

**SUMMARY OF NRDA-RELATED SURVEYS INITIATED
DURING THE EMERGENCY PHASE OF THE
SWANSON CREEK OIL SPILL**

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- Appendix B - MDNR Ichthyoplankton Survey Laboratory Report
- Appendix C - CBL Fluorimetry and Bioassay Report
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1.1 OVERVIEW

The Potomac Electric Power Company (Pepco) owns and operates a generating station at Chalk Point in Aquasco, Maryland. There is a 51.5-mile underground pipeline that supplies oil to the Chalk Point Generating Station. Pepco owns the pipeline and ST Services is the Pipeline Management Company that operates it. On April 7, 2000 at approximately 18:00 hours Eastern Daylight Savings Time (EDT), a fuel oil leak from the pipeline was identified in Swanson Creek Marsh. The pipeline normally transports Number 6 fuel oil used to generate electricity. The leak occurred while ST Services was flushing the line with Number 2 oil for inspection, releasing a mixture of Number 2 oil and Number 6 oil into Swanson Creek. An estimated 126,000 gallons of fuel oil leaked into Swanson Creek and the surrounding marsh area between Charles County and Prince George's County, Maryland.

Immediately upon the determination that there was a release of oil from the pipeline, numerous Federal, State, County, and local agencies were notified of the release to supervise and assist in clean-up (e.g., clean-up or response efforts) as well as assessing the impact of the spill on the natural resources within the spill area (e.g., Natural Resource Damage Assessment [NRDA]). The U.S. Environmental Protection Agency (USEPA), Maryland Department of the Environment (MDE), and Pepco created a Unified Command for directing clean-up efforts with USEPA as the lead agency. The National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources (MDNR), and MDE are the natural resource agencies responsible for conducting the NRDA.

During the first month of the spill, numerous surveys were conducted to assess the extent and magnitude of oil in the environment. In general, some of these activities were primarily conducted to determine where the oil was in order to direct clean-up activities as summarized in Section 1.2. Additional studies were conducted to assess impacts to the natural resources for NRDA purposes, and are summarized in Section 2.0.

1.2 CLEAN-UP EFFORTS

The Responsible Party (Pepco and ST Services, hereafter referred to as Pepco) and the USEPA began initial containment and recovery efforts on April 7, 2000. Initial emergency response efforts were focused in Swanson Creek, and were expanded when the oil spill expanded into the Patuxent River and its tributaries (e.g., Indian Creek and Trent Hall Creek). Clean-up efforts during the emergency phase of the project included boom deployment and maintenance, skimming and pumping of mobile oil, swabbing, trenching, pressure washing, raking and removal of oiled vegetation. A comprehensive overview of the clean-up efforts is summarized in the Response Action Plan (dated July 18, 2000).

On May 16, 2000, the emergency response phase of the clean-up was complete. More than 45,000 gallons of oil had been collected and three million pounds of oil-soaked booms and other clean-up materials were disposed. These clean-up actions conducted during the emergency response phase of the clean-up were directed and monitored based on shoreline oiling surveys,

oiled wildlife surveys, sediment blotting surveys, biostimulation monitoring, oil properties and fate, and post-emergency monitoring (e.g., long-term monitoring). The results of these clean-up/response surveys will be considered in the NRDA process and are summarized below.

1.2.1 Shoreline Oiling Surveys

Shoreline and aerial surveys were conducted to document the location, amount, and character of oil on the shoreline to aid in decision-making during clean-up operations. The SCAT procedure is the standard approach to document the extent and magnitude of oiling along shorelines associated with oil spills. The methodology was developed during the Exxon Valdez oil spill.

SCAT surveys were conducted during the emergency phase to document the initial shoreline oiling shortly after the spill. SCAT surveys consisted of multi-agency teams assessing the entire shoreline of the spill area and documenting oiling using standard methods and terminology. Documentation included specific information on oiling and habitat conditions. Oiling information included length, width, percent cover, oil character, and thickness. Habitat information included length and width of shoreline, habitat type, substrate type, and wave exposure. All data were recorded on datasheets and the results were mapped to direct clean-up operations.

Initial SCAT surveys were conducted between April 13 and April 24, 2000 in a total of 53 zones extending from approximately four miles upstream from Swanson Creek to the Thomas Johnson Bridge at Solomons, MD (included oiled and unoled shorelines). Initial SCAT surveys were conducted by representatives from NOAA, USFWS, MDNR, MDE, Pepco, and the U.S. Coast Guard (USCG).

Helicopter overflights were initiated immediately on April 7 upon reports that there were possible problems with the pressure in the pipeline. Initially, overflights were conducted to assess the existence of a release and then to determine the movements of the oil with changing winds and tidal conditions. Various overflights were conducted during the emergency phase to assess the extent of oiling on surface waters and shorelines; the success of clean-up activities; and the resources potentially impacted by the spill. In addition, aerial photography was conducted to document the extent of oiling and habitat conditions a couple of weeks after the release (April 24).

By the end of the emergency phase on May 16, 2000, approximately ten zones satisfied clean-up criteria according to the Unified Command. Additional clean-up efforts and SCAT surveys continued after the emergency phase to satisfy clean-up criteria established by the USEPA and MDE. These surveys continued through 2000, and will continue into 2001.

1.2.2 Oiled Wildlife Surveys

Oiled wildlife surveys were conducted to estimate the number of wildlife that died as a result of the oil spill, specifically waterfowl and furbearers (in particular muskrats). In the days following the spill, the USFWS organized wildlife survey teams to document wildlife impacts and use within Swanson Creek and along the Patuxent River. In general, wildlife survey teams were comprised of 2-4 individuals from Federal and State resource agencies, and, later, by trained volunteers. The survey teams walked the shoreline and recorded the following information:

wildlife observed within the zone (number and species); degree of oiling (none, light, moderate, or heavy) of observed wildlife; extent of oiling along shoreline (none, light, moderate, or heavy). In addition, each team collected any dead wildlife they encountered and notified wildlife rehabilitators of oiled wildlife in need of rescue. Additional information on bird populations in the area was provided via an aerial survey conducted on April 12, 2000. The survey encompassed approximately 32 miles of the Patuxent River from Eagle Harbor to the mouth of the Patuxent River. A ground survey was also conducted to evaluate impacts of the oil spill on muskrats in Swanson Creek. Later in the response effort, oil spill clean-up crews, and SCAT also collected dead wildlife. All retrieved wildlife carcasses and wildlife that died during the rehabilitation program were catalogued by USFWS personnel.

