

Skagit County Creosote Inventory and Removal Project: Phase III

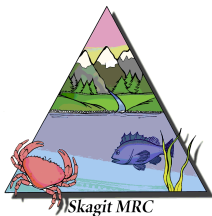
Skagit County Marine Resources Committee

Final Report – January 2009



Creosote Subcommittee

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County: Skagit
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PROJECT TITLE: Treated Wood Inventory and Removal

DELIVERABLES FOR TASK NO: 6 (Beach Watcher Training). This task involved training of Skagit Beach Watchers, who then volunteered for creosote log/piling resurveys on selected shorelines. No specific task for creosote inventories and removal was funded by NWSC during 2007-2009.

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The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its sub-agencies.

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Cover Photo: Loading creosote log pieces from Cypress Island. Photo by Nathan Rice



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Table of Contents

	<u>Page</u>
Introduction	5
Methods	7
Training	7
Resurveys of Selected Shorelines	7
Treated Wood Removal Operations	8
Results	9
Volunteers and Community Education/Outreach	9
Resurveys for Treated Wood	9
Treated Wood Removal Operations	9
Discussion	10
References	11

Appendix 1. Creosote Log Survey Training Agenda

Appendix 2. Phase III Treated Wood Resurveys

Appendix 3. Cypress Island Creosote Inventories, 2006 and 2008

List of Tables and Figures

	<u>Page</u>
Table 1. Skagit MRC and Skagit Beach Watchers creosote project volunteer names and estimated hours for 2008	13
Table 2. Summary of the numbers of pieces and cubic footage of treated wood found on four different beaches	14
Table 3. Summary of the total pieces of treated wood found during the original, first, second and third resurveys at the four sites identified in Table 2	15
Table 4. Treated wood found on the four resurveyed beaches (combined) as percentages of the amounts found on the original surveys	15
Table 5. Summary of the numbers of pieces and cubic footage of treated wood found on two additional shorelines surveyed by Skagit Beach Watchers in 2008	16
Table 6. Summary of the treated wood products removed along Skagit County shorelines from 2004 to 2008	17
Figure 1. Creosote compounds leaching from an old piling in South Fidalgo Bay	18
Figure 2. Creosote compounds leaking from a beached log	18
Figure 3. The vessel and crew used to remove treated wood from Cypress Island in 2008	18
Figure 4. Loading treated wood into a disposal bin on board the recovery vessel	18
Figure 5. Locations of treated wood inventory and removal operations in Skagit County in 2004 and 2005	19
Figure 6. Locations of treated wood inventories and removals by Skagit MRC, 2006-2007	20
Figure 7. Locations resurveyed for treated wood in 2008 by Skagit Beach Watchers and WDNR	21

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Introduction

A large number of docks, trestles, marina structures, floats and bulkheads have been built in the waters of Puget Sound. Most of these structures have been built using a variety of treated woods, although the vast majority has used pressure-treated creosote pilings and timbers.

The term “creosote” as used in this report refers to a variety of products that are mixtures of many chemicals including wood creosote, coal tar creosote, coal tar and coal tar pitch. The most common form of creosote used in the U.S. is coal tar creosote. It is a thick, oily liquid that is typically amber to black in color and is a distillation of coal tar. Creosote pilings and timbers can contain almost 300 chemicals, many of which can be toxic to marine life and can cause abnormalities and death. Up to about 60% of the compounds in creosote solutions are polycyclic aromatic hydrocarbons (PAHs). Creosote-associated compounds can cause human health problems including skin rashes, chemical burns, eye irritation, mental confusion, and kidney and liver problems, even with relatively brief exposures. Longer exposures can cause unconsciousness and death, and some creosote compounds are known to be human carcinogens (<http://www.nsc.org/library/chemical/Creosote.htm>).

Research with Pacific herring (*Clupea pallasii*) has shown that egg hatching success is reduced by 50% at creosote concentrations of 50 parts per billion (ppb) and that hatching success is significantly reduced when embryos were exposed to 3 ppb (Vines et al. 2000). Zooplankton microcosm studies with creosote found that a 50% reduction in abundance occurred at 2.9 ppb (Sibley et al. 2001) and Karrow et al. (1999) found a Lowest Observed Effect Concentration (LOEC) of 0.6 ppb for suppression of rainbow trout immune responses. Fish studies summarized by Weis and Weis (1989) indicate that hatching success of several other fish species is adversely affected in pentachlorophenol (PCP – a compound in creosote) concentrations in the range of 10 to 200 ppb. Other authors have described the effects of a plethora of creosote-related contaminants in marine sediments and sea-surface microlayers to adult fish, developing fish eggs and invertebrates (e.g., see Malins et al. 1984; Kocan et al. 1987; Hardy et al. 1987; PTI Environmental Services 1990; Misitano et al. 1994; Stratus Consulting 2005).

The newer generation of treated woods is primarily of two types: Ammoniacal copper zinc arsenate (ACZA) and chromated copper arsenate (CCA). These treated woods mostly contain metals that can be toxic to marine life in certain situations but these compounds do not generally pose bioaccumulation hazards that some creosote-related compounds might. These compounds may also pose health hazards to children who may be routinely exposed to treated wood chemicals by way of playground equipment and decking materials. While this project primarily targeted creosote-treated wood, both types of wood products were inventoried and removed during recovery operations.

Creosote compounds and other wood preservatives continually drip or leach from treated wood used in marine and aquatic situations (Figs. 1 and 2). Treated wood is often eroded into smaller particles due to the abrasive action of boat traffic, storms and contact with shorelines when pilings break off. Some creosote-related compounds can accumulate in marine sediments (Westin Solutions 2006) where they can cause direct toxicity or they may be mobilized into higher trophic levels via the food chain. Bioassays of sediments collected around creosote pilings in Fidalgo Bay, WA found that sediments were toxic to amphipods (*Rhepoxynius abronius*) and sand dollar (*Dendraster excentricus*) embryos within 0.5 meters of the pilings and that PAH compounds could be chemically detected in the sediments for at least two meters from the pilings (Stefansson 2008). Creosote compounds can also leach into the surface microlayer where they can adversely affect floating fish eggs, invertebrate larvae and plankton. Forage fish feeding on these organisms may then accumulate some compounds from the microlayer and pass them to higher trophic levels (marine fish, sea birds, marine mammals, and humans). Contaminants found in the surface microlayer eventually are deposited on shorelines (the bath tub ring effect), which are rich in marine life, including surf smelt and sand lance eggs, molluscan shellfish, juvenile fish, and crustaceans of many species. Indeed, the conclusions of a recently completed risk evaluation for NOAA (Stratus Consulting 2005) concluded that

“Based on the findings of this report, that creosote moves into the environment under a variety of realistic conditions, and environmental levels of contaminants originating from creosote-treated wood are often toxic, precautions to avoid creosote-treated wood where practical, and measures to isolate potential toxic effects appear to be justified. We recommend that similar precautions be implemented by regulating agencies throughout the United States.”

Given the hundreds of thousands (perhaps millions) of creosote-treated pilings and timbers used in Puget Sound waters, there is little doubt that this is one of many significant sources of non-point source pollution. Several Washington State agencies (e.g., WDFW, WDOE, WDNr, WSDOT) now encourage the use of non-creosote containing pilings and timbers for both new and replacement purposes. WSDOT is now in the process of replacing creosote pilings at most of its ferry terminals with concrete or steel pilings. Additionally, many creosote-treated wood products have ceased to function as they were intended but still leach toxic compounds into Puget Sound waters. These include rogue logs and timbers (those that have broken free and now reside on beaches) and derelict pilings (those still standing in place but that no longer serve a constructive function).

