

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
REGION 5

**ENVIRONMENTAL CONTAMINANTS PROGRAM
ON-REFUGE INVESTIGATIONS SUB-ACTIVITY**

**NJ - Effects of historical and active nursery operations on the Great Swamp National
Wildlife Refuge, Morris County, New Jersey**
Project ID: 200250001.1

By

Clay Stern
Environmental Contaminants Specialist
New Jersey Field Office
Pleasantville, New Jersey
July 2010

INTRODUCTION

This report presents preliminary reconnaissance data on sediment and fish samples collected within the Great Swamp National Wildlife Refuge (GSNWR) Tract 141A - the former Hidden Valley Nursery (HVN) and on GSNWR Tract 354. Tract 354 is juxtaposed and down gradient of a currently active nursery operation, the Great Swamp Greenhouses (GSGH). As sediment and biota samples collected only represent a few data points, caution should be taken by the reader as to not misconstrue this report as either an ecological risk assessment or site characterization/delineation report. The purpose of this report to present preliminary reconnaissance data so that land managers can make better informed resource allocations decisions that address, among other things, the numerous landscape level contaminant-related issues facing the refuge today and in the future.

Acquired in 1991, the HVN is a 22-acre parcel located off Sassafras Road in Long Hill Township. Vegetation on the HVN is a mix of abandoned nursery stock, non-native invasive species, scrub-shrub, and hardwoods. The HVN parcel gently slopes from about 260 to 240 feet in elevation, such that the topography promotes surface run-off into two small ponds which would act as “collection basins” reflective of the worst-case scenario of localized sediment contamination. The “upper pond” covers approximately 0.5 hectare and is hydrologically connected via surface pathway and seepage through a shared berm with the approximately 0.02 hectare “lower pond.” A review of historical aerial photographs revealed the presence of several outbuildings on the parcel which may have been used for equipment or pesticide storage as well as several greenhouses on the parcel. Many of the buildings and greenhouses were removed prior to acquisition by the refuge; the few remaining outbuildings were demolished under refuge oversight around 2004. No previous contaminant data regarding the site were found.

The Great Swamp Greenhouses (GSGH), an active commercial and retail nursery, is located on the northeast corner of Long Hill and White Bridge Roads. Michael and Casey Beneduce purchased 4.3 acres of the property in 1979 for use as a wholesale nursery and greenhouse operation. During the next 24 years, the GSGH expanded the operation into a wholesale and retail operation, and enlarged the overall facility to a 9.54-acre tract. Examination of topographic maps and aerial photography suggests a likely propensity for surface water to flow easterly from the GSGH facility towards the mixed emergent and forested wetlands in GSNWR Tract 354. Those wetlands form the headwaters of a tributary to the Black Brook. There are no known available data to determine whether GSGH run-off, which may contain elevated levels of facility-related chemicals, is entering the GSNWR.

In the pre-study timeframe, absence of available sediment or fish tissue residue data made it difficult, if not impossible, to determine if trust resources on or near the HVN or near the GSGH facility were being impacted by contaminant-tainted sediments or run-off. The potential existed for the contamination and/or depletion of food sources within localized aquatic communities due to elevated contaminant levels introduced from historical or active nursery operations.

METHODS

Sampling Methods

Sediment and fish samples were collected in late September of 2005.

Discrete sediment samples were collected using stainless steel hand trowels, or a ponar grab (whichever was most appropriate for site-specific conditions). Consistent with previous sampling efforts (USFWS 2005) sediment samples were collected from the 0-8 centimeter horizon; rocks and vegetative material removed and the resultant sediment placed into pre-clean I-Chem jars with teflon-lined lids. Samples were immediately placed in a cooler on blue ice. Upon return from the field, samples were stored at were stored at -20°C until shipment to the laboratory on dry ice. Sediment analyses included a metal suite and an organic combination suite that included organochlorines, aromatics, and the organophosphate chlorpyrifos.

