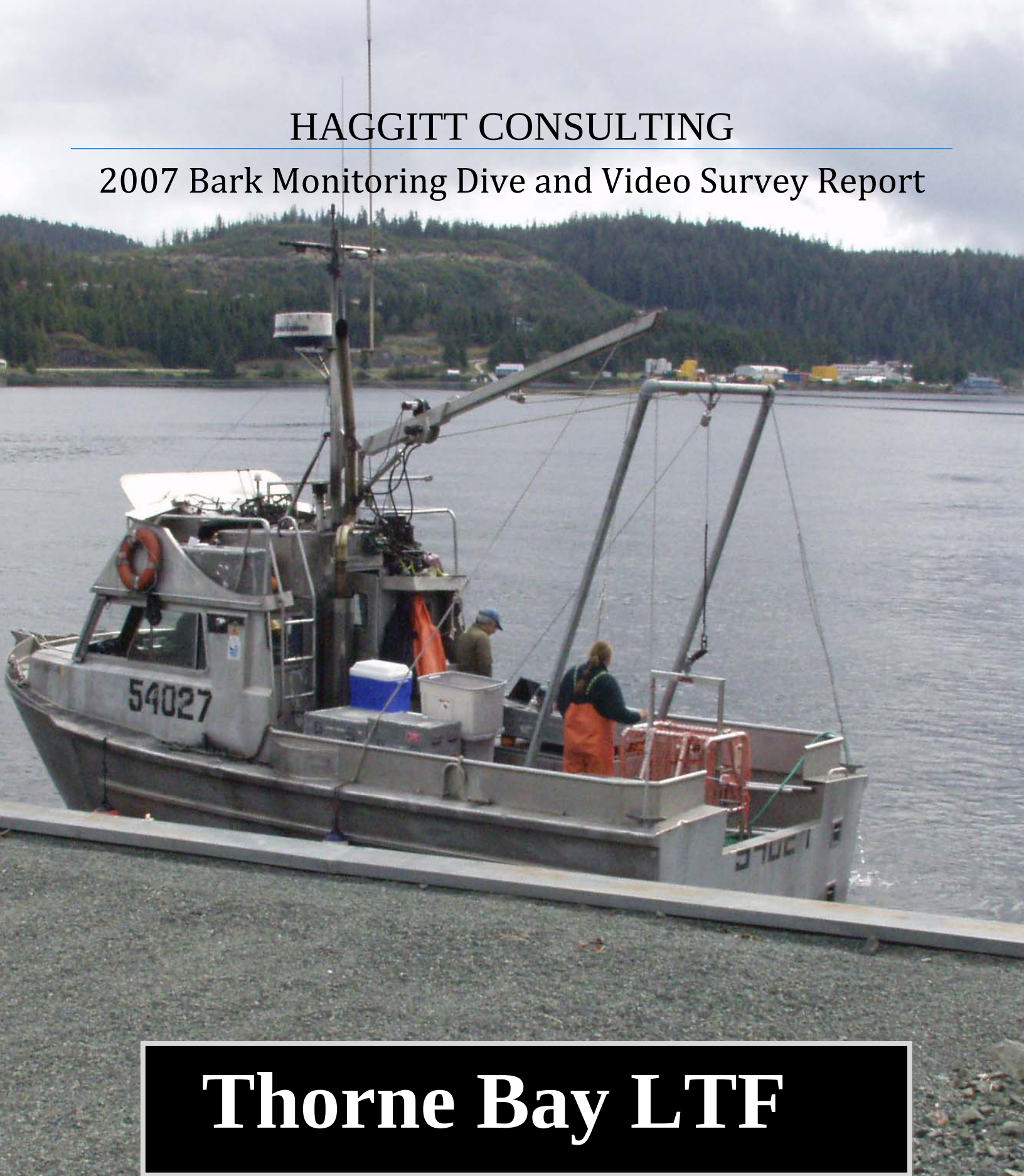
HAGGITT CONSULTING

2007 Bark Monitoring Dive and Video Survey Report



Thorne Bay LTF

MAY 12, 2007 THROUGH MAY 16, 2007 SURVEY

Thorne Bay Log Transfer Facility

Submitted to:
Alaska Department of Environmental Conservation
Division of Water
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Juneau, Alaska 99801

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Figures

Abstract

An underwater reconnaissance was conducted on May 12 through May 16, 2007 at the former Thorne Bay Log Transfer Facility (LTF) to determine the current extent of bark debris accumulation on the ocean bottom. Thorne Bay is located on the east coast of Prince of Wales Island, Alaska. The LTF and a companion Log Storage Area (LSA) were operated by Ketchikan Pulp Company at the head of Thorne Bay until cessation in 2000. The former LSA was the subject of a previous study conducted in 2003 and 2005. The present investigation was done under contract to the Alaska Department of Environmental Conservation (ADEC).

The survey combined the scientific resources of Haggitt Consulting and Germano and Associates. Haggitt Consulting conducted a benthic video and dive survey to assess surface bark distribution and thickness in the LTF marine area, which is described in this section of the report. Germano and Associates conducted a benthic sediment investigation in the LTF marine area, including Sediment Profile Imaging, surface photography, and grab sampling for biological and chemical assessments, which is described in the companion report.

Both parallel and radial transect patterns were used in the Haggitt Consulting video and dive survey. The parallel transect pattern used in the video survey consisted of 7 transects at 150 foot spacing intervals. The sampling frequency was at 75 and 150 foot intervals. The dive survey utilized five radial transects at a 15 foot sampling interval. The dive survey methods remained in compliance with the standard and alternate methods that can be found in ADEC's **"Required Method for Bark Monitoring Surveys under the LTF General Permits".**

The video and dive surveys documented that the LTF marine area contained both continuous and discontinuous bark debris on the benthic surface. The video survey using the parallel transect pattern quantified the extent and type of coverage as 1.29 acres continuous bark debris. The radial dive survey pattern quantified continuous cover near the former LTF input structure as 0.21 acres.

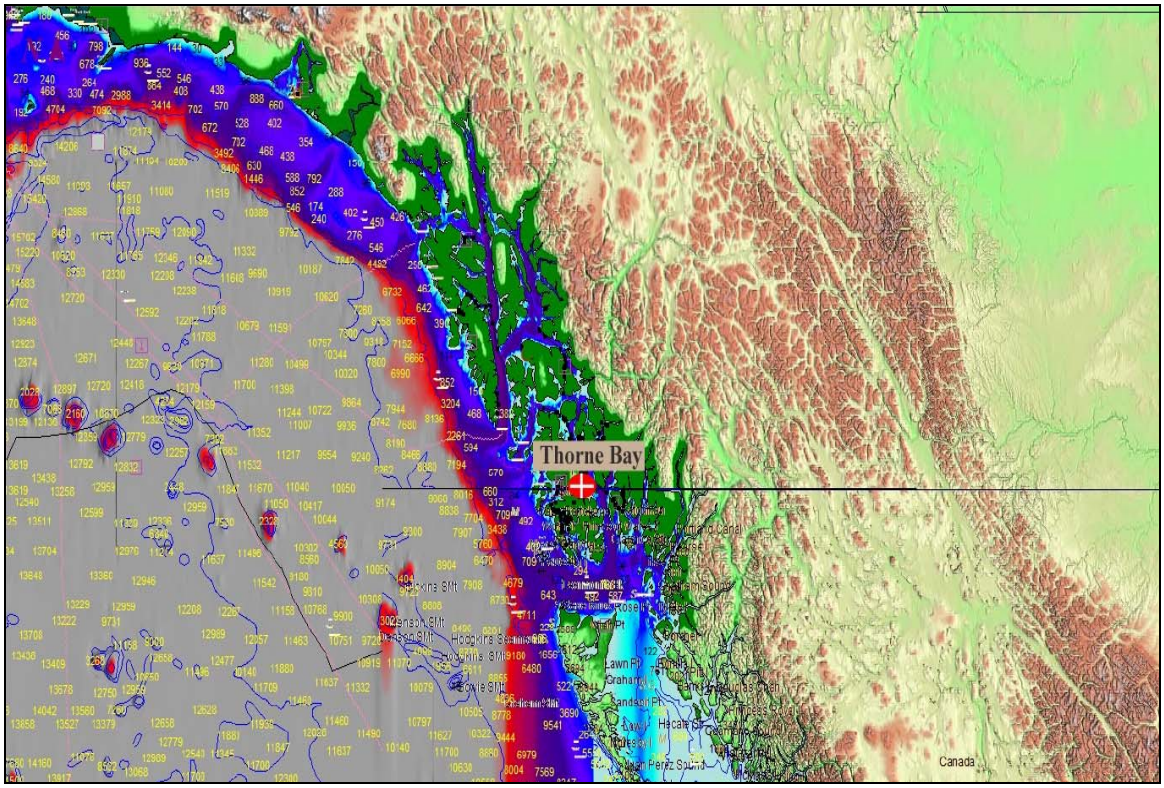

Figure 1 Satellite Overlay on Vector Chart

1992 photograph of the Thorne Bay Log Storage and Log transfer Facility by Diane Stittgen

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Introduction

The logging facility at Thorne Bay was developed as a result of a long term timber sales contract between the U.S. Forest Service and Ketchikan Pulp Company. In 1960, a floating logging camp was built, and in 1962 a shop, barge terminal, and a log sort yard were built to replace the facilities in Hollis. Thorne Bay was considered the largest logging camp in North America. At the peak of operations, the site processed approximately 200 MMBF per year and was the log storage depot for all of the timber harvested by Ketchikan Pulp Company in S.E. Alaska. It is estimated that six to seven billion board feet of timber were processed and stored in Thorne Bay from 1962 to 2001.

The Thorne Bay LTF was entirely dismantled after closure in 2000. The LTF is located in the northwestern head of Thorne Bay, with an eastern exposure. The weather conditions and underwater visibility were good during this bark assessment survey. The bathymetric conditions at the site are that of a flat grade at an average elevation of -18 ft MLLW. Bark debris and other organic debris were noted in continuous and discontinuous coverage and tended to congregate at areas where log rafting had been extensively used. A summary of the approach and techniques used in the LTF survey is provided below in the Methods Section. The result of the survey is then presented together with estimates of the spatial extent and thickness of bark cover on the seafloor.

Figure 2 Satellite image with ADL boundary lines.

Dive Survey Method

Standard diving methods were used to survey the Thorne Bay LTF. The methods used can be found in the ADEC publication "Required Method for Bark Monitoring Surveys under the LTF General Permits."

