

Brant Spit and The Portage Monitoring – 2015, Final Report

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Prepared by: Coastal Geologic Services Inc.

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Dec. 7, 2015

Introduction

This report serves to document changing conditions along the length of Brant Spit and The Portage (the spits), both associated with Portage Island, Lummi Indian Reservation, WA (Sheet 1). The spits are both accretional shoreforms, which have prograded northward from Portage Island. The spits are down-drift from the erosional feeder bluffs of southern Portage Island. The spits are important tribal properties that continue to serve as shellfish growing and harvesting areas for the Lummi Nation.

Past monitoring by Coastal Geologic Services, Inc. (CGS) began in 2003. Included here are the results of the most recent observations from 2015 along with a comparison of the spit crest to previous monitoring data.

Methods

Brant Spit

Topographic surveying along an approximately 2,800 FT length of beach along the Brant Spit complex was completed on August 27, 2015. Surveying was conducted with a Leica TCR-1105 total station with direct rod measurements. The survey used monuments previously established by CGS in the backshore at the base of the spit.

Mapping extended from the vegetation line and/or berm crest down to +5 FT mean lower low water (MLLW) on the west side and down to +7 FT MLLW on the east side. The main objective of the mapping extent was to accurately measure the middle and upper beachface, storm berm crest, and spit crest along the length of Brant Spit where the spit was low and frequently allowed circulation from Bellingham Bay to Portage Bay.

The survey elevation points were imported into AutoCAD Civil 3D 2015 where they were used to generate a 3D model of the spit. This surface was used to create a 1 FT contour interval map at 1"=200'. The August 2015 topography was compared to topography from September 2011, and a surface change map was created.

The Portage

Topographic surveying along an approximately 2,000 FT length of beach along the landform known as “The Portage” was completed on July 29, 2015. Surveying was conducted with a Leica TCR-1105 total station with direct rod measurements. The survey used monuments set by Pacific Survey and Engineering along Lummi Shore Road along with additional monuments set by CGS at the southern end of The Portage. Mapping extended from the spit crest down to +6 FT MLLW. The main objective of the mapping was to accurately measure the upper beachface, storm berm crest, and bar crest.

The survey points were imported into AutoCAD Civil 3D 2015 where they were used to generate a 3D model of the spit. This surface was used to create a 1 FT contour interval map at 1"=200'. The July 2015 topography was compared to topography from October 2005, and a surface change map was created.

Results

Brant Spit

Topography from the August 27, 2015 survey area (Sheet 1) is shown on Sheet 2. Data coverage extended from the vegetated uplands at the south end to Brant Point on the northwest end. The 2015 survey extent was slightly less in the north and northwest end than the 2011 survey due to budget limitations, with focus on the south and central portions of the spit and less coverage in the north end.

Overall, Brant Spit has lowered considerably since monitoring began in 2003 (Figure 1). In both 2003 and 2005, the crest in the northern half of the spit was between +10 and +12 FT MLLW, while the majority now lies between +9 and +10. The southern, vegetated portion of the spit has progressively prograded northward, adding more than 600 FT of overall length since 2003. The northern end of the spit, which was predominantly upland above MHHW, was only surveyed at its eastern extent where it had previously been eroded. Therefore the spit crest data longitudinal profile (Figure 1) does not extend through the high elevation “island” like area. The eastern end of Brant Point however, has continued to erode since 2011, with an additional 50–60 FT of horizontal erosion.

