Total Maximum Daily Load (TMDL) for

Residues

in the Waters of

Herring Cove of Silver Bay, Alaska

TMDL AT A GLANCE:	
Water Quality-limited?	Yes
Hydrologic Unit Code:	19010203 (Lat. 57°03'N.; Long. 135°12'W.)
Standard of Concern:	Residues in marine waters
Designated Use Affected:	Growth and propagation of fish, shellfish, other aquatic life and wildlife
Environmental Indicator:	102 acre deposit of bark and woody debris
Source:	Industrial, Timber Processing (Alaska Pulp Corporation)
Loading Capacity:	Equals zero (0) for residues because the standard for residues prohibits deposition on the bottom
Wasteload Allocation:	Existing or future point sources of pollution equals zero (0) for residues
Load Allocation:	Existing or future nonpoint sources of pollution or natural sources above background equals zero (0) for residues
Remedial Action to Date:	Sources have ceased; tideland dolphins removed; hazardous materials, logs, and miscellaneous debris (such as metal) have been removed from the tidelands and shoreline; the 100' long by 20' wide metal log slide at the former log transfer facility has been completely removed from the beach
Monitoring to Date:	Dive survey (1992); bathymetry and side-scan sonar surveys (1996); water column, sediment chemistry and contaminants of potential concern, biota sampling, and sediment toxicity tests collected (historical, up to September 1996)
Proposed Future Actions:	Permits or authorizations with strict limitations on residues or settleable solids; long range monitoring; possible remediation of nearshore habitat.

Overview

Section 303(d)(1)(C) of the Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require the establishment of a Total Maximum Daily Load (TMDL) for the achievement of state water quality standards when a waterbody is water quality-limited. A TMDL identifies the degree of pollution control needed to maintain compliance with standards using an appropriate margin of safety. The focus of the TMDL is the reduction of pollutant inputs to a level (or "load") that fully supports the designated uses of a given waterbody. The mechanisms used to address water quality problems after the TMDL is developed can include best management practices and/or effluent limits and monitoring required under National Pollutant Discharge Elimination System (NPDES) permits.

The state of Alaska identified Silver Bay (Figure 1-2, ADEC ROD 1999) as being water quality-limited for residues, toxic and other deleterious organic and inorganic substances, and dissolved gas (ADEC 1996,1998). The Herring Cove sub-unit is not water quality-limited for dissolved gas (low DO) or toxic and other deleterious substances, but is for residues.

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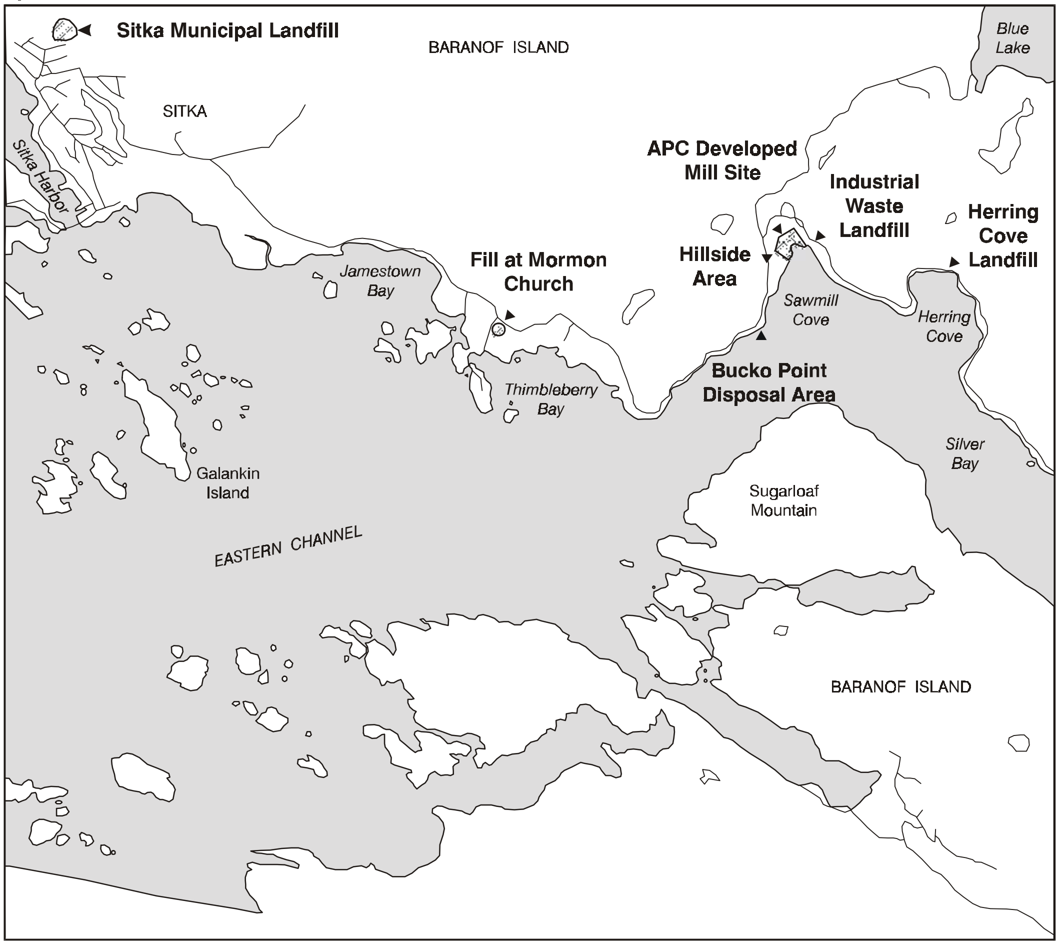


SOURCE: Ecology and Environment, Inc. 1998

Figure 1-2 DEVELOPED MILL SITE

The Alaska Department of Environmental Conservation (ADEC) reviewed monitoring and assessment data for Herring Cove and concluded that bark and woody debris from log storage, rafting and handling associated with pulp mill activities created a deposit of 102 acres in area of varying thickness on the seafloor. This deposit exceeds Alaska's water quality standards for residues. Designated uses for Herring Cove at Silver Bay include: 1) water supply for aquaculture, 2) water supply for seafood processing, 3) growth and propagation of fish, shellfish, other aquatic life and wildlife, and 4) harvesting for consumption of raw mollusks or other raw aquatic life [Alaska Administrative Code (AAC) Sec.18.70.020]. Existing data show that the affected designated use is growth and propagation of fish, shellfish, other aquatic life and wildlife. Silver Bay was placed on Alaska's Section 303(d) list in 1998 for residues, in addition to dissolved gas (low DO), and toxic and other deleterious substances, from timber processing. The uses at Silver Bay have been identified as being impaired since the mid-1980's and Silver Bay has been identified as water quality-limited since 1992.

