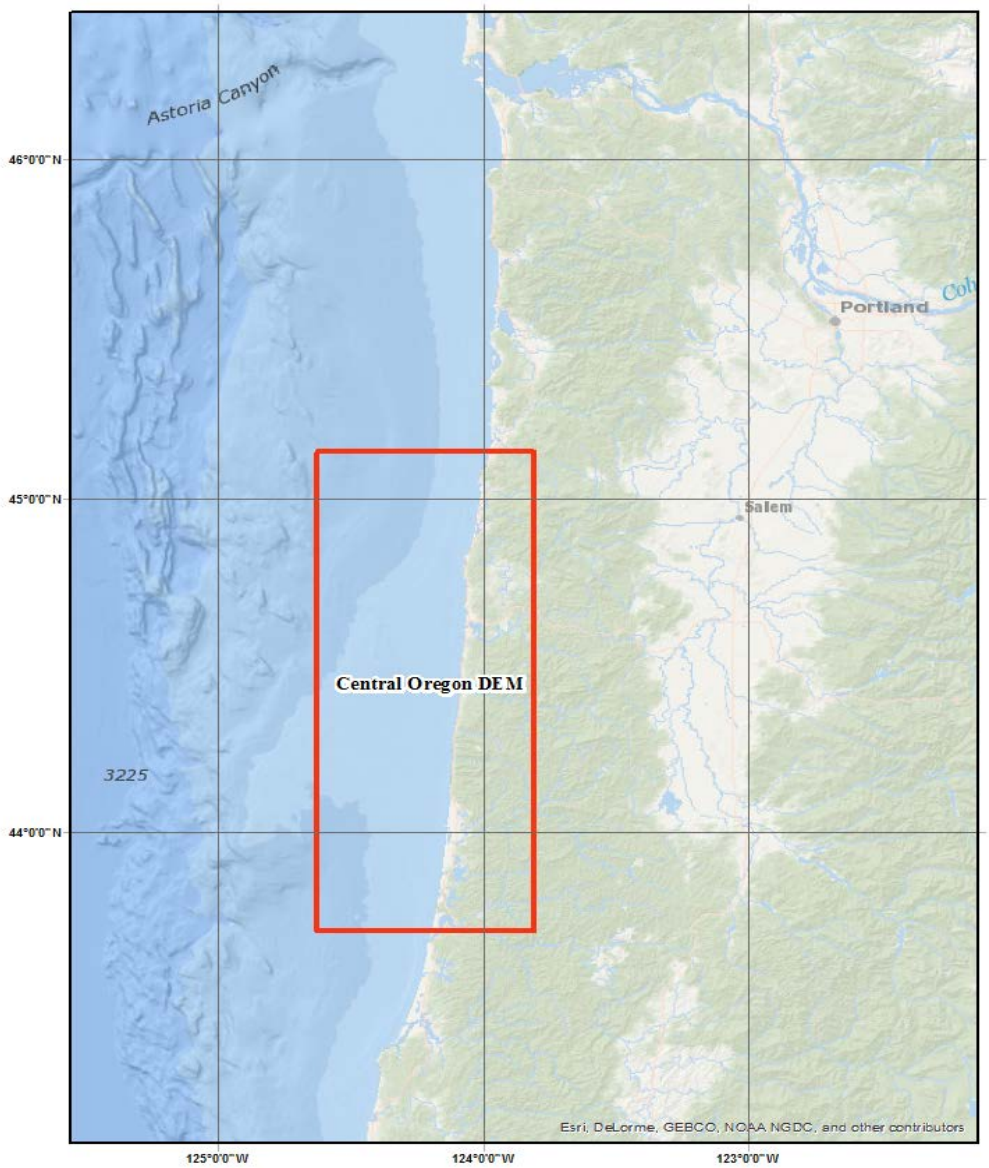

Figure 1. Map image of boundary for the 1/3 arc second DEM in red.