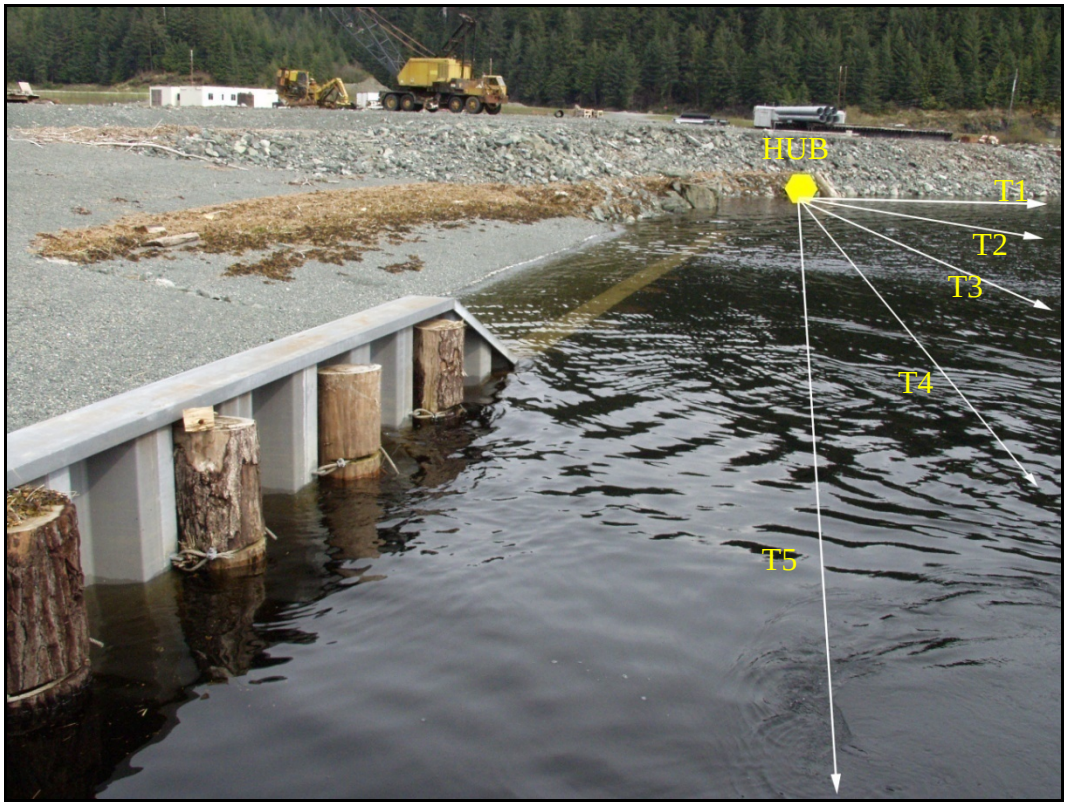


Figure 3 Radial transects HUB

The dive survey was conducted along radial transects that emanated from the central discharge hub. The fixed hub reference point for the transects radiating from the log transfer low angle ramp was initially located by assessing maps and diagrams provided by the US Forest Service. The hub location was then "fixed" at the center of the drive down ramp by DGPS coordinates.

The reference hub was located as close as possible to the center of the discharge site to facilitate future reconnaissance. Five transects were established, radiating from the reference hub at 30-degree intervals. Two separate magnetic compasses were compared to determine the bearings.

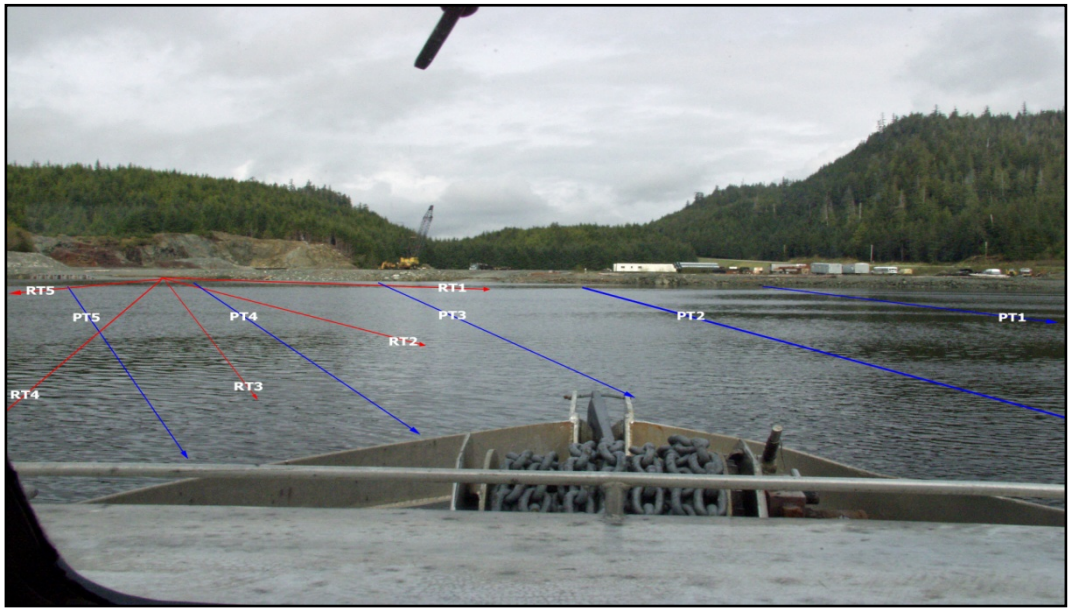
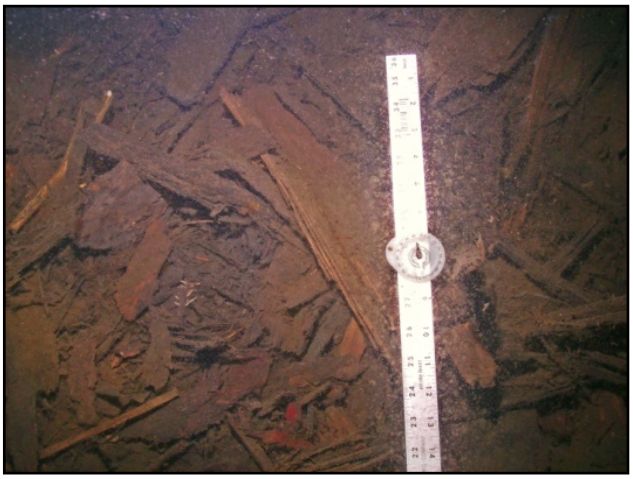


Figure 4 Parallel and Radial Transect overlay.

SPI/ PUC camera



Diver operated camera

Plan View Video camera with satellite overlay

Vessel- based personnel monitored the diver's progress and used radio/diver-telephone communications for course adjustments. Transect end points were recorded on DGPS to provide actual headings traveled.

The transects were terminated by the requisite of beyond the area of significant bark accumulation, or at a depth of 60 feet MLLW if the cover is discontinuous. In the event continuous cover is observed at 60 feet MLLW transects will continue until 100 feet of seawater; or the end of continuous cover, whichever comes first.

Figure 5 Survey Vessel

Observations were taken at sample points at intervals of 15 linear feet along each radial transect. This interval distance was established with the use of a rolling tape measure, the accuracy is reported as +/- 3 inches at 1000 feet. Each sample point was an approximate three-foot square on the bottom surface. At each sample point, the "percent coverage" by bark was recorded to the nearest 10 percent. The estimated thickness of the bark cover was measured by probing with a handheld ruler. A plan view photograph of the bottom surface was taken with an Olympus professional digital camera to record bark debris present, algal life, animal life and substrate. Observations were noted on the abundance and type of marine organisms present, the native vegetation, and composition of the substrate. Data including the water depth, current direction, and estimated current velocity also were incorporated into the field notes. Each of the sample points also included relevant observations on operational debris and existing bark debris. Sample location depth notations are based on readings from a Cochran Consulting Nemeses IIA dive computer calibrated for saltwater and altitude.

Video Survey Method

The Video survey methods used are approved by ADEC. The system is comprised of a 12 channel satellite receiver providing DGPS and WAAS coordinates to shipboard navigation and infrared camera equipment. The satellite receiving antenna is located directly above the sample point being observed. The camera is weighted and lowered on lead line from the vessel to within 2 vertical feet of the sample point. The infrared camera records the substrate condition for at least 60 seconds, this video feed is

combined with a live satellite data stream that includes; Latitude and Longitude (to the fourth decimal point), speed, heading, time (Greenwich mean time) and date. The video is then edited to the 30 second segment that includes the projected sample point location. This survey also included Video "stills".

The live data and tapes that result from this survey are reviewed by professional bark monitoring divers to determine the percent of bark coverage at each sample point. Observations of the debris viewed over the full 60 seconds of tape are compared against the representative clip of the sample point to ensure fair portrayal of the intended sample point. Observations are recorded in data tables and a coverage map is produced. Each report includes a video appendix of the sample points observed.

The fixed hub reference points for the parallel transects delineating bark debris areas are selected by observing the site conditions, operational history and positioning the hubs (baseline) in a location that would provide the best survey coverage of the area used as a Log Storage Area. Additionally, during the survey DGPS/WAAS coordinates are acquired at the hub and each sample point along the transect to facilitate relocation. Transects were established at 278 degrees magnetic. Transect sample points intervals were set at 75 feet near shore (for the first three sample points) and thereafter at a distance of 150 feet. Transects and sample points were pre-plotted onto an electronic chart[1], with coordinates. The vessel tracked on this chart using a satellite receiver that provides data for the electronic chart software to trace the vessels progress along the transect.

The transects were terminated by the requisite of beyond the area of significant bark accumulation, physical barrier or the required scope of services.

Figure 7 Photograph of Reference Station TBR2

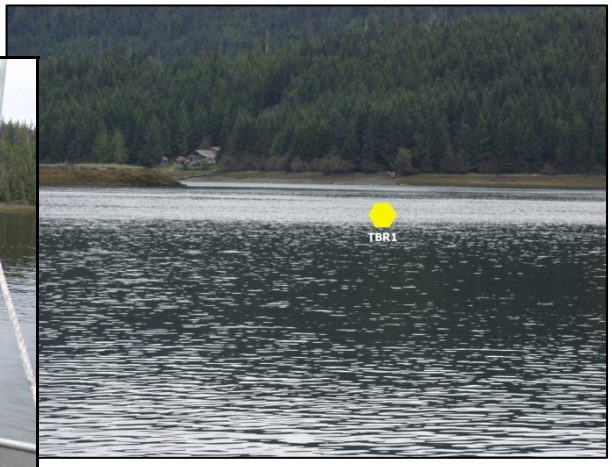


Figure 6 Photograph of Reference Station TBR1

[1] See Figure 1, next page.

Area of Bark Cover

For each survey, the percentage of bark coverage was determined by using the protocol for operating a bark-monitoring program given in the EPA General Permit for Log Transfer Facilities. The area calculation used in this report is outlined in the ADEC publication "Required Method for Bark Monitoring Surveys under the LTF General Permits".

Area calculations were accomplished by drafting scaled transect diagrams from the sample point tables in TurboCAD Professional V10. The TurboCAD program then accomplished the area calculations.