The majority of the bottom of Herring Cove is covered with sunken logs, bark and woody debris. This TMDL establishes that the assimilative capacity for residues of Herring Cove is zero and that capacity for the cove bottom to accept additional residues has been exhausted. Load allocations or waste load allocations of zero residues are assigned as the sources of residues have ceased and are not expected to occur in the foreseeable future. By assuming that the entire cove bottom is covered with bark and woody debris a margin of safety is accommodated.

General Background

The City of Sitka is located on the West Coast of Baranof Island fronting on Sitka Sound on the Pacific Ocean. Baranof Island is an outer coast island in upper northwest area of southeast Alaska's Alexander Archipelago adjacent to the Gulf of Alaska. Herring Cove is located approximately six miles east of Sitka.

The Alaska Pulp Corporation (APC) began operation in 1959. The mill used a magnesium acid sulfite process to produce high-grade wood fiber pulp. The pulp mill facility ceased operations in 1993. In the fall of 1995 ADEC assumed oversight of a comprehensive investigation of the facility from EPA. A Commitment Agreement (CA) signed by APC required APC to investigate and remediate "constituents of concern" determined to be a threat to human health and the environment to levels and standards established by ADEC based upon a variety of criteria. The CA also defined the general boundaries of the Mill and Bay Operating Unit (OU) study areas, and established an advisory Site Investigation and Remediation Team (SIRT).

The goal ADEC stated early in the project was a thorough and timely investigation and cleanup protective of human health and the environment so that the property could be returned to economic reuse. In the event that any hazardous substances had come to be located on the property through non-permitted releases, an appropriate action would be required. Through the CA, APC contracted Foster Wheeler Environmental Corporation to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the Mill and Bay OUs on behalf of the State.

A Record of Decision (ROD) was developed (dated April 28, 1999) in accordance with State of Alaska statutes and regulations governing the protection of human health and the environment from hazardous substances (AS 46.03, AS 46.09, and 18 Alaska Administrative Code, Chapter 75, Article 3). The decisions in the ROD are based on the Administrative Record for the APC cleanup project, which is located in the offices of the ADEC in Juneau, Alaska. The ROD serves as the basis for the Remedial Design and Remedial Action (RD/RA). In April of 1999 the APC transferred the mill site and property over to the City and Borough of Sitka (CBS). As a consequence, the State of Alaska and CBS entered into a Memorandum of Understanding (MOU) on April 28,1999 that set forth measures for implementing recorded institutional controls and other long-term responsibilities for management of the former APC property. RD/RA will be implemented by the City and Borough of Sitka under the MOU with ADEC entitled *Management Plan for the Sawmill Cove Property*, which will be adopted by ADEC (included as an appendix to the ROD and signed on April 28, 1999).

Following the completion of the Bay OU Ecological Risk Assessment and the Feasibility Study, the study area was reduced to an Area of Concern (AOC) within Sawmill Cove relevant to final Remedial Action Objectives. Six different alternatives were evaluated in the Proposed Plan and the *Bay Operable Unit Feasibility Study* finalized by Foster Wheeler in February 1999. The ***Natural Recovery with Long-Term Monitoring and Institutional Controls*** was the selected alternative.

The ROD is not inconsistent with procedures set forth by the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601 et seq.), and as modified by a Commitment Agreement. EPA has recognized the site as a state-lead site, conducted milestone reviews, and stated its acceptance of the State's approach to the site, as documented in a March 15, 1999 letter to ADEC.

Selection of the remedy and any institutional and site controls may affect future redevelopment, and, likewise, future redevelopment may affect the integrity of the remedy. Consequently, ADEC has taken this into consideration in developing a remedy where protection of human health and the environment and future site use will be compatible with each other.

The Bay Operable Unit, under the Remedial Investigation, includes Sawmill Cove, Herring Cove, and relevant sections of Silver Bay, Eastern Channel and Sitka Sound. The Herring Cove sub-unit is not water quality-limited for dissolved gas (low

DO) or toxic and other deleterious substances but is for residues. Hence, the development of a TMDL for the Herring Cove segment, or sub-unit, of Silver Bay is consistent and reasonable with the natural boundaries of Silver Bay, the remedial investigation and Record of Decision, the pollutant sources, potential controls, and the Section 303(d) listing. This TMDL for Herring Cove is a complementary component to a multi-pronged approach towards waterbody recovery for Silver Bay. This includes, but is not limited to:

-- the ADEC's Contaminated Sites Program's remediation effort and ROD for Silver Bay,
-- the Herring Cove TMDL,
-- future TMDL development for pollutants (such as toxic and deleterious substances) for other segments of the Silver Bay unit not addressed by any of the control efforts above, and
-- evaluation of the Section 303(d) listed area of impairment.

Site Description

Climate

The Sitka area is characterized by a maritime climate with frequent and heavy precipitation. Low-lying fog, overcast skies, rain and drizzle can dominate weather conditions. Average annual precipitation, some of which falls as snow, is approximately 86.11 inches at the airport (NWS Sitka FAA Japonski AP). It is believed that the average annual precipitation at Herring Cove is more than this due to, e.g., orographic effects. Normal summer air temperatures range from 49.9 degrees Fahrenheit (F) to 60.2 degrees F. (National Weather Service), while normal winter air temperatures range from 30.8 to 39.3 degrees F. Winter winds are mostly from the north and shift to southerly winds in the summer. Monthly average wind speeds range from approximately 3 to 6 mph (ROD 1999).

Tides within Herring Cove are semi-diurnal, with a Highest High Water of 14.4 feet, a Mean Higher High Water of 9.9, a Mean Lower Low Water of 0.0, and a lowest tide of minus 4.0 feet. (USC&GS Tidal Data)

Physical Setting

Silver Bay is a classic fjord that empties into Sitka Sound via Eastern Channel on the western coast of Baranof Island. The Bay is approximately 6.8 miles long and varies in width from 0.4 to 0.9 miles. It is approximately 400 feet deep at the mouth, decreasing to about 150 feet near the head of the bay. The surface area of the bay is approximately 4.2 square miles, with roughly 30 miles of shoreline (U.S. EPA 1975).

The shoreline of the bay is narrow, steep, and rocky with slopes typically exceeding 50 degrees. The nearshore environment of Silver Bay consists of bedrock covered with sediments. Much of the intertidal area is very steep and rocky, which is typical of a fjord environment. In a few coves the slope is less steep, allowing for the deposition of finer-grained materials. Sands and silts have also accumulated.

Freshwater from Sawmill Creek enters Sawmill Cove and mixes with the underlying marine water to form a shallow, warmer, and brackish surface layer. The difference in density of the surface water inside and outside of Silver Bay is greatest when freshwater runoff is greatest. The greater the density gradient, the greater the circulation. As surface water moves out of Silver Bay, it is replaced with low-velocity subsurface flows that move into Silver Bay and upward to replace the surface waters near the coast.