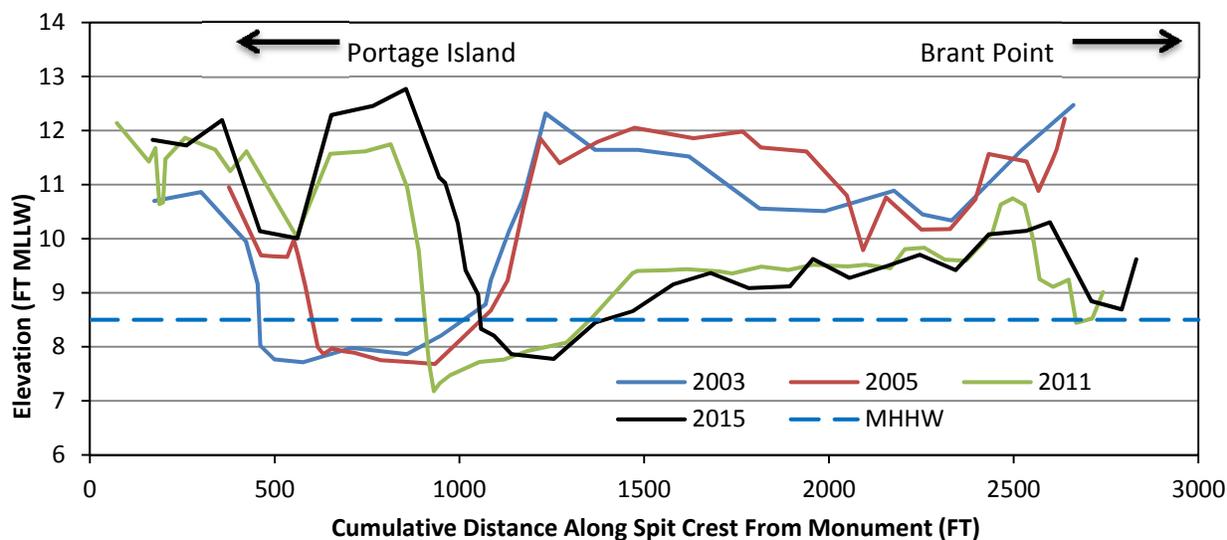


Figure 1. Brant Spit crest south of Brandt Point uplands/“island”, south (left) to north (right)

The length of spit crest that was below mean higher high water (MHHW) has been steadily decreasing from the 545 FT seen in 2003 down to a 334 FT gap in 2015 (Figures 1–3, Sheet 3). The elevation of the crest of the spit (bar) here was generally between +7.8 and +8.2 FT MLLW in this segment. This low area would allow a substantial amount of tidal flow over the spit during high water periods, which would influence water circulation and water quality in Portage Bay. The low elevation of the spit crest tended to promote the formation of a narrow and steep, but short, berm crest for the majority of the spit's length (Figures 2 and 3).



Figure 2. North end of low elevation portion of Brandt Spit looking south next to the spit crest.



Figure 3. Near north end of low elevation area of Brant spit looking north at the spit crest.

When a topographic sheet (T-sheet 1797b) from 1887 T-sheet is examined, it showed what appeared to be a continuous spit crest above MHHW. No elevations were given in the older mapping but the width of the spit crest area between the mapped MHW lines on either shore was generally 25–45 FT, which is similar or slightly less than distances surveyed in 2015.

The location of the spit crest has progressively moved to the west/southwest since 2003, generally on the order of 15 to 20 FT. This was caused by the much greater fetch (open water distance over which waves form) on the Bellingham Bay shore as compared to the Portage Bay shore. Additionally the Portage Bay is much shallower, resulting in limited-size wind wave generation. This is a common process known as barrier rollover or spit migration.

Brief examination of the location of the mapped mean high water line (MHW) from the 1887 T-sheet shows that the majority of the length of the spit has shifted approximately 60–80 FT to the west by 2015. The eastern point of the Brant Point high elevation (“island” like area) has shifted approximately 220–260 FT to the west between 1887 and 2015. Therefore major the recent trends area consistent with long-term trends. Earlier historical work is further detailed in Johannessen and Chase (2003).

Just over half (56%) of the area compared was relatively stable with less than 0.25 FT of vertical change as compared to the 2011 topographic surface (Sheet 4). The southern end of the comparison area experienced minor erosion on the Bellingham Bay side and significant accretion (up to 5.3 FT) where the spit crest has prograded, as a result of northward shift of the low elevation portion of the spit crest. The northern end of the area compared experienced erosion and a shifting of the berm crest 5 to 10 FT to the west (Sheets 3–4). The spit crest has accreted somewhat in the far northern end of the comparison area, with the majority of the gains on the west side of the crest. The eastern extent of the uplands at

Brant Point experienced up to 3 FT of erosion, which is readily seen in the surface change comparison (Sheet 4).

The Portage

Topography of The Portage was mapped on July 29, 2015 (Sheet 5). The majority of the spit had its crest below the elevation of MHHW (Sheet 6).

The low elevation portion of The Portage has exhibited a northward transition, with accretion to the spit extending from Portage Island (Figure 4) and corresponding erosion approximately 350 FT south of where it joins with the Lummi Peninsula (Figure 5). Of particular note was a large amount of sediment accreted in the central portion of the spit and a shift of the tide channel location by approximately 340 FT to the north (Figure 6, Sheet 5). However, The lowest elevation of the channel did not change appreciably, remaining just above +2.1 FT MLLW.