A complete summary of the results of the wildlife mortality survey is provided in a USFWS technical report including wildlife observations, and wildlife mortality counts (USFWS 2000). Wildlife surveys were conducted in the spill area from April 9 through April 16, 2000. Surveys were discontinued when it was determined that there would be minimal recovery of additional dead and injured wildlife. Wildlife carcasses were collected for approximately another month, after the daily wildlife surveys were discontinued, as part of response efforts. During the emergency phase, these surveys reported a total of 831 dead animals in the general spill area including dozens of birds (primarily ruddy ducks), dozens of mammals (primarily muskrats), and hundreds of fish (primarily mummichogs). Aerial and shoreline surveys indicated that resident and migratory waterfowl present in the impacted area during the spill included cormorants, coots, mallards, canvasbacks, Canada geese, and over 700 ruddy ducks (among others).

1.2.3 Sediment Blotting

On April 29-30, a survey was conducted to assess whether oil was settling on the bottom of the Patuxent River and its tributaries. The survey consisted of pushing a weighted, sorbent pad to the sediment, retrieving it, and visually inspecting it for the presence of oil. The testing was conducted at 64 locations in the spill area at depths up to 15 feet. Sampling was primarily conducted in Swanson Creek, Indian Creek, Trent Hall Creek, and the Golden Beach area. The survey found no evidence of oil on subtidal sediments. There were some oil specks documented in the intertidal shoreline habitat consistent with visual observations (e.g., SCAT results).

1.2.4 Biostimulation Monitoring

Biostimulation monitoring was initiated during the emergency phase of the project to quantitatively and qualitatively assess the success of biostimulation of interior marshes of Swanson Creek near the pipeline rupture that were heavily oiled during the spill, and were not actively cleaned to minimize impacts to the sensitive marsh habitat. Monitoring included collection of soil and water samples to assess concentrations of petroleum hydrocarbons and nutrient. The purpose for the nutrient analysis was to assess whether the addition of nutrient onto the marsh habitat was increasing nutrient concentrations in the surface water.

Biostimulation monitoring was initiated on April 24 at 18 sampling stations. By the end of the emergency phase of the project in mid-May, there was no quantitative or qualitative evidence that the biostimulation efforts were reducing petroleum hydrocarbons in the marsh compared to un-fertilized areas. Nutrient analysis found no evidence that fertilization was increasing nutrient concentrations in surface water. Fertilization was continued through the 2000 growing season and biostimulation monitoring will continue through, at least, February 2001.

1.2.5 Oil Properties and Fate

Both No. 6 and No. 2 oil were released into Swanson Creek. No. 6 oil is a heavy, high-viscosity, sticky oil, whereas No.2 is a light oil. The combined product released into Swanson Creek was analyzed and found to have the following physical properties:

- Specific Gravity of 0.94 g/cc at 60°F;
- API Gravity of 18.4 at 60°F ; and
- Kinematic Viscosity of 287.53 CentiStokes at 60°F.

NOAA conducted fate and transport modeling to estimate the fate of oil released from the pipeline based on the estimated volume released, climatic conditions, and the physical properties of the oil. This modeling was conducted using standard procedures established by NOAA for oil spills using the Adios Model. The model results indicated that almost 40% of the spilled volume evaporated into the air (31%) or dispersed into the water column (8%) within the first five days of the spill. The model can only estimate the fate of oil for five days after release, and these totals do not include active removal during the initial five-day period, nor atmospheric loss or active recovery after the first five days.

1.2.6 Post-Emergency Monitoring

In addition to the emergency phase efforts, there have been post-emergency monitoring surveys conducted as part of the clean-up effort required by USEPA. These include: comprehensive site characterization of the water and sediment conditions in the spill area; pipeline corridor assessment; revegetation monitoring of marsh habitat; biostimulation monitoring; long-term monitoring of surface water; and intertidal and subtidal sediments in the spill area. These studies are being conducted as part of the Response Action Plan with oversight by the Unified Command (USEPA, MDE, and Pepco) and the natural resource agencies (NOAA, USFWS, MDNR, and MDE).

2.0 NRDA-RELATED STUDIES INITIATED DURING THE EMERGENCY PHASE

2.1 INTRODUCTION

The NRDA trustees and Pepco (NRDA Council) implemented various studies to assess the oil's impact on the natural resources and associated services during the emergency phase of the project (April through May 16). During the emergency phase of the project, NRDA surveys were developed based on general procedures developed by NOAA for assessing the impact to natural resources associated with oil spills, and consensus among the natural resource trustees and local scientists. The NRDA-related studies initiated during the emergency phase included:

- Finfish community surveys;
- Ichthyoplankton surveys (fish eggs and larvae);
- Bioassays;
 - Striped bass
 - Sheepshead minnow
 - Copepod (*Eurytemora*)
- Tissue chemistry surveys;
 - Fish
 - Crab
 - Bivalve
- Bird surveys; and
- Abiotic surveys (water and sediment).
 - Initial
 - Second
 - Joint

Additional NRDA studies were developed after the emergency phase based on development of written workplans. These longer-term studies are not summarized in this document, and the workplans and survey reports will be provided to the public in the Swanson Creek Oil Spill Administrative Record. The results of these longer-term studies will be integrated with the results of the emergency phase studies to assess injury to the natural resources in the spill area including marsh habitats, wildlife, aquatic resources, and recreational use.

A summary of the objectives, methods, and results of the NRDA-related studies initiated during the emergency phase is provided below. Laboratory results and supporting documentation are provided in Appendices A through J. Quality control and quality assurance documentation for the laboratory analyses (e.g., matrix spike, surrogate recovery) is available upon request.

2.2 FINFISH COMMUNITY SURVEY

2.2.1 Objectives

The objectives of the finfish community survey were to determine the species inhabiting the Patuxent River in the vicinity of Swanson Creek and to assess evidence of exposure to petroleum hydrocarbons.

2.2.2 Methods

The finfish community survey was conducted using standard stock assessment techniques used by the MDE and the MDNR. The survey was conducted using a 16-foot trawl with a 1/2-inch codend. The trawls were typically six minutes in duration, and conducted at fixed stations both within the spill area and outside the spill area for comparison. All fish collected were identified to species, counted, measured to the nearest centimeter, and examined for external evidence of physical injuries potentially associated with the oil spill (e.g., lesions).