Herring Cove is located approximately one mile to the southwest of Sawmill Cove, along the north shore of Silver Bay. It is a small embayment of Silver Bay with a sill and a small island at the mouth. The cove is approximately 0.25 mile wide and 0.5 mile long comprising 102 acres, and it opens to Silver Bay on the southwest. On all other sides it is sheltered by slopes and is surrounded on three sides by the steep timbered slopes of the Tongass National Forest (Foster Wheeler 1996). Water depth in the cove ranges from about 70-80 feet in the interior of the cove to about 35-55 feet at the mouth (NOAA 1989, Foster Wheeler 1996). Unlike the Silver Bay and Sawmill Cove area, the water in Herring Cove is shallow at the mouth of the cove. The island and the surrounding sill retard circulation within the cove and flushing action from Silver Bay.

Sawmill Creek Road winds around the shoreline of the cove and the shore is rocky with no significant beach deposits. Two small freshwater streams flow into the cove from the north and the southeast, respectively. Both of these streams are Alaska Department of Fish and Game cataloged anadromous fish streams. The northern one is cataloged (ADFG# 113-41-10230) for Dolly Varden upstream to where it intersects the road. The southeastern stream is cataloged (ADFG# 113-41-10240) for pink, chum, and coho salmon, and also Dolly Varden. The Herring Cove shoreline is primarily Graywacke bedrock with few beach areas and little accumulated beach sediments. Offshore bedrock will predominate the cove bottom with varying depths of overlying sand and silt.

Delineation of the Herring Cove site boundaries within the RI/FS is based on oceanographic boundaries and the areal extent of log handling and storage operations conducted in the cove (Foster Wheeler 1996). Identification of the Herring Cove waterbody segment is a logical delineation, and is consistent with the RI/FS studies.

The Herring Cove sub-unit is not water quality-limited for dissolved gas (low DO) or toxic and other deleterious substances but is for residues. The area is geographically severable, and is an area within the Silver Bay unit where there were no significant measures of toxics. The Herring Cove sub-unit is not water quality-limited for dissolved gas (low DO) or toxic and other deleterious substances but is for residues. It is the only portion of the Bay unit where residue is on clean bottom sediments.

Applicable Water Quality Standards

Designated Uses

Designated uses for Alaska's marine waters are established by regulation and are found in the State of Alaska Water Quality Standards [18 AAC 70]. For marine waters of the state, these designated uses include: 1) water supply, 2) water recreation, 3) growth and propagation of fish, shellfish, other aquatic life, and wildlife, and 4) harvesting for consumption of raw mollusks or other raw aquatic life [18 AAC 70.020(a)(2)]. Herring Cove does not support the designated use of growth and propagation of fish, shellfish, other aquatic life, and wildlife.

Parameter of Concern

The Alaska 1998 Section 303(d) list, as well as all past 303(d) lists, identify Silver Bay as water quality limited due to exceedances of the residues standard from bark and woody debris deposits as result of log rafting, storage and handling associated with pulp mill activities. Logs and bark are prevalent in Herring Cove with the majority of the cove bottom (~102 acres) covered with sunken logs.

Applicable Water Quality Criteria

The Alaska Water Quality Standards state that residues in marine waters "May not .... cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines" [AAC Sec.18.70.020(b)(2)].

Pollutant Sources

Point Source

There are no NPDES point source discharges to Herring Cove, however there are two small pipes (approximately six and 12 inches) in the northeast corner of the cove that are leachate discharge points for the Herring Cove Wood Waste Landfill. Both pipes have very minor flows. The Herring Cove Wood Waste Landfill is located adjacent to Herring Cove, approximately one mile east of the mill, and covers an approximate area of 450 feet by 480 feet. The landfill operated under an ADEC permit and received wood debris from mill operations, including dredge spoils from the head of Sawmill Cove. The landfill closed officially in January 1993 and was later capped with a 2-foot compacted soil cover and re-vegetated. It currently has a thick grass cover.

Leachate samples from the Herring Cove Wood Waste Landfill contained dissolved copper at or near the surface water quality criteria (18 AAC 70). Follow-up sampling conducted as part of the landfill monitoring requirements under 18 AAC 60 documented dissolved copper in Herring Cove leachate in concentrations above the applicable water quality criterion (2.9 micrograms per liter). ADEC subsequently directed APC to collect samples immediately offshore of the leachate discharge point, in a small drainage seep east of Herring Cove, and in marine waters at nearby Whale Park and Bear Cove. The purpose of the follow-up sampling was to determine whether the concentrations of copper in the leachate were potentially affecting nearshore surface waters, and to document whether dissolved copper may be naturally occurring.

Samples were collected in February 1998. The detected concentration in marine water adjacent to the leachate discharge point was 17 micrograms per liter, while the leachate copper concentration was non-detect. Offshore samples at Bear Cove and Whale Park were 47 and 50 micrograms dissolved copper per liter respectively.

ADEC concluded that copper in both the nearshore marine waters and in the Herring Cove Wood Waste Landfill leachate is probably from natural sources. *Background Chemical Concentrations in Soil Near Sitka, Alaska* (Foster Wheeler, May 1998) documents background concentrations of copper in area soils. Recent information from the woodwaste leachate discharge shows that this is minor input and does not contribute residues to the cove (see Appendix: Herring Cove Woodwaste Landfill). ADEC is expecting a final report on the landfill and its discharges in the fall of 1999 and will be reviewed. If the report is approved it will end the post closure monitoring period for the landfill.

Other Sources and Natural Sources

Since 1959, the waters of Herring Cove have been used for industrial purposes. APC conducted log handling and storage operations in the cove for 30 years. Production at the pulp mill began in 1959 and continued until the mill closed permanently in 1993. Herring Cove was used by the mill primarily as a log storage area, where multi-layer log rafts (in log bundles) were brought, unbundled and reestablished as flat (single layer) rafts for transport to the pulp mill facility about a mile west to