Data Sources and Processing

Digital coastlines were extracted from NOAA's Office of Coast Survey (OCS) ENC Direct to GIS online extraction service (http://nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm). These coastlines were merged and edited to match either recently acquired high resolution lidar data or imagery available via Google Earth and ESRI's World Imagery map service (http://www.arcgis.com/features/maps/imagery.html). Bathymetric and topographic data were downloaded from NOAA's Office for Coastal Management (OCM), the U.S. Geological Society (USGS), the National Centers for Environmental Information (NCEI), the Oregon Department of Fish and Wildlife (ORDFW), Oregon State University (OSU), the Oregon Department of Geology and Minerals Industries (DOGAMI), NOAA's Pacific Marine Environmental Laboratory (PMEL), and the United States Army Corps of Engineers (USACE). Figure 2 shows the source and coverage of the datasets used in developing the Central Oregon Coast DEM.

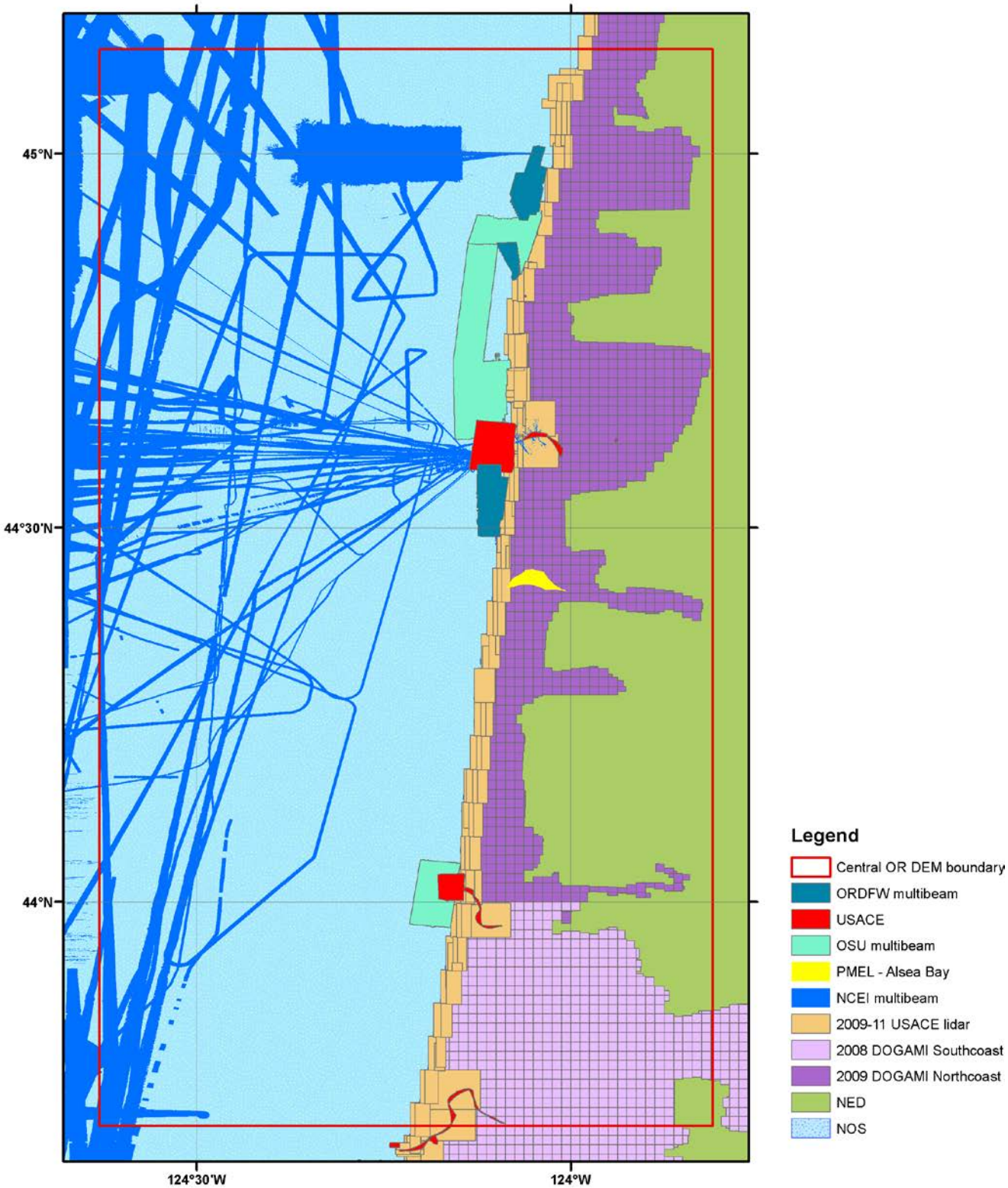

Figure 2. Source and coverage of the datasets used in compiling the Central Oregon Coast DEM.