2.2.3 Results

Eleven trawl surveys were conducted between April 10 and May 10 by fish biologists from the MDE-Fish Kill Investigations Section. Trawls were conducted for six minutes at five stations extending four miles upstream from Swanson Creek (Deep Landing) to approximately 11 miles downstream of Swanson Creek (Broomes Island). A map of the sampling stations is presented in Figure 1. The results of these surveys are summarized in Table 1. The MDE field report for the survey including the field datasheets is provided in Appendix A. The field report concludes that there was no evidence of a major acute impact to the fish community of the Patuxent River, although there was evidence of localized impact (e.g., mummichogs) in Swanson Creek Marsh. Additional trawl sampling was conducted on a monthly basis from May through October 2000 as part of Pepco's standard monitoring program.

2.3 ICHTHYOPLANKTON SURVEY

2.3.1 Objectives

The objectives of the ichthyoplankton survey were to document the fish species that may be spawning and rearing in the Patuxent River in the vicinity of Swanson Creek.

Figure 1. MDE Finfish Community Trawl Locations

**Table 1. Summary of MDE Community Finfish Survey Results
Patuxent River
April 10- May 10, 2000
(Sampling points include Potts Point, Power Lines, Swanson Creek, Hallowing Point and Broomes Island)**

Species	Total Number	Percent Composition	Survey Dates													
			April 10	April 12	April 14	April 19	April 21	April 25	April 27	April 30	May 2	May 4	May 10			
American eel	9	0.26%	0	0	0	0	0	0	0	0	0	3	0	0	1	5
Atlantic croaker	64	1.82%	0	7	4	1	4	13	4	12	6	11	2	0	0	0
Atlantic silverside	16	0.45%	0	0	0	0	0	0	0	0	0	0	0	0	0	16
Atlantic menhaden	3	0.09%	0	1	0	0	0	0	0	2	0	0	0	0	0	0
Bay anchovy	85	2.42%	0	0	0	1	0	0	0	79	0	0	0	0	0	5
Blue crab	171	4.86%	0	0	0	8	7	66	23	24	26	17	0	0	0	0
Brown bullhead	2	0.06%	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Channel catfish	3	0.09%	0	0	0	0	0	0	1	1	0	1	0	0	1	0
Hogchoker	1694	48.17%	14	63	14	131	164	180	147	129	245	410	197	0	0	0
Horseshoe crab	1	0.03%	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Oyster toadfish	3	0.09%	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Spot	9	0.26%	0	0	0	0	0	0	1	4	0	1	3	0	1	0
Spotted hake	7	0.20%	0	1	0	0	0	1	3	1	0	1	0	0	1	0
Striped bass	7	0.20%	2	0	1	0	0	0	0	3	0	0	0	0	0	1
Summer flounder	1	0.03%	0	0	0	0	0	0	0	1	0	0	0	0	0	0
White catfish	1	0.03%	0	0	0	0	0	0	0	0	0	0	0	0	0	1
White perch	1408	40.03%	164	90	143	331	29	83	84	204	66	100	114	0	0	0
Yellow bullhead	33	0.94%	0	0	0	3	0	6	0	0	2	3	19	0	0	0
Yellow perch	0	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Abundance per Sampling Date	180		163	162	475	204	349	264	464	346	547	363				
Total Abundance	3517															
Total Number of Species	19															

2.3.2 Methods

The ichthyoplankton surveys were conducted using standard protocol developed by the MDNR for ichthyoplankton sampling in the Chesapeake Bay drainage. The survey design included dividing the Patuxent River into 6 regions between Lyon's Creek (river kilometer 66) and Sheridan Point (river kilometer 29). During each survey, sampling was conducted in each region. Sampling was conducted using a 1.53 x 1.53 midwater trawl with a plankton net mounted in the cod-end. The trawl had a mesh size of 1.27 cm (mouth was 3.2 cm). The plankton net had a mesh size of 505 μm . Tows were conducted for approximately 5 minutes against the direction of the current. After each trawl, the contents of the plankton net were collected in a sample jar and preserved in 10% buffered formalin. Samples were transferred to a laboratory for processing. Laboratory processing consisted of sorting fish eggs and larvae from the detritus, and identifying the fish specimens to species. Selected species, such as striped bass, were measured to the nearest millimeter and categorized by lifestage (e.g., egg, yolk-sac larvae, post yolk-sac larvae).

2.3.3 Results

Eleven ichthyoplankton surveys were conducted by the Maryland Department of Natural Resources between April 10 and May 15, 2000. A map of the sampling stations is presented in Figure 2. A total of 75 samples were collected. The ichthyoplankton collected during these surveys is summarized in Table 2. The report is provided in Appendix B, and includes distribution maps for striped bass, white perch, and river herring. These results indicate that virtually all spawning and larval rearing of striped bass (99.9%), white perch (99.9%), and river herring (99.9%) occurred upstream of the spill area.

2.4 FLUORIMETRY AND SHEEPSHEAD BIOASSAY STUDY

2.4.1 Objectives

The objectives of this study were to qualitatively assess the extent of hydrocarbons in the Patuxent River using standard fluorimetry techniques, and document the potential impact of the Patuxent River water on the survival of fish and aquatic invertebrates.

2.4.2 Methods

Scientists from the University of Maryland - Chesapeake Biological Laboratory developed the study design for this effort to assess the utility of fluorimetry as a screening technique for documenting the presence of petroleum hydrocarbons and relating the results to fish and invertebrate survival. Fluorimetry is a screening technique used to qualitatively assess the presence of hydrocarbons in water based on the ultraviolet fluorescence of the water. Water samples were collected at various locations in the spill area, mixed with hexane, and the fluorescence of the mixture measured with a spectrometer to provide an estimate of the amount of petroleum hydrocarbons in the water sample. Additional information on the fluorimetry methods is included in Appendix C-1. Water was also collected at a subset of the

Figure 2. MDNR Ichthyoplankton Surveys: Region Boundaries

**Table 2. Summary of Collections during the Ichthyoplankton Survey- Patuxent River
April 10- May 15, 2000
Includes egg, yolksac (YS) and post yolksac (PYS) (mean number)**

Herring																				
Regions	Total Number	Percent Composition	April 10-14		April 17-20		April 24-27		May 1-3		May 8-10		May 15							
			Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	PYS					
Lyons' Creek	5495	32.04%	0	1	0	0	2.5	15.5	0	2.5	33	0	15	129.5	0	2	2958	8	0	2328
Ferry's Landing	11220	65.43%	0.25	0.5	19	19.5	1.5	287	0	6	80	0	0.5	230.5	12	133	6142	16	0	4272
Lower Marlboro	348.5	2.03%	0	0.5	27	1	0	36	0	0	12	0	0	112.5	0	14.5	123	0	0	22
Trueman Point	62	0.36%	0	0	0.5	0	0	2	0	0.5	1.5	0	1	10	0	0	33	0	0	13.5
Chalk Point	15.25	0.09%	0	0	0.75	1	0	0	0	0	0	0	0	0	1	0	4	0	0	8.5
Sheridan Point	8	0.05%	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	5	0	0	0.5
Total	17149																			