The fact that treated wood products contribute toxic compounds to sensitive parts of our marine environment (bottom sediments, surface microlayer, upper beaches important as spawning areas for forage fish) means that their removal improves estuarine habitats in two ways: 1) net gain in high value habitat and 2) increase in key marine indicator species (i.e., forage fish whose eggs may be adversely affected by toxic contaminants in spawning sand and gravel or in the surface microlayer).

Whatcom County, under the direction of Ms. Joni Cameron and the Whatcom County Marine Resources Committee, removed a substantial amount of treated wood products from their beaches about 5-6 years ago. Skagit MRC's inventory and removal project was modeled after Whatcom County's successful efforts. The Padilla Bay Research Reserve has carried out two creosote removal efforts in recent years, accounting for the removal of about 30 tons of treated wood from Padilla Bay (Riggs 2004; Riggs and Anderson 2005). The Washington Department of Natural Resources has also been carrying out extensive treated wood removal operations in several counties since 2005. The total amount of treated wood removed to date is now over 6,000 tons, which includes several piling removal projects in addition to beached wood (Nathan Rice, WDNR, pers. comm.). However, WDNR estimates that more than 20,000 tons will eventually need to be removed from Puget Sound waters (WDNR 2007).

This is the third of three Skagit County creosote inventory and removal reports. Approximately 1/2 of Skagit County shorelines were surveyed by volunteers for treated wood products during 2004 and 2005 (Dinnel et al. 2005). Most of the remaining county shorelines were inventoried in 2006 and 2007. Removal operations were also carried out in 2004-05 and again in 2006-07 (Dinnel et al. 2005, 2007). This report covers inventory efforts conducted in 2008 by Skagit Beach Watcher volunteers and a creosote removal operation carried out on Cypress Island by WDNR personnel. All inventory efforts in 2008 were targeted at resurveys of shorelines that had previously been surveyed and, in most cases, undergone cleanup work. In addition, the Beach Watcher volunteers were also trained to identify the invasive cordgrass, *Spartina* and report on its occurrence in the inventoried areas.

Methods

Training

A volunteer training meeting was held in May 2008 on Fidalgo Island (see Appendix 1 for a copy of the meeting agenda). Volunteers were provided with information on the identification of various types of treated wood (creosote, ACZA, CCA) and given color shoreline maps (printed from the WDOE shoreline aerial photos web site [<http://apps.ecy.wa.gov/shorephotos/>]) for their respective portions of the county shorelines. The volunteers were instructed to survey their beaches and record the locations, types and sizes of all treated wood products including wood lying on beaches or still in use. All photos and the resulting survey data were returned to Paul Dinnel for collation and analysis and copies were provided to WDNR and the Padilla Bay Research Reserve.

Resurveys of Selected Shorelines

In 2006-07, four beaches were resurveyed for treated wood products approximately one and two years following the original (Phase I) inventory and removal operations. These

four beaches were: 1) the “Casino” beach, just east of the Northern Lights Casino located at the north end of the Swinomish Channel, 2) Crandall Spit shoreline in Fidalgo Bay, 3) a small pocket beach just outside the entrance to Cap Sante marina in Fidalgo Bay, and 4) about 2/3 of the southern shoreline of Guemes Island (see Appendix 2 for photos of these shorelines). These same beaches were again resurveyed in 2008. Three of these beaches had undergone two removal operations each (#1, 2, 4) while the remaining beach (#3) had only been cleaned on one occasion. In addition, two other beaches were resurveyed: 1) the SneeOosh area in North Skagit Bay and 2) the area north and south of the town of Bay View on the eastern shore of Padilla Bay. Neither of these beaches has been cleaned of treated wood with the exception of the Sullivan Minor marsh area between Joe Leary Slough and the town of Bay View in Padilla Bay.

Treated Wood Removal Operations

Inventory data collected by the volunteers were used to prioritize locations for removal of treated wood products. The inventory data clearly showed locations where treated wood accumulated in high densities as a result of currents and proximity to sources. These sites were given highest priority for removal operations, which took place during two previous operations. Removal operations were conducted under the auspices of a Hydraulic Project Approval (HPA) permit issued by the Washington Department of Fish and Wildlife to the Washington Department of Natural Resources.

Treated wood removal in 2004-05 and again in 2006-07 was accomplished using a small tug/barge/work skiff combination provided by a hired contractor (Dunlap Towing of La Conner, WA) in combination with community volunteers. Recovery operations targeted the highest daytime fall and winter high tides so that the tug could best approach the treated wood and pull it off the beaches. Removal was accomplished in the following way: two to five volunteers surveyed the beach ahead of the tug crew and marked each piece with a red flag or fluorescent orange paint. The tug crew then fixed chokers around each piece and pulled it from the beach with the tug. Once a dozen or so pieces were gathered by the tug, the pieces were then loaded onto the small barge using a hydraulic crane. This operation was repeated until the barge was full (about 10-15 tons) upon which time the tug and barge returned to Dunlap Towing’s log yard in La Conner to offload the wood to a temporary storage yard. Volunteers also assisted recovery by picking up smaller pieces of treated wood and carrying these to the barge or work skiff. Additionally, volunteers filled plastic bags with beach debris (mostly plastics) and recovered old tires for disposal.

Treated wood removal from Cypress Island in 2008 was carried out by WDNR, which contracted the vessel *San Juan Enterprise* and its crew to perform the removal operation with assistance from Washington Conservation Corps workers. The vessel was a large landing craft with a drop-down bow ramp and a hydraulic crane (Figs. 3 and 4). The treated wood pieces were lifted from the beach using the crane and deposited in a large trash bin on the deck. These bins were then unloaded at the Port of Anacortes and sent to the hazardous waste landfill site located at Roosevelt, WA.

Results

Volunteers and Community Education/Outreach

Prior to any fieldwork being accomplished in 2008, eight Skagit Beach Watcher volunteers received training in identification of treated wood products. This workshop was held on the beach at SneeOosh, southwest Fidalgo Island (Appendix 1). These volunteers then conducted the treated wood resurveys in during the summer of 2008. These volunteers accounted for an estimated total of 100 hours of effort (Table 1). This is in addition to the time expended by WDNR, the contractor crew and Beach Watcher administrator hours.

Resurveys for Treated Wood

The first resurvey of treated wood on four selected beaches took place during the fall/winter of 2005-2006, approximately one year following removal of treated wood from these beaches. The second resurvey took place along these same four beaches during the fall/winter of 2006-2007, approximately two years following removal operations. The third resurvey took place during the summer of 2008. Each of these four beaches was resurveyed for wood that had repopulated the beaches from floating debris. Fixed pilings and structures were not included in these resurveys. Results of these resurveys (summarized in Tables 2 and 3 and Fig. 8) showed that a moderate amount of treated wood had returned to these shorelines, mostly because of resuspension and redistribution of wood during winter storms. Overall, the amount of new treated wood found on these four beaches (in terms of cubic feet) during the first resurvey was 19% of the amount of wood found during the original survey (all removed at that time), 27.9% during the second resurvey and 15.6% for the third resurvey.