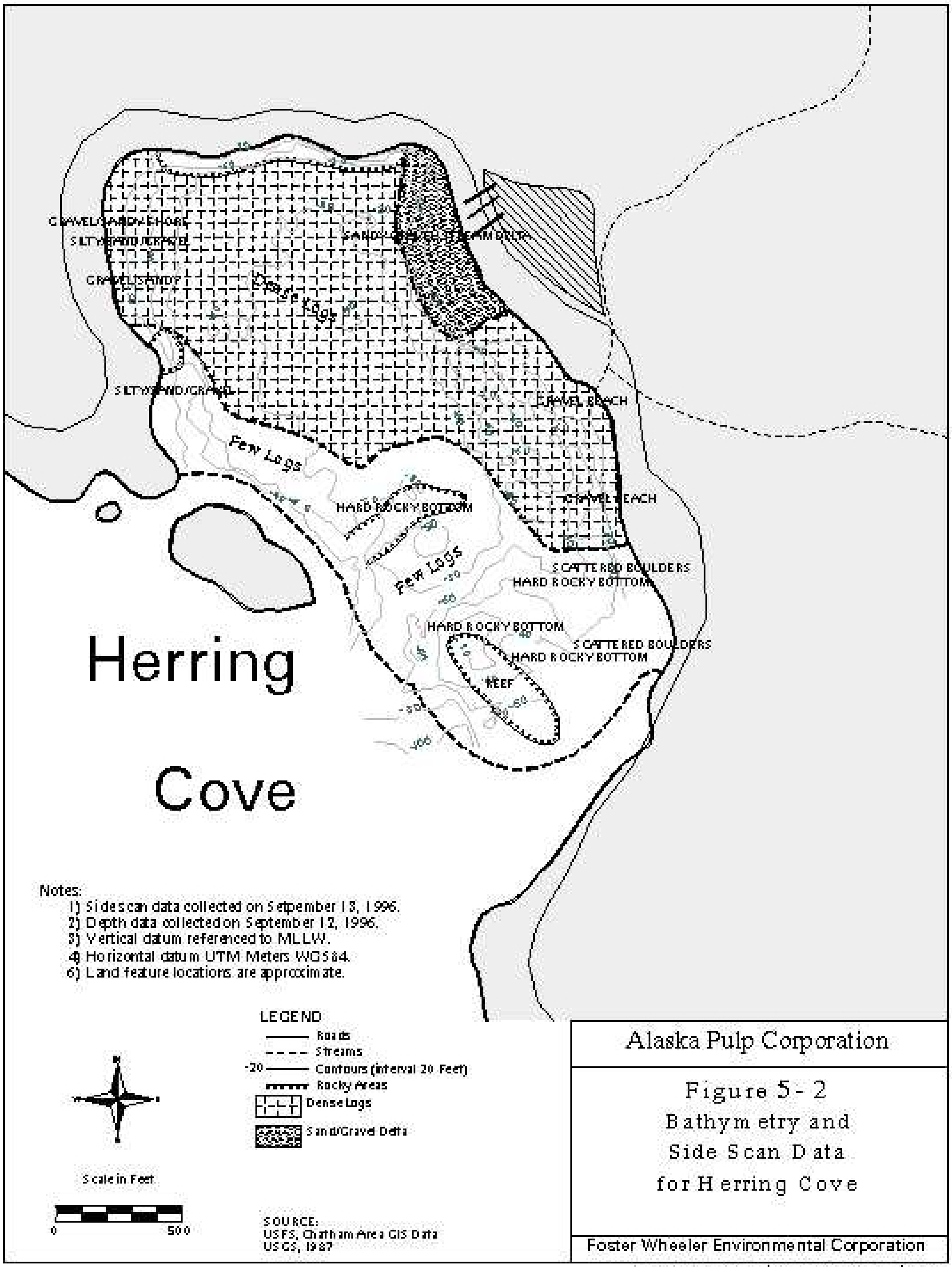
Sawmill Cove. Although there are US Army Corps of Engineers permits associated with Herring Cove dating back to 1956, regular use of the cove began in 1963-4.

Typical operations associated with log storage in Herring Cove included:

- Transport of log rafts (bundled) to and from the cove using tug boats
- Separation of log bundles (cutting of log bundles)
- Construction of flat rafts (single log depth instead of bundles)
- Transport of flat rafts to Sawmill Cove using tug boats
- Construction of log booms and stiff legs for anchoring log rafts.

One-inch steel cable shoreline ties to trees on the upland shore were established essentially along the entire shoreline of the cove as a means to secure log rafts. Logs typically were stored in all areas of the cove as evidenced in 1991 aerial photography (USDA 1991). A land based log storage area was located on the eastern side of the cove near the landfill area. Logs were brought to this area by log truck and were placed on the beach at low tide to be floated by the rising tide.

In the early 1980's the Herring Cove log transfer facility (LTF) was constructed along a gently sloping tidelands area on the northeastern side of the cove for placing logs in the water from the Green Lake dam and powerline construction project. In 1990 ADEC issued a (Section 401) Certificate of Reasonable Assurance for the LTF and proposed barge unloading area on the north shore of the cove. This 401 certification assigned the LTF a one acre zone of deposit. In 1990 the LTF, a low angle steel rail device, was constructed and APC transferred a small amount of timber volume across the facility in 1990 and 1991 (approximately 2,000 MBF). A dive survey (conducted on June 5, 1992) completed by APC (dated March 26, 1993) revealed that there was little or no accumulation of bark in the vicinity of the LTF from the recent operation at the site (APC 1993). The LTF log slide was removed in 1999.


GRAVEL/SANDY SHORE
SILTY SAND/GRAVEL
GRAVEL/SANDY
SILTY SAND/GRAVEL
SANDY GRAVEL STREAM DELTA
Dense Logs
Few Logs
GRAVEL BEACH
HARD ROCKY BOTTOM
Few Logs
GRAVEL BEACH
SCATTERED BOULDERS
HARD ROCKY BOTTOM
HARD ROCKY BOTTOM
SCATTERED BOULDERS
HARD ROCKY BOTTOM
REEF
Herring
Cove
Notes:
1) Sidescan data collected on Setpember 13, 1996.
2) Depth data collected on September 12, 1996.
3) Vertical datum referenced to MLLW.
4) Horizontal datum UTM Meters WGS84.
6) Land feature locations are approximate.
LEGEND
Roads
Streams
-20 Contours (interval 20 Feet)
Rocky Areas
Dense Logs
Sand/Gravel Delta
Scale in Feet
0
500
SOURCE:
USFS, Chatham Area GIS Data
USGS, 1987
Alaska Pulp Corporation
Figure 5-2
Bathymetry and
Side Scan Data
for Herring Cove
Foster Wheeler Environmental Corporation

The results of side scan sonar mapping conducted in Herring Cove as part of the Remedial Investigation and Feasibility study are depicted in Figure 5-2. The figure indicates that the majority of the cove bottom, excluding the shallow reef area at the southwestern end, is covered with sunken logs. This is consistent with the historical practices of unbanding rafts of log bundles in the cove to reconstruct single layer rafts for transport to the mill at Sawmill Cove. There is no evidence of processed wood solids debris (i.e., pulp process wood residue from the mill outfall) within Herring Cove, it is logs and bark that are prevalent throughout the cove. Bark and woody debris from pulp mill activities (log transfer, storage and rafting) have created a deposit of 102 acres in area of varying thickness on the bottom of the cove.

Long-term use of log storage areas in coastal Alaska, such as Herring Cove, can lead to impairment of beneficial uses through the deposition of bark and woody debris from historical log rafting activities. Long-term log storage areas are often sought in well-protected embayments where the effect of wind, tidal and storm events are minimized and thereby result in accumulation of residues on the ocean bottom. More specifically, for example, the state of Alaska has identified three similar long-term log storage areas on Alaska's 1998 Section 303(d) list as impaired from bark and woody debris residues (Schulze Cove, Twelvemile Arm, and Tolstoi Bay). All of these sites exceed the one acre/10 cm zone of deposit which has been the common interpretation of the water quality standards for residues that is routinely applied to such facilities (ADEC 1998; Tetra Tech 1996).