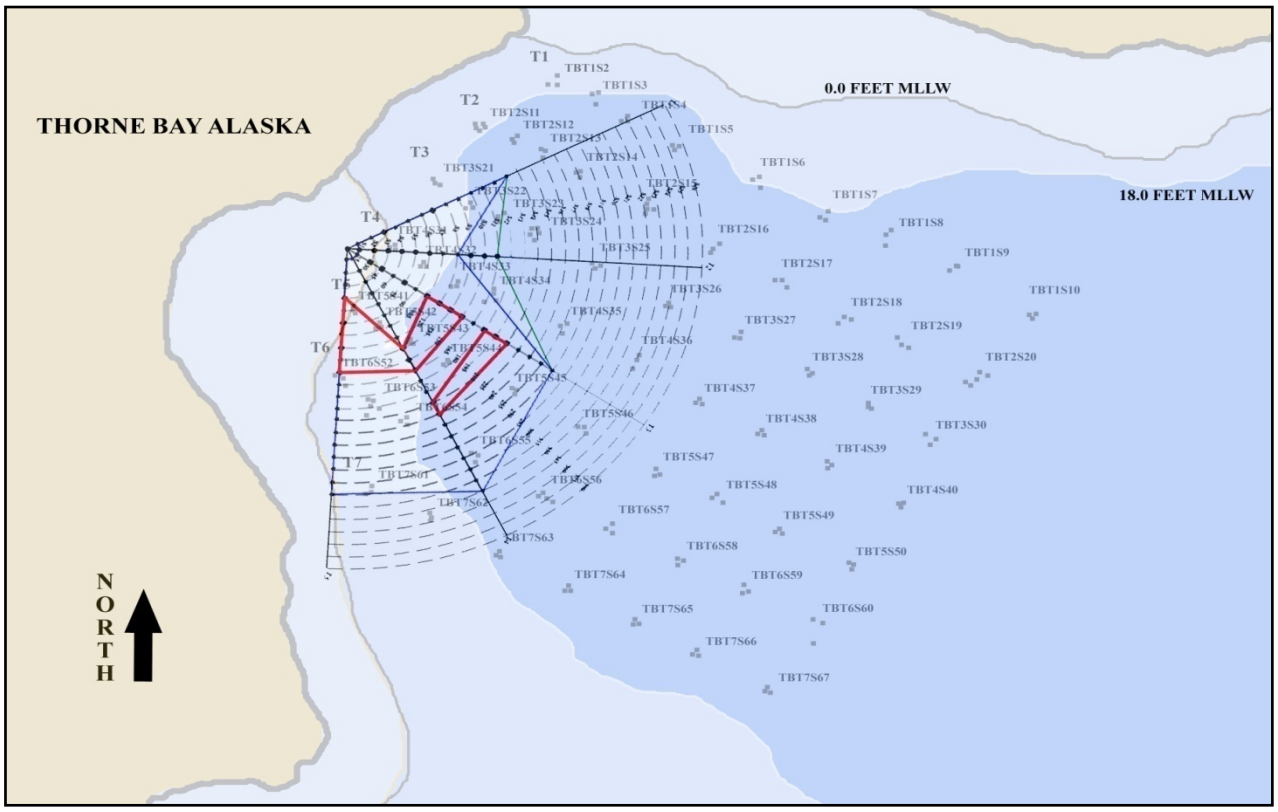


Figure 8 Radial transect diagram overlaid on chart of parallel transects

Area calculations were derived at by utilizing scaled AutoCAD drawings overlaid on nautical charts.

Chapter

1

Thorne Bay LTF Dive and Video Survey

Surveyed on May 12, 2007 through May 16, 2007

The dive and video survey was conducted under contract to the Alaska Department of Environmental Conservation.

An underwater reconnaissance was requested to determine the extent and nature of remaining bark debris accumulation in an area formally operated as a Log Transfer Facility (LTF). The dive and video survey was conducted May 12, 2007 through May 16, 2007. The site surveyed is located at the northwest head of Thorne Bay, Prince of Wales Island, Alaska.

This investigation documented findings according to the Alaska Department of Environmental Conservation (ADEC), Environmental Protection Agency (EPA) and NPDES requirements. The percentage of bark coverage was determined by using the protocol for operating a bark-monitoring program given in the EPA General Permit for Log Transfer Facilities. The area calculation used in this report is outlined in the ADEC publication **"Required Method for Bark Monitoring Surveys under the LTF General Permits".**

Findings[2]

Dive Survey Results:

Continuous Coverage	Discontinuous Coverage	Total Survey Area[3]
0.21 Acres / 724 M_2	**1.38 Acres / 4, 761 M_2**	**1.70 Acres / 5, 865 M_2**

Video Survey Results:

Continuous Coverage	Discontinuous Coverage	Total Survey Area[4]
1.29 Acres / 5, 210.51 M_2	**12.17 Acres / 49, 244 M_2**	**21.0 Acres / 84, 980 M_2**

[2] The Dive Survey Results for continuous cover are contained *within* the Video Survey Results and should not be added to the video results. The total combined continuous cover by bark debris for both surveys of this area does not exceed 1.29 acres.

[3] 0.11 acres of zero to trace coverage was present within the Total Survey Area.

[4] 7.44 acres of zero to trace coverage was present within the Total Survey Area.

Figure 9 Log Transfer Facility ***Hub Coordinates: 55 41 304 N 132 32 924 W***

Weather conditions during the survey consisted of overcast skies with winds at less than 5 knots. Surveying by video camera commenced on May 12, 2007; during high water. The tidal station (subordinate station #1423) was used to correct depths to MLLW. The station reported a tide level of 12.2 ft at 8:30 a.m. The current velocity remained negligible. Seawater temperature was recorded at 42 degrees F. The horizontal visibility was estimated to be 10 feet.

Seven parallel transects, emanating from a bearing line located at the south end of the LTF marine Area, traversed the bottom on bearings labeled: T1 - T7 at 278 degrees. A total of 67 sample locations at a 75 and 150 -foot interval distances was assessed. Two additional reference stations were also observed with a similar bottom type, in an area of Thorne Bay that had not been used for log storage activities.

Five radial transects emanating from the central discharge hub were assessed by standard bark monitoring methods. A total of 84 sample points was observed during the dive survey. Site conditions remained steady with winds less than 5 knots and overcast skies. Surveying concluded at 4:35 p.m. on May 16, 2007 during mid tide. The tidal station (subordinate station #1423) was used for depth corrections, reporting a 6.0 ft tide level at 4:30 p.m. The tidal current velocity was estimated to be 0.0 knots. The horizontal visibility remained constant and was estimated to be 10 feet. The grade for these transects remained fairly flat.

Observations

Surface supplied diving apparatus was used that included voice communications with surface personnel.

The bark debris encountered varied from trace to 100% coverage of the benthic surface. Of the 67 sample points in the dive survey, 14 were estimated to have 100 percent coverage by bark pieces. The bark pieces generally ranged from one to six inches in length, with occasional larger pieces up to several feet in length, and including decomposing small fragments (se photographs in appendix A). The bark formed both solid surface cover and was found to be intermixed with the natural silty sediment to depths that varied between 6 and 12 inches, estimated by probing with a ruler. Beyond those depths, the ruler encountered little resistance, other than silt.

The bark debris observed, all appeared to be brittle in nature, indicating a decomposing condition. Present in large areas was Beggiatoa. It quilted the substrate in both large and small patches. Most of the bark debris seemed to be intermixed in the top few inches of the silt substrate. Resistance from bark debris mixed in with the substrate was felt to the limit of the ruler (48 inches), near the hub of the LTF.

Visibility conditions remained constant throughout the balance of the survey. At depths of 15 feet, the horizon of visibility reduced to about ten linear feet as conditions grew darker. However, the visibility did not hamper the assessment of surface bark debris.

Generally, the observations are that of a fairly flat grade of alluvial silt deposits. Marine life is considered low in abundance in comparison with other bays with comparative flushing.

This determination is based on the calculations derived from the transect data collected for this report only. For further service regarding this report, please direct inquiries to (253) 209-9380 or e-mail at Haggitt1@juno.com.

Respectfully submitted,

Stephen Haggitt
December18, 2007

Chapter 2

Survey Summary

The area of continuous bark debris at the LTF marine area continues to decline at a slow but consistent rate. Dive survey reports over the past decade, with the exception of one report[5], have demonstrated this trend.

The results from the video survey and the dive survey differ in the finding for continuous bark debris (1.29 acres vs. 0.21acres). The video survey covered a large area (21 acres); as compared with the dive survey that focused on the area directly in front of the former input structure and was much smaller in spatial extent (1.70 acres).

In addition to the increased survey area, the video survey was done at a lower resolution. This may result in increased findings of continuous coverage by bark debris as discrete areas of discontinuous, trace and zero coverage' within the primary area of continuous coverage are not accounted for. The radial dive survey sampled every 15 linear feet and the parallel video grid was set at a 75 foot sampling interval near the shore and changed to an interval of 150 linear feet thereafter.

This survey used standard reporting methods and included only coverage that was determined to be 10% to 90% in the reported discontinuous coverage area. Determinations of bark debris coverage at 100% are reported as continuous coverage and determinations of bark debris coverage of less than 10% are reported as zero or trace coverage.

[5] A report from 2004 by Alaska Commercial Divers indicted approximately 8 acres of continuous coverage. This survey did not use the same hub near the "A" frame that was common to each of the other dive surveys.