Two additional surveys were accomplished by Skagit Beach Watchers in 2008: 1) The SneeOosh area of south Fidalgo Island fronting Skagit Bay and 2) the eastern shore of Padilla Bay from the south end of the town of Bay View north to Joe Leary Slough (Fig. 7). The SneeOosh area was originally surveyed in 2006-07 and no treated wood has been removed from that location yet. The east Padilla Bay shoreline was originally surveyed by Padilla Bay Reserve staff (Riggs and Anderson 2005) in 2005, although specific data are not available for this report. The only wood removal operation in this portion of Padilla Bay was at the Sullivan Minor marsh just south of Joe Leary slough in 2005 when 10 tons of treated wood was removed.

Treated Wood Removal Operations

Treated wood removal operations were conducted on Cypress Island in 2008 by WDNR and Washington Conservation crewmembers in association with a contractor. This operation covered all Cypress Island shorelines (Fig. 7) and resulted in the removal and disposal of 16.7 tons of treated wood. In addition, WDNR conducted a resurvey of

treated wood at four locations on Cypress Island (Appendix 3). Those data are not reported here.

The total amounts of treated wood removed from Skagit County shorelines by Skagit MRC and WDNR now totals approximately 214.7 tons, which includes 17.9 tons removed from the Deception Pass area by WDNR in 2007. This tonnage, in addition to treated wood removals by other agencies, is itemized in Table 6.

Discussion

For a fourth time, this project successfully used community volunteers to inventory treated wood products on county shorelines. In 2008, WDNR continued to use the methods developed by Skagit MRC (small vessel, choker lines, crane, barge combination) for treated wood recovery on Cypress Island, which was a priority location due to its relative pristine condition and its recent designation as a WDNR Aquatic Reserve. Use of small vessels and cranes has been a cost-effective method since most of shorelines have very little access from uplands or, as in the case of Cypress Island, do not have access roads at all. The cost of recovery by this method may increase somewhat as the density of treated wood decreases, but most county shorelines have little access other than by boat. Removal of treated wood from some areas (e.g., extensive marsh areas more than about 100 meters from a navigation channel) will require removal by hand or by helicopter, as was accomplished by Riggs (2004) at two locations in Padilla Bay.

It is clear from the resurvey data that derelict treated wood products are being resuspended from Puget Sound beaches and redistributed to new beaches during winter storm events. Thus, once beaches are cleaned of treated wood products, removal operations may need to be repeated in subsequent years. However, this may not be all bad, since some shorelines act as magnets (accretion beaches) to concentrate the treated wood, which then facilitates its removal. Some of this new wood is coming from continued failure of derelict structures by storms or accidents. Such an occurrence happened along Guemes Channel during a storm in 2006 when the Guemes Island ferry broke free of its moorings and subsequently broke off several dozen derelict creosote pilings near downtown Anacortes. Some of these derelict pilings were subsequently removed during our Phase II recovery operations. A program to remove derelict structures before they fail would be helpful and is now being pursued by WDNR.

In the last few years a number of other projects in Skagit County have been responsible for additional removals of treated wood in or near county shorelines (Table 6). However, a vast amount of treated wood is still in use in county marine waters, primarily in the form of docks, trestles, bulkheads and marina structures. Some of these pilings/structures are derelict (standing but no longer in use) and could be removed. Most other pilings and structures are still in use and should eventually be replaced with non-toxic alternatives such as steel, concrete or plastics (e.g., plastic pilings, lumber and railroad ties made from recycled plastic – see <http://www.plasticpilings.com/> for examples).

Washington State might wish to consider a legislative ban on the manufacture and use of creosote, or at least a tax on the industry to assist with public cleanup efforts. Such a ban now partially exists in about 40 countries around the world, including all of the European Union countries, which banned the sale and use of creosote for non-industrial uses in June 2003. A substantial number of alternatives to using creosote-treated wood now exist and the overall costs of using non-toxic alternatives (steel, concrete, plastics) is considered to be less than for creosote because of greater material life expectancies.

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Table 1. Skagit MRC and Skagit Beach Watchers creosote project volunteer names and estimated hours for 2008.

Name	Hours
Paul Dinnel, Project Lead	
• Data entry and analysis	10
• Final MRC report preparation	12
Catherine Davis	9
Jean Nelson	9
Tom Richards	25
Jack Middleton	27
Kurt Buchanan	10
Nancy Andrich	9
Elizabeth O'Berry	9
Ken Urstad	2
Total volunteers hours =	122

Table 2. Summary of the numbers of pieces and cubic footage of treated wood found on four different beaches during the original survey (fall/winter of 2004-05), the first resurvey (fall/winter 2005-06) and the second resurvey (fall/winter 2006-07). Wood removals took place only following the original and second resurveys. This summary only includes loose wood on the beaches -- no fixed pilings or structures. See Appendix 2 for detailed survey findings.

Location/Survey	Logs		Timbers*		Total	
	Pieces	Cubic Feet	Pieces	Cubic Feet	Pieces	Cubic Feet
Casino**						
Original Survey (2004-05)	31	283.5	37	399.8	68	399.8
First Resurvey (2005-06)	6	31.1	11	65.1	17	96.2
Second Resurvey (2006-07)	7	27.2	1	60.0	8	87.2
Third Resurvey (2008)	10	42.2	12	17.9	22	60.1
Crandall Spit						
Original Survey (2004-05)	7	70.9	2	30.7	9	101.6
First Resurvey (2005-06)	1	0.5	17	187.6	18	188.1
Second Resurvey (2006-07)	6	31.6	19	92.2	25	123.8
Third Resurvey (2008)	1	2.9	7	43.0	8	45.9
Cap Sante Pocket Beach						
Original Survey (2004-05)	6	46.9	9	4.1	15	51.0
First Resurvey (2005-06)	1	2.1	1	0.2	2	2.3
Second Resurvey (2006-07)	1	2.1	3	2.3	4	4.4
Third Resurvey (2008)	3	3.4	4	3.2	7	6.6
South Guemes Island						
Original Survey (2004-05)	119	1198.6	68	193.2	187	1391.8
First Resurvey (2005-06)	10	103.6	24	26.5	34	130.1
Second Resurvey (2006-07)	63	314.4	57	80.5	120	394.9
Third Resurvey (2008)	16	102.0	37	127.6	53	229.6

*Includes the occasional treated wood derelict structure found loose on the beach (e.g., old floats and docks).

**Casino site is the area east of the Northern Lights Casino at the north end of the Swinomish Channel.

Table 3. Summary of the total pieces of treated wood found during the original, first, second and third resurveys at the four sites identified in Table 2.

Survey	Logs		Timbers		Total	
	Pieces	Cubic Feet	Pieces	Cubic Feet	Pieces	Cubic Feet
Original	163	1559.9	116	627.8	279	2187.7
First Resurvey	18	137.3	53	279.4	71	416.7
Second Resurvey	77	375.3	80	235.0	157	610.3
Third Resurvey	30	150.5	60	191.7	90	342.2

Table 4. Treated wood found on the four resurveyed beaches (combined) as **percentages** of the amounts found on the original surveys.

Survey	Logs		Timbers		Total	
	Pieces	Cubic Feet	Pieces	Cubic Feet	Pieces	Cubic Feet
First Resurvey	11.0	8.8	45.7	44.5	25.4	19.0
Second Resurvey	47.2	24.0	69.0	37.4	56.3	27.9
Third Resurvey	18.4	9.6	51.7	30.5	32.2	15.6

Table 5. Summary of the numbers of pieces and cubic footage of treated wood found on two additional shorelines surveyed by Skagit Beach Watchers in 2008. The SneeOosh area was originally surveyed in 2006 and no treated wood has been removed from this location yet. The east Padilla Bay location was originally surveyed by the Padilla Bay Reserve. This was the first survey of this area by Skagit MRC/Skagit Beach Watchers. Treated wood has only been removed from the Sullivan Minor marsh portion of this shoreline. See Appendix 2 for detailed survey findings.

