Bloody Brook: Technical Evaluation of Sampling and Analysis Programs

Lockheed Martin Corporation
Syracuse, New York

October 1996

REPORT

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Executive Summary

Executive Summary

This report presents an evaluation of the findings of surface-water and sediment investigations voluntarily completed during May and July 1996 by Lockheed Martin Corporation (LMC) in Bloody Brook at and near LMC's Electronics Park facility (the facility) located in Syracuse, New York.

Prior to LMC's investigations, the NYSDEC conducted two investigations of Bloody Brook. The initial investigation conducted in September 1994 included an evaluation of the water quality upstream and downstream of the facility, and collection of biological samples. Based on this initial investigation, which was limited by poor habitat at most locations, the NYSDEC concluded that: 1) all stream locations are either moderately or severely impacted, and 2) none of the stream impacts are attributable to LMC. In February 1995, crayfish samples collected during the September 1994 stream assessment were submitted for laboratory analysis. The results of the crayfish analysis indicated that "provisional levels of concern" were exceeded for cadmium, copper and/or mercury in crayfish samples collected from three locations downstream of the facility. Polychlorinated biphenyls (PCBs) were also detected in the crayfish. A followup investigation included the deployment of passive in situ chemical extraction samplers in 11 streams, including Bloody Brook, entering or leaving Onondaga Lake to provide simultaneous PCB screening of major tributaries to Onondaga Lake. The results of this investigation indicate that PCBs were detected in 10 of 11 streams sampled, including Bloody Brook.

Based on NYSDEC's findings and in consideration of a real-estate transfer related to the facility, LMC elected to collect and analyze surface-water and sediment samples from within the Middle and West Branches of Bloody Brook at select locations. The objective of this initial investigation (the Phase I investigation) was to provide data that could be used to assess the presence or absence of PCBs, cadmium, copper, and mercury in surface water and sediments. The results of this investigation indicated the presence of PCBs, cadmium, copper, and mercury in sediments collected from both the Middle and West Branches of Bloody Brook; no surface-water impacts were identified. Based on the results of the Phase I investigation, NYSDEC and NYSDOH requested that LMC conduct additional sampling and analysis (the Phase II investigation) to assess the extent of PCBs, cadmium, copper, and mercury in sediments.

The analytical data generated as part of the Phase I and Phase II investigations have been evaluated in consideration of concerns raised by NYSDEC, the NYSDOH, and the Onondaga County Department of Health (OCDOH); NYSDEC-issued guidance documents; and a site-specific risk analysis. The following conclusions are based on this evaluation:

- Surface-water discharges from the facility meet applicable New York State surface-water quality standards, State Pollutant Discharge Elimination System (SPDES) discharge limitations, and NYSDEC guidance. Therefore, no PCB, cadmium, copper, or mercury impacts to surface water within the Middle and West Branches of Bloody Brook are attributable to the facility, and no ongoing sources of those parameters are being discharged from the facility.

- Based on the detection of PCBs in sediment samples collected upstream of the facility within the West Branch of Bloody Brook, an upstream source of PCBs exists. A number of potential industrial dischargers to Bloody Brook other than LMC have been identified upstream and downstream of the facility.

- Based on a site-specific risk analysis, the concentrations of PCBs and cadmium detected in sediment samples from the Middle and West Branches of Bloody Brook do not pose a risk to human health or wildlife.

- Due to the stream improvements (including the excavation and relocation of a portion of the stream) completed by the Onondaga County Department of Drainage and Sanitation (OCDDS) on both the Middle and West

Branches of Bloody Brook, historical deposition of sediment within and downstream of the stream improvements cannot be determined. The presence of PCB- and cadmium-containing sediments within and downstream of the stream improvement area is believed to be due to the suspension, transport, and redeposition of impacted sediments.

Since no risks to human health or wildlife associated with the presence of PCBs and cadmium in Bloody Brook have been identified in this evaluation, additional investigations (including biota or sediment sampling) or evaluations regarding Bloody Brook are not warranted. If additional information becomes available, LMC will review the new information in conjunction with the NYSDEC, NYSDOH, and OCDOH.

Introduction

1. Introduction

1.1 General

This report presents an evaluation of the findings from the investigations completed by Lockheed Martin Corporation (LMC) in the West and Middle Branches of Bloody Brook. These investigations were voluntarily undertaken with the approval and oversight of the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH). The purpose of these investigations was to evaluate the presence of polychlorinated biphenyls (PCBs), cadmium, copper, and mercury in Bloody Brook surface water and sediment. The investigations included sampling within the West Branch and the Middle Branch of Bloody Brook at locations upstream, downstream, and within the confines of LMC's Electronics Park facility (the facility) located in Syracuse, New York. LMC's investigations and the submission of this evaluative report do not constitute, and shall not be construed as, an admission of law or fact by LMC with respect to any potential liability, including, but not limited to, the condition of the West and Middle Branches of Bloody Brook.

1.2 Purpose and Scope

The purpose of this report is to present and evaluate the analytical data generated as part of the Bloody Brook investigations. The scope of this report includes the following:

Section 1: This section provides an introduction to the evaluation, and describes the purpose and scope of the data evaluation report;

Section 2: This section provides pertinent background information regarding the Electronics Park facility, Bloody Brook, and the findings of previous Bloody Brook investigations;

Section 3: This section provides a description of the sampling and analysis programs, presents the analytical data, and provides an evaluation of the data;

Section 4: This section provides the conclusions of the data evaluation regarding specific concerns raised by the NYSDEC and NYSDOH; and

Section 5: This section provides a summary of the data evaluation.

Background Information

2. Background Information

2.1 General

This section presents a summary of background information used in development of the sampling and analysis programs, and information considered in the development of this technical evaluation. The background information includes: 1) a description of pertinent location and physical setting information; 2) a review of potential dischargers to Bloody Brook; 3) a description of stream improvements conducted by the Onondaga County Department of Drainage and Sanitation (OCDDS); and 4) a summary of investigations performed by the NYSDEC.

2.2 Location and Physical Setting

The facility is located on Electronics Parkway in the Town of Salina, New York. The approximately 183-acre facility is bounded by the New York State Thruway to the southwest, Vine Street to the northwest, and Henry Clay Boulevard/Electronics Parkway to the northeast and southeast. The location of the facility is shown on the Site Location Map (Figure 1).

A portion of two separate branches of Bloody Brook, known as the West Branch and Middle Branch of Bloody Brook, flows through the facility. The West and Middle Branches are identified as the receiving waters on LMC's State Pollutant Discharge Elimination System (SPDES) Discharge Permit (No. NY-0002101; effective date May 1, 1994; expiration date May 1, 1999; modification date November 30, 1994).

The Middle Branch enters the facility at the southeastern perimeter and flows through a pond at the southeastern portion of the facility; flow from the pond is discharged at the southern property boundary. The West Branch enters the facility at the northwestern perimeter and flows south along the western portion of the facility through a series of underground culvert pipes; the West Branch discharges at the southwestern property boundary.

2.3 Potential Dischargers to Bloody Brook

Based on a NYSDEC/NYSDOH/OCDOH/LMC joint reconnaissance of Bloody Brook conducted on June 12, 1996 and document review conducted by LMC, a number of industrial and commercial facilities were identified as potential dischargers to Bloody Brook. Industrial and commercial facilities are located both upstream and downstream of the facility, and include but are not limited to a paint manufacturer, a marine and recreational vehicle supplier and service center, and a manufacturer of hydraulic valves and actuators. To the best of LMC's knowledge, the historical usage and potential discharge of contaminants from the identified commercial and industrial properties have not been determined by the NYSDEC. Based on a document review and discussions with the NYSDEC, LMC is the only industrial discharger to Bloody Brook that maintains a SPDES permit. Therefore, LMC is not aware of the existence of any publicly available documents regarding the quality of current and past surface-water discharges to Bloody Brook by facilities other than LMC.