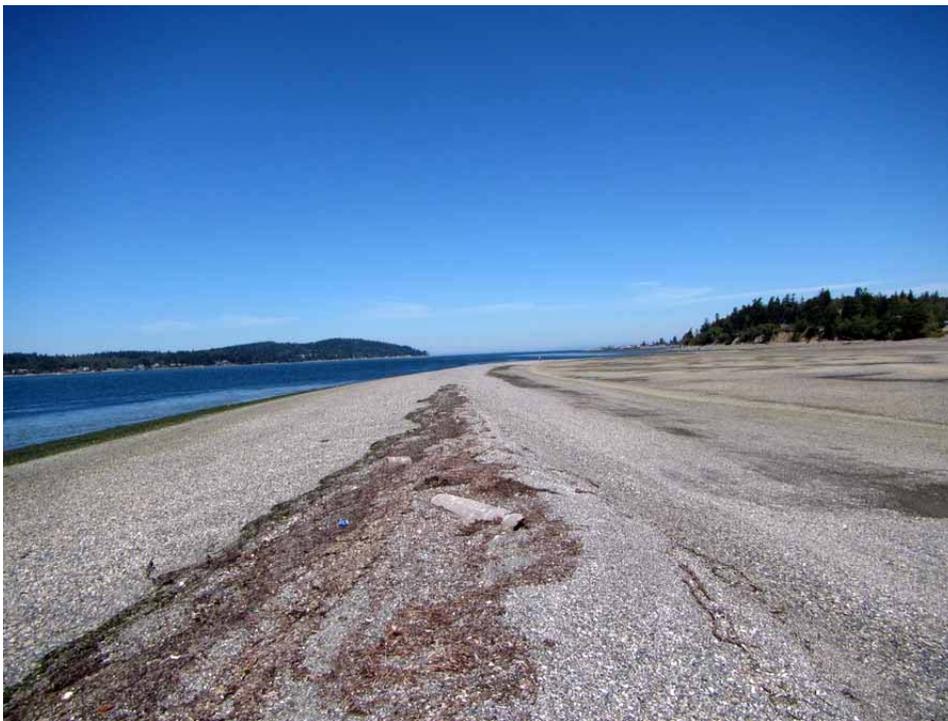


Figure 4. The Portage bar looking north from the vegetated portion of the spit.



Figure 5. The Portage bar platform looking southwest from the Lummi Peninsula.