Location/Survey	Logs		Timbers*		Total	
	Pieces	Cubic Feet	Pieces	Cubic Feet	Pieces	Cubic Feet
SneeOosh						
Original Survey (2006-07)	5	24.5	17	22.1	22	46.6
First Resurvey (2008)	4	21.0	9	19.6	13	40.6
East Padilla Bay						
Original Survey (2004)*	?	?	?	?	?	?
First MRC/BW survey (2008)	42	714.7	46	149.7	88	864.4

*Original survey was by the Padilla Bay Research Reserve (Riggs and Anderson 2005).

Table 9. Summary of treated wood products removed along Skagit County shorelines from 2004 to 2008.

Project	Treated Wood Removed
Cap Sante Marina (Port of Anacortes)	200 pilings
Guemes Island Ferry Docks (Skagit County)	About 60 pilings
Tommy Thompson Trail (City of Anacortes)	About 3,700 railroad ties
Skagit Marine Resources Committee, 2004-05	75.1 tons
Skagit Marine Resources Committee, 2006-07	105 tons
Swinomish Spit (Padilla Bay Reserve)*	19.9 tons
WDNR, Cypress Island, 2008	16.7 tons
Sullivan Minor Marsh (Padilla Bay Reserve)**	10 tons
WDNR, Deception Pass State Park, 2007	17.95 tons
Port of Anacortes, Dakota Creek Industries Dock, 2008	About 1,000 pilings

*Riggs 2004

**Riggs and Anderson 2005



Figure 1. Creosote compounds leaching from an old piling in South Fidalgo Bay. Photo by Paul Dinnel.



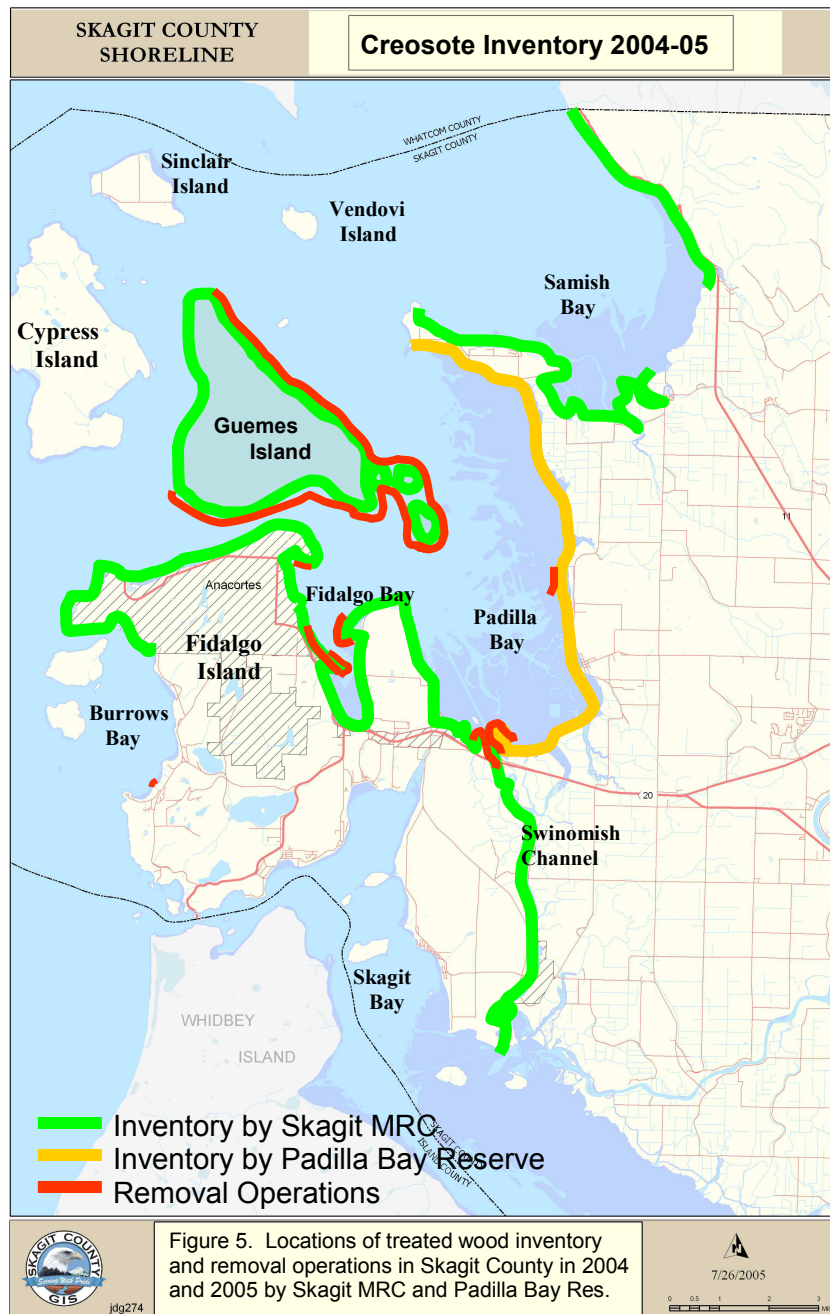
Figure 2. Creosote compounds leaching from a beached log (source: <http://www.pscap.net/id19.htm>).

