

Long Island Duck Farm History
and
Ecosystem Restoration Opportunities
Suffolk County, Long Island, New York



February 2009



**US Army Corps of Engineers
New York District**



Suffolk County, NY

APPENDIX C

APPENDIX C

Hazardous, Toxic and Radioactive Waste Sampling Report

PLANNING ASSISTANCE TO STATES

FORMER DUCK FARMS SEDIMENT SAMPLING SUFFOLK COUNTY, NEW YORK

Suffolk County (County) and the US Army Corps of Engineers, New York District (District) are partnering on an evaluation of the ecosystem restoration potential at former duck farm sites throughout Suffolk County. To aid in this evaluation, District and County Planning and Health Departments' personnel conducted field investigations including sediment sampling on December 12 and 19, 2006. The purpose of the sampling program was to collect sub-surface soil and sediment samples from watersheds on which there are former duck farm sites in order to analyze them for potential contaminants and bio-hazards.

The sampling effort was constrained by limited resources and therefore focused to obtain a sufficient sample to provide a preliminary characterization at one (1) farm and comparative data from others. The majority of the sample collection was conducted at the former Gallo Duck Farm, situated on Gazzola Road, which the County has already acquired as parkland and is currently evaluating for ecosystem restoration opportunities. The former Gallo Duck Farm is located on the east branch of Mud Creek which flows southwest through its confluence with the western branch of Mud Creek, into a small impoundment called Robinsons Pond, and thence into Great South Bay. For comparative purposes, additional, but limited sampling was conducted on two (2) other Great South Bay tributaries: Mill Pond on the Forge River, which has both existing and former duck farm properties and the former Robinson Duck Farm which is on the Carman River adjacent to the Wertheim National Wildlife Refuge.

A map illustrating all the sample locations is presented at the end of this Appendix. Over the two-day sampling effort, a total of fifteen samples were collected: eight (8) cores, two (2) sediment samples from the pond and one (1) surface composite grab from Mud Creek in the vicinity of the former Gallo Duck Farm; two (2) surface composite grabs from the Forge River/Mill Pond location; and one (1) core and one (1) surface composite grab from the Robinson Duck Farm. All samples were taken using a hand auger until coarse-grained sediments (sand) were encountered. Soil conditions facilitated sampling to a depth of four (4) to six (6) feet.

All samples were shipped over-night to the Fort Monmouth Environmental Laboratory (FMEL) in Fort Monmouth, New Jersey. Samples were analyzed for: Volatile Organics (VOAs), Semi-Volatile Organics (SVOAs), Pesticides, PCBs, Priority Pollutant Metals (PP Metals), E-Coli, Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon (TOC), Total Percent Solids. Sample turn-around time was standard at four (4) weeks. FMEL sub-contracted analysis for the E-Coli, Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon and Total Solids Percent.

Environmental parameters were evaluated using the New York State Department of Environmental Conservation “Technical Administrative Guidance Memorandum” (TAGMs). Results are reported on the following tables. Analytical results are presented by site.

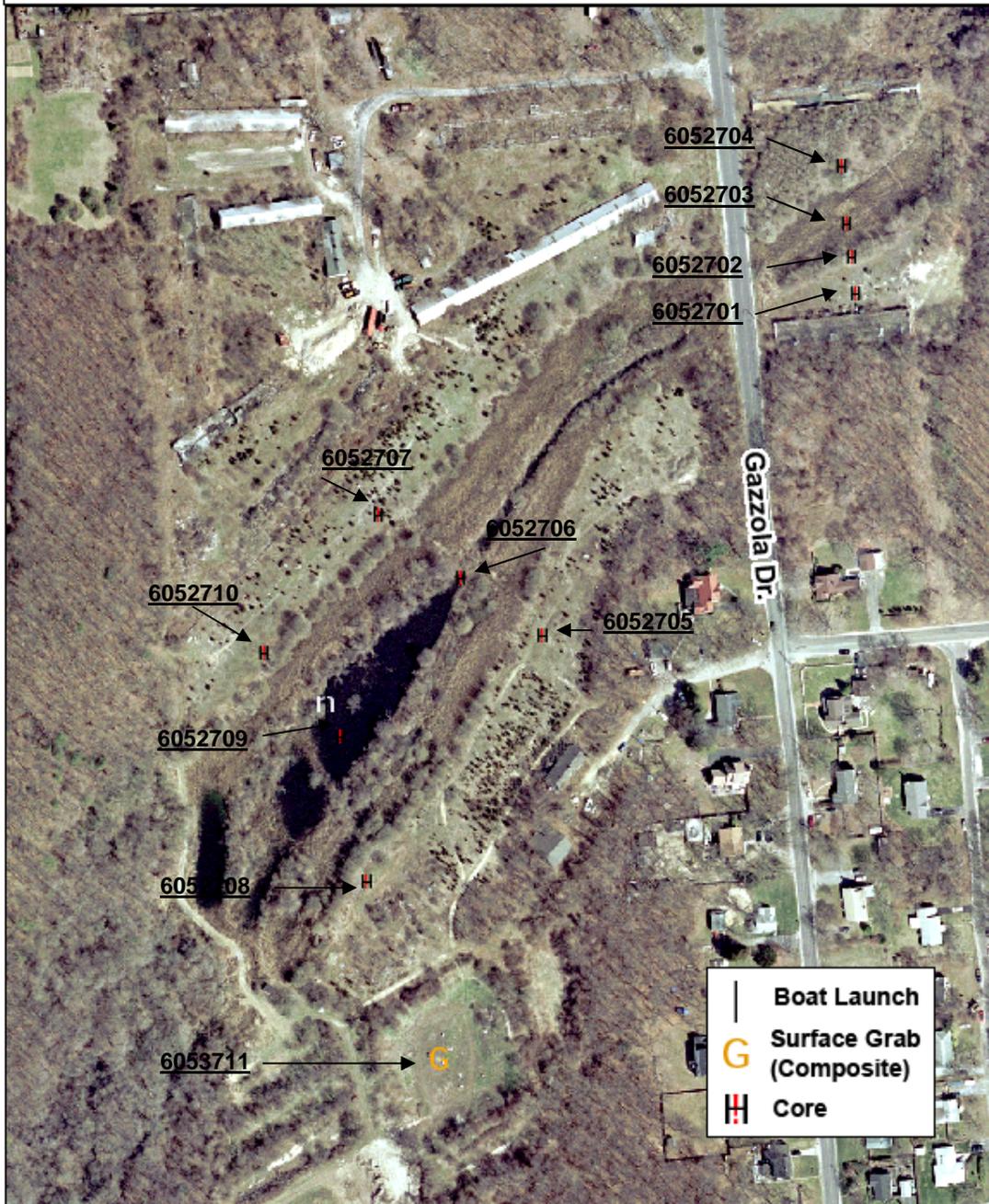
As samples were collected they were characterized according to color, texture (grain-size), odor, and moisture content. All samples were placed in clear glass two (2) ounce size jars. No preserving agents were used. Each sample was labeled with the initials of the person collecting the sample, date and time of the sample collection, sample location, type of analysis requested and who owned the sample (the District), and assigned a unique number identifier. Upland samples were typified by either rust or whitish colored sands. The in-water sediment samples were a mix of gray sands with silts. No noticeable odor was detected from the upland samples and minimal odor was detected from the sediments. Each sample location had four (4) sample jars filled.