2.4 OCDDS Bloody Brook Stream Improvements

In fall 1995, OCDDS conducted the initial phase of a series of stream improvements to the Middle and West Branches of Bloody Brook. Based on discussions with OCDDS personnel, the stream improvement project was reviewed and approved by the NYSDEC. The stream improvements included the relocation of a meandering portion of the West Branch to within the Onondaga County Bloody Brook right-of-way and the installation of gabion baskets along sections of the stream bank. Construction activities completed during fall 1995 were limited to sections of the stream located upstream of Brookview Lane on the West Branch and upstream of Sunflower Drive

on the Middle Branch. LMC understands that OCDDS anticipates conducting additional stream improvements to both the West and Middle Branches of Bloody Brook.

During construction of the stream improvements, excavated streambed material was reportedly used on site as backfill behind the gabion baskets and as backfill in the original stream location. Based on discussions with OCDDS, the stream bed was significantly disturbed during the construction activities through excavation and operation of equipment within the stream. These activities were reportedly completed while Bloody Brook was actively flowing; flow diversion was not used extensively as part of the construction. Siltation controls (e.g., silt fence) were reportedly used during the construction activities; however, the extent and placement of the siltation controls is not known. Due to the intrusive nature of the construction activities, historical sediment deposition trends within and downstream of the stream improvements cannot be determined. To more thoroughly understand the nature and extent of the completed and proposed stream improvements, LMC has requested a copy of project-related documentation through the provisions of the Freedom of Information Law (FOIL). As of the date of this submittal, the requested information has not been received.

Based on recent conversations with OCDOH, it is LMC's understanding that OCDOH anticipates conducting a sampling and analysis program within the West Branch of Bloody Brook on behalf of OCDDS. Based on a review of an October 2, 1996 letter to Mr. David Coburn, Director, Onondaga County Office of the Environment, from the NYSDEC and NYSDOH, it appears that the NYSDEC/NYSDOH do not object to the OCDDS completing additional stream improvements on the Middle Branch. This letter recommends that OCDDS postpone additional stream improvements on the West Branch and recommends that OCDDS discuss any future West Branch stream improvements with LMC.

2.5 Previous Bloody Brook Investigations

Prior to LMC's investigations, the NYSDEC conducted two investigations of Bloody Brook. The initial investigation, conducted in September 1994, included an evaluation of the water quality upstream (two locations) and downstream (four locations) of the facility, and the collection of biological samples. The NYSDEC coordinated this investigation with LMC, because it related to SPDES-permitted chlorine discharges from the facility. As documented by the NYSDEC-published *Biological Stream Assessment, Bloody Brook, Onondaga County, New York*, prepared by Mr. Robert Bode, Ms. Margaret Novak, and Mr. Lawrence Abele, dated October 4, 1994, the NYSDEC concluded that 1) all stream locations are either moderately or severely impacted, 2) none of the stream impacts are attributable to the LMC Electronics Park facility, and 3) poor habitat limited the assessments at most sites.

In February 1995, the NYSDEC analyzed crayfish collected downstream of the facility during the October 1994 stream assessment. The analysis of crayfish was completed without LMC's involvement or knowledge. The results of this analysis are documented in a NYSDEC memo issued by Mr. Robert Bode on January 26, 1996, which indicated that "provisional levels of concern" were exceeded for copper and mercury in one sample from the site (Station 2, located immediately downstream of the on-site pond), for cadmium and mercury in a second sample from the site (Station 4, located in the West Branch immediately south of the Thruway), and for cadmium and copper in a third sample (Station 6, located near the discharge to Onondaga Lake). PCBs were also identified in crayfish at levels of 7.4 parts per million (ppm), 2.4 ppm, and 2.7 ppm at Stations 2, 4, and 6, respectively (Figure 3).

In October 1995, NYSDEC deployed passive in situ chemical extraction samplers (PISCES) in 11 streams entering or leaving Onondaga Lake to provide simultaneous PCB screening of major tributaries to Onondaga Lake. Bloody Brook was sampled at a location adjacent to Old Liverpool Road during this investigation. The results of this

investigation, presented in a NYSDEC memo prepared by Mr. Simon Litten, dated January 26, 1996, indicate that PCBs were detected in 10 of the 11 streams sampled, including Bloody Brook.

The NYSDEC and United States Environmental Protection Agency (USEPA) issued a Joint Request for Information to LMC, dated March 11, 1996, pursuant to Section 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Section 9604(e), and New York Environmental Conservation Law, concerning Onondaga Lake. The March 11, 1996 request focused on information relating to the presence of PCBs, cadmium, copper, and mercury at or in the vicinity of the facility. The NYSDEC indicated that the request was prompted by the results of the above-described NYSDEC investigations. On April 10, 1996, LMC issued a response to the request.

Analytical Results and Data Evaluation

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3. Analytical Results and Data Evaluation

3.1 Bloody Brook Sampling and Analysis Program

Based on the findings of the NYSDEC's investigations and in consideration of a real-estate transfer related to the facility, LMC elected to conduct a voluntary surface-water and sediment sampling and analysis program within the on-site pond and at the locations where Bloody Brook discharges from the facility to determine the presence or absence of PCBs, cadmium, copper, and mercury in those media. The scope of this and subsequent investigations completed by LMC is discussed below. The investigation activities were completed with NYSDEC and NYSDOH approval and oversight.

LMC completed initial sampling and analysis of surface water and sediment in select locations at and near the facility (Phase I) in accordance with the *Bloody Brook Sampling and Analysis Work Plan* (Phase I Work Plan, Blasland, Bouck & Lee, Inc. [BBL], May 1996). The objective of the Phase I investigation was to provide data to assess the presence or absence of PCBs, cadmium, copper, and mercury in surface water and sediments within Bloody Brook at or near the facility. Sampling locations included both the pond and Middle Branch within the confines of the facility, and the West Branch immediately downstream of the facility.

The Phase I surface-water and sediment sampling was completed on May 31, 1996 in accordance with the Phase I Work Plan. In addition to the samples collected by LMC, NYSDEC collected split samples for analysis by a NYSDEC-contracted laboratory. A complete analytical data package for the LMC-collected samples, including quality assurance/quality control documentation, was submitted to the NYSDEC on June 28, 1996. The Phase I sample locations are shown on Figure 2.

Based on a review of the Phase I data, the NYSDEC and NYSDOH requested that additional sediment sampling and analysis be completed to evaluate the extent of PCBs and inorganics in sediments within the West and Middle Branches of Bloody Brook downstream of the facility. In response to this request, LMC developed a *Sampling and Analysis: Phase II Work Plan* (Phase II Work Plan, BBL, June 1996). The objective of the Phase II sediment sampling was to provide data to assess the extent of PCBs, cadmium, copper, and mercury in sediments within Bloody Brook at other locations upstream and downstream of the facility.

The Phase II sediment sampling was completed on July 11, 1996 in accordance with the Phase II Work Plan. Sampling locations included both upstream and downstream locations in the West Branch, and downstream locations in the Middle Branch. Since the NYSDEC split-sample analysis from Phase I generally agreed with LMC's data, the NYSDEC elected not to collect split samples during Phase II sampling. A complete analytical data package, including quality assurance/quality control documentation, was submitted to the NYSDEC and NYSDOH on August 7, 1996. The Phase II sample locations are shown on Figure 2.

The results of the Phase I and Phase II investigations are presented below.