There are no other sources of residue in Herring Cove. Although it can be assumed that the two small freshwater streams contribute some level of natural residue or settleable solids to the cove bottom (i.e., natural background), it is believed that the contribution of these residues from these natural sources is insignificant, and therefore is not treated as a source in this TMDL.

Effects of Bark and Woody Debris

Extensive accumulations of bark and woody debris have been recorded at a number of LTFs in southeast and southcentral Alaska and the degradation rate of bark and woody debris appears to be very low. If transport processes (i.e., wind-, tidal-, storm-driven currents) do not remove bark and woody debris from the vicinity of a LTF or log storage area, marine organisms in the receiving waters may be adversely affected. Adverse affects are likely to occur through one or more of the following processes:

-- Burial
-- Alteration of substrates

-- Reduction of dissolved oxygen in sediments and waters

Bark and woody debris are most likely to affect benthic organisms; those invertebrates that are sessile or capable of only limited movement are particularly susceptible to impacts. Studies have documented adverse effects of bark and woody debris accumulations on benthic organisms associated with LTFs. The observed effects include reductions in abundance, diversity, biomass, fecundity, and growth rate. It is likely that observed effects are the result of a number of processes occurring together (i.e., burial and oxygen reduction) (Tetra Tech. 1996).

The effects of burial by bark and woody debris on organisms are likely to be species-specific. As little as 1 cm of debris may adversely affect the diversity of benthic infauna. Reduction in abundance and diversity is likely to occur for benthic infauna (e.g., polycheate worms), and habitat loss may adversely affect mobile epifauna (e.g., crabs). Sessile epifauna (e.g., sea anemones) may actually experience an increase due to the increase in habitat suitable for anchoring and growth. (Tetra Tech 1996)

The alteration of substrate is likely to be the primary adverse impact due to bark and woody debris, and substrate alteration could continue to prevent community establishment for decades, even after cessation of activities. Changes that may adversely affect organisms include disruption of feeding activities, reduction in the mobility of organisms, and reduction in the recruitment potential of the site due to the presence of substrates inappropriate for inhabitation by organisms adapted to sediments (Tetra Tech 1996).

Leaching of water-soluble substances from a log begins immediately after the log enters the water and, as time passes, these substances are depleted and no further leaching takes place (Tetra Tech 1996). The decomposition of bark and woody debris is accompanied by a reduction in oxygen levels. Oxygen may be reduced in sediment interstitial waters and in the overlying water column. To calculate potential oxygen depressions due to oxygen demand caused by decaying bark and woody debris it is necessary to have estimates of a number of variables (such as, bottom area covered, ambient oxygen concentration of the receiving water, biological oxygen demand of the debris per unit area, etc. and other variables, temperature, salinity, etc.). For instance, if receiving waters are relatively well-flushed, an assumed dilution factor may be greater, yielding lower oxygen reductions than calculated. A lack of data concerning the transport processes occurring within the receiving water precludes more definitive statements. If organisms are directly exposed to low oxygen concentrations (e.g., infauna under a large accumulation of bark and woody debris in a poorly flush area of a bay), they could suffer from sub-lethal effects or mortality. Impacts to organisms due to oxygen stress are likely to occur only in poorly flushed areas and are likely to affect only benthic infauna or sessile epifauna. (Tetra Tech 1996)

Water Quality Analysis

Water Quality Data

There is extensive water quality information contained within the RI/FS documents for the Mill and Bay OUs, including water column, sediment chemistry and contaminants of potential concern, biota sampling, and sediment toxicity tests, with limited sampling of all of the above for Herring Cove. One of the best sources of available information for Herring Cove is the bathymetry and side-scan sonar surveys collected in September 1996. Past practices, i.e., log storage and handling activities in the cove for 30 years, has resulted in log and woody debris coverage of virtually the entire cove bottom. (Foster Wheeler 1996) Although the LTF had an authorized zone of deposit in 1990, the log storage and handling activities in the cove did not, and this is an exceedance of water quality standards.

Although impacts to organisms due to oxygen stress are likely to occur only in poorly flushed areas, DO measurements taken (September 1997) in Herring Cove were within range. DO in Herring Cove ranged from 13.1 ppm at the surface to 6.8 ppm at depth. These concentrations were within the range observed in a 1956 study. (Foster Wheeler 1998)

Sediment chemistry results and the sediment toxicity evaluation provided information to identify the Contaminants of Concern (COCs). Ecological Chemicals of Potential Concern (COPCs), described in the ROD, were compared to State of Washington sediment management standards and NOAA ecological benchmarks to help develop the suite of ecological Contaminants of Concern. No contaminants from Herring Cove and other Bay Unit embayments (Jamestown Bay, and Thimbleberry Bay) were elevated above these benchmarks. Ammonia and sulfides (as measured in sediments), associated with the degradation of organic material in the absence of oxygen, were present in Sawmill Cove and Herring Cove.

TMDL Evaluation and Approach

This TMDL sets a loading capacity and load allocation of zero, since the water quality standard says that no debris may be deposited on the bottom.

Though side scan sonar survey results show an area of dense logs in the cove, approximately that area in the northern half of the cove, the remainder of cove is identified as having “few logs.” Based on the level of historical log storage and rafting activities, and other available information, it is believed that the entire cove bottom (102 acres) is covered with bark and woody debris residues and the bottom substrate has been adversely altered.

Assimilative capacity is the ability of the receiving waters to assimilate the pollutant. With seafood residues, for example, the particles can degrade and/or be washed away by currents and transport processes, so a certain amount of pollutant discharge can be allowed without a deposition of residues on the bottom. Historic and recent data indicate that the driving factors, which have established patterns in Silver Bay, do not apply to Sawmill Cove and that the upper reaches of Sawmill Cove are relatively quiescent with limited current velocity in the deep water. (Foster Wheeler 1999) By comparison, in Herring Cove, a much smaller embayment with a sill at its mouth, it is believed that there is little flushing action and dispersal of woody debris and degradation of residues occurs very slowly, so that settleable solids or residues that get discharged to the cove gets deposited on the bottom.

When assessing the capacity of a flowing waterbody to assimilate pollutant inputs, water quality agencies can perform straightforward calculations using the critical design flow for the waterbody and the water quality criteria values for the pollutant of concern. In these cases, loading capacities are expressed as pollutant mass per time (such as pounds per day).