Striped Bass																				
Regions	Total Number	Percent Composition	April 10-14		April 17-20		April 24-27		May 1-3		May 8-10		May 15							
			Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	PYS					
Lyons' Creek	20.5	1.13%	0	0	0	0	0.5	0	0	4	0	0	0	0	0	2	14	0	0	0
Ferry's Landing	1111.5	61.48%	9	0	0	360	0	4	2.5	2	22.5	0.5	0	0	5	133	549	0	0	24
Lower Marlboro	581.5	32.16%	0.5	1	0	379	9	2	1.5	0	85.5	5	0.5	0	0	85	12.5	0	0	0
Trueman Point	92.75	5.13%	1.25	0	0	6	4	0	0.5	0	65.5	15	0.5	0	0	0	0	0	0	0
Chalk Point	0.25	0.01%	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sheridan Point	1.5	0.08%	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1808																			

White Perch																				
Regions	Total Number	Percent Composition	April 10-14		April 17-20		April 24-27		May 1-3		May 8-10		May 15							
			Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	Egg	YS	PYS					
Lyons' Creek	422.75	5.36%	1	5	12.8	0	2.5	15.5	0	1.5	83.5	14	5.5	29.5	2	2	240	0	0	8
Ferry's Landing	6715	85.16%	10.5	0.75	182	92	7	691	0	0	594	1	0.5	106	3	0	4964	0	0	64
Lower Marlboro	698.25	8.86%	0.25	1.50	53	3.5	5.5	204	0.5	0	23	0	0	21.5	0.5	0	191	0	0	1
Trueman Point	43.75	0.55%	0.25	0	1	0.5	0	2.5	0	0	3	0	0	36	0	0.5	0	0	0	0
Chalk Point	3.75	0.05%	0.25	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
Sheridan Point	1.5	0.02%	0	0	0	0.5	0	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0
Total	7885																			

water fluorimetry stations for conducting bioassays and laboratory analysis polycyclic aromatic hydrocarbons (PAHs). The bioassays consisted of collecting water from the Patuxent River, and placing the water in aquaria with fish (eggs and larvae of sheepshead minnow) and aquatic invertebrate (specifically the copepod, *Eurytemora*). The tanks were monitored for 96 hours, and fish survival documented. A more complete description of the bioassay methods is included in Appendix C-1. Laboratory analysis was conducted to quantify the PAH concentrations and compare them to the qualitative fluorimetry results and volatile hydrocarbon concentrations in the water used during the bioassay tests. PAH analysis was conducted using modified USEPA Method 8270, and volatile analysis was conducted using USEPA Method 8021B.

2.4.3 Results

Ten fluorimetry surveys were conducted between April 17 and July 11 (specifically April 17, 21, 24 and 28; May 1, 5, 12 and 18; June 2; and July 11, 2000). Fluorescent measurements were generally collected at 26 stations along 8 transects between Deep Landing and Solomons, MD (the exact number of stations sampled varied on some surveys). A map of sampling locations is provided in Figure 3. The sampling was generally repeated during each survey at the same locations. The results of the fluorescence survey indicated initial elevated levels (measured as chrysene equivalents) adjacent to Chalk Point and Trent Hall Creeks. After the first couple of weeks, measurements were largely at background levels throughout the spill area.

During the first month of the study, water samples were collected from five of the fluorimetry stations for bioassay analysis. The study report summarizing the fluorimetry and bioassay results is provided in Appendix C-1. In general, the bioassay section concludes there was little evidence of toxicity of the Patuxent River water on fish eggs and larvae, or aquatic invertebrates. PAH samples were collected during seven of the fluorimetry surveys and generally at the bioassay sampling stations (no PAH samples were collected on April 24, May 12 or June 2). Total PAH concentrations were below 0.001 ppm at all stations during all surveys. The laboratory results for the PAH analysis are provided in Appendix C-2.

2.5 STRIPED BASS BIOASSAY STUDIES

2.5.1 Objective

The objective of the striped bass bioassay studies was to document the potential impact of the petroleum hydrocarbons on larval survival of striped bass.

2.5.2 Methods

Striped bass studies were conducted by the Academy of Natural Science Estuarine Research Center to assess survival of striped bass larvae associated with the Swanson Creek oil spill. The bioassay exposed striped bass larvae to water from Swanson Creek. The water was collected from an area that visually had the greatest presence of oil (e.g., sheen) a few days after the spill. The Swanson Creek water was diluted with clean water to provide a range of test concentrations (dilutions of 0, 10, 20, 50 and 100%). Striped bass larvae were obtained and

Figure 3. Fluorimetry Surveys

placed in the water and monitored for 48 and 96 hours. During the collection of water from Swanson Creek, a water sample was also collected for PAH analysis using modified USEPA Method 8270. Water samples were also collected from the bioassay aquaria for PAH analysis.

2.5.3 Results

Water sampling was conducted in Swanson Creek on April 13. The general results of the first bioassay showed little impact to striped bass survival after 48 hours of exposure to petroleum hydrocarbons (mean survival over 99%). After 96 hours, survival generally decreased with increasing petroleum hydrocarbon concentrations (mean survival of 12% in undiluted Swanson Creek water). The total PAH concentration in the water sample from Swanson Creek was 0.029 ppm. The results of the bioassay are provided in Appendix D.

2.6 FISH TISSUE SURVEYS

2.6.1 Objective

The objective of the fish chemistry studies was to determine the concentration of petroleum hydrocarbons in fish of the Patuxent River to assess potential human-health effects. The data from these studies are also being used to quantify the exposure of these resources to the spilled oil.

2.6.2 Methods

There were two fish tissue surveys conducted in the Patuxent River as a result of the oil spill: one in April and one in May 2000. The survey designs were developed by the NRDA Council, and used the general sampling and documentation procedures outlined in the *Natural Resource Damage Assessment Emergency Guidance Manual* (NOAA 1997). Specific fish collection methods were comparable to those employed by MDNR for their fish population monitoring program. During the April survey, fish were collected using a 16-ft bottom trawl as part of the fish community surveys conducted by MDE-Fish Kill Section. Sampling was conducted in the Patuxent River at four stations between Potts Point (approximately four miles upstream of Swanson Creek) and Broomes Island (approximately 11 miles downstream from Swanson Creek). During the May survey, fish were collected by local watermen, MDNR biologists, and Pepco biologists using gill nets and trawls. Sampling was conducted at nine stations during the May survey between Eagle Harbor (located approximately three miles upstream of Swanson Creek) and Broomes Island. During both the April and May surveys, the target species were striped bass, white perch, and catfish. Whole fish and fish fillet samples were collected, and frozen on dry ice for delivery to the analytical laboratory. At the laboratory, samples were analyzed for petroleum hydrocarbons, specifically PAHs by modified USEPA Method 8270.