3.2 Analytical Results

This section presents the analytical results of samples obtained during the Phase I and Phase II investigations of the West and Middle Branches of Bloody Brook.

3.2.1 Middle Branch of Bloody Brook

LMC collected and analyzed surface-water samples from four on-site locations, and sediment samples from four on-site and two off-site locations along the Middle Branch of Bloody Brook, including the on-site pond. The

samples were analyzed for PCBs, cadmium, copper, and mercury, in accordance with the Phase I and Phase II Work Plans. The Phase I and Phase II sampling and analysis data for surface water and sediments are described below, presented on Figure 2, and summarized on Tables 1 and 2.

- PCBs were not detected in the surface water within the on-site pond or on site immediately downstream of the pond (detection limit range: 0.062 parts per billion [ppb] to 0.064 ppb).

- PCB Aroclor 1254 was identified in the sediment within the on-site pond, and Aroclors 1254 and 1260 were identified in sediment collected on site immediately downstream of the pond (concentration range: 0.075 ppm to 2.7 ppm).

- PCB Aroclor 1260 was identified in the sediment at two locations downstream of the facility (concentrations of 0.11 ppm and 0.13 ppm).

- Mercury and cadmium were not detected in the surface water in the on-site pond or on site immediately downstream of the pond (detection limits: mercury, 0.10 ppb and cadmium, 1.0 ppb). Copper was identified at a concentration of 2.2 ppb in one surface-water sample collected from the on-site pond. Copper was not detected in the remaining surface-water samples (detection limit: 2.0 ppb).

- Mercury, copper, and cadmium were detected in sediment samples from the on-site pond (concentration ranges: mercury, 0.19 ppm to 0.24 ppm; copper, 25 ppm to 161 ppm; and cadmium, 1.3 ppm to 2.6 ppm) and on site immediately downstream of the on-site pond (concentrations: mercury at 0.36 ppm; copper at 107 ppm; and cadmium at 1.6 ppm).

- Mercury, copper, and cadmium were detected in sediment downstream of the facility (concentration range(s): mercury, 0.07 ppm; cadmium, 1.10 ppm to 1.60 ppm; and copper, 30.6 ppm to 35.6 ppm).

Although Aroclors 1254 and 1260 were identified in the sediment samples, it is recognized that identification of specific PCB congeners, especially in weathered PCBs, is interpretive, since the retention times of weathered PCBs are shifted from the unweathered congeners, and the retention times overlap.

During Phase I sampling, NYSDEC collected split samples for analysis by a NYSDEC-contracted laboratory. In general, the NYSDEC's results were comparable to LMC's data, with the following exceptions:

- NYSDEC's detection limit range for PCBs in the surface-water samples is 0.050 ppb to 0.051 ppb. NYSDEC did not detect PCBs in the surface water.

- NYSDEC detected PCBs in the sediment sample collected on site immediately downstream of the pond (sample SD-04) at a concentration of 0.26 ppm.

- NYSDEC did not detect copper in any surface-water samples collected from the Middle Branch (detection limit: 2.3 ppb).

3.2.2 West Branch of Bloody Brook

LMC collected and analyzed surface-water samples from two locations downstream of the facility, and sediment samples from two locations upstream of the facility, one location (which included two samples) within the facility (upstream of LMC discharges to Bloody Brook), and seven locations downstream of the facility. Because the on-

site sediment sample location is upstream of any LMC discharges to Bloody Brook, this sample location (SD-16) is considered an upstream sample location. The samples were analyzed for PCBs, cadmium, copper, and mercury, in accordance with the Phase I and Phase II Work Plans. The Phase I and Phase II sampling and analysis data for surface water and sediments are described below, and are presented on Figure 2 and summarized on Tables 1 and 2.

- PCBs were not detected in the surface water downstream of the facility (detection limit range: 0.062 ppb to 0.064 ppb).

- PCB Aroclor 1254 was identified in the sediment samples collected upstream of the facility (concentration range: 0.061 ppm to 0.30 ppm).

- PCB Aroclors 1254 and 1260 were identified in the sediment samples collected downstream of the facility (concentration range: 2.58 ppm to 4.4 ppm).

- Mercury and cadmium were not detected in the surface-water sample collected downstream of the facility (detection limits: mercury, 0.1 ppb; cadmium, 1.0 ppb). Copper was detected in the surface-water sample collected downstream of the facility (concentration range: 5.3 ppb to 6.6 ppb).

- Copper and cadmium were detected in each of the upstream sediment samples (concentration ranges: copper, 15 ppm to 19.8 ppm; cadmium, 1.48 ppm to 2.2 ppm). Mercury was detected in two of the four upstream sediment samples (concentration range: 0.14 ppm to 0.26 ppm).

- Mercury, copper, and cadmium were detected in downstream sediment samples (concentration ranges: mercury, 0.17 ppm; cadmium, 21.4 ppm to 267 ppm; copper, 20.6 ppm to 68.9 ppm).

Although Aroclors 1254 and 1260 were identified in the sediment samples, it is recognized that identification of specific PCB congeners, especially in weathered PCBs, is interpretive, since the retention times of weathered PCBs are shifted from the unweathered congeners, and the retention times overlap.

During Phase I, NYSDEC collected split samples for analysis by a NYSDEC-contracted laboratory. In general, the NYSDEC's results were comparable to LMC's data, with the following exceptions:

- NYSDEC's detection limit for PCBs in the surface water samples is 0.050 ppb. NYSDEC did not detect PCBs in the surface water.

- NYSDEC detected cadmium in one downstream surface-water sample at a concentration of 4.4 ppb.

3.3 Data Evaluation

The analytical data generated as part of the Phase I and Phase II sampling programs have previously been submitted to the NYSDEC and NYSDOH. The NYSDEC and NYSDOH identified the following three concerns during follow-up conversations with LMC:

Concern 1: Ongoing discharges of PCBs and inorganics in surface water from the Electronics Park facility;

Concern 2: Human health risks associated with the cadmium concentrations identified in sediments within the West Branch of Bloody Brook; and

Concern 3: Ecological risks associated with the PCB and cadmium concentrations identified in sediments within the Middle Branch and West Branch of Bloody Brook.

The data evaluation presented below addresses these concerns and includes an assessment of the identified PCB and inorganic concentrations relative to published guidance, criteria, and site-specific, risk-based concentrations. The following documents were reviewed as part of the data evaluation:

- New York State Technical and Operational Guidance Series (TOGS) 1.1.1; *Ambient Water Quality Standards and Guidance Values*, October 1993;
- New York State TOGS 1.3.4 and 1.3.4.a, *Best Professional Judgement for PCBs*;
- NYSDEC *Technical Guidance for Screening Contaminated Sediments*, November 1993;
- LMC's SPDES Discharge Permit (Number NY-0002101), November 30, 1994; and
- USEPA *Risk Assessment Guidance for Superfund: Volume I* - "Human Health Evaluation Manual, Part B, Evaluation of Risk-Based Preliminary Remediation Goals (PRGs), " 1991.

3.3.1 Concern 1: Ongoing Surface-Water Sources

Inorganics

The highest concentration of copper identified in the Middle Branch surface water (2.2 ppb at sample location SW-02) is below LMC's SPDES-established discharge limit for total copper (120 ppb). Discharges of cadmium and mercury are not regulated in LMC's SPDES permit. The cadmium and mercury levels have, therefore, been compared to the New York State Ambient Water Quality Standards and Guidance Values.