Since the sources (i.e., loads from point and nonpoint sources) have ceased at Herring Cove, there is no on-going discharge. Herring Cove is impaired from historical sources. It is recognized that some water quality nonattainment is due in part, or entirely, to extremely difficult to solve historic problems and require special consideration. These include circumstances are, for example, where remediation/restoration is technically and/or practically very difficult and extremely costly, where restoration is a function of processes that are inherently slow, or where no federal, State, or local agency has legal authority to force active restoration. It has also been recognized that in such instances, where necessary, a TMDL implementation plan involving such sources allow for a relatively longer timeframe for water quality standards attainment (FACA 1998). The 30-year accumulation of bark and woody debris over an area greater than 100 acres of marine waters is a case study of such a historic problem.

The Herring Cove problem stemming from historical residue deposits, and not water column contamination, is not amenable to a traditional TMDL loading capacity approach. Such historical impairments are difficult or impossible to express in terms of load. Nevertheless, the goal is to achieve and maintain water quality standards.

Because of the designated use that is impaired (aquatic life), and the critical adverse effects of bark and woody debris are manifest through burial, altered substrate, and reduction of DO, the amount of natural bottom in the cove is the key measure of health. The capacity of the cove to accept additional residues may, however, be expressed through the areal extent of unaltered cove bottom. The areal extent of the cove bottom is 102 acres. Since available information indicates that the entire cove bottom is covered with bark and woody debris residue the capacity of Herring Cove for residue has been exhausted.

Clean Water Act §303(d)(1)(C) requires that TMDLs incorporate a margin of safety component that accounts for the uncertainty about the pollutant loads and the quality of the receiving water. Setting a margin of safety makes sense where the response of the water body to the pollutant parameter in question is uncertain. As stated previously, the degradation rate of bark and woody debris appears to be very low and the persistence of bark and woody debris in the marine environment can be highly variable and unclear. Similar bark and woody debris deposits elsewhere in coastal Alaska have been suspected of persisting for decades. Factors that can enhance the rate of recovery of such water are transport processes (i.e., wind-, tidal-, storm-driven currents) that remove bark and woody debris from the vicinity of a LTF and log storage area.

Herring Cove is a small embayment with a sill at its mouth and it is uncertain how much flushing or water circulation is present to enhance this transport processes effect. Another factor that can enhance the rate of recovery is the introduction of fresh sand and gravel (e.g., freshwater sources) on top of the woody debris layer to establish new habitat for bottom dwelling organisms. The freshwater input into the cove is minor and though the freshwater sources may contribute some fresh sand and gravel to the cove bottom and enhance recovery. It is believed that that this input is minor natural background input to the cove, hence the assimilative capacity of the cove is zero beyond natural background.

Since the side scan sonar surveys show dense logs in the northern half of the cove and few logs elsewhere, and all that is known is that the entire cove was used for log storage and handling, it is uncertain as to the extent of coverage over the entire bottom. That is, there may be isolated areas of bottom in Herring Cove where aquatic life has been unaltered. The margin of safety for Herring Cove, therefore, is the establishment of a presumption that the entire cove bottom is covered and that the cove bottom is exhausted for residues as a means to protect any isolated unaltered bottom. A "no additional residues" prescription for Herring Cove would ensure that adequate capacity exists or is maintained for dissolved oxygen (DO) until additional investigations are conducted or a TMDL is developed.

Seasonal Variation

Seasonal variation must be considered in TMDL development. Seasonal variation considers changes in pollutant sources or other conditions that might effect the assimilative capacity or the beneficial uses of the waterbody.

Hydrologic features (e.g., vertical density structure and currents) of Silver Bay were extensively studied in 1957 by the University of Washington, prior to the construction of the mill. The oceanography was re-evaluated in 1974 by EPA, who verified many of the features described in the 1957. The circulation within Silver Bay and the vertical distribution of temperature and salinity are function of freshwater runoff entering the bay. Freshwater entering the bay mixes to some extent with the salt water and eventually flows out to sea in the upper layer. A corresponding inflow of sea water takes place below the upper layer, and an approximate steady state prevails.

There is no seasonal variation of the residue input into Herring Cove because the sources have ceased, the sources are historic. The residue (primarily bark and logs) is relatively immobile. Although decomposition of existing in-place residues may vary slightly over the course of a year, both decomposition and residue are not seasonal in nature. Season has no known effect on the assimilative capacity or impact on the beneficial use.

Freshwater flows are at a minimum during February and March and are at a maximum during June through October, largely as a consequence of summer snow melt and fall rains. Although, in general, the circulation within Herring Cove can be assumed to be similar to Silver Bay and Sawmill Cove, Herring Cove is much smaller than Silver Bay and the freshwater input far less than that of the Bay and Sawmill Cove. Freshwater circulation would be far less in Herring Cove than Sawmill Cove because of the sill at the mouth of the cove and nominal freshwater sources. (Foster Wheeler 1998) Hence, there is no seasonal variation of residue in Herring Cove to be accounted for in this TMDL.

Timeframe for Attainment of Water Quality Standards

The RA/ROD concludes that the natural recovery process in the AOC in Sawmill Cove is expected to improve the substrate to a condition that will fully support aquatic life in 40 years. Although both residues and toxic and deleterious substances may physically remain in Sawmill Cove after 40 years, if the ecological remedial action objective (RAO) has been met, the water quality criteria will also have been met. (ADEC 1999)

This TMDL for Herring Cove, however, is based on the residue criteria so the timeframe for attainment is much longer. Pollutant persistence is a function of the degradation rate of a pollutant, the transport processes, and cycling of the pollutant between sediments, waters, and biota. Transport models have not been developed for materials discharged from LTFs, and to develop such a model would require the availability of a wide range of site-specific information. Frequently a lack of necessary data prevents estimates of transport. Although persistence of bark and wood debris at LTFs in southeast Alaska has not been directly measured, it is likely that degradation of the pollutants would occur over decades. There have been reported decay rate constants of 0.011/yr and 0.135/yr, respectively, for Sitka spruce and western hemlock and these decay rates correspond to half-lives of 63 and 51 years, respectively. The amount of time required for 90 percent decay of Sitka spruce and western hemlock is 209 and 171 years, respectively. Discharge of larger-sized particles (e.g., whole logs to the bottom of Herring Cove) may increase the persistence of bark and woody debris. Although these values were measured for log mineralization on land, not in a marine environment, they illustrate the extremely slow degradation rate of bark and wood debris.

Natural attenuation may be the best implementation method for Herring Cove because it involves less habitat disturbance/destruction than active removal of bark and woody debris. For a full discussion of the rationale for selection of the natural recovery alternative for the mill and bay operable units under the contaminated site clean-up work and why ADEC considers the selected alternative the most appropriate alternative, see section **5.7.2.1 Rational for Selection of Alternative** in the ROD. (ADEC 1999) Many of the supportive rationalizations for the selected alternative in the ROD apply to Herring Cove.

Possible Future Actions and Controls

Feasibility of log removal

There are a range of issues associated with consideration of removal of logs on the bottom of Herring Cove, such as feasibility, costs, costs associated with disposal, impacts to established flora and fauna in terms of disturbance, resuspension of pollutants, and control measures or authorities by which to require dredging/log removal.