2.6.3 Results

A map of the fish tissue sampling stations is provided in Figure 4. The April survey was conducted on April 12, and resulted in collection of white perch samples from all stations (no

striped bass and few catfish were caught). A total of 19 composite fish samples were collected during the survey (4-5 samples from each station). The total PAH concentrations in April ranged from less than 0.1 to 1.0 ppm. The second round of sampling was conducted approximately a month after the spill (May 10), and resulted in the analysis of 11 white perch samples. The May concentrations were approximately an order of magnitude lower than in April (range of 0.01 to 0.17 ppm). The total PAH concentrations in fish tissue for the April and May surveys are provided in Table 3. The laboratory results are provided in Appendix E.

MDE reviewed the PAH results for each survey and determined fish did not pose a human health risk. The results of this study will be integrated with the results from other NRDA studies and information in the literature to determine the injury to the aquatic resources associated with the Swanson Creek oil spill.

2.7 CRAB TISSUE SURVEY

2.7.1 Objectives

Surveys were conducted to determine the concentration of petroleum hydrocarbons in blue crabs of the Patuxent River to assess potential human-health effects. The data from these studies are also being used to quantify the exposure of these resources to the spilled oil.

2.7.2 Methods

Crab tissue surveys were based on general sampling and documentation procedures outlined in the *Natural Resource Damage Assessment Emergency Guidance Manual* (NOAA 1997). Specific crab survey methods were developed by the NRDA Council and site-specific conditions (e.g., extent of the spill). Three crab tissue surveys were completed between April and June 2000. The April crab survey was conducted using a 16-ft trawl by scientists from the University of Maryland - Chesapeake Biological Laboratory and Pepco representatives. The survey was conducted at five stations in the Patuxent River between Trueman Point (approximately four miles upstream from Swanson Creek) and Broomes Island located approximately 11 miles downstream from Swanson Creek. The May crab survey was conducted in shallow water habitat primarily using standard crabbing techniques. Selection of specific sampling locations and field collections were conducted by commercial crabbers. In areas where crabbing was not successful, samples were collected using a 16-ft trawl. The May survey was conducted at ten stations between Trueman Point and Broomes Island, and included stations at Swanson Creek, Indian Creek, and Trent Hall Creek. The June crab survey consisted of collecting specimens in commercial bank traps, and was conducted by local watermen and Pepco representatives. The survey included eight stations at bank traps in the Patuxent River and Indian, Trent Hall,

Figure 4. Fish Tissue Surveys

**Table 3. Total PAH Concentrations in Fish Tissue
Patuxent River
April and May 2000**

Date	Location	Sample ID	Analytical Total PAH (ug/g)
April 4/12/00	Trueman Point	PR-MC-01-01	0.4281
	Trueman Point	PR-MC-01-02	0.0982
	Trueman Point	PR-MC-01-03	0.9180
	Trueman Point	PR-MC-01-04	0.5100
	Trueman Point	PR-MC-01-05	0.2790
	Teague Point	PR-MC-03-01	1.0177
	Teague Point	PR-MC-03-02	0.8861
	Teague Point	PR-MC-03-04	0.4140
	Teague Point	PR-MC-03-05	0.1150
	Hallowing Point	PR-MC-04-01	0.1803
	Hallowing Point	PR-MC-04-02	0.3715
	Hallowing Point	PR-MC-04-03	0.1579
	Hallowing Point	PR-MC-04-04	0.5390
	Hallowing Point	PR-MC-04-05	0.1660
	Broomes Island	PR-MC-05-01	0.2228
	Broomes Island	PR-MC-05-02	0.1645
	Broomes Island	PR-MC-05-03	0.0369
	Broomes Island	PR-MC-05-04	0.0508
	Broomes Island	PR-MC-05-05	0.0345
May 5/10/00 - 5/12/00	Trueman Point	TRP-1	0.0427
	Swanson Creek	SWC-1	0.0654
	Swanson Creek	SWC-4	0.0753
	Teague Point	TEP-1	0.0570
	Caney Creek	CAC-1	0.0392
	Hallowing Point	HAP-1	0.0509
	Indian Creek	IC-1	0.1290
	Trent Hall	TH-1	0.1650
	Jack's Bay	JB-1	0.0342
	Jack's Bay	JB-2	0.0106
	Broomes Island	BI-1	0.0217

Washington, and Persimmon creeks. During all surveys, specimens were immediately frozen on dry ice for delivery to the laboratory for petroleum hydrocarbon analysis. At the laboratory, crab tissue samples were analyzed for petroleum hydrocarbons, specifically PAHs (modified USEPA Method 8270).

2.7.3 Results

A map of the crab tissue sampling stations is provided in Figure 5. The April crab survey was conducted within a few days of the spill (April 13 and 14), and resulted in laboratory analysis of

Figure 5. Crab Tissue Surveys Approximate Sampling Vicinities

27 samples. Total PAH concentrations during the April survey ranged from less than 0.01 to 0.75 ppm. The May survey was conducted approximately a month after the spill (May 10; 11 samples), and the June survey was conducted June 24 (14 samples). In May, the total PAH concentrations ranged between 0.02 and 0.26 ppm. In June, total PAH concentrations ranged between 0.02 and 0.07 ppm. A summary of the total PAH concentrations in crab tissues found during the April, May, and June surveys is provided in Table 4, and the laboratory results are provided in Appendix F.

MDE reviewed the PAH results for all three surveys and determined crab did not pose a human health risk. The results of this study will be integrated with the results from other NRDA studies and information in the literature to determine the injury to the aquatic resources associated with the Swanson Creek oil spill.

2.8 BIVALVE TISSUE SURVEY

2.8.1 Objective

Bivalve tissue surveys were conducted to determine the concentration of petroleum hydrocarbons in bivalves of the Patuxent River to assess potential human-health effects. The data from these studies are also being used to quantify the exposure of these resources to the spilled oil.

