where elevation changes (both gains and losses) of between one and two feet were measured. The areas of the localized elevation changes are discontinuous and the locations of increased versus decreased elevations do not follow a discernible pattern either upstream to downstream or shallow to deeper zones. In addition, the bathymetry between T12 and T13 (where the downstream end of the Area 2 riprap waterway is) where the canal is the shallowest was nearly identical between 2005 and 2007. Therefore the changes do not appear to be the result of erosion. Overall no significant areas of erosion or consolidation were noted and the overall cap surface elevation remains consistent with previous measurements (between 91 and 95 feet NGVD). The maximum predicted consolidation in the northern canal and turning basin (presented in *Design Change #11*, JCO, 2003) was 2.3 feet for a three-foot thick cap. The observed reduction in cap elevations between 2003 and 2007 combined with the earlier consolidation demonstrated by the settlement plates results in a total consolidation of about three feet for a 3-4 foot cap thickness near T8+50. This is reasonably comparable to the predicted consolidation.

Less than 0.2 feet of consolidation occurred below the majority of the West Bank Cap as indicated by a comparison of the 2007 survey data with the July 2004 survey conducted immediately after the cap installation. This is considerably less than the predicted total consolidation of up to 0.9 feet (JCO, 2003b). The peat below most of the West Bank Cap may not have completed primary consolidation by 2007. The top-of-cap elevation directly east of the western cribbing was approximately 96.5 ft NGVD or higher in 2007, as compared with approximately 98 ft NGVD at the end of construction. This consolidation occurred shortly (within three months) after the cap installation and the differential settlement between the portions of cap over the canal and outside the canal was likely due to the significant differences in geotechnical properties between the underlying sediment within the canal and the peat outside the canal. A comparison of the 2007 survey data with measurements performed in 2005 indicates that there has been little change since that time.

The 2007 data indicate that no significant erosion, slumps or sloughing of cap material has occurred in the Area 2 Waterway or in Area 3. The reported ground surface elevations in Area 3 in 2007 are similar to those measured in 2005. These measurements coincide well with design estimates of primary consolidation beneath the Area 3 cap, which were between 0.6 and 1.0 feet. The 2007, 2005, and 2003 survey data indicate that there has been no significant settlement of the coir log structures along the edge of the Area 2 Waterway. The data also confirm that the coir logs are still in their designed alignment.

The 2007 data indicate that no significant erosion, slumps or sloughing of cap material has occurred in Area 7. The reported ground surface elevations in Area 7 in 2007 are generally within 0.5 feet of the end-of-construction elevations reported in 2003 with the exception of an approximate increase of one foot in the bottom elevation of the pond along North Road.

The bathymetric surveys indicate that the minimum water depth maintained by the weir has been sufficient to prevent erosion and scouring. The bathymetric surveys also indicate that erosion and scouring of the subaqueous cap has not occurred.

Chemical Monitoring. Constructed cap core sampling and analysis has been conducted annually from 2003 through 2010 with laboratory chemical analysis performed on the surface (0-10 cm) and mid-cap (circa 30-40 cm) strata. The sediment ER-Ms for copper, lead, mercury, zinc and the sum-of-13-PAHs were designated as performance standards for the mid-cap samples. There are no chemical performance standards for the surface cap samples, only for the mid-cap.

Core sample locations included Areas 1, 2 and 8 (subaqueous cap), and, Areas 3 and 7 (wetland area caps). Samples were also collected in the natural cap Area 4/5, with laboratory chemical analysis performed on the surface (0-10 cm) stratum only. The performance standards for the capped areas are not applicable to Area 4/5. Cap samples were analyzed for PAHs, metals and physical parameters. Cap coring in Area 2 was not conducted during the 2008, 2009 or 2010 monitoring events due to NAPL releases that were being addressed separately (see section 5.1).

No exceedances of the ER-Ms were reported in cap core samples collected in 2006. No PAHs were detected in any of the mid-cap samples. The only top-of-cap samples containing all 13 PAHs were from near the mouth of the canal and the railroad bridge and near the southern end of the canal where stormwater enters the canal.

No PAHs were detected in any of the 2007 mid-cap samples. No reported metals or PAHs in samples from any of the capped areas exceeded the benchmark values. Only one sample (near the mouth of the canal) contained reported PAHs, although all the detections were reported as estimated concentrations below the practical quantitation limit (PQL).

In 2008, no PAHs were detected in any of the mid-cap samples with the exception of one sample taken from the turning basin which contained estimated concentrations of phenanthrene, fluoranthene and pyrene below the laboratory PQL. No reported metals or PAHs from any of the capped areas exceeded the benchmark values. No reported metals or PAHs from any of the capped areas exceeded the benchmark values in the 2009 or the 2010 cap samples.

Cap Compliance Monitoring Summary. Across most of the Site, compliance monitoring data collected indicate that the cap has met the performance standards of containing and isolating the contaminated sediment and is resistant to erosion or bioturbation that would expose contamination to ecological receptors, with the exception of portions of Area 2 which experienced seasonal releases of NAPL through the cap from 2005 to installation of the Amended Cap in 2010.

The sum-of-PAHs and metals in surface sediment samples collected in Area 4/5 are routinely above the ER-M mid-cap benchmark value. As discussed above, there are no chemical performance standards for Area 4/5. The high organic carbon content in the sediments in Area 4/5 limits the bioavailability of PAHs, and the SEM/AVS ratio of less than one indicates that the metals would not be bioavailable. Therefore, the contaminants in Area 4/5 sediments are not likely adversely impacting ecological receptors.

Amended Cap Operation, Maintenance and Monitoring. Due to the absence of a surface sand layer in the Amended Cap, the cap mid-depth chemical, sediment trap and habitat restoration performance standards found in the RD/RA SOW are no longer appropriate for the small portion of the canal covered by the Amended Cap. However, the performance standard for the isolation of contaminants that requires that contaminant migration through the cap be minimized is still applicable and the performance monitoring program has been revised to include monitoring for visual sheens, potential gas build-up, and removal of NAPL from recovery wells.

Second Five-Year Review Report

for

Pine Street Barge Canal Superfund Site

Burlington,

Chittenden County, Vermont

December 2011

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12/22/2011
Date