A review of monitoring information associated with the Sediment Remediation Project for the Ward Cove pulp mill in Ketchikan, Alaska showed that there is no reason to believe that sunken logs are a source of toxicity and it is believed that sunken logs do not pose a toxic risk to human health or the environment (U.S. EPA 1999). It has been suggested that organic compounds leaching from logs submerged in seawater could have adverse effects on marine organisms. However, research indicates that leaching of water-soluable substances begins immediately after the log enters the water and, as time passes, these substances are depleted and no further leaching takes place (Tetra Tech 1996). Estimated costs for removing and disposing of logs in Ward Cove were very high. Based on its findings, EPA recommended for Ward Cove that sunken logs need not be removed in areas not proposed for dredging to meet the remedial action objectives under the clean-up (Exponent 1999), and explained that:

- Sunken logs do not pose a significant toxic risk to human health and the environment
- Removing sunken logs is not necessary to meet the remedial action objectives for a sediment clean-up
- Removing sunken logs is not cost-effective and is limited using available technologies
- Removing sunken logs will cause short-term impacts to the environment with no reduction in long-term risk to the environment

As was determined for Ward Cove, and is believed to be at Herring Cove at Silver Bay, the available information suggests that logs have been on the bottom of the cove for 30 or more years, making it unlikely that there is any ongoing leaching of such substances from those logs.

Furthermore, it is unlikely that there will be a significant ongoing source of new logs sinking into the cove (U.S. EPA 1996; Exponent 1999). With better than half of Herring Cove (approximately more than 50 acres) having dense log coverage on the bottom, restoration (i.e., log removal) would be extremely costly, and there are no federal, State, or local authorities to force log removal, hence log removal at Herring Cove is determined to be not feasible at this time.

Both thick and thin capping were evaluated for Ward Cove and Silver Bay problems sediments. The value of capping within the context of Herring Cove would provide an enhanced environment for the colonization of benthic organisms. At Ward Cove, however, capping of sediment for confinement in the presence of buried logs or on steep slopes was expected to be ineffective. Also, past experience with other projects indicated that substantially more clean material is needed to ensure coverage in waters greater than about minus 60 ft MLLW. More importantly, and for Ward Cove again, it was determined that a thick cap for isolation purposes cannot be successfully constructed where log densities are classified as medium or higher, because capping material would fall into holes around the logs and leave thin or bare areas. Thin capping (amending surface sediments) could be implemented in low- to high-density log areas because thin capping requirements allow for varying degrees of capping and physical mixing with surface sediments. Thin capping, it was concluded for Ward Cove, could not be conducted in very high-density log areas because it would have limited beneficial effect (i.e., little or no capping material would reach and amend surface sediments). For Ward Cove and Herring Cove no information is available concerning thickness of the log piles. (Exponent 1999)

As noted, the Herring Cove area was used as for log raft storage by the Alaska Pulp Corporation during mill operations. APC gained a tideland lease authorization from the Alaska Department of Natural Resources in June 1968 in order to, among other things, store log rafts, placement of pile dolphins, and the construction and use of a log transfer facility. In the spring of 1999, APC closed out its tideland lease with ADNR and as part of this relinquishment conducted clean-up activities of the tideland areas of Silver Bay's Herring Cove. These clean-up efforts included, for instance: complete removal of tideland dolphins, hazardous materials, logs, and miscellaneous debris (such as metal) from the tidelands and shoreline, and the 100' long by 20' wide metal log slide at the former log transfer facility has been completely removed from the beach. (ADNR 1999, Southeast Management Services 1999) Although other tideland authorizations (such as tideland permits or leases) may be considered in the future by ADNR, authorizations which would contribute additional residues or settleable solids should be strictly examined or even avoided to prevent the unnecessary introduction of additional residues which may inhibit the natural recovery of the cove bottom.

The APC Mill Site includes uplands near Silver Bay, and various tidelands in Silver Bay, Sawmill Cove and Herring Cove. To control future exposure to residual contamination from the mill, the APC properties have been deeded with several restrictions on their use. Such restrictions may be in place for a significant time. They will apply to any future lessees or purchasers.

A deed restriction is a narrative limitation that is printed on the deed for the property and then recorded. This is one type of "institutional control" on the property under 18 AAC 75.375. A deed notice informs the public of limitations imposed in other documents.

Two institutional controls will be recorded: (1) the property is for industrial use only; residential use (or use as a school, or hospital) is banned; and (2) establishment of a No Disturbance Zone near outfall 001 in the area of concern. Navigational dredging or other in-water construction outside the No Disturbance Zone will not be precluded.

The MOU specifies that any additional controls required of the City and Borough of Sitka will be implemented through the normal permitting process and will be consistent with the use of the property. Among other things, the MOU also goes on to require provisions for waterbody recovery planning for the entire Silver Bay unit and the intent for ADEC and CBS to work cooperatively to develop and review a waterbody recovery plan and a component of the long-term monitoring program that will compliment a recovery plan for the §303(d) impairment issues. The MOU goes on to assert that ADEC and CBS will work together with the Sitka Tribe of Alaska, and other interested parties, to identify grant funding opportunities for water quality and habitat improvements in Silver Bay, including Herring Cove (ADEC April 1999).

In the Herring Cove area, some of the upland area has been transferred from APC over to the City and Borough of Sitka with the hope that intended uses of the cove area would be used for recreational purposes. Though there is nothing in the transfer that specifically limits the use towards this intent.

The City and Borough of Sitka is contemplating the use of the cove area as a park, day use recreation, kayak/small boat launch, baseball/softball fields, or a playground area with ball fields. All these uses are compatible with this TMDL's finding that Herring Cove has no ability to assimilate any additional persistent or accumulative residues.

As stated earlier, in relation to margin of safety, a "no additional residues" prescription for Herring Cove would ensure that adequate capacity exists or is maintained for dissolved oxygen (DO) until additional investigations are conducted or a TMDL is developed.

Monitoring

The January 1999 underwater video survey has demonstrated that natural recovery has begun in portions of the Sawmill Cove Area of Concern (AOC). Since most discharges from the APC facility have been eliminated, recovery of benthic macroinvertebrate communities is expected to proceed more rapidly and should follow the classical patterns of colonization and recovery documented for organically enriched areas and degraded material disposal areas. Evidence of natural recovery will include initial colonization by "pioneering" species, subsequent modification of physical/chemical characteristics of the substrate and overlying waters, and final colonization by deeper dwelling "equilibrium" species (*Benthic Community Succession: Sediment Profile Imaging and Supporting Information* [Foster Wheeler, February 1999]).

Monitoring the recovery of the benthic community is a key component of the natural recovery action in the ROD. The approach, summarized below (and more fully described in the Monitoring Program (Foster Wheeler July 1999), will be incorporated as an integral component of the ROD upon its approval by ADEC.