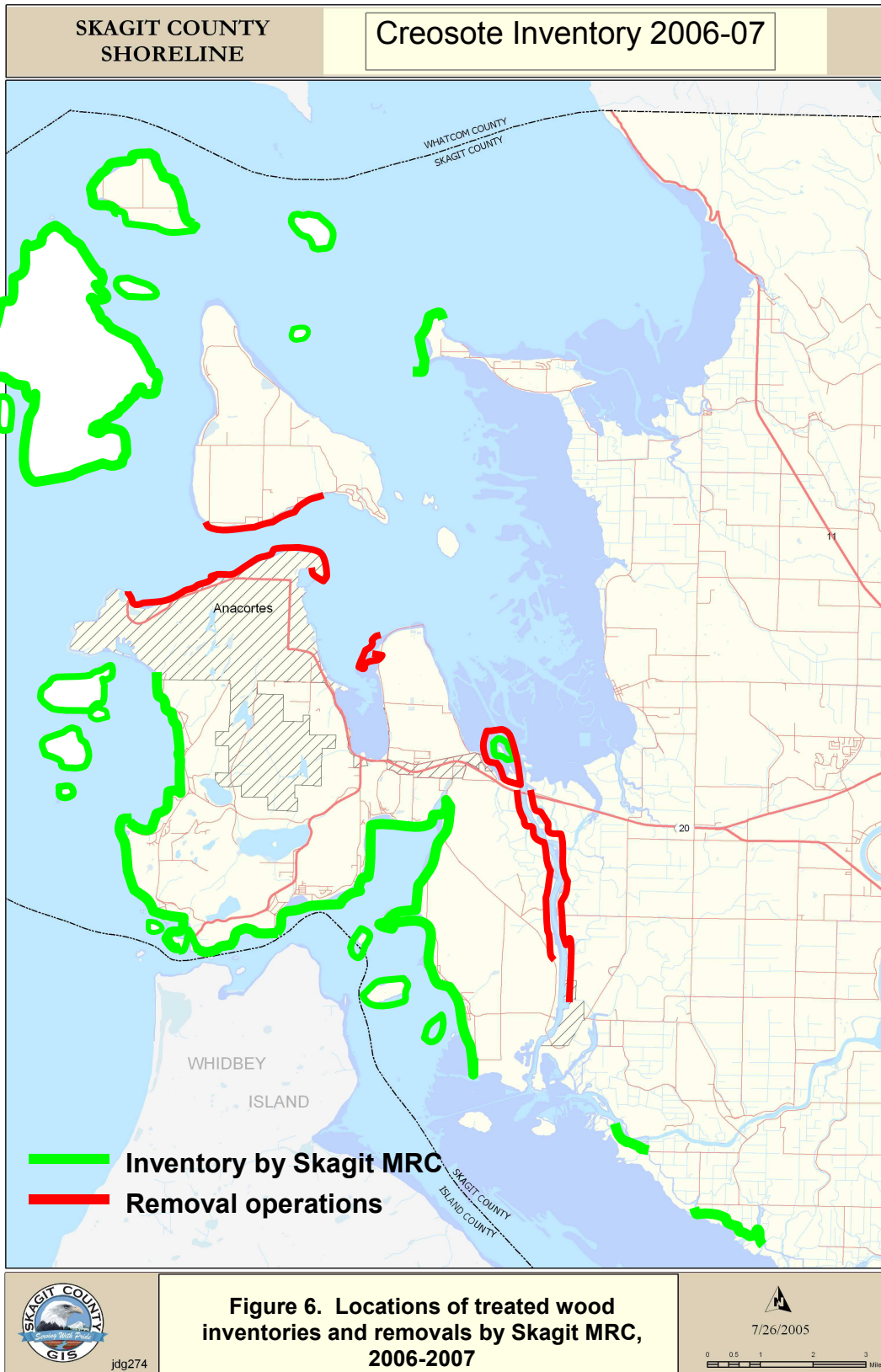


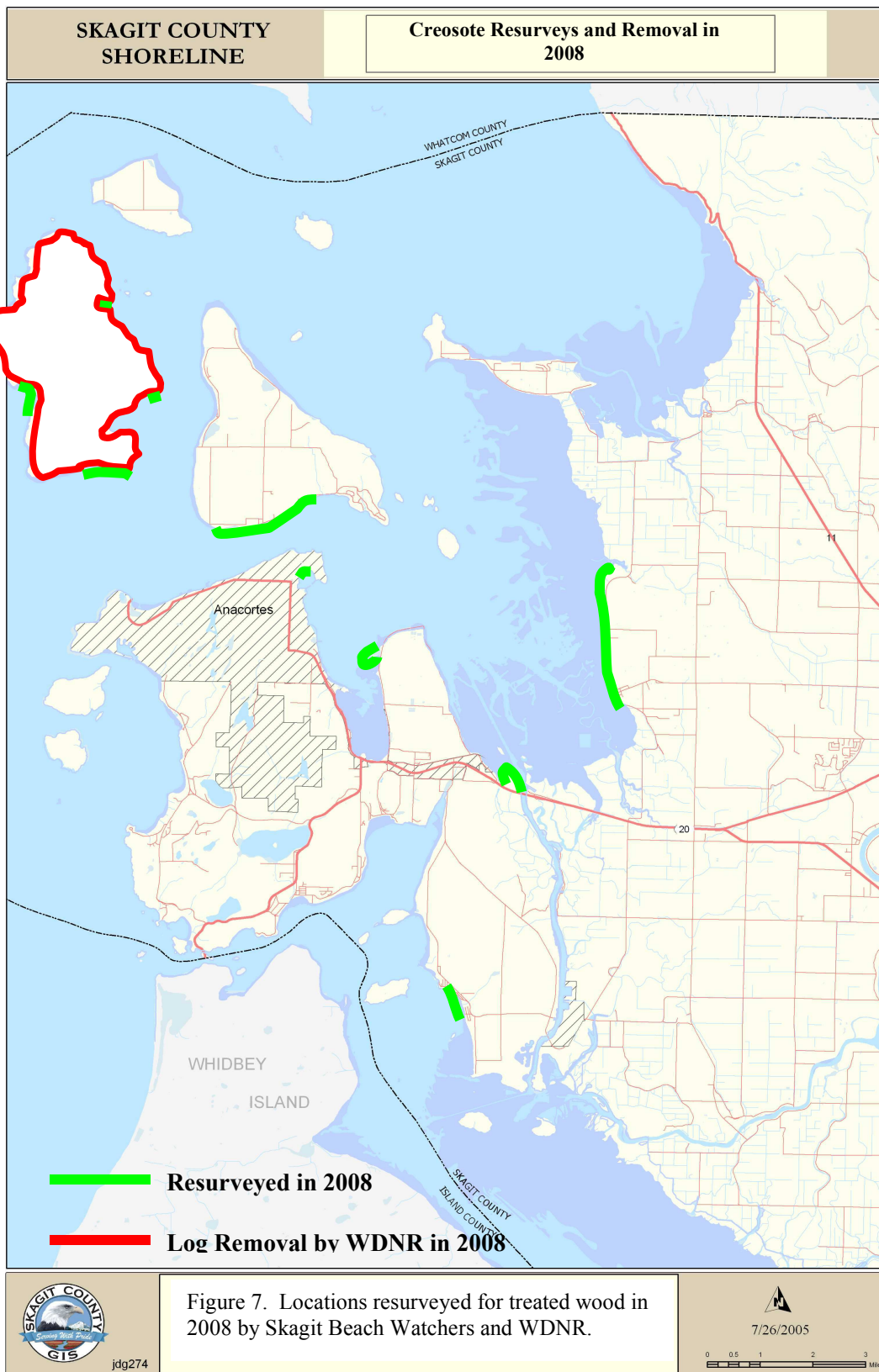
Figure 3. The vessel and crew used to remove treated wood from Cypress Island in 2008. Photo by Nathan Rice.



Figure 4. Loading treated wood into a disposal bin on board the recovery vessel. Photo by Nathan Rice.