HVN samples

- Pond samples: Prior to shipping to the analytical laboratories, the 4 discrete sediment samples from the upper pond and the 2 discrete samples from the lower pond were thawed and pooled as a single representative sediment sample for each pond and identified as “upper pond” and “lower pond.”
- Seep samples: Discrete sediment samples collected from 2 seeps located on the walking path on the easterly up-gradient aspect of the upper pond. The samples are identified as “Seep-1” (the more southerly seep) and “Seep-2” (located approximately 30 meters north of Seep-1).

Tract 354 samples

Two sediment samples were collected at Tract 354 from depositional areas. As such, sediment concentrations can be interpreted as representing a worst-case scenario.

- Sample SS-1 was collected from a depositional area within hummocky wetlands just above the point where the tributary to the Black Brook became clearly defined.
- Sample SS-2 was collected approximately 20 meters down gradient of SS-1.

Fish

Eastern mud minnow (*Umbra pygmaea*) and largemouth bass (*Micropterus salmoides*) were selected as the target fish species for Tract 354 and the HVN ponds, respectively. Fish residue analyses included a metal suite and an organic combination suite that included organochlorines, and the organophosphate chlorpyrifos.

- Mudminnows were collected using a battery-powered electroshocker. The whole-body fish composite (n=15) were stored in pre-cleaned I-Chem jars with teflon-lined lids, immediately placed on wet ice for transport from the field, and then stored at -20°C until shipment to the laboratory on dry-ice.
- Largemouth bass were collected using line and lure; all were weighed and descaled. Fillets, with skin on, were taken from the 2 largest fish caught (HVNLMB-1, 1571.9 g; HVNLMB-7, 574.9 g). Four whole-body specimens were also submitted for analysis.

Bass carcasses and fillets were rinse in deionized water, wrapped in nitric acid / acetone / methanol / deionized water rinsed aluminum foil and stored at -20°C until shipment to the laboratory.

Analytical Methods

Inorganic analyzes were performed at the Laboratory & Environmental Testing, Inc., (LET) Columbia, Missouri. Organic analyzes were performed at the Geochemical & Environmental Research Group (GERG), College Station, Texas. Laboratory-specific analytical methods, as required by the Service's Analytical Control Facility (ACF), can be found at: http://www.fws.gov/chemistry/acf_labs.html.

Data Analysis

Sediment analyte concentrations were compared to consensus-based sediment quality guidelines (MacDonald, *et al.*, 2000). The consensus-based sediment quality guidelines use the Toxic Effect Concentration (TEC) defined as the concentration below which harmful effects to benthic organisms are unlikely to be observed, and the Probable Effects Concentration (PEC) defined as the concentration above which harmful effects are likely to be observed. The TEC and PEC are screening values, not enforceable cleanup standards.

Raw Data

Raw data in a customized format may be retrieved from the Environmental Conservation Online System (ECOS) web site through the Environmental Contaminants Data Monitoring System (ECDMS) – Catalog 5040082.

RESULTS AND DISCUSSION

Hidden Valley Nursery

Sediments Residues

Exceedances of sediment quality guidelines (MacDonald, *et al.*, 2000) are summarized in Table 1. With the exception of nickel (97 mg/kg) in Seep-2 exceeding its respective PEC (48.6 mg/kg) and Σ DDE (36.45 ug/kg) in the upper pond exceeding its respective PEC (31.3ug/kg), no other analyte exceeded its respective PEC. The slightly elevated levels of zinc seen in the Seeps-1 and -2 (130 and 231mg/kg, respectively) and in the upper pond (150 mg/kg) appear to be a refuge-wide phenomena. The organochlorine pesticides detected above their respective TECs are no longer in general use in the United States. Polycyclic aromatic hydrocarbon (PAH) concentrations detected in the sediments are relatively low and are not at concentrations indicative of the presence of an actively leaking underground storage tank. Collectively, the contaminant residue exceedances observed are considered only slightly elevated and likely do not represent an imminent population-level threat to benthic macroinvertebrates inhabiting the HVN ponds.

Fish (largemouth bass)

Largemouth bass in the HVN ponds are scheduled for collection in September 2010 as part of the region-wide bass endocrine study (Project No. 5N44). Upon receipt of 2010 study, an assessment of the bass endocrine status relative to contaminant body burden data will be appended to this report.