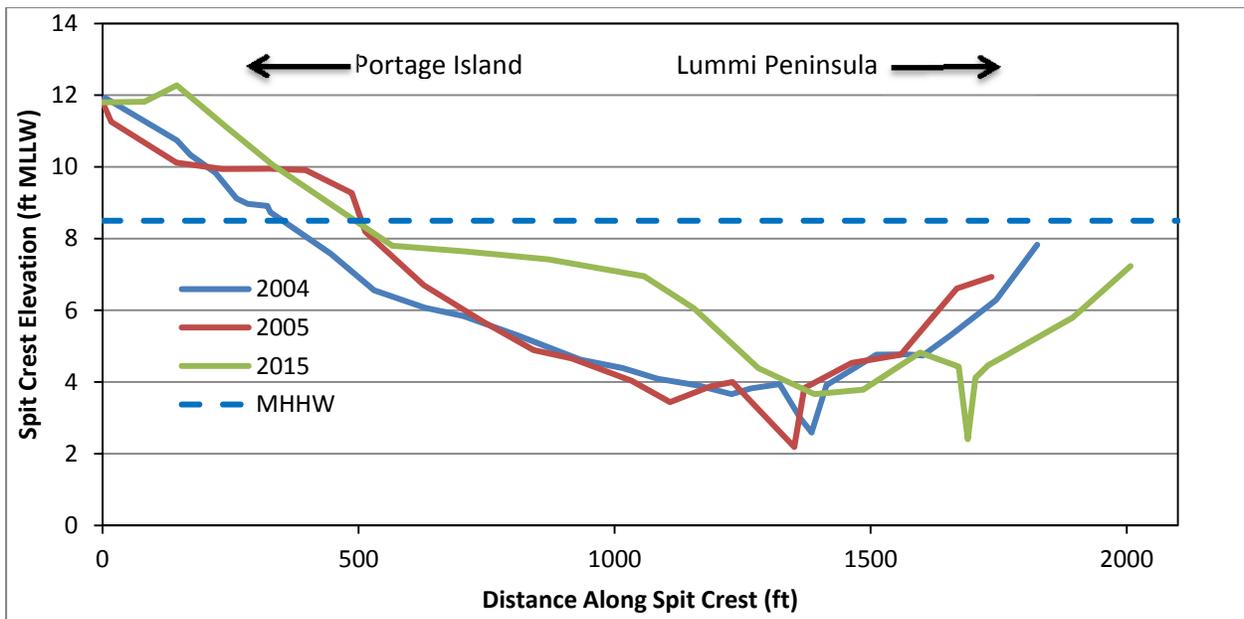


Figure 6. Portage Spit Crest, South (left) to North (right).

The crest of The Portage has been dynamic since monitoring began in 2004 (Sheet 6). The southern area moved westward between 2004 and 2005, with slight additional apparent accretion on the west through 2015. Similar to Brant Spit, the central area has shifted to the east, likely due to the greater wave energy from Hale Pass. The northern reach of The Portage has shifted slightly to the west.

Brief examination of the location of the mapped mean high water line (MHW) at The Portage on the 1887 T-sheet shows that the relatively narrow and low northern half of the spit has shifted up to 330 FT to the west by 2015. Therefore the northern portion of spit has been in a very different location during the survey monitoring period between 2004 and 2015 as compared to the late 1880s. Earlier historical work is further detailed in Johannessen and Chase (2003).

About one-quarter of the comparison area (27%) showed relative stability with less than 0.25 FT of vertical change as compared to the 2011 topographic surface (Sheet 7). Approximately 41% of the comparison area was at least 0.25 FT higher than in 2005, with a net gain of 490 cubic yards (CY) of sediment along the upper spit elevations. The majority of the accretion was in the area closer to Portage Island, representing an extension of the higher elevations of the spit toward the Lummi Peninsula.

References

Johannessen, J. W. and M. A. Chase, 2003. Coastal Processes, Historic Shoreline Change, and Sediment Distribution of Portage Bay, Lummi Indian Reservation, WA, In: Droscher, Toni and David A. Fraser (eds.) 2003 Georgia Basin/Puget Sound Research Conference, March 31-April 3, 2003, Vancouver, British Columbia - Proceedings (Dec, 2003). Excerpted from longer report prepared for LIBC.

Coastal Geologic Services, Inc.