ADEC anticipates that baseline conditions will be documented in 1999, assuming detailed workplans are finalized in time to conduct the fieldwork (approximately October). To establish baseline conditions, the first monitoring event will include sediment chemistry, photometric surveys above and in the sediments, and benthic community analysis that will include measurement of faunal abundance and diversity. The baseline monitoring will be conducted throughout the AOC to tailor subsequent monitoring events to site-specific conditions. The baseline information will provide a critical link between past observations, trends in chemical and biological succession of site sediments, and future site management decisions.

Foster Wheeler Environmental is completing detailed monitoring workplans in 1999. The workplans will provide specific criteria ADEC will use to determine whether recovery is occurring as projected, identify sampling locations, and present standard operating procedures and quality control measures. Opportunities may present themselves, such as identification of a site in the cove, or a similar embayment nearby, as a reference site and indicator by which to measure rate of recovery in Herring Cove.

The conceptual approach for the Sawmill Cove monitoring program should be examined for integrating some long-term monitoring elements associated with the Herring Cove TMDL into the monitoring program in partnership with the ADEC, City and Borough of Sitka and others.

PUBLIC PROCESS

Public notice, and public review and comment period on the draft Herring Cove TMDL from August 27, 1999 to September 24, 1999.

Public workshop in Sitka, Alaska on September 16, 1999.

Response to public comments developed.

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Appendix: Sawmill Cove and Herring Cove Dissolved Copper

Summary

Dissolved copper in the nearshore marine environment at the point of leachate discharge from the Sawmill Cove Industrial Landfill and Herring Cove Wood Waste Landfill will continue to be investigated. This issue is of heightened concern due to the 303(d) listing implications described below. These implications will be discussed in additional detail in the Bay Unit Record of Decision.

Clean Water Act Section 303(d) Listing Background

For each of the 14 freshwater and marine uses designated in the state's water quality standards at 18 AAC 70, criteria are specified for a variety of parameters or pollutants. The criteria are both numeric and descriptive. The pollutant parameters are fecal coliform bacteria, dissolved oxygen, pH, turbidity, temperature, dissolved inorganic substances, sediment, toxic substances, color, petroleum hydrocarbons, radioactivity, total residual chlorine, and residues (floating solids, foam, debris, deposits).

Section 303(d) of the Clean Water Act requires identification of surface waterbodies that are water quality-limited by point and/or nonpoint sources of pollution which may require additional controls to meet state water quality standards. These waterbodies are prioritized based on the severity of the pollution and other factors. Silver Bay has been a 303(d) waterbody since 1994 due to concerns with Atoxic and other deleterious substances, residues, and dissolved oxygen.@

The 303(d) list and prioritization schedule are divided into two tiers. Tier II represents water quality-limited waterbodies with complete assessments, which now require a waterbody recovery plan to meet water quality standards. Silver Bay is classified as a Tier II waterbody because the APC Cleanup Project investigation served as the complete assessment. Based on a complete evaluation of investigation results, Tier II status may be further defined by ADEC as applicable to only two distinct subsets of Silver Bay: Sawmill Cove and Herring Cove. Sawmill Cove was the primary receiving body for the mill=s effluent discharges. Herring Cove was used for log storage.

A waterbody recovery plan describes the process and steps to be taken to restore a water quality-limited waterbody to a condition which meets the water quality standards for the pollutant parameters indicated. A waterbody recovery plan may include a Total Maximum Daily Load (TMDL), described in accordance with Section 303(d)(4)(A) of the

Clean Water Act to include effluent limitations based on a TMDL wasteload allocation. The TMDL establishes the allowable loading for a water body and thereby provides a basis for water quality-based controls.

Landfill Solid Waste Permit History

Herring Cove Woodwaste Landfill
The Herring Cove Wood Waste Landfill is located on the northeastern shore of Herring Cove, approximately one mile east of the mill. APC first applied for a solid waste disposal permit in 1978, but DEC did not issue the permit until 1984. As with the Industrial Waste Landfill, it was constructed without a subsurface liner because it was operational prior to the promulgation of landfill liner regulations.

The site contained a large stockpile of wood waste at one time, but ADEC issued a compliance order to reduce the size of the fill, control runoff into Herring Cove, and close the facility. APC provided runon diversion from all upward areas of the site through two culverts under the road into Herring Cove. French drains within the site collect all landfill water and discharge through the culvert into Herring Cove.

Following closure, the landfill was capped with two feet of compacted soil and revegetated. The site is presently thickly vegetated with forbs and grasses.

Landfill leachate was sampled during the 1990 multi-media study conducted by EPA. The marine aquatic life water quality criteria for copper was exceeded. Offshore sampling did not occur.

Current Situation
APC complied and also implemented sampling for metals at the Herring Cove Wood Waste Landfill for ADEC=s Solid Waste Program.

In the fall of 1997, the ADEC Contaminated Sites Program assumed oversight of the monitoring program from Solid Waste. The ADEC cleanup project manager requested APC to increase the sampling frequency from quarterly to monthly. Additionally, sampling was requested immediately offshore of the leachate discharges.

Continued monitoring indicated that dissolved copper was elevated in the sensitive nearshore marine environment as well as the leachate. Table 1 (below) presents the December 1997 and January 1998 sampling results. The applicable acute and chronic saltwater criteria of 2.9 micrograms per liter dissolved copper is exceeded at both the leachate and offshore sample locations. The clean-up project manager concluded that copper in both the nearshore marine waters and in the Herring Cove Wood Waste Landfill leachate is probably from natural sources. *Background Chemical Concentrations in Soil Near Sitka, Alaska* (Foster Wheeler, May 1998) documents background concentrations of copper in area soils.

Sampling Location	**Dissolved Copper Concentrations (micrograms/liter)**	
	December 1997	January 1998
Herring Cove Landfill Seep	51	17
Herring Cove Offshore	21	61
Industrial Landfill Seep	less than 2*	26
Industrial Seep Offshore	15	35
Background Site - Drainage east of Herring Cove	less than 2*	3

*The laboratory reporting limit is 2 micrograms per liter.

These results are not conclusive enough to indicate whether leachate control and/or treatment is necessary to ameliorate dissolved copper water quality violations. Additional monitoring will continue at least through May with the following questions in mind:

(1) Has a trend in elevated dissolved copper concentrations in leachate been established?

(2) Can offshore dissolved copper concentrations be attributed to landfill leachate?

(3) Are naturally occurring background levels of copper a primary source?

An automatic composite sampler designed to sample at designated intervals will be used to more fully characterize leachate. Additional nearshore areas will be sampled east of Herring Cove to determine if naturally occurring background copper levels are contributing to the exceedance of water quality criteria. A leachate collection and treatment system may be implemented in the future if the results of additional monitoring confirm the landfills are the direct cause of the marine aquatic life water quality criteria exceedance.