Human Consumption of HVN Bass

The State of New Jersey has issued and maintains a State-wide mercury consumption advisory on largemouth bass. Based on guidance for assessing chemical contaminant data for use in fish advisories (USEPA, 2000) all largemouth bass collected from the HVN ponds (4 whole body specimens and 2 carcass/fillet specimens) would be subject to consumption advisories for methylmercury, arsenic (non-cancer endpoint), DDT, and total polychlorinated biphenyls (PCBs). Currently, fishing is prohibited within the GSNWR, and it is recommended that this prohibition remain in effect.

Tract 354

Sediment Residues

Exceedances of sediment quality guidelines (MacDonald, *et al.*, 2000) are summarized in Table 2.

Metals

In sample SS-1, copper (41 mg/kg) and lead (87 mg/kg) exceeded their respective TECs of 31.6 and 35.8. No exceedances the respective metals PECs were observed in SS-1.

No exceedances of the respective metals TECs or PECs were observed in sample SS-2.

Organochlorines

In sample SS-1, Σ DDTs (sum of all 6 isomers, 11.2 ug/kg) and Σ DDE (5.7 ug/kg) exceeded their respective TECs of 5.28 ug/kg and 3.16 ug/kg. No exceedances of the respective organochlorine TECs were observed in sample SS-2. No exceedances the respective organochlorine PECs were observed.

Polycyclic Aromatic Hydrocarbons

No exceedances of the respective PAH TECs or PECs were observed in sample SS-1 or SS-2.

Fish (mud minnow) composite

Broadly accepted fish screening benchmarks for whole-body residue concentrations are scarce. All metals and organochlorine tissue concentrations reported were unremarkable and are considered low. The tissue residue concentrations observed (data not shown) are fairly consistent with those of GSNWR mud minnows sampled in 1999 (USFWS 2005).

The limited sediment and fish tissue sampling conducted on Tract 354 did not reveal any significant contamination that warrants management action.

Table 1: Hidden Valley Nursery Sediment Exceedances (Bold values indicate exceedance of the PEC)																		
	Cooper (mg/kg)	Nickel (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)	Chlordane (ug/kg)	Total DDT (ug/kg)	Σ DDD (ug/kg)	Σ DDE (ug/kg)	Σ DDT (ug/kg)	Dieldrin (ug/kg)	Total PCBs (ug/kg)	Anthracene (ug/kg)	Benzo(a)anthracene (ug/kg)	Benzo(a)pyrene (ug/kg)	Chrysene (ug/kg)	Fluoranthene (ug/kg)	Phenanthrene (ug/kg)	Pyrene (ug/kg)
Seep-1			65	130		11.94		4.79										
Seep-2		97		231		10.58		7.76										
Upper Pond	34		47	150	13.92	60.98		36.45	7.47	6.07	85.5	237	393	522	368	904	207	704
Lower Pond					9.58	17.06	6.39				81.4	168	151	185			351	
TEC	31.6	22.7	35.8	121	3.24	5.28	4.88	3.16	4.17	1.9	59.8	57.2	108	150	166	423	204	195
PEC	149	48.6	128	459	17.6	572	28	31.3	62.9	61.8	676	845	1050	1450	1290	2230	1170	1520

Table 2: GSG Sample SS-1 Exceedence Summary				
Analyte	units	Reported value	TEC	PEC
Copper	mg/kg	41	31.6	149
Lead	mg/kg	87	35.8	128
Σ DDTs	ug/kg	11.2	5.28	572
Σ DDE	ug/kg	5.7	3.16	31.3

REFERENCES

MacDonald, D.D., C.G, Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol.* 39:20-31.

US Environmental Protection Agency. 2000. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2: Risk Assessment and Fish Consumption Limits - Third Edition.* EPA 823-B-00-008.

US Fish and Wildlife Service. 2005. *Contaminants in fish and sediments of the Great Swamp national Wildlife Refuge, Morris County, New Jersey: A 10-year follow-up investigation.* New Jersey Field Office, Pleasantville, New Jersey.