Bloody Brook is classified as a Class D stream (classification for fish survival or wildlife consumption of fish). The water-quality guidance value established for mercury for a Class D stream is 0.10 ppb. Mercury was not detected (detection limit: 0.10 ppb) in any of the surface-water samples collected in the Middle Branch. The cadmium water-quality standard for a Class D stream is calculated using the measured hardness of the surface-water. Since water hardness was not determined as part of the sampling and analysis program, LMC has compared the Middle Branch surface-water data to the water-quality standards established for a Class A stream (classification for source of drinking water). The use of the Class A classification provides a conservative comparison, since surface water within Bloody Brook is not used as a drinking water source. The Class A water quality standard for cadmium is 10 ppb. Cadmium was not detected (detection limit: 1.0 ppb) in any of the surface-water samples collected in the Middle Branch.

The highest concentration of copper identified in the West Branch surface water (6.6 ppb at sample location SW-05) is below the discharge limit for total copper (120 ppb) established in the facility SPDES permit. Cadmium and mercury were not detected in samples from any of the West Branch surface-water sample locations.

PCBs

Discharge of PCBs is not regulated in LMC's SPDES permit. Therefore, the PCB concentrations in surface water have been compared to NYSDEC TOGS 1.3.4.a, which provides guidance for allowable PCB discharge limits to surface water and sets a discharge limit of 0.065 ppb for discharge permits. PCBs were not detected

in the surface water in the Middle Branch or the West Branch above the detection limits of 0.062 ppb to 0.064 ppb.

3.3.2 Concern 2: Human-Health Risks Associated with Cadmium in the West Branch

In the absence of human-health-based guidance values for inorganics in sediment, risk-based values for the protection of human health have been calculated as part of this evaluation based on the USEPA's guidance for deriving risk-based preliminary remediation goals *(Risk Assessment Guidance for Superfund*: Volume 1 - "Human Health Evaluation Manual, Part B, Development of Risk-based PRGs," 1991). The guidance uses conservative default assumptions about exposure, in conjunction with USEPA-derived reference toxicity values to derive PRGs associated with either residential or commercial/industrial exposure. While the guidance does not specifically address exposure to sediment, the exposure scenario associated with residential soil can be used to estimate a PRG for sediment. Since exposure to sediment is likely to be less frequent than exposure to soil at a residence, a PRG based on residential exposure to soil is considered conservative. Based on the USEPA guidance, a PRG of 274 ppm has been calculated for cadmium in sediments, as presented in Appendix A. None of the sediment samples collected from Bloody Brook contained cadmium in concentrations exceeding the human-health PRG for cadmium.

3.3.3 Concern 3: Ecological Risks Associated with Cadmium and PCBs in Sediments

The concentrations of PCBs and cadmium identified in sediments have been evaluated in consideration of the screening criteria (i.e., lowest-effect level [LEL] and severe-effect level [SEL]) presented in the NYSDEC *Technical Guidance for Screening Contaminated Sediments* (sediment-screening guidance) and calculated site-specific, risk-based sediment concentrations that are protective of potential wildlife receptors. The identified sediment concentrations were initially compared to the sediment criteria to determine if the sediments are "potentially contaminated." The screening guidance defines "contamination" as an exceedance of the screening criteria. As prescribed by the sediment-screening guidance, "Once it has been determined that a sediment screening criterion is exceeded, more information is required to determine if remediation is necessary and what actual risks to the environment are present." To that end, a preliminary site-specific risk analysis which addressed potential exposure of wildlife receptors in the food chain was conducted as part of this evaluation. The risk analysis included the development of risk-based criteria to be used as a basis of comparison and to determine if remediation actions are necessary.

Cadmium

In the Middle Branch of Bloody Brook, the cadmium concentration in the four samples collected on site and the two samples collected downstream of the facility exceed the LEL for cadmium (0.6 ppm); none of the sediment samples collected in the Middle Branch contain cadmium in concentrations exceeding the SEL for cadmium (9.0 ppm). In the West Branch of Bloody Brook, the cadmium concentrations detected in sediment samples exceed the LEL at each of the upstream and downstream sample locations; the SEL for cadmium (9.0 ppm) is also exceeded at each of the downstream sample locations in the West Branch.

The effects of inorganics in sediment on wildlife cannot be determined solely by measuring bulk metals concentrations, because the toxicity of metals is highly influenced by other environmental conditions, such as pH, reduction/oxidation potential (REDOX), acid volatile sulfide concentration, and other toxicity-mitigating factors. Toxicity of inorganic concentrations in sediment can vary dramatically from site to site, because the inorganics may not be bioavailable. Thus, a site-specific, risk-based concentration for cadmium that is considered protective of wildlife has been calculated using existing Bloody Brook data and published literature. Using a risk-based approach is consistent with the provisions of the sediment-screening guidance.

The NYSDEC uses "provisional levels of concern," established in the NYSDEC's *Quality Assurance Work Plan for Biological Stream Monitoring in New York State* (QA Work Plan, February 1991) for comparison of inorganic levels in tissue. As presented in the QA Work Plan, the provisional levels of concern are based on a statistical analysis of a state-wide inorganic tissue concentration database, which consists of 16 crayfish samples. The provisional levels of concern do not consider risks to wildlife associated with the inorganic tissue concentrations and should not be used as a screening level to evaluate risks to wildlife.

To establish a risk-based concentration of cadmium in sediment that is protective of wildlife, a cadmium concentration in edible biota tissue, specifically crayfish, was established at a level considered protective of wildlife. A tissue concentration considered protective of wildlife was established by developing toxicity benchmarks for a selected wildlife species, specifically raccoon. Based on the assumptions and calculations presented in Appendix B, a concentration of 28 ppm of cadmium in crayfish tissue is considered protective of wildlife, based on wildlife consumption of crayfish. None of the crayfish samples collected from Bloody Brook has a cadmium tissue concentration exceeding 28 ppm.

Ecological risk-based sediment values were calculated using the crayfish tissue concentration of 28 ppm, and site-specific biota-sediment accumulation factors (BSAFs). BSAFs are calculated as the ratio of the chemical concentration in tissues to the concentration in sediments. Site-specific BSAFs were calculated using the existing crayfish tissue data (generated by the NYSDEC) and co-located sediment data (generated by LMC) at NYSDEC's Middle Branch (sample Station 2) and West Branch (sample Station 4) sample locations (Figure 3).

Risk-based sediment values were calculated by dividing the risk-based crayfish cadmium concentration (28 ppm) by the site-specific BSAFs (Station 2 BSAF=0.13; Station 4 BSAF=0.10). Using this approach, acceptable sediment concentrations are calculated as 215 ppm for Station 2 (i.e., Middle Branch) and 280 ppm for Station 4 (i.e., West Branch). None of the sediment concentrations detected in samples from on site, upstream, or downstream of the facility in the Middle or West Branch exceed the respective station-specific, risk-based sediment values.

PCBs

Screening values for PCBs in sediment were calculated using the procedures presented in the NYSDEC *Technical Guidance for Screening Contaminated Sediments* using the average total organic carbon (TOC) content measured in sediment samples collected from the Middle Branch (i.e., 1% TOC) and West Branch (i.e., 2.3% TOC) of Bloody Brook, resulting in PCB screening concentrations of 0.014 ppm and 0.031 ppm, respectively. The PCB concentration identified in each sample collected on the Middle Branch and West Branch, including samples collected upstream of the facility, exceeds the calculated screening values.

Similar to the approach used to evaluate cadmium, a site-specific, risk-based concentration for PCBs that is considered protective of wildlife (assuming wildlife consumption of crayfish) was calculated using existing Bloody Brook data and published literature. Using a risk-based approach is consistent with the provisions of the sediment-screening guidance.