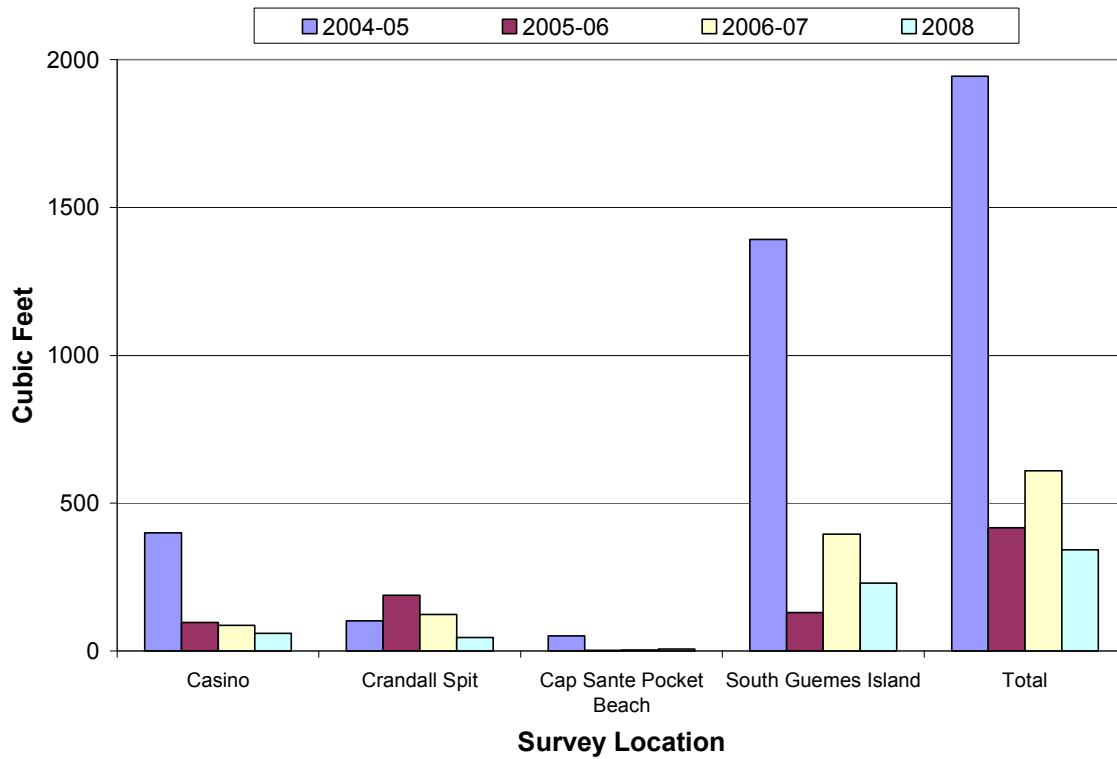


Figure 8. Summary of the amounts of treated wood found on four index beaches surveyed during four periods. The original survey was in 2004-05, followed by resurveys in following years. Treated wood was removed from all beaches (except Cap Sante) in 2005 and again in 2006-2007. Wood was removed from Cap Sante in 2005 only.

Appendix 1

Creosote Log Survey Training

May 23, 2008

SneeOosh Beach, Fidalgo Island

AGENDA

- | | |
|------|--|
| 1:00 | Welcome / Introductions
<i>Adria Banks, WSU Beach Watchers, Skagit County</i> |
| 9:05 | Creosote Log Survey: Collecting Quality Data
<i>Adria Banks, WSU Beach Watchers, Skagit County</i> |
| 1:30 | Break and Head to the Beach |
| 1:45 | Field Session Main Elements
<i>Nathan Rice, Washington Department of natural Resources</i>
GPS use
Creosote log ID
Data collection practice run – beach survey |
| 3:00 | Beach Sign Up and Training Evaluation |

Appendix 2

Phase III Treated Wood Resurveys

(Includes all resurveys from previous years)

Resurvey of Selected Areas for Repopulation of Treated Wood on Cleaned Shorelines

- 1. Resurvey and removal of treated wood at the north end of the Swinomish Channel, just east of the Swinomish Casino. The original survey was in October 2004. At that time, 68 pieces of treated wood were recorded and all but a few pieces were removed. The first resurvey was in January 2006 and the second resurvey was in December 2006, after which time a second cleanup operation again removed all but a few pieces of treated wood. The third resurvey was in June 2008. See previous MRC reports (Dinnel et al. 2005, 2007) for previous inventory data and figures.**

Third resurvey, 13 June 2008

Shoreline Aerial Photo #SKA0349

Surveyed by Catherine Davis, Jack Middleton and Kurt Buchanan



1. Treated beam, 24" x 6" x 4"
2. Creosote timber 84" x 8" x 6"
3. Creosote beam 78" x 13" x 13"
4. Creosote beam 41" x 5" x 3"
5. Creosote log 15" x 13" dia.
6. Creosote log 240" x 10" dia.
7. Creosote beam 96" x 8" x 4"
8. Creosote beam 48" x 12" x 4"
9. Treated beam 40" x 8" x 2"

Third resurvey, 13 June 2008

Shoreline Aerial Photo #SKA0350

Surveyed by Catherine Davis, Jack Middleton and Kurt Buchanan



1. Creosote log, 60" x 14" dia.
2. Creosote log, 25" x 12" dia.
3. Creosote log, 46" x 12" dia.
4. Creosote beam, 90" x 8" x 4"
5. Creosote log, 44" x 7" dia.
6. Creosote log, 102" x 12" dia.
7. Creosote log, 63" x 16" dia.
8. Creosote log, 48" x 12" dia.
9. Creosote beam, 40" x 6" x 8"
10. Treated beam, 42" x 3" x 2"
11. Creosote log, 14" x 18" dia.
12. Treated beam, 64" x 6" x 2"
13. Treated beam, 28" x 8" x 3"

2. **Resurvey and removal of treated wood at Crandall Spit, north Fidalgo Bay. The original survey was in August 2004 after which all treated wood (9 pieces) was removed. The first resurvey was in December 2005, the second resurvey was in January 2007, after which time a second cleanup effort again removed all treated wood. The third resurvey was in June 2008.**

Third resurvey 11 June 2008

Shoreline Aerial Photo #SKA0370

Surveyed by Jack Middleton and Kurt Buchanan



Third resurvey 11 June 2008

Shoreline Aerial Photo #SKA0371

Surveyed by Jack Middleton and Kurt Buchanan



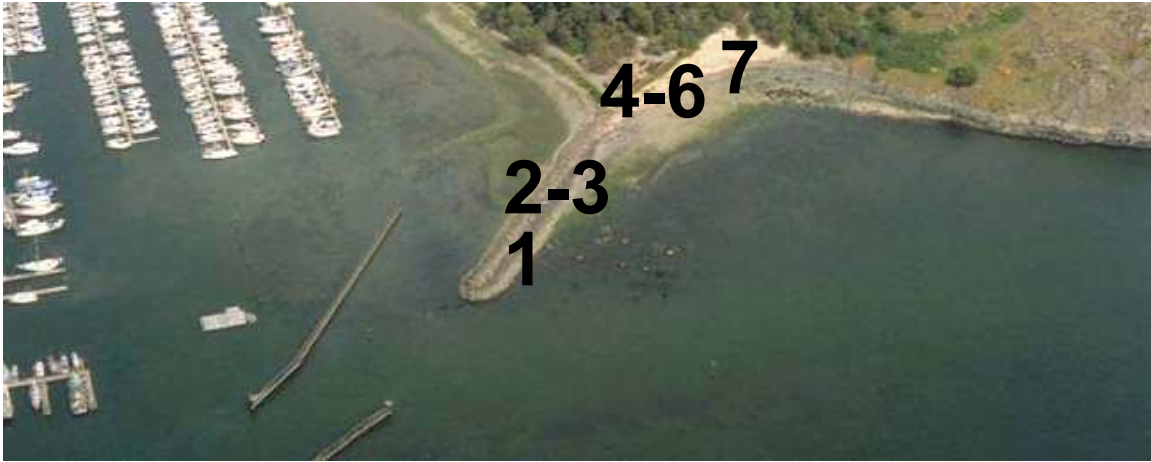
1. Creosote beam, 180" x 16" x 16"
2. Creosote beam, 78" x 6" x 6"
3. Creosote beam, 42" x 8" x 8"
4. Creosote beam, 48" x 6" x 6"
5. Creosote beam, 324" x 4" x 4"

3. **Resurveys of treated wood at a pocket beach just outside and to the east of the entrance to Cap Sante Marina, approximately one and two years following removal activities in 2004. The original survey was in November 2004. At that time, 15 pieces of treated wood were recorded and all were removed in 2004. The first resurvey was in November 2005, the second resurvey was in May 2007 and the third in June 2008. Treated wood at this site was only removed once (2004).**

Third resurvey 13 June 2008

Shoreline Aerial Photo #SKA0402

Surveyed by Catherine Davis, Jack Middleton and Kurt Buchanan



1. Creosote beam, 48" x 3" x 1"
2. Creosote timber, 72" x 6" x 5"
3. Creosote log, 25" x 14" dia.
4. Creosote log, 24" x 10" dia.
5. Creosote log, split, 65" x 1"
6. Treated beam, 108" x 6" x 4"
7. Creosote beam, 31" x 5" x 4"

4. Resurveys of treated wood along the south shore of Guemes Island, approximately one and two years following removal activities in 2004. The original survey was in August 2004. At that time, 187 pieces of treated wood were recorded and all were removed in 2004 (not including a few fixed pilings). The first resurvey was in November 2005 and the second resurvey was in January 2007, after which time most treated wood was once again removed. The third resurvey was in June 2008.