2.8.2 Methods

Bivalve tissue surveys were developed by the NRDA Council based on general sampling and documentation procedures outlined in the *Natural Resource Damage Assessment Emergency Guidance Manual* (NOAA 1997). Specific survey methods followed the *Shellstock Sample Preparation Protocol* developed by MDE (MDE 2000). During all surveys, bivalve samples were collected by MDE using a dredge. At each station, approximately 30-60 bivalves were collected as a composite sample (depending on size and availability). The target species differed among surveys. The April survey was conducted by MDE, MDNR and Pepco biologists within the first days of the spill (April 10) at four oyster beds between Teague Point (located immediately downstream of Swanson Creek) and Jack's Bay located approximately eight miles downstream from Swanson Creek. The May survey was conducted by local watermen and MDE biologists at five stations between Teague Point and Broomes Island located approximately 11 miles downstream from Swanson Creek, and focused on collection of razor clam and softshell clam samples. The June survey was conducted by local watermen and MDE biologists at two stations (Teague Point and Jack's Bay) to further assess softshell clam concentrations. The August survey was conducted by local watermen and MDE biologists at four stations between Teague Point and Broomes Island to assess petroleum hydrocarbon concentrations in oysters prior to the beginning of the Fall 2000 oyster season. Tissue samples from all surveys were analyzed for petroleum hydrocarbons, specifically PAHs by modified USEPA Method 8270.

**Table 4. Total PAH Concentrations in Crab Tissue
Patuxent River Drainage April - June 2000**

Month	Location	Sample ID	Analytical Total PAH (ug/g)	
April 4/13/00 - 4/14/00	Trueman Point	C0-1 thru C0-4 Crabs	0.2300	
		C0-5 thru C0-8 Crabs	0.1541	
		C0-9 thru C0-12 Crabs	0.1717	
		C0-13 thru C0-16 Crabs	0.3855	
		C0-17 thru C0-20 Crabs	0.2690	
	Teague Point	C1-1 thru C1-4 Crabs	0.3505	
		C1-5 thru C1-8 Crabs	0.3731	
		C1-9 thru C1-12 Crabs	0.2362	
		C1-13 thru C1-16 Crabs	0.3399	
		C1-17 thru C1-20 Crabs	0.5920	
	Sheridan Point	C3-1 thru C3-4 Crabs	0.4702	
		C3-5 thru C3-8 Crabs	0.6781	
		C3-9 thru C3-12 Crabs	0.5503	
		C3-13 thru C3-16 Crabs	0.6540	
		C3-17 thru C3-20 Crabs	0.6020	
	Jack's Bay	C3-21 thru C3-24 Crabs	0.7470	
		C4-1 thru C4-4 Crabs	0.0137	
		C4-5 thru C4-8 Crabs	0.0164	
		C4-9 thru C4-12 Crabs	0.0067	
		C4-13 thru C4-16 Crabs	0.0113	
	Broomes Island	C4-17 thru C4-21 Crabs	0.0278	
		C5-1 thru C5-4 Crabs	0.0032	
		C5-5 thru C5-8 Crabs	0.0033	
		C5-9 thru C5-12	0.0040	
		C5-13 thru C5-16 Crabs	0.0076	
	May 5/10/00 - 5/11/00	Trueman Point	Station 1 Crab	0.08
			Swanson Creek	Station-4 Crab
		Teague Point	Teague Point Crab	0.18
Teague Point		TP-C1 Crab	0.16	
Caney Creek		Caney Creek Crab	0.22	
Hallowing Point		Hallowing Point Crab	0.26	
Indian Creek		IC-C1 Crab	0.19	
Trent Hall		ST-7 Crab	0.23	
Sheridan Point		ST-8 Crab	0.08	
Jack's Bay		ST-9 Crab	0.02	
Broomes Island	ST-10 Crab	0.03		
June 6/24/00	Indian Creek	Indian Creek	0.0533	
	Billiard Point	Billiard Point	0.0267	
	Trent Hall	Trent Hall #4	0.0938	
		Trent Hall #5	0.0413	
	White Point	White Point	0.0576	
	Washington Creek	Washington Creek- Trap #2	0.0508	
		Washington Creek- Trap #3	0.0508	
	Marsh Point	Marsh Point- Trap #2	0.0255	
Marsh Point- Trap #3		0.0255		
	Persimmon Creek	Persimmon #1	0.0565	
		Persimmon #2	0.0285	
	Cremona Creek	Cremona- Trap #1	0.0196	
		Cremona- Trap #2	0.0196	
		Cremona- Trap #3	0.0196	

2.8.3 Results

Four bivalve surveys were conducted between April 10 and August 10. A map of the bivalve tissue sampling stations is presented in Figure 6. A total of eight samples were analyzed in April and total PAH concentrations ranged from less than 0.01 to 0.59 ppm. In May, June and August, total concentrations for all samples were below 0.002 ppm. A summary of the total PAH concentrations found during the April, May, June, and August surveys is presented in Table 5, and the analytical results from the laboratory are included in Appendix G.

MDE determined the concentrations of petroleum hydrocarbons in bivalves were below human health concern levels during all surveys. The results of this study will be integrated with the results from other NRDA studies and information in the literature to determine the injury to the aquatic resources associated with the Swanson Creek oil spill.

2.9 NESTING BIRD SURVEYS

2.9.1 Objective

The primary objective of this study was to determine the degree and extent to which the oil spill affected the reproductive success of bird species, including osprey, great blue heron, and bald eagle that were nesting in the area when the spill occurred. Additional bird surveys were conducted as part of the clean-up activities as summarized in Section 1.2.2.

2.9.2 Methods

Nesting studies were developed jointly by scientists from USFWS, MDNR, the Patuxent Wildlife Research Center (PWRC), and Pepco. Nesting success of birds in the vicinity of the spill zone was documented to evaluate if the oil spill may have impacted the eggs or prey base of some bird species. In order to evaluate the degree and extent of impacts on reproductive success, nests of osprey, great blue heron, and bald eagle were routinely monitored until fledging occurred. In general, post-spill survey results include number of eggs per nest, percentage hatching, number of young, and fledging success. Biologists from USFWS, Pepco, and the Nanjemoy Creek Environmental Education Center conducted the nest inspections and monitoring.