To establish a risk-based PCB sediment concentration that is protective of wildlife, a PCB concentration in edible biota tissue (i.e., crayfish) was established at a level considered protective of wildlife. An acceptable tissue concentration was established by developing toxicity benchmarks for a selected wildlife species, specifically raccoon.

Based on the assumptions and calculations presented in Appendix B, a concentration of 13 ppm of PCBs in crayfish tissue is considered protective of raccoons. None of the crayfish samples collected from Bloody Brook has a PCB tissue concentration exceeding 13 ppm. A site-specific BSAF was calculated using the existing crayfish tissue data (generated by the NYSDEC) and co-located sediment data (generated by LMC) at NYSDEC sample Station 2 and Station 4. Using the calculated acceptable crayfish tissue concentrations and the station-specific BSAFs, the site-specific acceptable sediment concentration for PCBs at Station 2 is 4.8 ppm, and at Station 4 is 20 ppm. None of the sediment concentrations identified on site or downstream of the facility on the West Branch or Middle Branch exceed the acceptable risk-based sediment concentrations for PCBs.

Conclusions

4. Conclusions

The following conclusions regarding each of the concerns identified by the NYSDEC and NYSDOH are based on the data evaluation presented above.

Ongoing Surface-Water Sources

As discussed above, surface-water discharges from the facility meet applicable surface-water quality standards, SPDES-established discharge limitations, and NYSDEC guidance. Since there are no exceedances of applicable standards, guidance values, or discharge limitations, it has been concluded that there is not an ongoing source of cadmium, copper, mercury, or PCBs to the Middle Branch or the West Branch of Bloody Brook. No further investigations or evaluations regarding surface water within Bloody Brook are warranted.

Human-Health Risks Associated with Cadmium in the West Branch

Cadmium has been identified in sediment samples collected from the West Branch of Bloody Brook at concentrations up to 267 ppm. In the absence of established sediment criteria for the protection of human health, a PRG for sediment has been calculated as part of this evaluation assuming a conservative exposure scenario (i.e., residential ingestion of soil). The cadmium PRG for protection of human health is 274 ppm. Since none of the identified cadmium concentrations exceed the PRG, the level of cadmium in the West Branch of Bloody Brook is not considered a significant risk to human health. Thus, no further investigations regarding human-health risks associated with the identified cadmium levels in sediment are warranted.

Ecological Risks Associated with Cadmium and PCBs in Sediments

The concentration of cadmium exceeds the NYS Sediment Screening Criteria LEL at all sediment sample locations within the Middle Branch and the West Branch of Bloody Brook, including upstream sampling locations. The concentration of cadmium exceeds the NYS Sediment Screening Criteria SEL at four locations downstream of the facility in the West Branch of Bloody Brook. The concentrations of PCBs identified in sediment exceed NYS Sediment Screening Criteria at all sediment sample locations within the Middle Branch and West Branch of Bloody Brook, including locations upstream of the facility.

In accordance with the sediment-screening guidance, further study was performed in the form of a risk-based analysis to determine if the concentrations of cadmium and PCBs identified in sediment present a significant risk to wildlife. The risk-based analysis indicates that the identified concentrations of cadmium and PCBs in sediment within Bloody Brook are within the range considered protective of wildlife. Therefore, no further investigations regarding risks to fish and wildlife associated with the identified cadmium and PCB levels in sediment are warranted.

Summary

5. Summary

NYSDEC, NYSDOH, OCDOH and LMC have maintained a dialogue regarding the investigation of Bloody Brook and the follow-up evaluation. LMC's position regarding the primary concerns discussed with the NYSDEC, NYSDOH, and OCDOH is presented below.

5.1 Human-Health Risks Due to Cadmium in the West Branch

LMC reiterates that there are no human-health risks associated with the concentration of cadmium identified in the West Branch of Bloody Brook. Since there are no human-health risks associated with the concentration of cadmium, further investigations or evaluations regarding the effects of cadmium in Bloody Brook on human health are not warranted.

5.2 Biota Sampling

Due to the exceedance of the NYSDEC's sediment screening criteria for cadmium and PCBs, the NYSDEC has requested that LMC implement a caged-biota study. The purposes of this study would be to: 1) identify the effects of PCBs and cadmium on biota upstream and downstream of the facility; and 2) determine if a continuing source of PCBs and cadmium to Bloody Brook is present.

LMC does not believe that such a study is warranted and will not be undertaken by LMC for the following reasons:

- Existing data are sufficient to conduct a preliminary site-specific risk analysis (as presented in Section 3) to determine if there is reason for concern regarding a bioaccumulation exposure pathway;

- Although NYSDEC data indicate that the levels of cadmium in crayfish tissue exceed New York State provisional levels of concern (i.e., statewide background concentrations), the provisional levels of concern are not risk-based or indicative of adverse effects on biota and thus were not used as part of this evaluation. Based on a site-specific risk analysis, the levels of cadmium currently observed in resident biota tissue do not pose a risk to wildlife under a conservative exposure scenario; therefore, further investigation or evaluation is not warranted;

- Based on a site-specific risk analysis, the levels of PCBs currently observed in resident biota tissue do not pose a risk to wildlife under a conservative exposure scenario; therefore, further investigation or evaluation is not warranted; and

- Existing surface-water data indicate that surface-water discharges from the facility are within the acceptable standards and criteria; therefore, the facility is not a continuing source of PCBs and cadmium to Bloody Brook. No further investigations or evaluation regarding the discharge of PCBs and cadmium to Bloody Brook is not warranted.

5.3 Industrial Dischargers to Bloody Brook

Based on this evaluation, no significant human health or ecological risks are associated with the concentrations of PCBs and cadmium identified in the sediment. Nonetheless, with regard to a source(s) of the identified parameters, a number of potential industrial dischargers to Bloody Brook other than LMC have been identified upstream and downstream of the facility. As of the date of this submittal, LMC has not received any analytical data that indicates the quality of the water discharged by others to Bloody Brook. Without investigating all potential industrial and commercial dischargers to Bloody Brook, the NYSDEC cannot conclusively determine the source(s)

of PCBs, cadmium, copper, and mercury identified by the NYSDEC in biota. All industrial and commercial dischargers to Bloody Brook should be considered potential sources of the parameters identified in Bloody Brook.

Regarding other potential dischargers to Bloody Brook, a request has been made, pursuant to the provisions of the FOIL, that all information submitted by Young & Franklin, Inc. (located downstream of the facility) and Strathmore Paints (located upstream of the facility) in response to a CERCLA 104(e) request be forwarded for review as part of this evaluation. According to the NYSDEC, a CERCLA 104(e) request had not been forwarded to Young & Franklin as of July 25, 1996. The NYSDEC correspondence to LMC did not indicate if NYSDEC or USEPA intends to submit a CERCLA 104(e) request to Young & Franklin. The NYSDEC has indicated that as of July 16, 1996, Strathmore Paints had not responded to the CERCLA 104(e) request.

An additional potential discharger to Bloody Brook, (A.C. Lamb, Inc.) is located immediately upstream of (i.e., adjacent to) the facility. Based on discussions with the NYSDEC, information regarding A.C. Lamb, Inc. has not been requested pursuant to the provisions of CERCLA 104(e), although the A.C. Lamb, Inc. facility is a potential current or past discharger to Bloody Brook.

5.4 Bloody Brook Stream Improvements

As described above, OCDDS has completed stream improvements along a section of both the Middle and West Branches of Bloody Brook. Based on a visual inspection of the stream, a review of the Contract Drawings that detail the stream improvements, and discussions with OCDDS personnel, the stream improvements conducted in fall 1995 included relocating a meandering portion of the West Branch to within the Onondaga County Bloody Brook right-of-way and installation of gabion baskets along a section of stream bank. Construction completed during fall 1995 was limited to sections of the stream located upstream of Brookview Lane on the West Branch and upstream of Sunflower Drive on the Middle Branch.