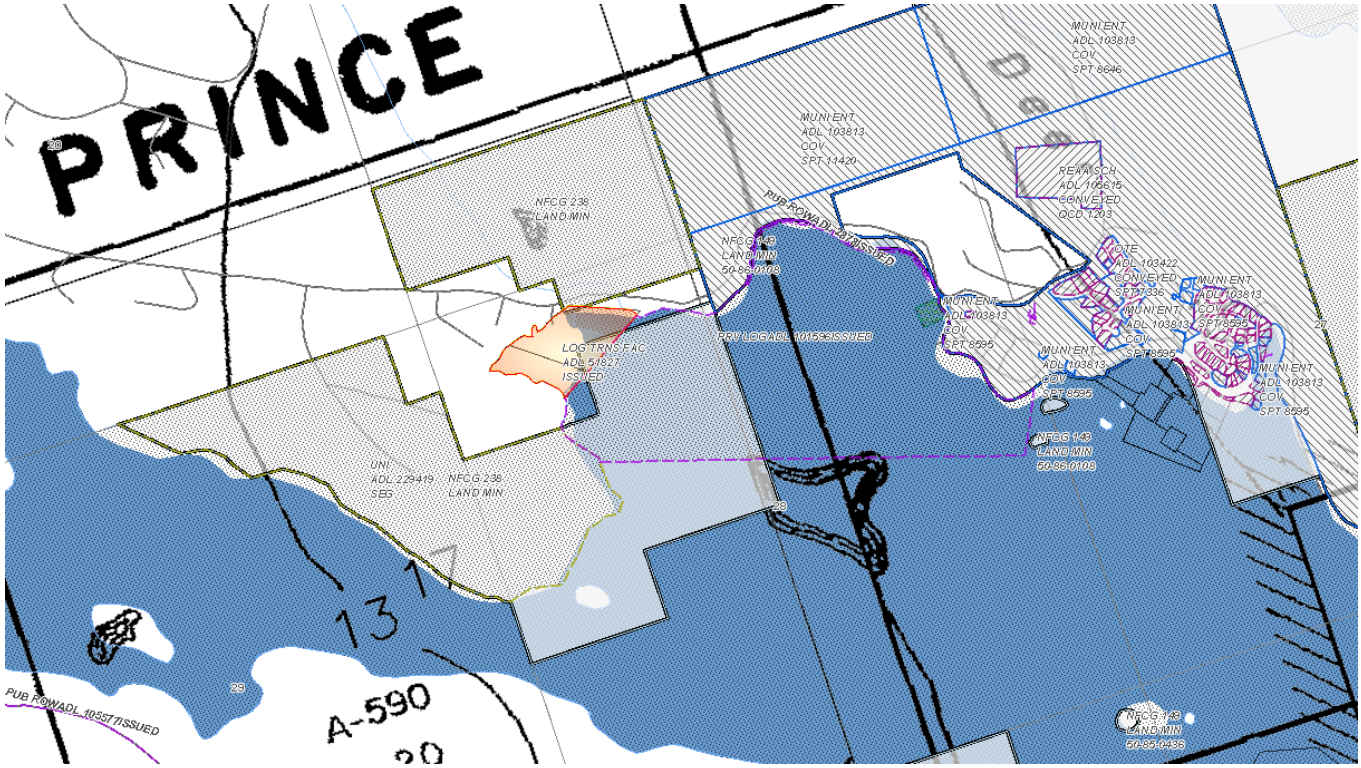


Figure 10 Diagram of Lease boundaries

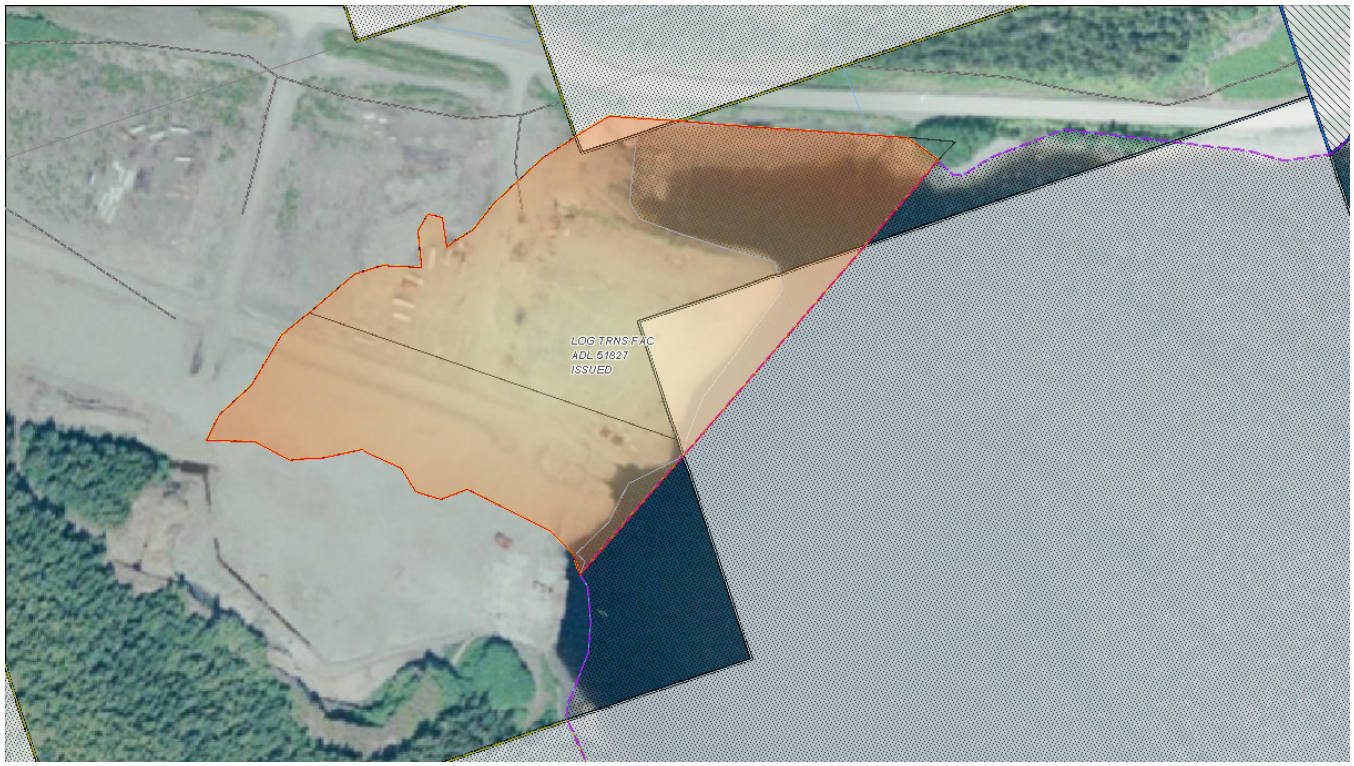


Figure 11 Enlarged Lease boundaries over Satellite image. The section highlighted in orange is the operational area for the Tongass National Forest; the current lease holder for ADL 51827.

Figure 12 Transect maps overlaid on Satellite image with lease boundaries.

This is an overlay of a satellite image and transect diagram from this study. The survey area comprised two leased areas. The first (as indicated by the thin black lines) is ADL 51827 (Operated by the Tongass National Forest). The next is the area of water in the right of the photograph; ADL 101596 (Formally operated by the Ketchikan Pulp Company). It should be noted that at the time of this report, a portion of lease ADL 51827 is being conveyed to the City of Thorne Bay, Alaska.