For osprey, active nesting pairs were examined several times immediately following the spill between Trueman Point (four miles upstream from Swanson Creek) and Cremona (located six miles downstream from Swanson Creek). During these inspections, any oiled adults were collected (if possible) for rehabilitation, and rehabilitated birds were released. Nests were revisited every two weeks until fledging occurred. The field results will be compared historical data for the middle Patuxent River and to 2000 data for the upper river (above the spill zone and extending to Jug Bay) to evaluate spill impacts on the local nesting population. For great blue herons, the field efforts focused on a heronry on Swanson Creek and an un-impacted site on Black Swamp Creek located approximately six miles upstream from Swanson Creek. Nests were monitored weekly through fledging. The observations from the Swanson

Figure 6. Bivalve Tissue Surveys

**Table 5. Total PAH Concentrations in Bivalve Tissue
Patuxent River
April - August 2000**

Date	Location	Station ID	Analytical Total PAH (ug/g)
April 4/10/00	Teague Point	Teague Point Rep. 1	0.3545
	Teague Point	Teague Point Rep. 2	0.5910
	Hallowing Point	Hallowing Point Rep. 1	0.0598
	Hallowing Point	Hallowing Point Rep. 2	0.0543
	Sheridan Point	Sheridan Point Rep. 1	0.0284
	Sheridan Point	Sheridan Point Rep.2	0.0153
	Jack's Bay	Jack's Bay Rep. 1	< 0.010
	Jack's Bay	Jack's Bay Rep. 2	0.0136
May 5/10/00	Teague Point/ Buena Vista	Teague Point/Buena Vista #2	0.0016
	Hallowing Point	Hallowing Pt. #3	0.0002
	Sheridan Point	Sheridan Pt. #4	0.0001
	Jack's Bay	Jack's Bay #5	0.0000
	Hollywood Shores	Hollywood Shores #6	0.0001
June 6/19/00	Buena Vista	Station 1 Buena Vista	0.0005
	Jack's Marsh	Station 2/Jack's Marsh (1 of 2)	0.0001
	Jack's Marsh	Station 2/Jack's Marsh (2 of 2)	0.0003
August 8/10/00	Teague Point	Teague Point #4 1/4 & 2/4	0.000002
	Teague Point	Teague Point #4 3/4 & 4/4	0.000018
	Hallowing Point	Hallowing Point #3 1/4 & 2/4	0.000028
	Hallowing Point	Hallowing Point #3 2/4 & 4/4	0.000015
	Sheridan Point	Sheridan Point #2 1/4 & 2/4	0.000007
	Sheridan Point	Sheridan Point #2 3/4 & 4/4	0.000023
	Jack's Bay	Jack's Bay #1 1/4 & 2/4	0.000011
	Jack's Bay	Jack's Bay #1 3/4 & 4/4	0.000008
	Broomes Island	Broomes Island #1A 1/4 & 2/4	0.000002
	Broomes Island	Broomes Island #1A 3/4 & 4/4	0.000009

Creek heronry will be compared to the literature and to nesting results from the reference heronry at Black Swamp Creek to assess impacts on the nesting population. For bald eagles, nests were identified within the spill zone and inspected following the spill. Nests with chicks were observed weekly until the fledglings left the area.

2.9.3 Results

Field surveys were conducted between April and August 2000, and a map of the osprey nest sites is presented in Figure 7. The general results of these field efforts included:

For osprey, there were 37 active nesting pairs monitored between Trueman Point and Cremona. These birds were examined several times immediately following the spill. During these inspections, six oiled adults were observed, four of which were later rehabilitated and released.

Figure 7. Osprey Monitoring Locations

Nests were revisited every two weeks until successful fledging of all birds occurred in July/August.

For great blue herons, the heronry on Swanson Creek was inspected on April 19 and April 20, 2000. Three adult birds were observed to be oiled. Of the total of 34 nests observed, 17 were accessible to the climbers. In mid-May, scientists began weekly monitoring of these 17 nests and continued to monitor them through successful fledging.

For bald eagles, three eagle nests were documented within the spill zone, and inspected following the spill. Two of the nests contained eagle chicks. No oiling of adults or juveniles was observed. During the first week of May, one of the nests containing chicks appeared to have been blown from the tree by high winds. The only other nest with chicks, located at Cremona, was observed weekly until the two fledglings left the area.

2.10 INITIAL ABIOTIC SURVEY

2.10.1 Objective

The initial abiotic survey was initiated within 24 hours of the pipeline release to characterize the extent and magnitude of petroleum hydrocarbons in the surface water and sediments of Swanson Creek Marsh and creek.

2.10.2 Methods

The general sampling approach was directed by USFWS, and focused on the area of Swanson Creek where visual observations indicated oil was present. Sampling was conducted by personnel familiar with environmental sampling with instruction from USFWS. Water samples were collected in lab-cleaned 1-liter amber bottles. Sediment samples were collected with clean, steel scoops or a Ponar (used in deeper water). All sampling equipment was cleaned with acetone and wrapped in foil prior to each sample collection. Sampling points were mapped using GPS. Water samples were analyzed for PAHs using modified USEPA Method 8270. Sediment samples were archived pending a decision on the analytical approach by the NRDA Council.

2.10.3 Results

The survey was conducted on April 8 and included the collection of surface water and surface sediment samples from six locations in Swanson Creek Marsh and Creek (a map of the sampling locations is presented in Figure 8). Total PAH concentrations in surface water ranged from less than 0.001 to 0.097 ppm, with floating oil product observed in some water samples. A summary of total PAH concentrations are presented in Table 6. The analytical results from the laboratory are provided in Appendix H.