Table 2: Bathymetric data sources used in compiling the Central Oregon Coast DEM.

Source	*Year*	*Data Type*	*Spatial Resolution*	*Original Horizontal Datum*	*Original Vertical Datum*
NOS	1927 to 2010	Hydrographic survey soundings	Ranges from 10 m to 1 km (varies with scale of survey)	NAD 27 or NAD 83	MLLW
USACE	2005 to 2015	Hydrographic survey soundings	Various, from 3 to 40 meter point spacing	NAD 83 Oregon State Plane (feet)	MLLW
NCEI	1987 to 2003	Multibeam sonar files	Raw MB files gridded to 1/3 arc second	WGS 84	Assumed MSL
PMEL	2002	Extracted bathymetric points	10 meters	WGS 84	MSL
ORDFW/OSU	2003	Multibeam sonar files	1 meter point data 2 meter DEM	WGS 84 UTM Zone North	MLLW

Table 2 lists the bathymetry data used in the compilation of the Central Oregon Coast DEM including NOS hydrographic surveys (Appendix A), multibeam surveys (Appendix B) and USACE hydrographic surveys (Appendix C). Bathymetric data were transformed to WGS 84 geographic and NAVD 88 using GDAL and NOAA's VDatum transformation tool. Where recent, higher resolution data exists, older data were superseded. The topographic-bathymetric lidar data were filtered to select and use only the bathymetric classed points in generating the bathymetric surface. The bathymetric data were converted to xyz format before combining with the coastline data to generate a bathymetric pre-surface at 1/3 arc-second. This bathymetric surface grid was converted to xyz format before incorporating in the final DEM.

Table 3: Topographic-Bathymetric data source used in compiling the Central Oregon Coast DEM.

Source	*Date*	*Data Type*	*Spatial Resolution*	*Horizontal Datum*	*Vertical Datum*
2010-11 U.S. Army Corps of Engineers (USACE) JALBTCX Topo-bathy Lidar	2010 to 2011	Topographic-Bathymetric Lidar DEM	2 meter grid	NAD 83 geographic	NAVD 88

Table 4: Topographic data sources used in compiling the Central Oregon Coast DEM.

Source	*Year*	*Data Type*	*Spatial Resolution*	*Original Horizontal Datum*	*Original Vertical Datum*
2009 OR DOGAMI Oregon Lidar: North Coast	2008 to 2009	Lidar LAS	≥ 8 points per m2	NAD 83 geographic	NAVD 88
2008 - 2009 OR DOGAMI South Coast LiDAR	2008 to 2009	Lidar LAS	≥ 8 points per m^2	NAD 83 geographic	NAVD 88
USGS NED	1999	Topographic DEM	1/3 arc second	NAD 83 geographic	NAVD 88
ENC Elevations	2008	S-57 extracted points		WGS 84 geographic	MHW
NCEI digitized jetties		Digitized Points		WGS 84 geographic	MHW

Bathymetric-topographic and topographic data used in developing the Central Oregon Coast DEM are listed in Tables 3 and 4. Lidar LAS files were filtered to retain only ground classification points. Transformations to WGS 84 geographic were done using GDAL. The converted data files were clipped to the coastline to remove NoData values or filtered to remove returns over water. All topographic data were converted to xyz format for the final gridding process.

DEM Development

Development of the Central Oregon Coast DEM followed procedures documented in NOAA Technical Memorandum NGDC-52 for Central California and San Francisco Bay (Carignan et al., 2011). Exceptions being the bathymetric pre-surface was generated at 1/3 arc-second. Gridding weight was modified to Table 5.

Table 5: Data hierarchy used to assign gridding weight in MB-System.

Dataset	*Relative Gridding Weight*
2010-11 U.S. Army Corps of Engineers (USACE) JALBTCX Topo-bathy Lidar (only ground class)	100
2009 OR DOGAMI Oregon Lidar: North Coast	10
2008 - 2009 OR DOGAMI South Coast Lidar	10
NCEI digitized jetties	100
ORDFW/OSU Multibeam surveys	100
NOS Hydrographic surveys	100
USACE surveys	10
USGS NED	1
Bathy pre-surface	1

MHW DEM Development

The MHW Central Oregon Coast DEM was developed by generating a conversion grid based on VDatum software. The conversion grid was then used to convert the existing NAVD88 DEM.