Tidal Graphs

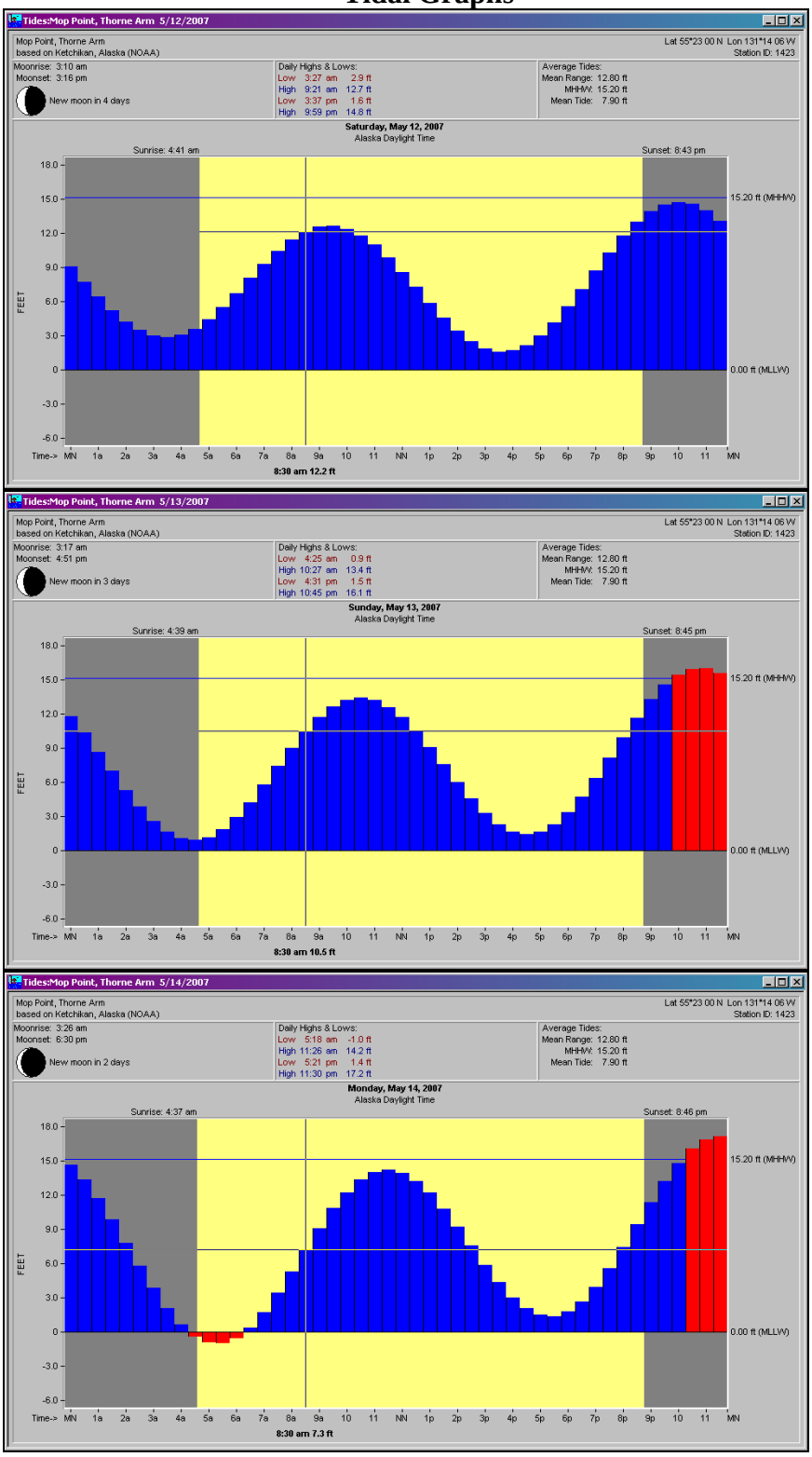


Figure 13 Tide graph for May 12, 13, 14, and 2007

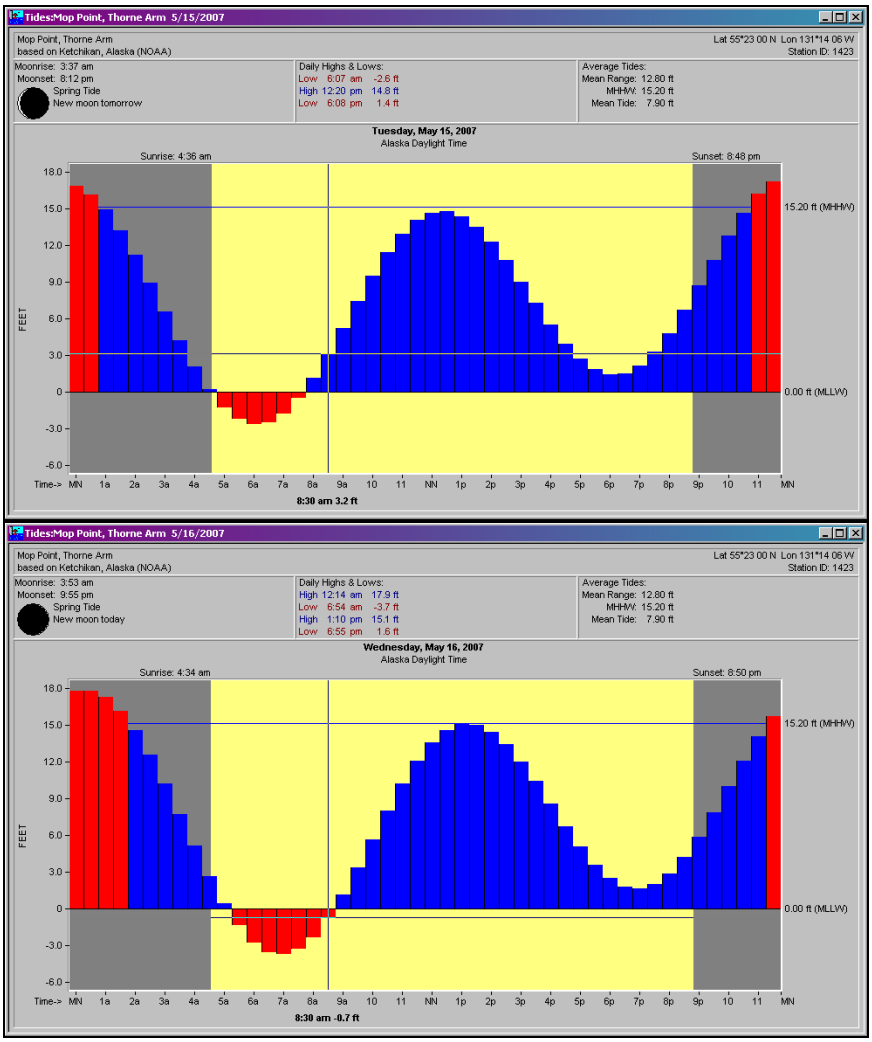


Figure 14 Tide graph for May 15 and 16, 2007

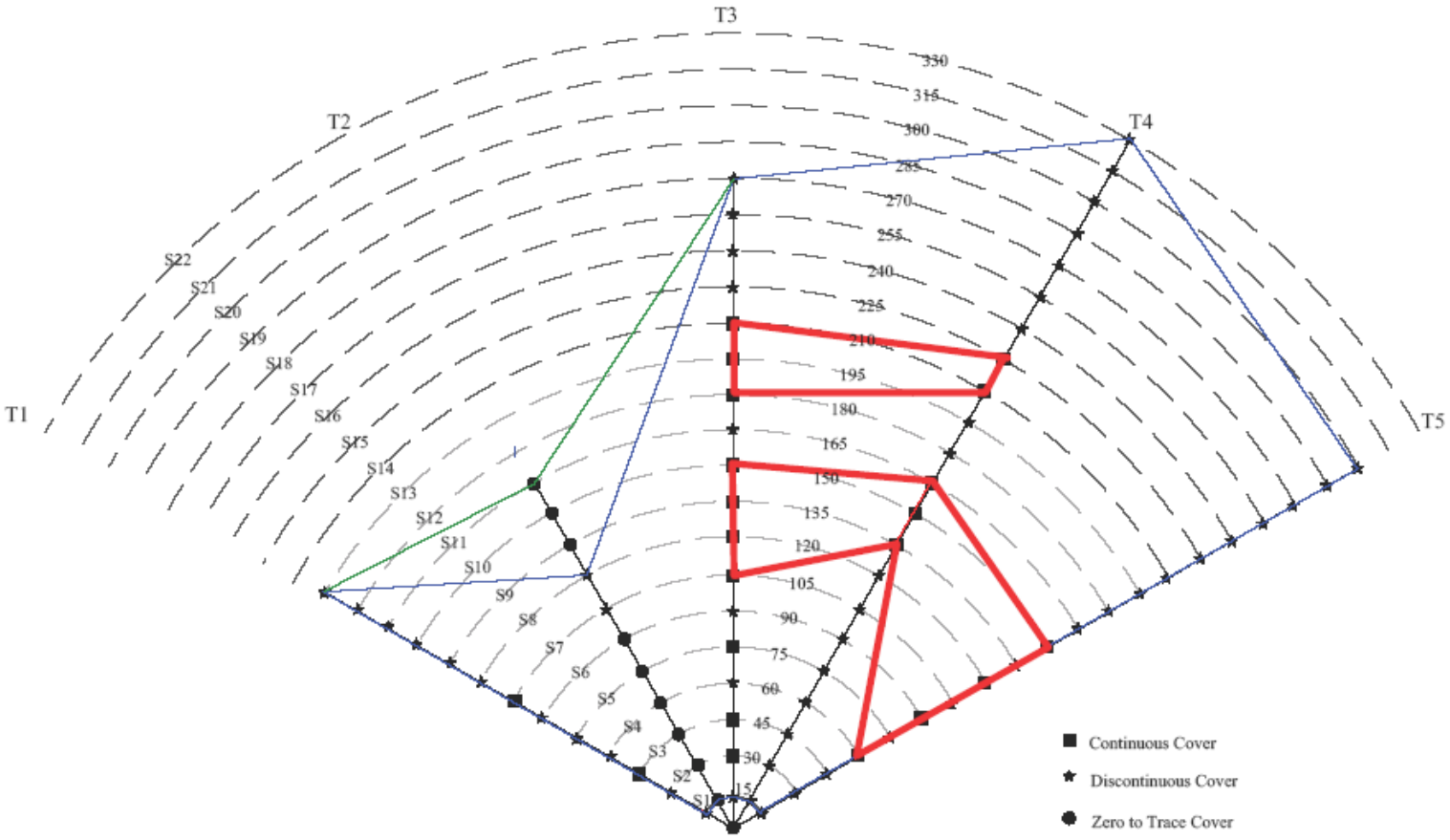


Figure 15 Radial Calculation Diagram

Blocks 100% Cover
Stars 10%--99% Cover
Circle 0%--9% Cover

Plan View Video Calculation Diagram

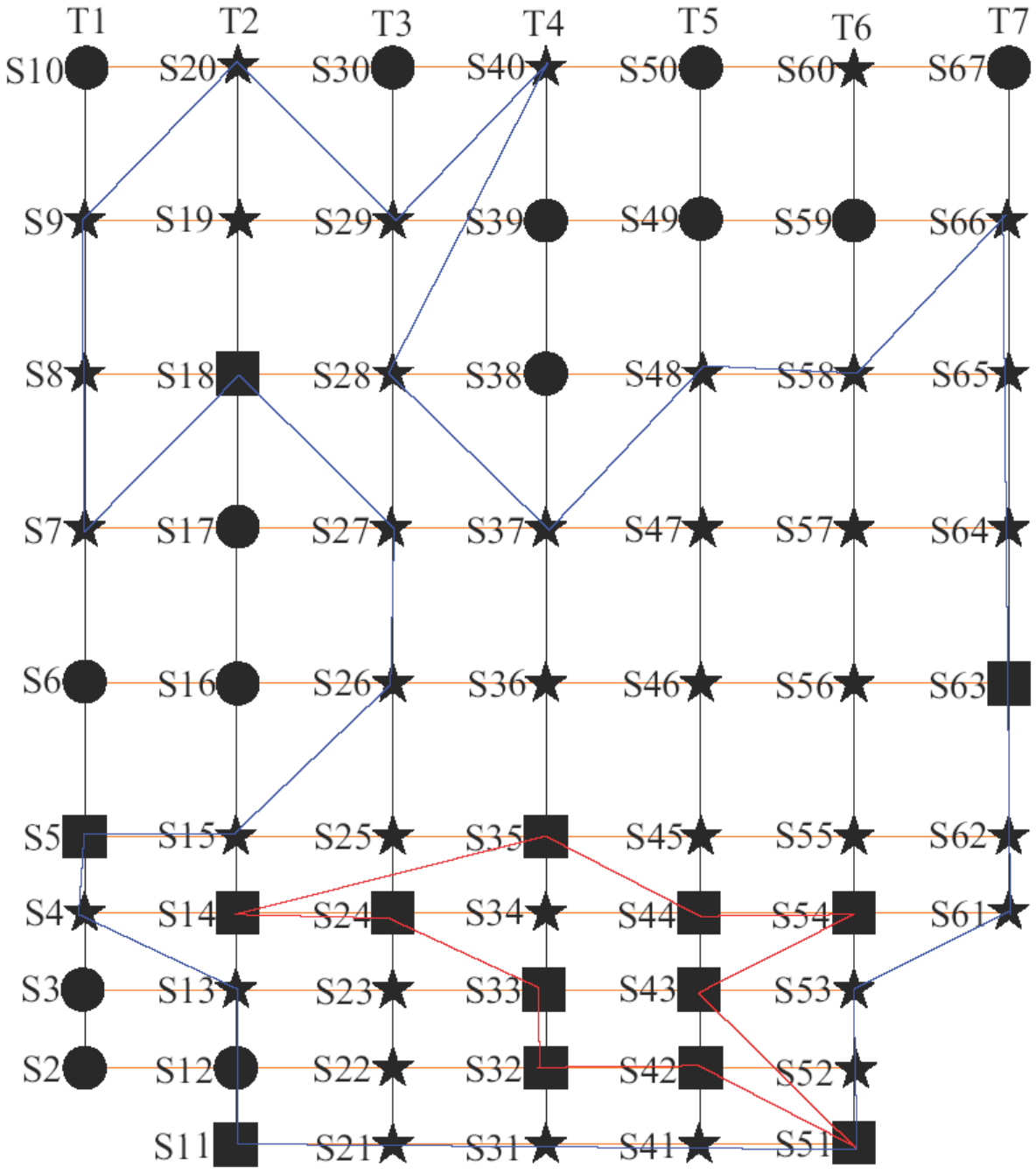


Figure 16 Parallel PVV Diagram

Blocks 100% Cover
Stars 10%--99% Cover
Circle 0%--9% Cover

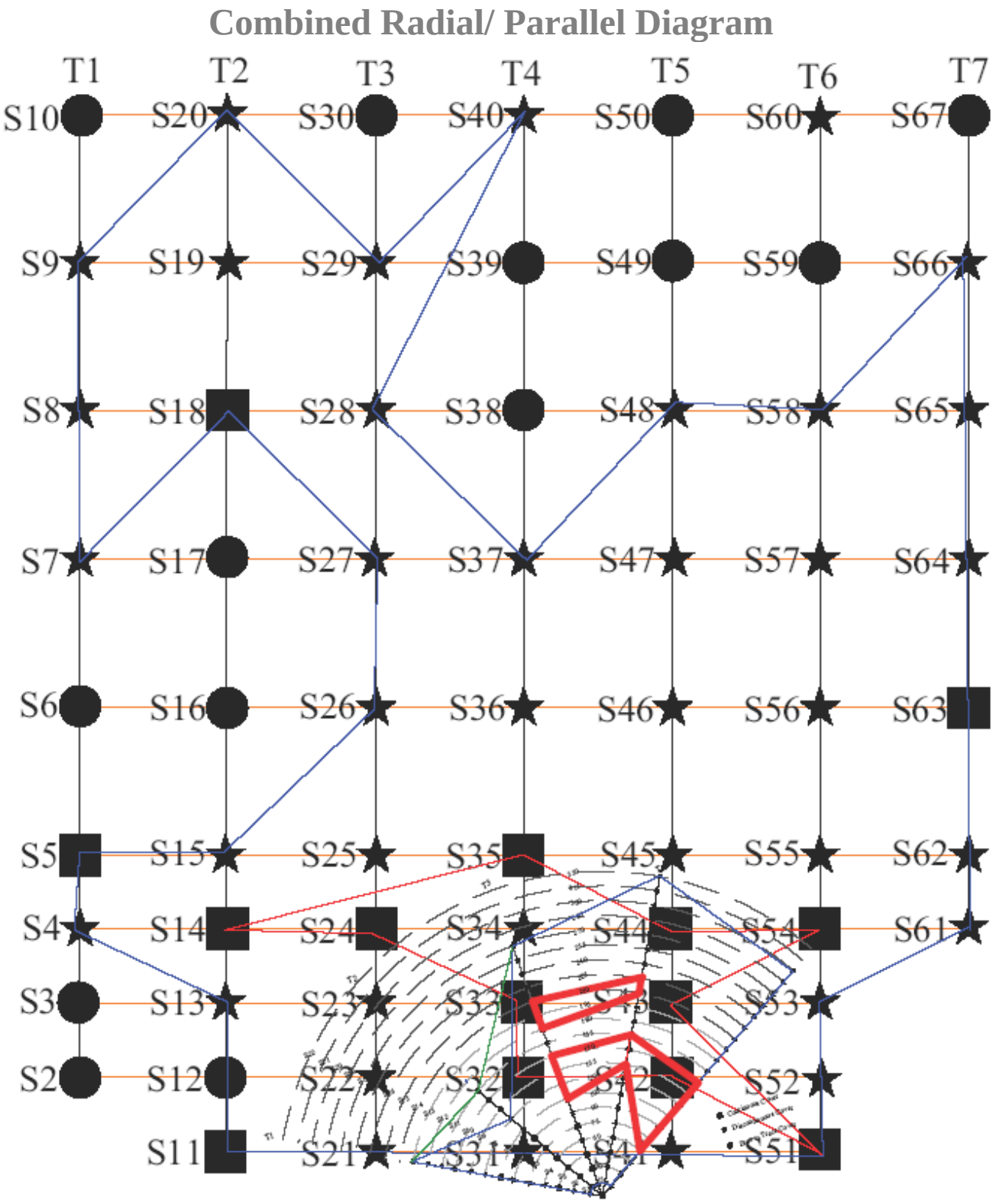


Figure 17 Combined Parallel and Radial Diagram

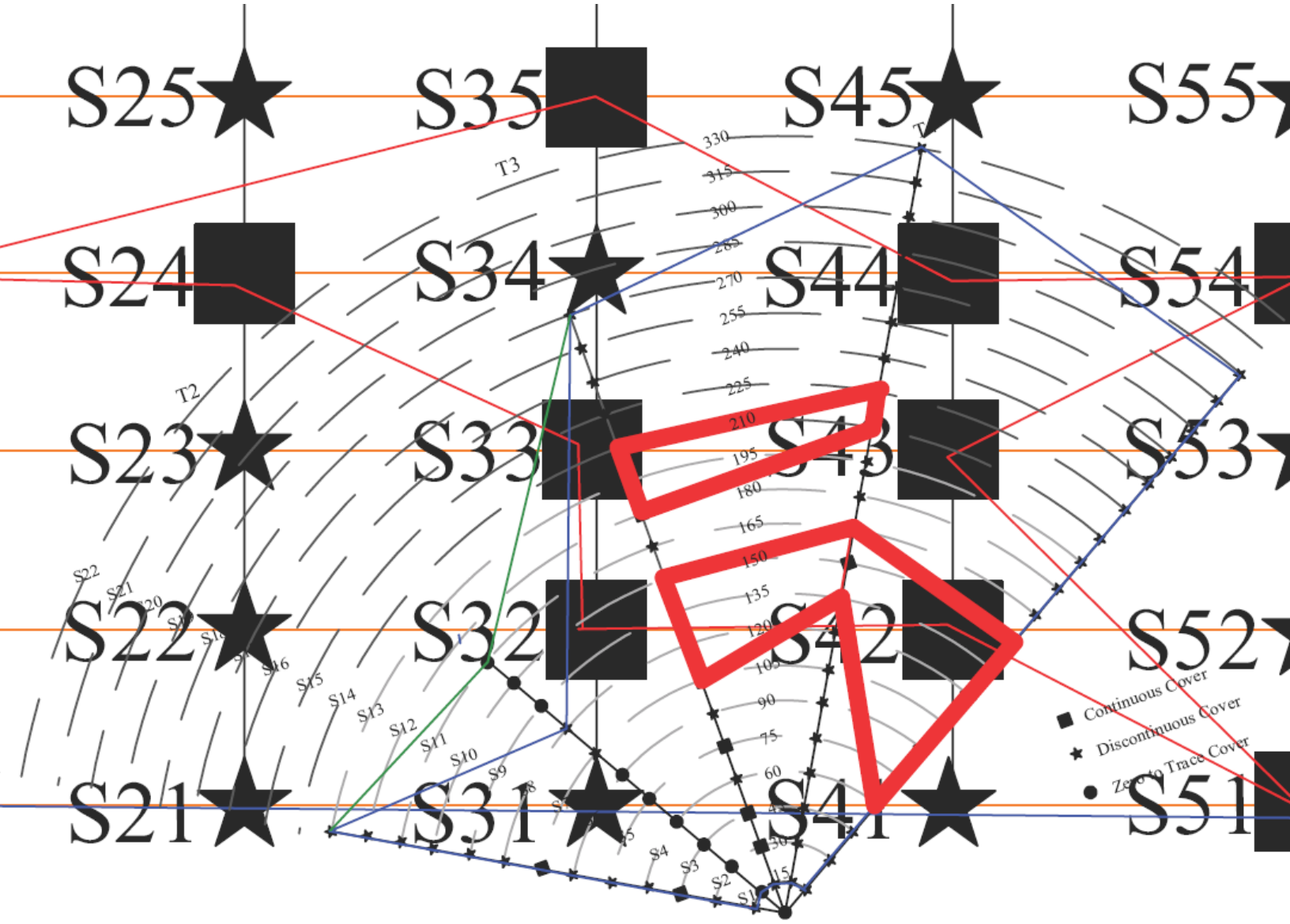


Figure 18 Enlarge area of Combined Radial and Parallel Diagram

The enlarged area of the calculation diagram above demonstrates how the parallel Plan View Video transect grid interacted with the radial Dive survey array. The higher resolution (Sampling every 15 feet in the radial array and every 75 feet in the parallel grid) of the radial array, produced reduced findings within an area of continuous bark cover.

Dive Data Tables

Transect 1 40 Degrees

Sample Point	Depth at MLLW	Bark Depth *(Inches)*	% of Cover	Substrate Type
1	4	1	20	S,M
2	8	2	30	S,M
3	11	3	60	S,M
4	17	3	100	S,M
5	20	1	60	S,M
6	22	4	100	S,M
7	23	<1	20	S,M
8	23	6	100	S,M
9	19	<1	60	S,M
10	19	4	100	S,M
11	19	<1	70	S,M
12	19	<1	20	S,M
13	19	1	40	S,M
14	17	1	90	S,M
15	17	1	70	S,M
16	16	<1	20	S,M
17	16	<1	30	S,M
18	15	<1	40	S,M
19	15	<1	20	S,M
20	16	<1	10	S,M
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Key:
Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

Transect 2 70 Degrees

Sample Point	Depth at MLLW	Bark Depth *(Inches)*	% of Cover	Substrate Type
1	6	<1	10	S,M
2	7	<1	20	S,M
3	7	<1	20	S,M
4	9	<1	20	S,M
5	10	<1	10	S,M
6	18	2	60	S,M
7	20	1	70	S,M
8	19	<1	10	S,M
9	19	2	100	S,M
10	17	4	100	S,M
11	17	6	100	S,M
12	19	1	40	S,M
13	20	<1	10	S,M
14	20	3	100	S,M
15	19	4	100	S,M
16	18	1	70	S,M
17	20	<1	60	S,M
18	21	<1	40	S,M
19	22	1	70	S,M
20	20	<1	50	S,M
21	19	<1	70	S,M
22	21	<1	10	S,M
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Key:

Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

Transect 3 100 Degrees

Sample Point	Depth at MLLW	Bark Depth *(Inches)*	% of Cover	Substrate Type
1	5	<1	40	S,M
2	9	2	100	S,M
3	11	6	100	S,M
4	11	2	30	S,M
5	12	4	100	S,M
6	12	2	70	S,M
7	14	2	100	S,M
8	16	3	100	S,M
9	15	4	100	S,M
10	17	4	100	S,M
11	19	1	70	S,M
12	20	6	100	S,M
13	19	6	100	S,M
14	22	3	100	S,M
15	18	3	90	S,M
16	19	<1	80	S,M
17	20	1	90	S,M
18	21	<1	10	S,M