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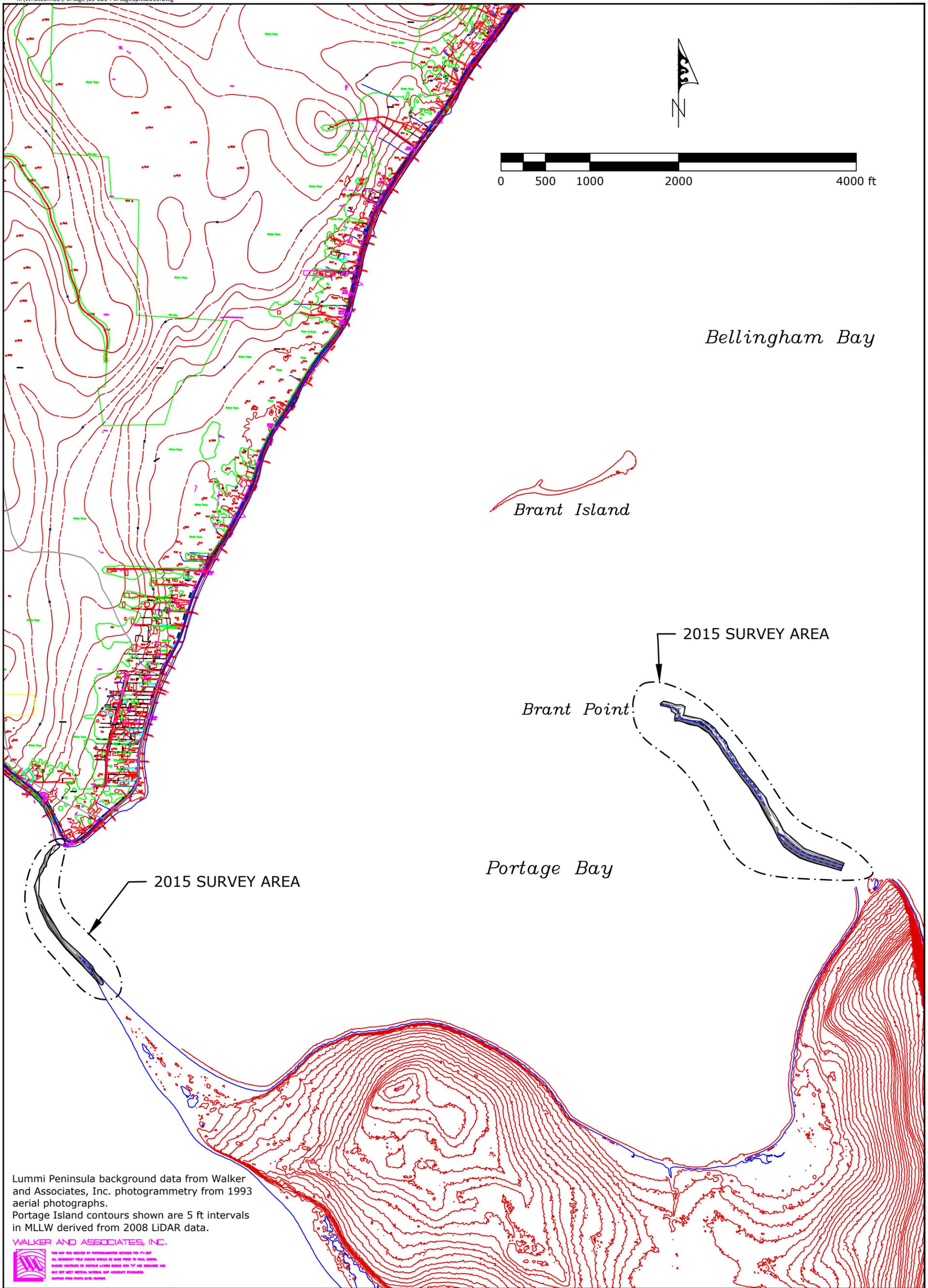


James W. Johannessen

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Licensed Engineering Geologist, MS

ATTACHMENTS

- Sheet 1.** Location map
- Sheet 2.** Brant Spit 2015 Topography
- Sheet 3.** Brant Spit Crest and MHHW Gap Comparison
- Sheet 4.** Brant Spit Surface Change, 2011 to 2015
- Sheet 5.** The Portage 2015 Topography
- Sheet 6.** The Portage Spit Crest
- Sheet 7.** The Portage Surface Change, 2005 to 2015



Lummi Peninsula background data from Walker and Associates, Inc. photogrammetry from 1993 aerial photographs.
 Portage Island contours shown are 5 ft intervals in MLLW derived from 2008 LiDAR data.

WALKER AND ASSOCIATES, INC.
THIS MAP WAS CREATED BY PHOTOGRAMMETRY METHODS FOR 1/4"=100'
 ALL NECESSARY FIELD CHECKS SHOULD BE MADE PRIOR TO FINAL ADJUST.
 SHOWN CONTOURS ON COASTAL LINES SHOWN WITH "P" ARE DERIVED AND
 MAY NOT MEET VERTICAL DATUM, MAP ACCURACY STANDARDS.
 SHIPPED FROM PHOTO DATA MAPPING

OF: 7

1

SHEET:

DATE: 12/7/15

SCALE: AS NOTED

MLLW=0.0'

