Executive Summary

Sawmill Cove is located near the mouth of Silver Bay in southeast Alaska approximately three miles east of the City and Borough of Sitka. The cove was the receiving point for effluent and storm water discharges from the Alaska Pulp Mill, which produced pulp at the site from 1959 to 1993. Operations at the mill resulted in the accumulation of wood solids and associated contaminants on the seafloor from an historic outfall adjacent to the site.

A remedial investigation of the Bay Operable Unit, which encompassed Sawmill Cove and the shoreline area of Silver Bay and Galankin Island, was conducted in the mid-1990's, and the results from those studies indicated that a portion of Sawmill Cove, designated as the initial AOC, remained adversely affected from past operations. The option chosen in the final the remedial action objective (RAO) issued by the Alaska Department of Environmental Conservation (DEC) was natural recovery with continued monitoring at 10-year intervals; the baseline survey for the RAO was carried out in 2000 by EVS Environment Consultants. Baseline results indicated that benthic habitat conditions and recovery status could be assessed using *in situ* photographs of the sediment, and that it was no longer necessary to include benthic community analysis of discrete sediment samples. Other findings indicated that the first two RAO recovery milestones (shown in Table E-1) had been achieved by 2000: 81 percent of the site was covered with decomposers (bacterial colonies, most likely *Beggiatoa* spp.) (Milestone 1), and primary consumers (Stage 1 polychaetes) were present in sufficient densities (89 percent) of the stations sampled (Milestone 2). Approximately 16 percent of the initial AOC had fully recovered and achieved the final milestone, and therefore required no further monitoring. Twenty-two (22) percent was in transition to the final recovery stage with notable abundances of deposit-feeding taxa. Sixty-two percent of the initial AOC was still considered seriously impaired in 2000 as far as benthic community status. Based on these results, the AOC designated for continued monitoring was stratified and reduced in area by approximately 16 percent.

Table E-1. AOC Recovery Milestones.

Milestone	Area	Time (Years)	Successional Stage
1	>75 % coverage of the Initial AOC	5–10	Decomposers and primary producers
2	>75 % coverage of the Initial AOC	10–20	Primary consumers and detritivores
3	>75 % coverage of the Initial AOC	20–40	Secondary consumers
4	>75 % coverage of the Initial AOC	> 40	Climax (equilibrium) community

In May 2011, Germano and Associates (G&A) on behalf of the City and Borough of Sitka conducted the first "post baseline" 10-year interval monitoring survey (to verify if the minimum requirements outlined in Milestone 2 of the above table had been met or exceeded). The overall objectives of the 2011 monitoring program were as follows:

> **Performance Measure 1**: *"Document the observable succession of benthic species (living both on and in the sediments) that will result in balanced, stable communities as assessed by measures of abundance and diversity at various locations over time."*

> **Performance Measure 2**: *"Include a bioaccumulation survey to evaluate the potential change in dioxin concentrations that may occur, over time, in the tissues of various target species."*

The ultimate goal for Performance Measure 1 is to have at least 75 percent of the initial Sawmill Cove Area of Concern (AOC) in an equilibrium community by the year 2040 based on the ecological recovery management milestones shown in Table E-1. The objective of Performance Measure 2 was to determine if there is a potential for the mill-related sediment contaminant, dioxin, to bioaccumulate to harmful levels in targeted marine species in the AOC.

A combination of sediment profile and plan-view (SPI/PV) imaging was performed to address Performance Measure 1, and sediment sampling with resulting chemical analyses and bioaccumulation testing were performed to address Performance Measure 2. The results from the combined SPI/PV survey provided a comprehensive update to the earlier baseline study results from eleven years ago.

There were two significant findings from the 2011 SPI/PV survey that update the predictions/trends documented in the 2000 baseline survey (which compared its results to the earlier 1994-95 Remedial Investigation data):

1. The rate of decomposition of the wood waste particles is much slower than anticipated.
2. An additional major source of organic input to the Sawmill Cove benthic ecosystem since the 2000 survey will undoubtedly affect the rate of recovery the remaining areas of bottom still affected by the wood waste.

While there is a substantial increase in stations showing the presence of bacterial colonies compared to the 2000 survey, future source control efforts at the Silver Bay Seafoods plant should ameliorate this effect. Even though increased organic loading can cause a retrograde in benthic successional status, the benthic community in Sawmill Cove has continued to improve since the baseline survey in 2000. All of Stratum 2, which was indicated as "transitional" after the 2000 survey results were analyzed, is now fully recovered.

Out of the original 100 acres (approximately) of AOC seafloor identified in the original Record of Decision (ROD) as having a severely compromised benthic ecosystem, the current status as a result of the 2011 survey is as follows:

Table E-2. Current status of the AOC

2011 AOC Description	Acres
Stratum 1 (area of impact)	17.0
Stratum 2 (transitional)	29.0
Stratum 3 (recovered) − to 2011 border	37.3
Stratum 3 (recovered) – to original AOC border	54.6

With Stratum 2 (transitional) meeting the recovery milestone of having "secondary consumers", there are now approximately 83 acres of seafloor that have achieved Milestone 3 (TableE-1) from the original ROD, which was originally anticipated to occur sometime between 2020−2040.

Results from the May 2011 sediment chemical analyses and bioaccumulation studies showed that AOC sediment dioxin concentrations remain elevated compared to local background concentrations. Although mean sediment dioxin concentrations in the AOC exceeded draft guidelines considered protective of west coast marine habitats, dioxin was neither bioavailable nor did it bioaccumulate in benthic organisms exposed to AOC sediment. The sediments in the AOC, therefore, pose no adverse risk to higher trophic organisms, including fish, from dioxin. Although low part-per-trillion levels of sediment dioxin remain, concentrations are roughly half of the concentrations measured in Sawmill Cove surface sediment in the 1996 remedial survey, suggesting that chemical recovery of the AOC is in step with the benthic infaunal recovery documented through use of SPI and plan view images.

With 54% of the AOC having a completely recovered benthic community, the City and Borough of Sitka has achieved better-than-expected results from this latest round of monitoring. Not only have the most recent monitoring results confirmed earlier indications that there are no threats to ecosystem or human health from any persistent contaminants of concern in the sediments, but the original decision of natural recovery as the preferred remedial option turned out to be a wise choice. Not only is benthic ecosystem recovery proceeding as anticipated, it is actually occurring at a much faster rate than originally predicted.