LMC understands that stream improvements included the excavation of the stream bed to allow for relocation of a portion of the stream and installation of the gabion baskets. The excavated material was reportedly used on site as backfill behind the gabion baskets and as backfill for the original stream location. Based on discussions with OCDDS, the stream bed was significantly disturbed during the construction activities. These activities were reportedly completed while Bloody Brook was actively flowing; flow diversion was not used extensively as part of the construction. Siltation controls (e.g., silt fence) were reportedly used during the construction activities; however, the extent and placement of the siltation controls is not known. Due to the intrusive nature of the construction activities, historical sediment deposition trends within and downstream of the stream improvements cannot be determined. LMC believes that the presence of PCBs and cadmium identified in sediment samples collected within and downstream of the stream improvement project may be due to the suspension, transport, and deposition of PCB- and cadmium-containing sediments from the stream improvement project area.

Appendices

Appendix A

Lockheed Martin Corporation
Electronics Park Facility
Bloody Brook: Technical Evaluation of Sampling and Analysis Programs

Derivation of Human Health Preliminary Remediation Goal for Cadmium

The USEPA provides guidance for deriving risk-based PRGs (USEPA, 1991. *Risk Assessment Guidance for Superfund*: Volume I - "Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). Office of Emergency and Remedial Response," Washington, DC. PB92-963333, December 1991). The guidance uses conservative default assumptions about exposure along with USEPA-derived reference toxicity values to derive PRGs associated with either residential or commercial/industrial exposures. While the guidance does not specifically address exposure to sediment, the exposure scenario associated with exposure to residential soil can be used to estimate a PRG for sediment. Because exposure to sediment is likely to be less frequent than exposure to soil at a residence, a PRG derived on the basis of residential exposure to soil will be overly conservative, and hence, protective of health, when used to evaluate exposure to sediment.

USEPA assumes that incidental ingestion is the primary route associated with exposure to soil in a residential-use setting, and thus, estimates PRGs for soil solely from oral exposure. USEPA's standard default scenario for residential exposure to soil assumes that exposure will occur over a 30-year period, with 6 years of exposure reflecting an ingestion rate (200 mg soil/day) and body weight (15 kg) typical of a young (1- to 6-year-old) child, and 24 years of exposure reflecting an ingestion rate (100 mg/day) and body weight (70 kg) typical of an adult. Exposure is assumed to occur 350 days per year. Using these assumptions and USEPA's chronic reference dose (RfD) of 0.001 mg/kg-day for cadmium (USEPA Integrated Risk Information System, 1994) yields a residential risk-based PRG of 274 mg cadmium/kg soil.

1. Assumptions

Residential Exposure:

C_s = Sediment concentration, to be calculated
ED = Expected duration, 30 years (6 years as a child; 24 years as an adult) = 10,950 days
EF = Expected frequency, 350 days per year
IR = Ingestion Rate, 100 mg/day for adult; 200 mg/day for child
BW = Body weight, 70 kg for adult; 15 kg for child
CF = 1×10^{-6} mg/kg
RfD Food = Reference dose, 1×10^{-3} mg/kg - day = non-carcinogenic dose

2. PRG Calculation

$$RfD = C_s \times CF \times EF/365 \text{ days per year}/ED \times [(IR_{Adult} \times ED_{Adult})/BW_{Adult} + (IR_{Child} \times ED_{Child})/BW_{Child}]$$

$$C_s = \frac{RfD \times 365 \times 30}{10^{-6} \times 350 \times 114.28571}$$

$$C_s = \frac{1 \times 10^{-3} \times 365 \times 30}{0.04}$$

$$C_s = 273.75 \approx 274 \text{ mg/kg}$$

Appendix B

Lockheed Martin Corporation
Electronics Park Facility
Bloody Brook: Technical Evaluation of Sampling and Analysis Programs

Derivation of Ecological Risk-Based Sediment Concentrations

Risk-Based Crayfish Tissue Concentrations

Potential target tissue concentrations for cadmium and PCBs were calculated based on the protection of wildlife receptors which may consume crayfish (i.e., raccoon). The calculations are based on a generalization of the USEPA (1993) wildlife dose equation. The equation normally calculates a wildlife dose from each type of food item. In this instance, the equation was not run for each particular food item, but was used to back-calculate an average dietary concentration analogous to a specific toxicity benchmark. The toxicity benchmarks were selected from the available data base, and were normalized to the receptor's body weight using the method presented in Opresko et al. (1994) as appropriate.

Cadmium

A target cadmium tissue concentration of 28 mg/kg was calculated as shown on the attached Table B-1 and is based on the following assumptions:

- a toxicity benchmark for raccoon of 5.6 mg/kg-day (based on a LOAEL for rats of 12.5 mg/kg-day (ASTDR, 1993).

- the assumption that 100% of a raccoon diet comes from the site. [Note: The tissue concentration assumes that all of the diet contains cadmium, and represents an average for the entire diet. A portion of a raccoon's diet is not expected to contain cadmium, so an acceptable tissue value for crayfish may be higher.]

PCBs

A target PCB tissue concentration of 13 mg/kg was calculated as shown on the attached Table B-1 and is based on the following assumptions:

- a toxicity benchmark for raccoon of 2.6 mg/kg-day (based on a raccoon LOAEL at 50 mg/kg for Aroclor 1254 (Eisler, 1986).

- the assumption that 100% of a raccoon diet comes from the site. [Note: The tissue concentration assumes that all of the diet contains PCBs, and represents an average for the entire diet. A portion of a raccoon's diet is not expected to contain PCBs, so an acceptable tissue value for crayfish may be higher.]

Risk-Based Sediment Concentrations

Ecological risk-based sediment values were calculated by dividing the risk-based crayfish tissue concentrations by biota-sediment accumulation factors (BSAFs). BSAFs are calculated as the ratio of the chemical concentration in tissues to the concentration in sediments. Station-specific BSAFs were calculated using the existing co-located crayfish tissue data (generated by the NYSDEC) and sediment data (generated by LMC). The station-specific BSAF provides a station-specific correlation between the sediment concentration of cadmium and PCBs and the actual accumulation of cadmium and PCBs in crayfish tissue.

This station-specific approach allows for incorporation of various environmental conditions which may mitigate the accumulation of cadmium and PCBs in crayfish. The Station 2 BSAF was calculated using NYSDEC's Station 2 crayfish data and LMC's co-located SD-04 sediment data. The Station 4 BSAF was calculated using NYSDEC's Station 4 crayfish data and the average of LMC's SD-05, SD-06 and SD-07 sediment data. Based on this approach the following BSAFs have been established:

Station	Cd. Tissue Conc. (ppm)	Cd. Sediment Conc. (ppm)	Cd. BSAF	PCB Tissue Conc. (ppm)	PCB Sediment Conc. (ppm)	PCB BSAF
2	0.2	1.6	0.13	7.4	2.7	2.7
4	19	190	0.10	2.4	3.7	0.65

The BSAFs were used to calculate ecological risk-based sediment values by dividing the risk-based tissue concentrations by the site-specific BSAFs. Based on this approach the following risk-based sediment concentrations have been established:

Station	Cd. Risk-based Tissue Conc. (ppm)	Cd. BSAF	Cd. Risk-based Sediment Conc. (ppm)	PCB Risk-based Tissue Conc. (ppm)	PCB BSAF	PCB Risk-based Sediment Conc. (ppm)
2	28	0.13	215	13	2.7	4.8
4	28	0.10	280	13	0.65	20

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological Profile for Cadmium. Atlanta, GA.