Figure 8. Initial Abiotic Survey

**Table 6. Total PAH Concentrations in Water during Abiotic Surveys
April 8- 13, 2000**

Survey	Date	Location	Station	Total Analytical PAH value (ug/L)
Initial	April 4/8/00	Swanson Channel	SW-3-12	0.762
		Swanson Channel	SW-8-24	29.3392
		Swanson Marsh	SW-4-16	97.9221
		Swanson Creek- Trestle Bridge	SW-7-20	1.016
		Swanson Creek	SW-2-8	0.7688
Second	April 4/10/00	Eagle Harbor	SW-18	1.076
		Swanson Creek- Bridge at 381	SW-17	0.0924
		Swanson Creek- Chalk Point	SW-21	17.8817
		Swanson Creek	SW-2	210.7112
		God's Grace Point (West)	SW-22	13.2707
		Teague Point	SW-20	2.3143
		Buena Vista	SW-23	520.5553
		Benedict Bridge (East Shore)	SW-19	767.8235
Joint	April 4/12/00 4/13/00	Patuxent River- Main Channel	PR-MC-12W	0.2061
		Patuxent River- Main Channel	PR-MC-11W	0.6365
		Patuxent River- Main Channel	PR-MC-9W	2.2571
		Patuxent River- Main Channel	PR-MC-13W	0.6146
		Patuxent River- Main Channel	PR-MC-10W	0.9599
		Patuxent River- Main Channel	PR-MC-8W	1.5499
		Patuxent River- Main Channel	PR-MC-7W	2.7963
		Patuxent River- Main Channel	PR-MC-6W	0.2755
		Patuxent River- Main Channel	PR-MC-5W	0.1433
		Black Swamp Creek	SW-45-32	0.2837
		Black Swamp Creek	SW-47-36	0.4818
		Black Swamp Creek	SW-43-28	0.3108
		Swanson Creek	SW-53-48	14.3034
		Swanson Creek	SW-55-52	16.5075
		Swanson Creek	SW-51-44	7.0354
		Swanson Creek	SW-49-40	9.2225
		Indian Creek	SW-40-19	10.1683
		Indian Creek	SW-41-22	5.6315
		Indian Creek	SW-39-15	5.2932
		Indian Creek	SW-42-25	7.0434
		Trent Hall Creek	SW-38-12	2.4442
		Trent Hall Creek	SW-37-9	2.2162
		Trent Hall Creek	SW-35-3	9.4177
		Trent Hall Creek	SW-36-6	6.0526
		Washington Creek	SW-30-21	0.6432
		Washington Creek	SW-31-24	2.4867
		Washington Creek	SW-32-27	2.8287
		Washington Creek	SW-33-30	2.4911
		Washington Creek	SW-34-33	3.2544
		Persimmon Creek	SW-29-18	4.209
		Persimmon Creek	SW-27-12	9.096
		Persimmon Creek	SW-28-15	7.6888
		Cat Creek	SW-25-6	0.2265
		Cat Creek	SW-24-3	0.1951
		Cat Creek	SW-26-9	1.1871

2.11 SECOND ABIOTIC SURVEY

2.11.1 Objective

The second abiotic survey was initiated within three days of the oil spill to characterize the extent and magnitude of petroleum hydrocarbons in the surface water and sediment of Swanson Creek and the adjacent Patuxent River.

2.11.2 Methods

The second abiotic survey was conducted by Pepco contractors (Gascoyne Laboratories) at locations specified by USFWS, and included re-sampling at the locations identified by USFWS during the initial abiotic survey. In addition, the extent of the survey was expanded to account for oil flowing into and across the Patuxent River. Sampling included collection of water and sediments from the Patuxent River shoreline upstream and downstream of the confluence of Swanson Creek on the western shore and along the Eastern Shore in the vicinity of God's Grace Point. Water samples were collected in lab-cleaned 1-liter amber bottles. Sediment samples at shallow stations were collected using a lab-cleaned jar as a scoop. The jar was filled and the cap firmly secured. At the deeper water locations, a clean clamshell sampler was used to collect sediment samples. Water samples were analyzed for PAHs using modified USEPA Method 8270. Sediment samples were archived pending a decision on the analytical approach by the NRDA Council.

2.11.3 Results

The survey was conducted on April 10 and included sampling at 17 locations in Swanson Marsh and Creek, and six additional stations near the mouth of Swanson Creek and in the Patuxent River, adjacent to Swanson Creek. A map of the sampling stations is presented in Figure 9. Sediments were collected at 23 stations, and surface water samples were collected at eight stations including Swanson Marsh and the Patuxent River. Total PAH concentrations in water samples ranged from less than 0.001 to 0.768 ppm, with floating oil product in some of the water samples. Total PAH concentrations are presented in Table 6, and the analytical results from the laboratory are provided in Appendix I.

2.12 JOINT ABIOTIC SURVEY

2.12.1 Objective

The joint abiotic survey was developed by the NRDA Council to characterize the potential presence of petroleum hydrocarbons in the sediment and water column of shoreline habitat of Swanson Creek, the Patuxent River, and other tributaries of the Patuxent River.

Figure 9. Second Abiotic Survey

2.12.2 Methods

The joint abiotic survey was developed and implemented by representatives of the NRDA Council. The survey focused on tributaries of the Patuxent River since the majority of observed shoreline oiling was reported in the tidal portions of tributaries downstream of Swanson Creek. The survey was conducted along transects in 7 tributaries and the mainstem of the Patuxent River. The seven tributaries included five areas impacted by oil and two tributaries located outside of the reported spill area for comparative purposes. The impacted tributaries included Swanson, Indian, Trent Hall, Washington, and Persimmon creeks. The background sites included Black Swamp Creek (located approximately six miles upstream of Swanson Creek) and Cat Creek located approximately ten miles downstream of Swanson Creek. Water sampling in the Patuxent River included samples from within the spill area and upstream and downstream background stations. Water samples were collected by holding a capped lab-cleaned bottle approximately 2-6 inches under the water surface, removing the cap, allowing the bottle to fill with water, and capping the bottle before removing it from the water. Intertidal and subtidal sediment samples were collected using a petit Ponar to a sample depth of approximately four inches. The contents were emptied into a clean bucket, and a sample of the surface sediment collected in a lab-cleaned jar. All sampling equipment was cleaned using standard decontamination protocol prior to use. All samples were labeled, and placed on ice until delivery to the laboratory. All sampling locations were documented using GPS. At the laboratory, the water samples were analyzed for PAHs using modified USEPA Method 8270. Sediment samples were archived pending a decision on the analytical approach by the NRDA Council.

2.12.3 Results

The survey was conducted April 12 through 14 by representatives of the NRDA Council including USFWS and Pepco. Water grab samples were collected at 26 stations and soil grab samples were collected at 33 stations. The sampling locations are shown in Figure 10. The water samples were analyzed for PAH and sediment samples were archived pending a decision on analytical approach by the NRDA Council. Laboratory results show total PAH levels in the mainstem of the Patuxent River water were below 0.003 ppm in all samples, and most samples were below 0.001 ppm. Analytical results for the tributaries indicate that total PAH samples were below 0.02 ppm in all samples. A summary of the total PAH concentrations for all water samples is provided in Table 6. The analytical results from the laboratory are provided in Appendix J.

Figure 10. Joint Abiotic Survey

3.0 REFERENCES

National Oceanic and Atmospheric Administration (NOAA). 1997. Natural Resource Damage Assessment Emergency Guidance Manual, version 3.1. July 1997.

United States Fish and Wildlife Service (USFWS). 2000. U.S. Fish and Wildlife Service Response During the Chalk Point Oil Spill. Chesapeake Bay Field Office, Annapolis, MD. October 5, 2000.

Maryland Department of the Environment (MDE). 2000. Shellstock Sample Preparation Protocol. Baltimore, MD.