DEM Analysis

The completed Central Oregon Coast DEM was compared to NGS topographic benchmarks and high resolution imagery. Inconsistencies were evaluated and resolved based on most current or reliable data available.

Acknowledgement

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Reference

Carignan, K.S., L.A. Taylor, B.W. Eakins, R.J. Caldwell, D.Z. Friday, P.R. Grothe, E. Lim (2011). Digital Elevation Models of Central California and San Francisco Bay: Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-52, NOAA, pp. 49.

VDatum Version 3.4, Central Oregon Coast – Pt. Buchon to Cape Flattery, Washington v.1 (2010). http://vdatum.noaa.gov/welcome.html [October 2010]

Appendix A: NOS Hydrographic surveys

Survey ID	*Scale*	*Date*	*Digital Data Horizontal Datum*	*Vertical Datum*	*Original Horizontal Datum*
H04746	20,000	1927	NAD 27	MLLW	NAD 13
H04747	20,000	1927	NAD 27	MLLW	NAD 13
H04748	20,000	1927	NAD 27	MLLW	NAD 13
H04749	20,000	1927	NAD 27	MLLW	NAD 13
H04753	120,000	1927	NAD 27	MLLW	NAD 13
H04754	80,000	1927	NAD 27	MLLW	NAD 27
H04756	40,000	1927	NAD 27	MLLW	NAD 13
H04757	120,000	1927	NAD 27	MLLW	NAD 13
H04758	80,000	1927	NAD 27	MLLW	NAD 27
H04878	20,000	1928	NAD 27	MLLW	NAD 13
H04879	20,000	1928	NAD 27	MLLW	NAD 13
H04880	20,000	1928	NAD 27	MLLW	NAD 13
H04881	20,000	1928	NAD 27	MLLW	NAD 13
H04882	40,000	1928	NAD 27	MLLW	NAD 13
H04883	40,000	1928	NAD 27	MLLW	NAD 13
H04884	20,000	1928	NAD 27	MLLW	NAD 13
H04885	20,000	1928	NAD 27	MLLW	NAD 13
H04888	120,000	1928	NAD 27	MLLW	NAD 13
H04889	120,000	1928	NAD 27	MLLW	NAD 13
H04890	40,000	1928	NAD 27	MLLW	NAD 13
H04894	40,000	1928	NAD 27	MLLW	NAD 13
H04895	80,000	1928	NAD 27	MLLW	NAD 27
H04896a	80,000	1928	NAD 27	MLLW	NAD 27
H07896	5,000	1952	NAD 27	MLLW	NAD 27
H08039	5,000	1953	NAD 27	MLLW	NAD 27
H08040	10,000	1953	NAD 27	MLLW	NAD 27
H08041	10,000	1953	NAD 27	MLLW	NAD 27
H09238	10,000	1971	NAD 27	MLLW	NAD 27
H09239	10,000	1971	NAD 27	MLLW	NAD 27
H09240	2,500	1971	NAD 27	MLLW	NAD 27
B00019	50,000	1985	NAD 83	MLLW	NAD 83
B00020	50,000	1985	NAD 83	MLLW	NAD 83
B00048	50,000	1986	NAD 83	MLLW	NAD 83
B00051	50,000	1986	NAD 83	MLLW	NAD 83
B00095	20,000	1987	NAD 83	MLLW	NAD 83
H12127	20,000	2008	NAD 83	MLLW	NAD 83
H12128	20,000	2010	NAD 83	MLLW	NAD 83
H12129	20.000	2009	NAD 83	MLLW	NAD 83
H11989	5,000	2008	NAD 83	MLLW	NAD 83