Eisler, R. 1986. Polychlorinated Biphenyl Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.7).

Newell, A.J., D.W. Johnson, and L.K. Allen. 1987. Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife. NYSDEC Tech. Report 87-3. Division of Fish and Wildlife. Albany, NY.

NYSDEC. 1993. Technical Guidance for Screening Contaminated Sediments. Div. of Fish and Wildlife.

Opresko, D.M., B.E. Sample, and G.W. Suter. 1994. Toxicological Benchmarks for Wildlife: 1994 Revision. Oak Ridge National Laboratory. Oak Ridge, TN.

Persaud, D., R. Jaagumagi, and A. Hayton. 1992. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment, Queen's Printer for Ontario.

USEPA. 1993. Wildlife Exposure Factors Handbook. EPA/600/R-93/187a. Office of Research and Development. Washington, D.C.

Table B-1

Lockheed Martin Corporation
Electronics Park Facility
Bloody Brook: Technical Evaluation of Sampling and Analysis Programs

Calculation of Crayfish Tissue Concentrations
Protective of Wildlife Consumers

1. Wildlife Dose Equation

Dose = (C x FR x NIR)

Where:
Dose = Potential dose (mg/kg-day)
C = Target concentration in food (mg/kg)
FR = Fraction of diet from site (unitless)
NIR = Normalized ingestion rate (g/g-day)

2. Reformulated Equation

C = Dose / (FR x NIR)

3. Calculations

	Dose (mg/kg-day)	FR	NIR (g/g-day)	C (mg/kg)
Cadmium	5.6[1]	1	0.2[3]	28
PCBs	2.6[2]	1	0.2[3]	13

Notes:

1. Cadmium benchmark is based on a rat LOAEL of 12.5 mg/kg - day (ATSDR, 1993) normalized for raccoon with a rat body weight of 0.35 kg and a raccoon body weight of 4 kg.

2. PCB benchmark is based on a raccoon LOAEL of 50 mg/kg for Aroclor 1254 (Eisler, 1986), a raccoon food consumption rate of 0.21 kg/day and body weight of 4 kg (USEPA, 1993).

3. The normalized ingestion rate is estimated from the USEPA (1993) Wildlife Exposure Factors Handbook.

Tables

Table 1

Lockheed Martin Corporation
Electronics Park Facility

Bloody Brook: Technical Evaluation of Sampling and Analysis Programs
Surface-Water Analytical Data Summary

Surface-Water Analytical Results				
Sample ID	Parameter			
	Cadmium	Copper	Mercury	PCBs
SW-01	<1.0	<2.0	<0.10	<0.062
SW-02	<1.0	2.2	<0.10	<0.062
SW-03	<1.0	<2.0	<0.10	<0.062
SW-04	<1.0	<2.0	<0.10	<0.063
SW-05	<1.0	6.6	<0.10	<0.064
SW-07	<1.0	5.3	<0.10	<0.062

Notes:

1. All surface-water concentrations are reported in micrograms per liter (ug/l) or ppb.
2. The PCB detection limit shown is the detection limit for individual Aroclors.

Table 2

Lockheed Martin Corporation
Electronics Park Facility

Bloody Brook: Technical Evaluation of Sampling and Analysis Programs
Sediment Analytical Data Summary

Sediment Analytical Results						
Sample ID	Parameter					
	Cadmium	Copper	Mercury	PCB Aroclor 1254	PCB Aroclor 1260	TOC
SD-01	1.3	25	<0.07	<0.027	0.075	NA
SD-02	2.4	112	0.19	<0.050	0.330	NA
SD-03	2.6	161	0.24	<0.058	0.40	NA
SD-04	1.6	107	0.36	0.70	2.0	NA
SD-05	199	48.8	<0.06	1.6	0.98	NA
SD-06	104	42.9	<0.06	2.5	1.9	NA
SD-07	267	68.9	0.17	1.9	2.3	NA
SD-08	177.2	46.2	<0.06	<0.026	0.33	15,000
SD-09	22.4	15.6	0.07	<0.026	0.30	24,700
SD-10	38.8	29.6	<0.06	<0.053	0.55	12,000
SD-11	21.4	20.6	<0.06	<0.028	0.24	19,500
SD-12	1.1	30.6	<0.06	<0.025	0.11	6,260
SD-13	1.6	35.6	0.07	<0.027	0.13	12,700
SD-14	1.48	19.4	0.07	0.30	<0.031	14,400
SD-15	2.2	19.8	<0.10	0.12	<0.040	32,700
SD-16 (0-12")	2.0	17.8	<0.06	0.061	<0.028	32,600
SD-16 (12-18")	2.2	15.0	0.13	0.21	<0.027	30,100

Notes:

1. All sediment concentrations are reported in milligrams per kilogram (mg/kg) or ppm.
2. NA = not analyzed.
3. Only detected Aroclors are listed.

Figures

REFERENCE: BASE MAP PREPARED FROM SYRACUSE WEST, NY USGS QUADRANGLE, PHOTOREVISED 1978.

2000' 0 2000'

Approximate Scale: 1" = 2000'

AREA LOCATION

LOCKHEED MARTIN CORPORATION
SYRACUSE, NEW YORK

ELECTRONICS PARK FACILITY

SITE LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 1

10/96 54 PMC
38134001/38134G01.CDR

SAMPLE ID	SD-14
PCB AROCLOR 1254	0.30 ppm
CADMIUM	1.48 ppm
COPPER	19.4 ppm
MERCURY	0.07 ppm

SAMPLE ID	SD-15
PCB AROCLOR 1254	0.12 ppm
CADMIUM	2.2 ppm
COPPER	19.8 ppm
MERCURY	<0.10 ppm

SAMPLE ID	SD-16 0-12"	SD-16 12-18"
PCB AROCLOR 1254	0.061 ppm	0.21 ppm
CADMIUM	2.0 ppm	2.2 ppm
COPPER	17.8 ppm	15.0 ppm
MERCURY	<0.06 ppm	0.13 ppm

SAMPLE ID	SD-05	SW-05
PCB AROCLOR 1254	1.6 ppm	<0.064 ppb
PCB AROCLOR 1260	0.98 ppm	<0.064 ppb
CADMIUM	189 ppm	<1.0 ppb
COPPER	48.8 ppm	6.6 ppb
MERCURY	<0.06 ppm	<0.10 ppb

SAMPLE ID	SD-06
PCB AROCLOR 1254	2.5 ppm
PCB AROCLOR 1260	1.9 ppm
CADMIUM	104 ppm
COPPER	42.9 ppm
MERCURY	<0.06 ppm

SAMPLE ID	SD-07	SW-07
PCB AROCLOR 1254	1.9 ppm	<0.062 ppb
PCB AROCLOR 1260	2.3 ppm	<0.062 ppb
CADMIUM	267 ppm	<1.0 ppb
COPPER	68.9 ppm	5.3 ppb
MERCURY	0.17 ppm	<0.10 ppb

SAMPLE ID	SD-08
PCB AROCLOR 1260	0.33 ppm
CADMIUM	177.2 ppm
COPPER	46.2 ppm
MERCURY	<0.06 ppm

SAMPLE ID	SD-09
PCB AROCLOR 1260	0.30 ppm
CADMIUM	22.4
COPPER	15.6
MERCURY	0.07 ppm

SAMPLE ID	SD-10
PCB AROCLOR 1260	0.55 ppm
CADMIUM	38.6 ppm
COPPER	29.6 ppm
MERCURY	<0.06 ppm