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Key:

Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

Transect 4 130 Degrees

Sample Point	Depth at MLLW	Bark Depth *(Inches)*	% of Cover	Substrate Type
1	5	<1	TRACE	S,M
2	7	<1	TRACE	S,M
3	9	<1	TRACE	S,M
4	10	<1	TRACE	S,M
5	16	<1	TRACE	S,M
6	20	<1	TRACE	S,M
7	23	<1	TRACE	S,M
8	25	<1	TRACE	S,M
9	29	<1	TRACE	S,M
10	31	<1	TRACE	S,M
11	33	<1	TRACE	S,M
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Key:
Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

Transect 5 180 Degrees

Sample Point	Depth at MLLW	Bark Depth *(Inches)*	% of Cover	Substrate Type
1	5	1	30	R
2	7	<1	30	R
3	9	2	100	R
4	12	<1	10	M
5	14	<1	20	M
6	15	<1	90	M
7	17	2	100	S,M
8	19	<1	40	S,M
9	24	<1	10	S,M
10	25	<1	30	S,M
11	20	<1	30	S,M
12	18	<1	10	S,M
13	14	<1	10	S,M
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Key:
Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

PVV Results

Sample Point	Depth at MLLW	% of Cover	Substrate Type
TBT1S1	0	N/A	TO SHALLOW
TBT1S2	6	0	S,M
TBT1S3	14	0	S,M
TBT1S4	16	60	S,M
TBT1S 5	15	100	S,M
TBT1S 6	18	0	S,M
TBT1S 7	14	TRACE	S,M
TBT1S 8	22	TRACE	S,M
TBT1S 9	24	60	S,M
TBT1S10	24	0	S,M
TBT2S11	19	100	S,M
TBT2S12	10	TRACE	S,M
TBT2S13	15	10	S,M
TBT2S14	18	100	S,M
TBT2S15	18	30	S,M
TBT2S16	21	0	S,M
TBT2S17	23	0	S,M
TBT2S18	32	100	S,M
TBT2S19	35	70	S,M
TBT2S20	35	20	S,M
TBT3S21	26	10	S,M
TBT3S22	32	50	S,M
TBT3S23	36	40	S,M
TBT3S24	33	100	S,M
TBT3S25	34	90	S,M
TBT3S26	33	70	S,M
TBT3S27	34	60	S,M
TBT3S28	35	10	S,M
TBT3S29	35	10	S,M
TBT3S30	33	0	S,M
TBT4S31	25	40	S,M
TBT4S 32	28	100	S,M
TBT4S 33	29	100	S,M
TBT4S 34	30	20	S,M

Key:
Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock, C=Cobble, G=Gravel
Bark Depth Recorded in Inches

PVV Results

Sample Point	Depth at MLLW	% of Cover	Substrate Type
TBT4S35	31	100	S,M
TBT4S36	33	40	S,M
TBT4S37	35	30	S,M
TBT4S38	35	0	S,M
TBT4S39	36	0	S,M
TBT4S40	39	10	S,M
TBT5S41	20	30	S,M
TBT5S42	22	100	S,M
TBT5S43	25	100	S,M
TBT5S44	24	100	S,M
TBT5S45	26	20	S,M
TBT5S46	26	20	S,M
TBT5S47	35	10	S,M
TBT5S48	27	10	S,M
TBT5S49	33	0	S,M
TBT5S50	34	0	S,M
TBT6S51	6	100	S,M
TBT6S52	14	50	S,M
TBT6S53	16	80	S,M
TBT6S54	21	100	S,M
TBT6S55	23	40	S,M
TBT6S56	26	30	S,M
TBT6S57	26	30	S,M
TBT6S58	27	10	S,M
TBT6S59	28	10	S,M
TBT6S60	28	0	S,M
TBT7S61	16	10	S,M
TBT7S62	19	40	S,M
TBT7S63	17	100	S,M
TBT7S64	20	20	S,M
TBT7S65	20	10	S,M
TBT7S66	21	10	S,M
TBT7S67	20	0	S,M
TBR1	40	0	S,M
TBR2	42	0	S,M

Key:
Substrate Type; S=Sand, M=Mud, SL=Silt, R=Rock
C=Cobble, G=Gravel
Bark Depth Recorded in Inches