Brandt Spit Change Analysis Portage Spits and Vicinity

Lummi Indian Business Council

DRAWN BY: JFW	REVISIONS
DESIGNED BY:	
CHECKED BY: JWJ	
DATE SURVEYED:	
Portage 7/29/15	
Brant 8/27/15	

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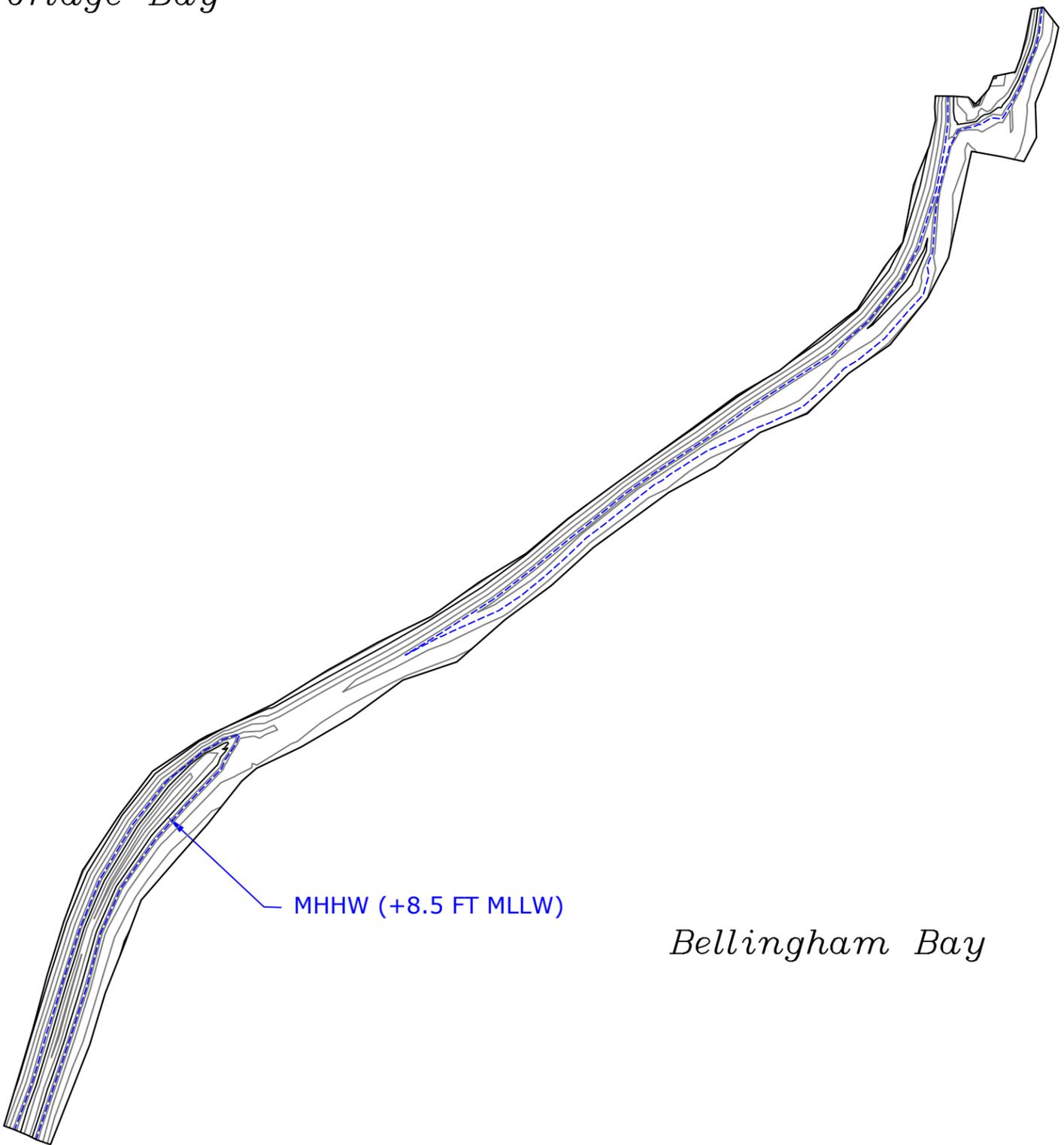


Brant Spit Mon #1
N: 632516.394
E: 1207277.786
Z: +11.04' MLLW



Brant Point

Portage Bay



MHHW (+8.5 FT MLLW)

Bellingham Bay

Brant Spit Base Mon #1
N: 630795.031
E: 1210515.384
Z: +10.64' MLLW

Brant Spit Base Mon #2
N: 630741.222
E: 1210712.876
Z: +12.51' MLLW

Portage Island

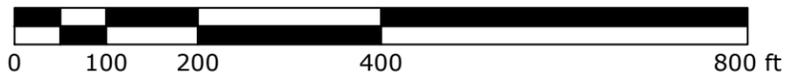
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2
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DATE: 12/7/15
SCALE: AS NOTED
MLLW=0.0'

Portage Spits Change Analysis
Brant Spit Site Plan
2015 Topography
Lummi Indian Business Council