Appendix B: NCEI Multibeam surveys

Cruise ID	*Ship*	*Year*	*Original Vertical Datum*	*Original Horizontal Datum*	*Institution*
AII8L20	Atlantis II	1987	Assumed mean sea level	WGS 84	University of Rhode Island (URI)
AII8L21	Atlantis II	1987	Assumed mean sea level	WGS 84	University of Rhode Island
AII8L22	Atlantis II	1987	Assumed mean sea level	WGS 84	University of Rhode Island
RNDB05WT	Washington	1988	Assumed mean sea level	WGS 84	University of California, Scripps Institution of Oceanography (UC/ISO)
SO108	Sonne	1996	Assumed mean sea level	WGS 84	University of Kiel, Germany, GEOMAR Forshungszentrum
Tecfluc	Ocean Alert (1)	1998	Assumed mean sea level	WGS 84	Monterey Bay Aquarium Research Institute (MBARI)
Tran2new	Ocean Alert (2)	1999	Assumed mean sea level	WGS 84	Monterey Bay Aquarium Research Institute
Heceta	Ocean Alert	1998	Assumed mean sea level	WGS 84	Monterey Bay Aquarium Research Institute
LWAD99MV	Melville	1999	Assumed mean sea level	WGS 84	University of California, Scripps Institute of Oceanography
AT07L20	Atlantis I	2002	Assumed mean sea level	WGS 84	Woods Hole Oceanographic Institution (WHOI)
AT07L14	Atlantis I	2002	Assumed mean sea level	WGS 84	Woods Hole Oceanographic Institution
CNTL04RR	Revelle	2003	Assumed mean sea level	WGS 84	University of California, Scripps Institution of Oceanography

Appendix C: USACE Hydrographic surveys

Survey Title/River Mile	*Date*	*Original Vertical Datum*	*Original Horizontal Datum*
DP_01_DEP Boat Basin	2014	MLLW	NAD 83
YB_00_YBA Offshore	2014	MLLW	NAD 83
YB_00_YBN Offshore	2015	MLLW	NAD 83
YB_00_YBS Offshore	2015	MLLW	NAD 83
YB_01_YB1 -01-00 to 00+25	2015	MLLW	NAD 83
YB_02_YB2 00+25 to 02+21	2015	MLLW	NAD 83
YB_03_YB3 02+21 to 04+40	2013	MLLW	NAD 83
YB_04_YR1 04+40 to 07+30	2015	MLLW	NAD 83
YB_05_YR2 07+30 to 10+00	2015	MLLW	NAD 83
YB_06_YR3 10+00 to 13+30	2015	MLLW	NAD 83
YB_07_DSL 00+00 to 00+17+28		MLLW	NAD 83
UM_00_UMA Offshore	2014	MLLW	NAD 83
UM_00_UMN Offshore	2015	MLLW	NAD 83
UM_00_UMS Offshore	2014	MLLW	NAD 83
UM_01_UM1 -01-20 to 01+07	2015	MLLW	NAD 83
UM_02_UM2 01+07 to 03+14	2014	MLLW	NAD 83
UM_03_UM3 03+14 to 05+18	2015	MLLW	NAD 83
UM_04_UM4 05+18 to 07+25	2015	MLLW	NAD 83
UM_05_UM5 07+25 to 09+35	2015	MLLW	NAD 83
UM_06_UM6 09+35 to 11+40	2015	MLLW	NAD 83
UM_07_WIN East & West Boat Basin	2015	MLLW	NAD 83
SL_00_SSA Offshore	2014	MLLW	NAD 83
SL_00_SSN Offshore	2015	MLLW	NAD 83
SL_00_SSS Offshore	2015	MLLW	NAD 83
SL_01_SS1 -00-40 to 00+45	2015	MLLW	NAD 83
SL_02_SS2 00+45 to 02+17	2015	MLLW	NAD 83
SL_03_SS3 02+17 to 04+00	2015	MLLW	NAD 83
SL_04_SS4 04+00 to 05+25	2014	MLLW	NAD 83
SL_05_SS5 05+25 to 06+47	2013	MLLW	NAD 83
SL_06_SS6 06+47 to 08+23	2010	MLLW	NAD 83
SL_07_SS7 08+23 to 10+10	2010	MLLW	NAD 83
SL_08_SS8 10+10 to 11+40	2010	MLLW	NAD 83
SL_09_SS9 11+40 to 13+10	2010	MLLW	NAD 83
SL_10_S10 13+10 to 14+40	2010	MLLW	NAD 83
SL_11_S11 14+40 to 16+10	2010	MLLW	NAD 83
SL_12_S12 No Channel	2010	MLLW	NAD 83
SL_13_S13 No Channel	2010	MLLW	NAD 83