Third resurvey, 30 June 2008

Shoreline Aerial Photo #SKA0047, south shore, west of ferry dock

Surveyed by Tom Richards and Nancy Andrich



1. Creosote log, 62" x 15" dia.
2. Treated timber, 41" x 6" x 2"
3. Creosote beam, 162" x 8" x 4"

Third resurvey, 30 June 2008

Shoreline Aerial Photo #SKA0048, south shore, west of ferry dock

Surveyed by Tom Richards and Nancy Andrich



1. Creosote beam, 94" x 12" x 12"
2. Creosote beam, 122" x 12" x 4"
3. Creosote piling, 48" x 10" dia.
4. Creosote beam, 30" x 12" x 6"

Third resurvey, 30 June 2008

Shoreline Aerial Photo #SKA0049, south shore, west of ferry dock

Surveyed by Tom Richards and Nancy Andrich



1. Creosote beam, 30" x 6" x 4"
2. Creosote beam, 192" x 8" x 6"

Third resurvey, 30 June 2008

Shoreline Aerial Photo #SKA0050, south shore, west of ferry dock

Surveyed by Tom Richards and Nancy Andrich



1. Treated beam, 67" x 8" x 4"
2. Creosote log, 145" x 12" dia.
3. Creosote log, 33" x 11" dia.
4. Creosote log, 52" x 14" dia.
5. Creosote log, 79" x 9" dia.
6. Creosote log, 101" x 12" dia.

Third resurvey, 30 June 2008

Shoreline Aerial Photo #SKA0050, south shore, west of ferry dock

Surveyed by Tom Richards and Nancy Andrich



1. Treated beam, 50" x 8" x 2"
2. Creosote beam, 348" x 18" x 12"
3. Creosote log, 30" x 9" dia.
4. Creosote log, 12" x 9" dia.
5. Creosote beam, 48" x 8" x 4"
6. Creosote beam, 60" x 9" x 2"
7. Creosote beam, 30" x 10" x 2"

8. Creosote beam, 80" x 8" x 4"

Third resurvey, 30 January 2007

Shoreline Aerial Photo #SKA0052, south shore, east of ferry dock

Surveyed by Jean Nelson and Nancy Andrich



1. Treated beam, 41" x 9" x 2"
2. Creosote beam, 66" x 8" x 4"
3. Various creosote pilings pieces, 12"-14" dia.
4. Creosote beam, 78" x 12" x 10"
5. Treated beam, 22" x 10" x 4"
6. Treated beam, 82" x 5" x 4"
7. Creosote beam, 17" x 12" x 12"
8. Creosote log, 12" x 12" dia.
9. Treated beam, 44" x 12" x 2"
10. Treated beam, 36" x 10" x 3"
11. Creosote beam, 18" x 4" x 4"

Third resurvey, 30 January 2007

Shoreline Aerial Photo #SKA0053, south shore, east of ferry dock

Surveyed by Jean Nelson and Nancy Andrich



1. Creosote log, 92" x 7" dia.
2. Creosote beam, 252" x 10" x 10"

3. Treated beam, 39" x 12" x 6"
4. Creosote log, 102" x 12" dia.
5. Treated beam, 51" x 12" x 12"

Third resurvey, 30 January 2007

Shoreline Aerial Photo #SKA0054, south shore, east of ferry dock

Surveyed by Jean Nelson and Nancy Andrich



1. Treated beam, 15" x 11" x 4"
2. Treated beam, 27" x 3" x 1"
3. Creosote beam, 16" x 12" x 12"
4. Creosote log, 264" x 12" dia.
5. Treated beam, 20" x 12" x 4"

Third resurvey, 30 January 2007

Shoreline Aerial Photo #SKA0055, south shore, east of ferry dock

Surveyed by Jean Nelson and Nancy Andrich



1. Creosote timber, 80" x 5" x 1"
2. Creosote log, 276" x 15" dia.

Third resurvey, 30 January 2007

Shoreline Aerial Photo #SKA0056, south shore, east of ferry dock

Surveyed by Jean Nelson and Nancy Andrich



1. Creosote beam, 48" x 14" x 14"
2. Creosote beam, 52" x 3" x 3"
3. Treated beam, 122" x 4" x 8"
4. Creosote beam, 158" x 12" x 4"
5. Creosote beam, 104" x 10" x 6"
6. Creosote log, 237" x 12" dia.
7. Treated beam, 134" x 6" x 2"

5. **First resurvey of SneeOosh area of North Skagit Bay. The original survey was in the October 2006 at which time 22 pieces of treated wood were found in the resurvey area. The first resurvey was conducted in May 2008. No removal operations have occurred along this shoreline yet.**

First resurvey, 23 May 2008

Shoreline Aerial Photo #SKA0550, Hope Island Inn

Surveyed by Tom Richards and Kurt Buchanan



1. Treated beam, 36" x 6" x 2"

First resurvey, 23 May 2008

Shoreline Aerial Photo #SKA0551, south of Hope Island Inn
Surveyed by Tom Richards and Kurt Buchanan



1. Creosote beam, 144" x 10" x 10"
2. Creosote log, 79" x 12" dia.
3. Creosote log, 16" x 12" dia.
4. Treated beam, 36" x 6" x 2"
5. Creosote log, 79" x 12" dia.
6. Treated beam, 79" x 6" x 2"
7. Creosote log, 216" x 10" dia.
8. 5 treated beams, each 96" x 6" x 6"

First resurvey, 23 May 2008

Shoreline Aerial Photo #SKA0552, south of Hope Island Inn
Surveyed by Tom Richards and Kurt Buchanan



1. Patch of *Spartina*, ~1 meter diameter.

6. Survey of the East shore of Padilla Bay, Dike trail north to Joe Leary Slough. This area was originally surveyed by Padilla Bay Reserve personnel (Sharon Riggs, pers. comm.). This is the first survey by Skagit MRC/Skagit Beach Watchers. A cleanup operation in 2005 removed most treated wood from the Sullivan Minor marsh area (see photos SKA0311 and 0312 below) (Riggs and Anderson 2005).

26 June 2008

Shoreline Aerial Photo #SKA0319, North of dike trail

Surveyed by Jack Middleton and Tom Richards



1. 2 creosote piles, each 48" x 10" dia.
2. Unknown number (estimate = 20) of creosote beams used as a bulkhead, each 156" x 10" x 5"

26 June 2008

Shoreline Aerial Photo #SKA0318, at town of Bay View

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 290" x 14" dia.
2. Creosote beam, 28" x 8" x 6"
3. Creosote log, 54" x 12" dia.
4. 20 creosote pilings in use as dock, each 180" x 16" dia.
5. Creosote piling, 36" x 9" dia. plus two small pieces of treated wood

26 June 2008

Shoreline Aerial Photo #SKA0317, at Bay View State Park

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 204" x 14" dia.
2. Creosote log, 339" x 11" dia.
3. Creosote log, 351" x 11" dia.
4. Creosote log, 380" x 16" dia.
5. Creosote log, 84" x 9" dia.
6. Creosote beam, 108" x 11" x 11"

26 June 2008

Shoreline Aerial Photo #SKA0316, north of Bay View State Park

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 360" x 11" dia.