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
1	TBT1S1	55º 41.369´ N	132º 32.818´ W	PROPOSED TOO SHALLOW
2	TBT1S2	55º 41.364´ N 55º 41.363´ N 55º 41.363´ N 55º 41.365´ N	132º 32.804´ W 132º 32.806´ W 132º 32.803´ W 132º 32.803´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
3	TBT1S3	55º 41.359´ N 55º 41.359´ N 55º 41.356´ N 55º 41.359´ N	132º 32.788´ W 132º 32.785´ W 132º 32.784´ W 132º 32.788´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
4	TBT1S4	55º 41.353´ N 55º 41.352´ N 55º 41.351´ N 55º 41.351´ N	132º 32.769´ W 132º 32.766´ W 132º 32.766´ W 132º 32.768´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
5	TBT1S5	55º 41.342´ N 55º 41.341´ N 55º 41.342´ N 55º 41.342´ N	132º 32.735´ W 132º 32.739´ W 132º 32.740´ W 132º 32.737´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
6	TBT1S6	55º 41.329´ N 55º 41.330´ N 55º 41.330´ N 55º 41.328´ N	132º 32.695´ W 132º 32.695´ W 132º 32.698´ W 132º 32.985´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
7	TBT1S 7	55º 41.317´ N 55º 41.317´ N 55º 41.319´ N 55º 41.317´ N	132º 32.656´ W 132º 32.660´ W 132º 32.656´ W 132º 32.658´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
8	TBT1S8	55º 41.306´ N 55º 41.311´ N 55º 41.312´ N 55º 41.308´ N	132º 32.622´ W 132º 32.625´ W 132º 32.622´ W 132º 32.625´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
9	TBT1S9	55º 41.296´ N 55º 41.300´ N 55º 41.301´ N 55º 41.301´ N	132º 32.589´ W 132º 32.591´ W 132º 32.587´ W 132º 32.586´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV
10	TBT1S10	55º 41.283´ N 55º 41.285´ N 55º 41.283´ N 55º 41.284´ N	132º 32.548´ W 132º 32.543´ W 132º 32.545´ W 132º 32.547´ W	PROPOSED PRIMARY SPI, PUC REPLICATE SPI, PUC PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
11	TBT2S11	55º 41.348´ N	132º 32.845´ W	PROPOSED
		55º 41.348´ N	132º 32.844´ W	PRIMARY SPI, PUC
		55º 41.349´ N	132º 32.844´ W	REPLICATE SPI, PUC
		55º 41.347´ N	132º 32.847´ W	PVV
		55º 41.348´ N	132º 32.845´ W	PRIMARY BTA
		55º 41.351´ N	132º 32.845´ W	REPLICATE BTA
12	TBT2S12	55º 41.343´ N	132º 32.828´ W	PROPOSED
		55º 41.344´ N	132º 32.826´ W	PRIMARY SPI, PUC
		55º 41.343´ N	132º 32.827´ W	REPLICATE SPI, PUC
		55º 41.344´ N	132º 32.827´ W	PVV
13	TBT2S13	55º 41.337´ N	132º 32.810´ W	PROPOSED
		55º 41.340´ N	132º 32.810´ W	PRIMARY SPI, PUC
		55º 41.340´ N	132º 32.811´ W	REPLICATE SPI, PUC
		55º 41.337´ N	132º 32.810´ W	PVV
		55º 41.338´ N	132º 32.810´ W	PRIMARY BTA
14	TBT2S14	55º 41.332´ N	132º 32.792´ W	PROPOSED
		55º 41.333´ N	132º 32.791´ W	PRIMARY SPI, PUC
		55º 41.331´ N	132º 32.791´ W	REPLICATE SPI, PUC
		55º 41.332´ N	132º 32.792´ W	PVV
15	TBT2S15	55º 41.321´ N	132º 32.758´ W	PROPOSED
		55º 41.323´ N	132º 32.756´ W	PRIMARY SPI, PUC
		55º 41.322´ N	132º 32.756´ W	REPLICATE SPI, PUC
		55º 41.321´ N	132º 32.755´ W	PVV
		55º 41.320´ N	132º 32.756´ W	PRIMARY BTA
		55º 41.321´ N	132º 32.753´ W	REPLIATE BTA
16	TBT2S16	55º 41.308´ N	132º 32.718´ W	PROPOSED
		55º 41.307´ N	132º 32.719´ W	PRIMARY SPI, PUC
		55º 41.306´ N	132º 32.720´ W	REPLICATE SPI, PUC
		55º 41.308´ N	132º 32.717´ W	PVV
17	TBT2S17	55º 41.296´ N	132º 32.678´ W	PROPOSED
		55º 41.296´ N	132º 32.681´ W	PRIMARY SPI, PUC
		55º 41.296´ N	132º 32.683´ W	REPLICATE SPI, PUC
		55º 41.295´ N	132º 32.679´ W	PVV
18	TBT2S18	55º 41.285´ N	132º 32.645´ W	PROPOSED
		55º 41.282´ N	132º 32.651´ W	PRIMARY SPI, PUC
		55º 41.284´ N	132º 32.645´ W	REPLICATE SPI, PUC
		55º 41.284´ N	132º 32.647´ W	PVV
19	TBT2S19	55º 41.274´ N	132º 32.612´ W	PROPOSED
		55º 41.274´ N	132º 32.617´ W	PRIMARY SPI, PUC
		55º 41.277 N	132º 32.620´ W	REPLICATE SPI, PUC
		55º 41.274´ N	132º 32.612´ W	PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
20	TBT2S 20	55º 41.262´ N	132º 32.573´ W	PROPOSED
		55º 41264´ N	132º 32.575´ W	PRIMARY SPI, PUC
		55º 41.266´ N	132º 32.575´ W	REPLICATE SPI, PUC
		55º 41.262´ N	132º 32.575´ W	PVV
		55º 41.261´ N	132º 32.577´ W	PRIMARY BTA
		55º 41.262´ N	132º 32.579´ W	REPLICATE BTA
21	TBT2S21	55º 41.328´ N	132º 32.868´ W	PROPOSED
		55º 41.328´ N	132º 32.868´ W	PRIMARY SPI, PUC
		55º 41.329´ N	132º 32.868´ W	REPLICATE SPI, PUC
		55º 41.328´ N	132º 32.867´ W	PVV
22	TBT2S22	55º 41.322´ N	132º 32.851´ W	PROPOSED
		55º 41.321´ N	132º 32.853´ W	PRIMARY SPI, PUC
		55º 41.323´ N	132º 32.851´ W	REPLICATE SPI, PUC
		55º 41.321´ N	132º 32.850´ W	PVV
23	TBT2S23	55º 41.317´ N	132º 32.834´ W	PROPOSED
		55º 41.317´ N	132º 32.837´ W	PRIMARY SPI, PUC
		55º 41.318´ N	132º 32.837´ W	REPLICATE SPI, PUC
		55º 41.319´ N	132º 32.835´ W	PVV
24	TBT2S24	55º 41.311´ N	132º 32.814´ W	PROPOSED
		55º 41.313´ N	132º 32.814´ W	PRIMARY SPI, PUC
		55º 41.313´ N	132º 32.817´ W	REPLICATE SPI, PUC
		55º 41.312´ N	132º 32.814´ W	PVV
		55º 41.310´ N	132º 32.816´ W	PRIMARY BTA
		55º 41.312´ N	132º 32.818´ W	REPLICATE BTA
25	TBT2S25	55º 41.300´ N	132º 32.781´ W	PROPOSED
		55º 41.301´ N	132º 32.782´ W	PRIMARY SPI, PUC
		55º 41.302´ N	132º 32.784´ W	REPLICATE SPI, PUC
		55º 41.301´ N	132º 32.781´ W	PVV
26	TBT2S26	55º 41.287´ N	132º 32.740´ W	PROPOSED
		55º 41.287´ N	132º 32.744´ W	PRIMARY SPI, PUC
		55º 41.288´ N	132º 32.743´ W	REPLICATE SPI, PUC
		55º 41.287´ N	132º 32.742´ W	PVV
27	TBT2S27	55º 41.276´ N	132º 32702´ W	PROPOSED
		55º 41.277´ N	132º 32.706´ W	PRIMARY SPI, PUC
		55º 41.278´ N	132º 32.704´ W	REPLICATE SPI, PUC
		55º 41.276´ N	132º 32.704´ W	PVV
28	TBT2S28	55º 41.264´ N	132º 32.668´ W	PROPOSED
		55º 41.264´ N	132º 32.667´ W	PRIMARY SPI, PUC
		55º 41.266´ N	132º 32668´ W	REPLICATE SPI, PUC
		55º 41.264´ N	132º 32.666´ W	PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
29	TBT2S29	55º 41.264´ N	132º 32.636´ W	PROPOSED
		55º 41.254´ N	132º 32.636´ W	PRIMARY SPI, PUC
		55º 41.265´ N	132º 32.636´ W	REPLICATE SPI, PUC
		55º 41.254´ N	132º 32.635´ W	PVV
30	TBT2S30	55º 41.241´ N	132º 32.596´ W	PROPOSED
		55º 41.241´ N	132º 32.601´ W	PRIMARY SPI, PUC
		55º 41.244´ N	132º 32.602´ W	REPLICATE SPI, PUC
		55º 41.242´ N	132º 32.597´ W	PVV
31	TBT4S31	55º 41.307´ N	132º 32.893´ W	PROPOSED
		55º 41.308´ N	132º 32.894´ W	PRIMARY SPI, PUC
		55º 41.308´ N	132º 32.895´ W	REPLICATE SPI, PUC
		55º 41.307´ N	132º 32.893´ W	PVV
32	TBT4S32	55º 41.302´ N	132º 32.874´ W	PROPOSED
		55º 41.301´ N	132º 32.878´ W	PRIMARY SPI, PUC
		55º 41.303´ N	132º 32.876´ W	REPLICATE SPI, PUC
		55º 41.301´ N	132º 32.874´ W	PVV
33	TBT4S33	55º 41.296´ N	132º 32.858´ W	PROPOSED
		55º 41.295´ N	132º 32.860´ W	PRIMARY SPI, PUC
		55º 41.296´ N	132º 32.859´ W	REPLICATE SPI, PUC
		55º 41.296´ N	132º 32.859´ W	PVV
34	TBT4S34	55º 41.289´ N	132º 32.838´ W	PROPOSED
		55º 41.291´ N	132º 32.837´ W	PRIMARY SPI, PUC
		55º 41.293´ N	132º 32.838´ W	REPLICATE SPI, PUC
		55º 41.289´ N	132º 32.837´ W	PVV
		55º 41.289´ N	132º 32.842´ W	PRIMARY BTA
35	TBT4S35	55º 41.279´ N	132º 32.803´ W	PROPOSED
		55º 41.281´ N	132º 32.802´ W	PRIMARY SPI, PUC
		55º 41.281´ N	132º 32.799´ W	REPLICATE SPI, PUC
		55º 41.278´ N	132º 32.802´ W	PVV
36	TBT4S36	55º 41.266´ N	132º 32.765´ W	PROPOSED
		55º 41.268´ N	132º 32.762´ W	PRIMARY SPI, PUC
		55º 41.271´ N	132º 32.762´ W	REPLICATE SPI, PUC
		55º 41.266´ N	132º 32.763´ W	PVV
37	TBT4S37	55º 41.254´ N	132º 32.726´ W	PROPOSED
		55º 41.255´ N	132º 32.729´ W	PRIMARY SPI, PUC
		55º 41.256´ N	132º 32.727´ W	REPLICATE SPI, PUC
		55º 41.254´ N	132º 32.726´ W	PVV
38	TBT4S38	55º 41.243´ N	132º 32.691´ W	PROPOSED
		55º 41.245´ N	132º 32.698´ W	PRIMARY SPI, PUC
		55º 41.246´ N	132º 32.695´ W	REPLICATE SPI, PUC
		55º 41.244´ N	132º 32.694´ W	PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
39	TBT4S39	55º 41.232´ N	132º 32.658´ W	PROPOSED
		55º 41.234´ N	132º 32.655´ W	PRIMARY SPI, PUC
		55º 41.236´ N	132º 32657´ W	REPLICATE SPI, PUC
		55º 41.233´ N	132º 32.657´ W	PVV
40	TBT4S40	55º 41.221´ N	132º 32.618´ W	PROPOSED
		55º 41.220´ N	132º 32.618´ W	PRIMARY SPI, PUC
		55º 41.221´ N	132º 32.619´ W	REPLICATE SPI, PUC
		55º 41.221´ N	132º 32.617´ W	PVV
41	TBT5S41	55º 41.285´ N	132º 32.913´ W	PROPOSED
		55º 41.285´ N	132º 32.914´ W	PRIMARY SPI, PUC
		55º 41.286´ N	132º 32.914´ W	REPLICATE SPI, PUC
		55º 41.285´ N	132º 32.913´ W	PVV
42	TBT5S42	55º 41.280´ N	132º 32.899´ W	PROPOSED
		55º 41.282´ N	132º 32.900´ W	PRIMARY SPI, PUC
		55º 41.280´ N	132º 32.901´ W	REPLICATE SPI, PUC
		55º 41.281´ N	132º 32.899´ W	PVV
43	TBT5S43	55º 41.274´ N	132º 32.881´ W	PROPOSED
		55º 41.274´ N	132º 32.881´ W	PRIMARY SPI, PUC
		55º 41.275´ N	132º 32.881´ W	REPLICATE SPI, PUC
		55º 41.274´ N	132º 32.882´ W	PVV
44	TBT5S44	55º 41.268´ N	132º 32.861´ W	PROPOSED
		55º 41.269´ N	132º 32.863´ W	PRIMARY SPI, PUC
		55º 41.268´ N	132º 32.864´ W	REPLICATE SPI, PUC
		55º 41.268´ N	132º 32.862´ W	PVV
45	TBT5S45	55º 41.257´ N	132º 32.827´ W	PROPOSED
		55º 41.259´ N	132º 32.827´ W	PRIMARY SPI, PUC
		55º 41.259´ N	132º 32.829´ W	REPLICATE SPI, PUC
		55º 41.258´ N	132º 32.827´ W	PVV
46	TBT5S46	55º 41.245´ N	132º 32.788´ W	PROPOSED
		55º 41.247´ N	132º 32.792´ W	PRIMARY SPI, PUC
		55º 41.246´ N	132º 32.789´ W	REPLICATE SPI, PUC
		55º 41.244´ N	132º 32.788´ W	PVV
47	TBT5S47	55º 41.232´ N	132º 32.750´ W	PROPOSED
		55º 41.230´ N	132º 32.748´ W	PRIMARY SPI, PUC
		55º 41.229´ N	132º 32.752´ W	REPLICATE SPI, PUC
		55º 41.232´ N	132º 32.750´ W	PVV
48	TBT5S48	55º 41.221´ N	132º 32.715´ W	PROPOSED
		55º 41.222´ N	132º 32.717´ W	PRIMARY SPI, PUC
		55º 41.222´ N	132º 32.716´ W	REPLICATE SPI, PUC
		55º 41.221´ N	132º 32.714´ W	PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
49	TBT5S49	55º 41.211´ N	132º 32.682´ W	PROPOSED
		55º 41.212´ N	132º 32.685´ W	PRIMARY SPI, PUC
		55º 41.212´ N	132º 32.683´ W	REPLICATE SPI, PUC
		55º 41.210´ N	132º 32.681´ W	PVV
50	TBT5S50	55º 41.198´ N	132º 32.644´ W	PROPOSED
		55º 41.201´ N	132º 32.646´ W	PRIMARY SPI, PUC
		55º 41.201´ N	132º 32.643´ W	REPLICATE SPI, PUC
		55º 41.198´ N	132º 32.643´ W	PVV
51	TBT6S51	55º 41.264´ N	132º 32.937´ W	PROPOSED
		55º 41.260´ N	132º 32.939´ W	PVV
52	TBT6S52	55º 41.259´ N	132º 32.922´ W	PROPOSED
		55º 41.262´ N	132º 32.920´ W	PRIMARY SPI, PUC
		55º 41.263´ N	132º 32.923´ W	REPLICATE SPI, PUC
		55º 41.260´ N	132º 32.919´ W	PVV
53	TBT6S53	55º 41.253´ N	132º 32.905´ W	PROPOSED
		55º 41.255´ N	132º 32.902´ W	PRIMARY SPI, PUC
		55º 41.256´ N	132º 32.905´ W	REPLICATE SPI, PUC
		55º 41.252´ N	132º 32.904´ W	PVV
		55º 41.249´ N	132º 32.907´ W	PRIMARY BTA
		55º 41.251´ N	132º 32.898´ W	REPLICATE BTA
54	TBT6S54	55º 41.247´ N	132º 32.884´ W	PROPOSED
		55º 41.250´ N	132º 32.884´ W	PRIMARY SPI, PUC
		55º 41.249´ N	132º 32.888´ W	REPLICATE SPI, PUC
		55º 41.247´ N	132º 32.883´ W	PVV
55	TBT6S55	55º 41.236´ N	132º 32.889´ W	PROPOSED
		55º 41.239´ N	132º 32.851´ W	PRIMARY SPI, PUC
		55º 41.238´ N	132º 32.846´ W	REPLICATE SPI, PUC
		55º 41.234´ N	132º 32.846´ W	PVV
56	TBT6S56	55º 41.224´ N	132º 32.811´ W	PROPOSED
		55º 41.224´ N	132º 32.812´ W	PRIMARY SPI, PUC
		55º 41.223´ N	132º 32.814´ W	REPLICATE SPI, PUC
		55º 41.222´ N	132º 32.810´ W	PVV
		55º 41.221´ N	132º 32.807´ W	REPLICATE PVV
57	TBT6S57	55º 41.211´ N	132º 32.773´ W	PROPOSED
		55º 41.212´ N	132º 32.779´ W	PRIMARY SPI, PUC
		55º 41.213´ N	132º 32.774´ W	REPLICATE SPI, PUC
		55º 41.210´ N	132º 32.774´ W	PVV
58	TBT6S58	55º 41.201´ N	132º 32.738´ W	PROPOSED
		55º 41.201´ N	132º 32.738´ W	PRIMARY SPI, PUC
		55º 41.201´ N	132º 32.736´ W	REPLICATE SPI, PUC
		55º 41.200´ N	132º 32.738´ W	PVV