DRAWN BY: JFW	REVISIONS
DESIGNED BY:	
CHECKED BY: JWJ	
DATE SURVEYED: 8/27/15	



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Portage Bay

NO GAP IN 2015

33 FT
2011 GAP

2003 SPIT CREST

2005 SPIT CREST

2011 SPIT CREST

2011 SPIT CREST

334 FT, 2015 GAP

443 FT, 2011 GAP

507 FT, 2008 GAP

450 FT, 2005 GAP

545 FT, 2003 GAP

Bellingham Bay

Brant Spit Base Mon #1
N: 630795.031
E: 1210515.384
Z: +10.64' MLLW

OF: 7

3

SHEET:

DATE:

12/7/15

SCALE: AS NOTED

MLLW=0.0'



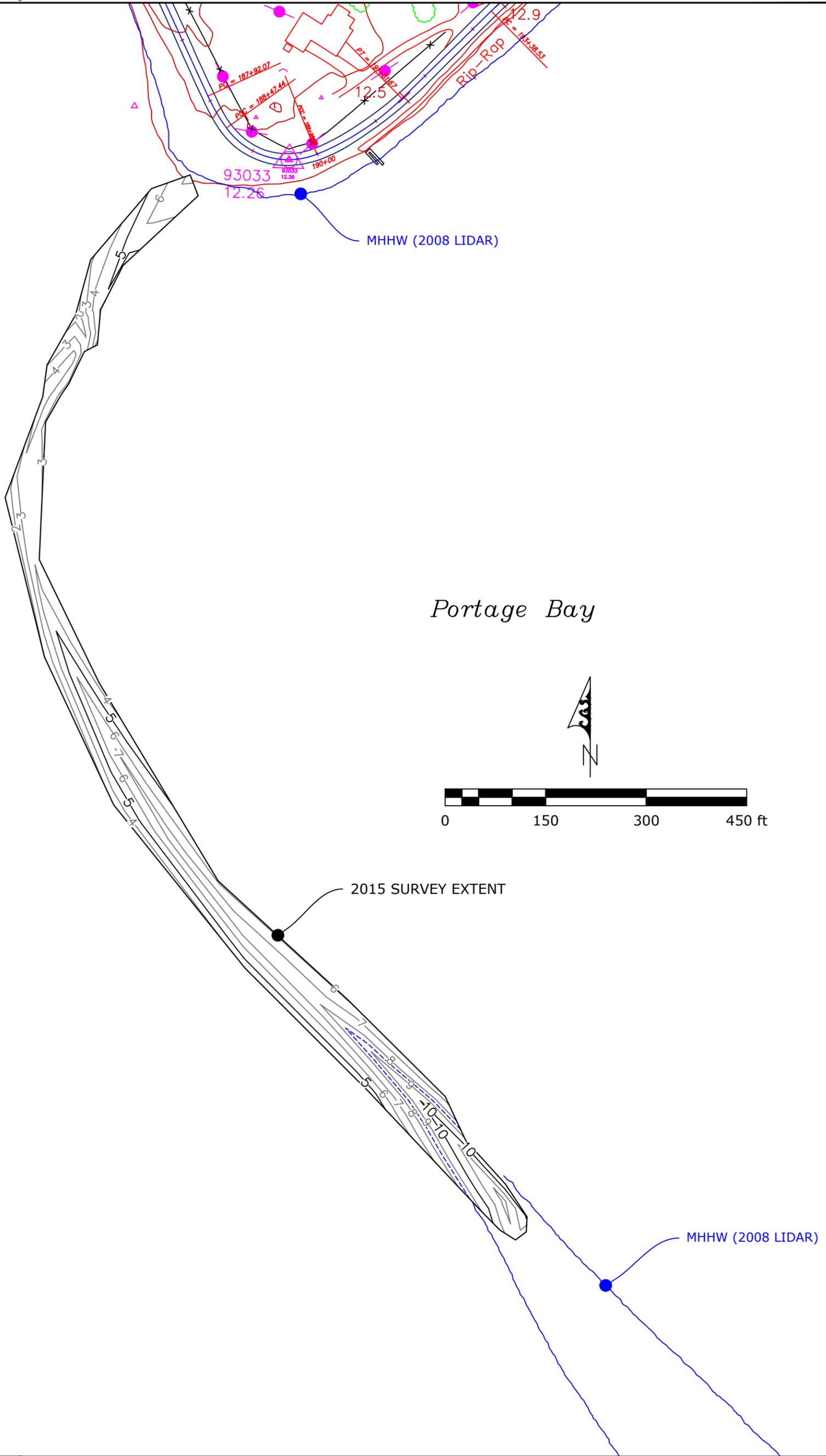
Brandt Spit Change Analysis
 Brant Spit Site Plan
 Spit Crest and MHHW Gap Comparison
 Lummi Indian Business Council