26 June 2008

Shoreline Aerial Photo #SKA0316, at Padilla Bay Research Reserve Headquarters

Surveyed by Jack Middleton and Tom Richards



1. Creosote beam, 40" x 8" x 6"

26 June 2008

Shoreline Aerial Photo #SKA0314, north of Padilla Bay Research Reserve Headquarters

Surveyed by Jack Middleton and Tom Richards



1. Creosote beam, 42" x 3" x 2"
2. Treated beam, 31" x 4" x 4"

26 June 2008

Shoreline Aerial Photo #SKA0313, south of Persons Road
Surveyed by Jack Middleton and Tom Richards



1. Creosote piling, 238" x 13" dia.
2. Creosote log, 42" x 12" dia.
3. Creosote beam, 64" x 7" x 4"
4. Creosote log, 24" x 14" dia.
5. 3 railroad ties, each 72" x 8" x 6"
6. Creosote piling, 80" x 16" dia.
7. Creosote beam, 244" x 12" x 6"
8. Creosote beam, 72" x 12" x 5"

23 July 2008

Shoreline Aerial Photo #SKA0312, north of Persons Road
Surveyed by Jack Middleton and Tom Richards



1. Creosote beam, 43" x 4" x 4"
2. Creosote beam, 60" x 16" x 8"
3. Treated beam, 28" x 12" x 2"

23 July 2008

Shoreline Aerial Photo #SKA0311, north of Persons Road

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 364" X 10" dia.
2. Creosote beam, 87" x 8" x 2"
3. Creosote beam, 96" x 12" x 3"
4. Treated beam, 147" x 4" x 4"
5. Creosote beam, 254" x 12" x 2"
6. Treated beam, 41" x 6" x 2"
7. Treated plywood box, 18" square plus misc. small treated wood debris
8. Creosote beam, 266" x 12" x 4"
9. Creosote log, 14" x 14" dia.
10. Creosote log, 124" x 10" dia.

23 July 2008

Shoreline Aerial Photo #SKA0310, north of Persons Road

Surveyed by Jack Middleton and Tom Richards



1. Treated timber, 57" x 4" x 2"
2. Creosote railroad tie, 43" x 8" x 6"
3. Creosote beam, 72" x 15" x 5"

23 July 2008

Shoreline Aerial Photo #SKA0309, north of Persons Road

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 49" x 6" dia.

23 July 2008

Shoreline Aerial Photo #SKA0308, south of Joe Leary Slough

Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 20" x 14" dia.
2. Creosote beam, 75" x 6" x 3"
3. Creosote beam, 24" x 12" x 3"

4. Creosote log, 686" x 17" dia.

23 July 2008

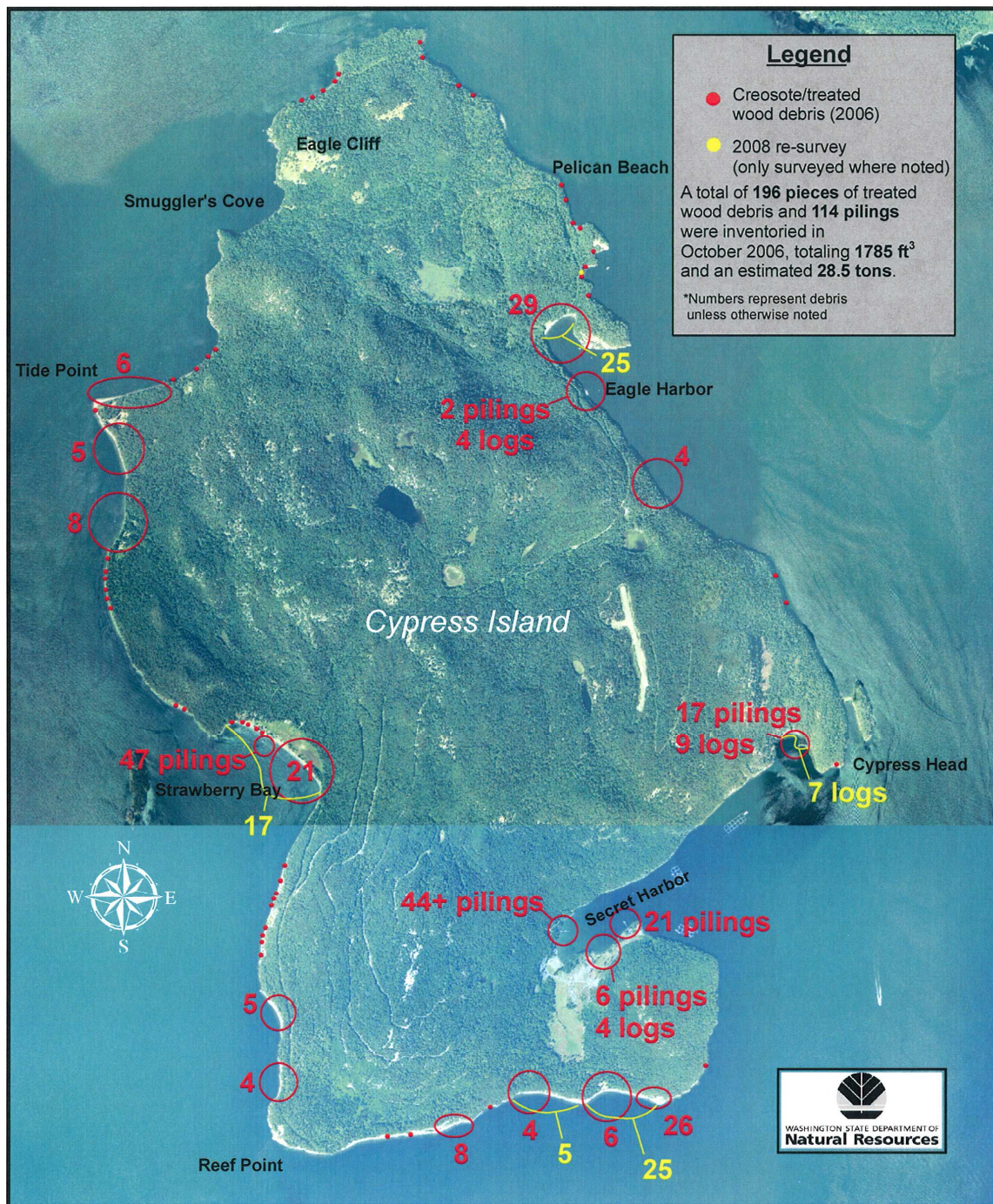
Shoreline Aerial Photo #SKA0307, at Joe Leary Slough
Surveyed by Jack Middleton and Tom Richards



1. Creosote log, 66" x 14" dia.
2. Creosote log, 39" x 10" dia.

Appendix 3

Map of Cypress Island Showing Locations of 2006
and 2008 Treated Wood Inventories by WDNR
Personnel



Cypress Island Creosote Inventory (Oct. 06 / June 08)

Adapted from Skagit County Creosote Inventory and Removal Project Final Report

Map created by Nathan Rice 1/31/08