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
59	TBT6S59	55º 41.189´ N	132º 32.704´ W	PROPOSED
		55º 41.192´ N	132º 32.702´ W	PRIMARY SPI, PUC
		55º 41.190´ N	132º 32.700´ W	REPLICATE SPI, PUC
		55º 41.190´ N	132º 32.703´ W	PVV
60	TBT6S60	55º 41.178´ N	132º 32.667´ W	PROPOSED
		55º 41.180´ N	132º 32.658´ W	PRIMARY SPI, PUC
		55º 41.172´ N	132º 32.664´ W	REPLICATE SPI, PUC
		55º 41.181´ N	132º 32.655´ W	PVV
61	TBT7S61	55º 41.226´ N	132º 32.907´ W	PROPOSED
		55º 41.226´ N	132º 32.903´ W	PRIMARY SPI, PUC
		55º 41.223´ N	132º 32.907´ W	REPLICATE SPI, PUC
		55º 41.224´ N	132º 32.904´ W	PVV
62	TBT7S62	55º 41.215´ N	132º 32.871´ W	PROPOSED
		55º 41.217´ N	132º 32.873´ W	PRIMARY SPI, PUC
		55º 41.215´ N	132º 32.872´ W	REPLICATE SPI, PUC
		55º 41.215´ N	132º 32.872´ W	PVV
63	TBT7S63	55º 41.203´ N	132º 32.834´ W	PROPOSED
		55º 41.203´ N	132º 32.843´ W	PRIMARY SPI, PUC
		55º 41.206´ N	132º 32.837´ W	REPLICATE SPI, PUC
		55º 41.201´ N	132º 32.836´ W	PVV
64	TBT7S64	55º 41.191´ N	132º 32.796´ W	PROPOSED
		55º 41.194´ N	132º 32.801´ W	PRIMARY SPI, PUC
		55º 41.192´ N	132º 32.804´ W	REPLICATE SPI, PUC
		55º 41.191´ N	132º 32.797´ W	PVV
65	TBT7S65	55º 41.179´ N	132º 32.761´ W	PROPOSED
		55º 41.180´ N	132º 32.763´ W	PRIMARY SPI, PUC
		55º 41.182´ N	132º 32.763´ W	REPLICATE SPI, PUC
		55º 41.180´ N	132º 32.760´ W	PVV
66	TBT7S66	55º 41.169´ N	132º 32.728´ W	PROPOSED
		55º 41.172´ N	132º 32.731´ W	PRIMARY SPI, PUC
		55º 41.170´ N	132º 32.736´ W	REPLICATE SPI, PUC
		55º 41.169´ N	132º 32.729´ W	PVV
67	TBT7S67	55º 41.157´ N	132º 32.690´ W	PROPOSED
		55º 41.157´ N	132º 32.694´ W	PRIMARY SPI, PUC
		55º 41.160´ N	132º 32.691´ W	REPLICATE SPI, PUC
		55º 41.158´ N	132º 32.689´ W	PVV
68	TBR1	55º 41.692´ N	132º 32.861´ W	PRIMARY SPI, PUC
		55º 41.694´ N	132º 32.860´ W	REPLICATE SPI, PUC
		55º 41.689´ N	132º 32.865´ W	PVV
		55º 41.692´ N	132º 32.880´ W	PRIMARY BTA

-TABLE 1. SAMPLING LOCATION COORDINATES [a]				
Sample #	Transect ID	Latitude	Longitude	Comments
69	TBR2	55º 41.892´ N	132º 32.549´ W	PRIMARY SPI, PUC
		55º 41.895´ N	132º 32.560´ W	REPLICATE SPI, PUC
		55º 41.890´ N	132º 32.544´ W	PVV
		55º 41.889´ N	132º 32.549´ W	PRIMARY BTA
		55º 41.889´ N	132º 32.544´ W	REPLICATE BTA

Abundance Tables

Scientific Name	Common Name	Abundance
Plants		
Ulva / Monstroma spp.	Sea lettuce	C
Lithothamnion spp.	Crustose red algae	L
Agarum clathratum	Sieve Kelp	L
Laminaria saccharina	Suger kelp	L
Zostera marina	Eel Grass	L
Invertebrates		
Mediaster aequalis	Red star	L
Luidia foliolata	Sand star	C
Pycnopodia helianthoides	Sunflower star	L
Pisaster ochraceus	Ochre star	L
Pododesmus macrochisma	Jingle	L
Cucumaria miniata	Orange sea cucumber	C
Dermasterias imbricata	Leather star	L
Solaster sp.	Sun star	L
Ophiuroidea spp.	Brittle star	L
Chionoecetes bairdi	Tanner crab	L
Cancer products	Red rock crab	L
Pandalus spp.	Shrimp	C
Pagurus spp.	Hermit crab	L
Bankia setacea	Shipworm	L
Protothaca staminea	Littleneck clam	C
Beggiatoa sp.	Bacteria	A
Polyplacophora spp.	Chiton	L
Unidentified Benthic Infauna	Benthic Infauna	L
Metridium senile	Anemone	L
Parastichopus californicus	Sea cucumber	C
Invertebrates		
Cottidae spp.	Sculpin	L
Hexagrammos decagrammus	Kelp greenling	L