SAMPLE ID	SD-11
PCB AROCLOR 1260	0.24 ppm
CADMIUM	21.4 ppm
COPPER	20.6 ppm
MERCURY	<0.06 ppm

SAMPLE ID	SD-01	SW-01
PCB AROCLOR 1260	0.075 ppm	<0.062 ppb
CADMIUM	1.3 ppm	<1.0 ppb
COPPER	25 ppm	<2.0 ppb
MERCURY	<0.07 ppm	<0.10 ppb

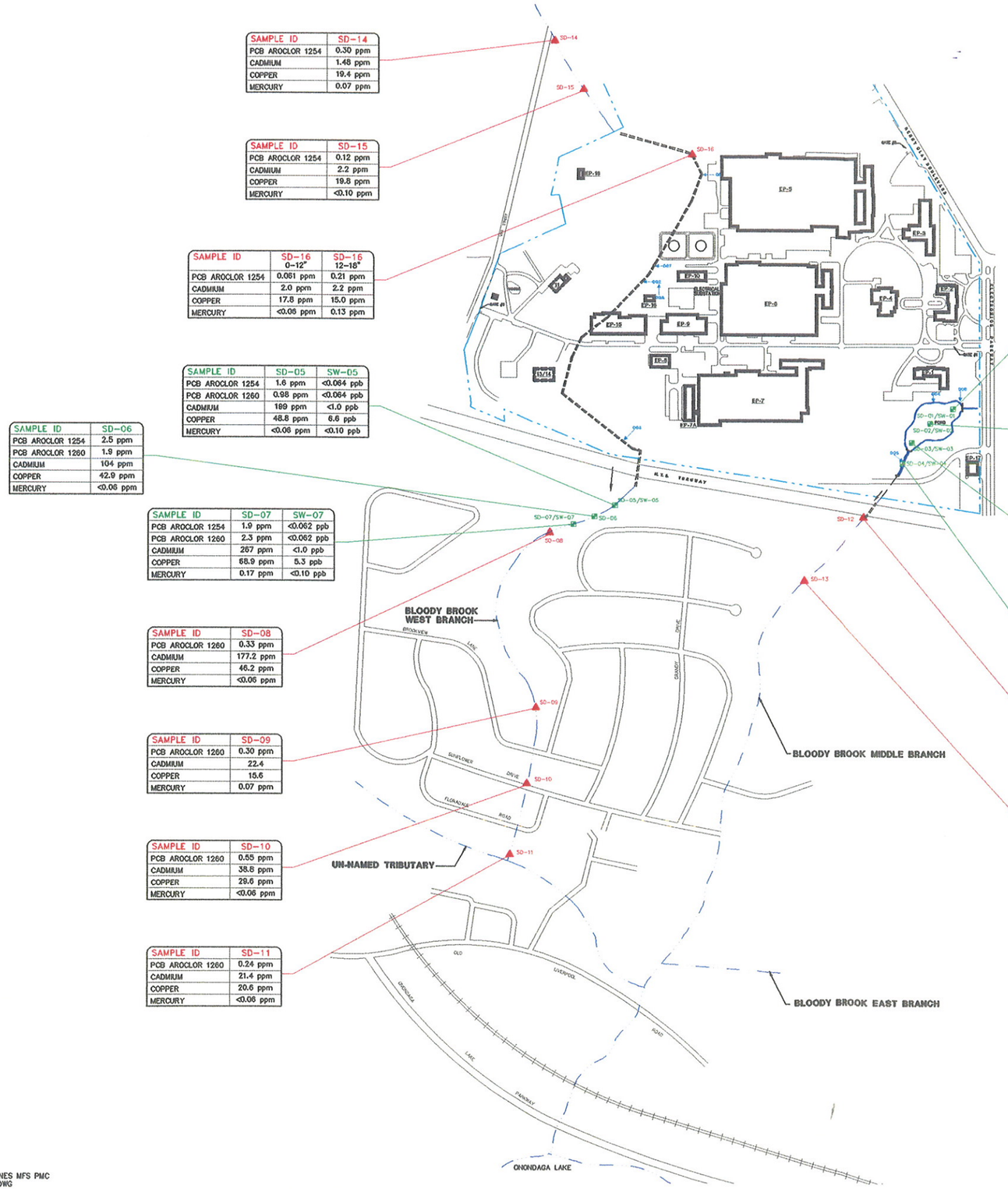
SAMPLE ID	SD-02	SW-02
PCB AROCLOR 1260	0.330 ppm	<0.062 ppb
CADMIUM	2.4 ppm	<1.0 ppb
COPPER	112 ppm	2.2 ppb
MERCURY	0.19 ppm	<0.10 ppb

SAMPLE ID	SD-03	SW-03
PCB AROCLOR 1260	0.40 ppm	<0.062 ppb
CADMIUM	2.6 ppm	<1.0 ppb
COPPER	161 ppm	<2.0 ppb
MERCURY	0.24 ppm	<0.10 ppb

SAMPLE ID	SD-04	SW-04
PCB AROCLOR 1254	0.70 ppm	<0.063 ppb
PCB AROCLOR 1260	2.0 ppm	<0.063 ppb
CADMIUM	1.6 ppm	<1.0 ppb
COPPER	107 ppm	<2.0 ppb
MERCURY	0.36 ppm	<0.10 ppb

SAMPLE ID	SD-12
PCB AROCLOR 1260	0.11 ppm
CADMIUM	1.1 ppm
COPPER	30.6 ppm
MERCURY	<0.06 ppm

SAMPLE ID	SD-13
PCB AROCLOR 1260	0.13 ppm
CADMIUM	1.6 ppm
COPPER	35.6 ppm
MERCURY	0.07 ppm



LEGEND

- PHASE I SURFACE WATER/SEDIMENT SAMPLING LOCATION
- PHASE II SEDIMENT SAMPLING LOCATION
- APPROXIMATE PROPERTY LINE
- SPDES OUTFALL
- SURFACE WATER

NOTE:

1. MAPPING DERIVED FROM "SITE PLAN SUMPS AND STORM SEWER SYSTEM" BY LAW ENVIRONMENTAL, DATED AUGUST 28, 1991.
2. PHASE I AND PHASE II ANALYSIS INCLUDED PCBs, CADMIUM, COPPER AND MERCURY. ONLY DETECTED AROCLORS ARE LISTED.

400' 0 400' 800'

APPROXIMATE SCALE

L:ON==,REF
P: STD-PCP/DL
10/96 SYR-54-YCC NES MFS PMC
38128005/38128002.DWG

LOCKHEED MARTIN CORPORATION
ELECTRONICS PARK
SYRACUSE, NEW YORK

BLOODY BROOK PHASE I AND PHASE II ANALYTICAL DATA SUMMARY

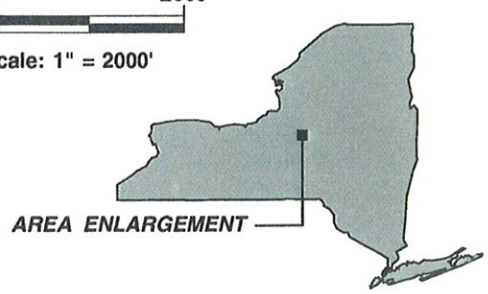
BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 2

REFERENCE: BASE MAP PREPARED FROM SYRACUSE WEST, NY USGS QUADRANGLE, PHOTOREVISED 1978.

2000' 0 2000'

Approximate Scale: 1" = 2000'



10/96 SYR-D54-PMC, DJH
38114201/38114n01.CDR

LOCKHEED MARTIN CORPORATION
SYRACUSE, NEW YORK

ELECTRONICS PARK FACILITY

NYSDEC SAMPLE LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 3