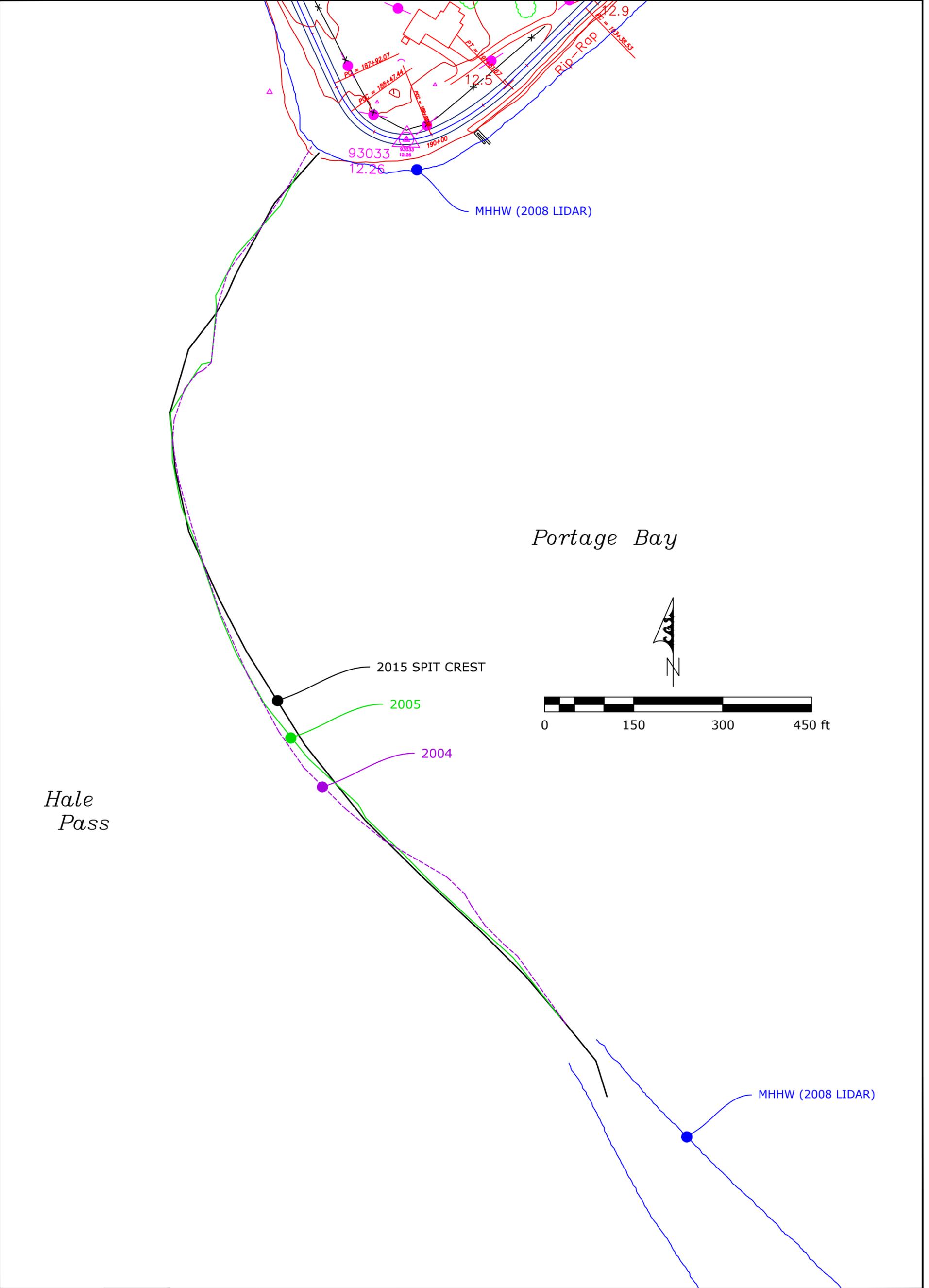
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OF: 7

6

MILLW=0.0'

SCALE: AS NOTED

DATE: 12/7/15

SHEET:

Portage Spits Change Analysis
 The Portage Site Plan
 Spit Crest
 Lummi Indian Business Council

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