Former Gallo Duck Farm (Mud Creek)

At Mud Creek on the Former Gallo Duck Farm, sampling was designed to test both upland and in-water locations with transects aligned to traverse the creek. The eight (8) transect samples (lab sample identification nos. 6052701, 6052702, 6052703, 6052704, 6052705, 6052707, 6050708 and 6052710) were positioned to evaluate both wetland and upland sediments on either side of the creek. Sample 6053711 was a composite taken from an impoundment area adjacent to the creek. At Mud Creek on the Former Gallo Duck Farm, two (2) sediment samples were collected in-water (lab sample identification nos. 6052706 and 6052709).

All of the samples (upland or sediment samples) were analyzed for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, and Total Solids Percent. Only upland samples 6052706 and 6052709 were analyzed for E-Coli. In addition, all upland samples were collected and analyzed for Volatile Organics, Semi-Volatile Organics, Pesticides, PCBs and priority pollutant metals.

Former Gallo Duck Farm Sediment/Core 2006 Sampling Locations



ANALYTICAL RESULTS

LAB ID	TAGMS	6052701 Upland	6052702 Upland	6052703 Upland	6052704 Upland	6052705 Upland	6052706 Sediment	6052707 Upland	6052708 Upland	6052709 Sediment Sample	6052170 Upland	6053711 Composite
Units	ppb	ppb	ppb	ppb	ppb	ppb	Ppb	ppb	ppb	ppb	ppb	ppb
VOA+15 Acetone TIC	.0002	10	6	12	13			9				
ABN+25 (SVOA) Diethylphthalate	.0071	25		24				19	24	32J	16	
Di-n-butylphthalate	.0081	1200B	570JB	1300B	570 JB	1100B	1100 JB	800	1400JB	1300JB	810JB	970JB
Di-n-octylphthalate	.050							15J				
Bis(2-ethylhexyl)phthalate	.050	42JB	37JB	40 JB	33 JB	59JB	72 JB	120JB	130JB	120JB	60JB	
Pyrene TIC	.050	15,447	15,667	13,464	11,543	21,369	27 71,569	37,484	35,224	101,722	21,316	34,840
Pesticides	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Arsenic	7.5*	2.12				1.08		1.98				
Beryllium	0.16*					0.102		0.119				
Cadmium	1*					0.663	4.94	0.952			0.458	
Chromium	10*	2.12	11.4	1.98		7.12	1.79	11.6	2.91		6.55	1.65
Copper	25*	1.18	5.03	1.75	1.62	2.82	3.79	3.02	1.68	2.13	3.12	2.82
Lead	Background		3.83			4.36	9.18	3.41	2.05	10.5	3.84	4.85
Nickel	13*				2.03	3.64	1.45	3.66	1.24		3.09	
Silver	Background					1.17		1.60				
Zinc	20*		17.4						12.8		18.6	18.6
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Kjeldahl Nitrogen	NA	74.1	134	95	5420	268	261	87.3	91.6	393	142	1090
Total Phosphorous	NA	48.2	332	114	2060	201	97.1	423	709	275	659	360
Total Organic Carbon	NA	ND	1370	1340	121,000	2100	2680	ND	3650	9560	1950	6090
Total Solids	NA	81.66%	84.46%	82.08%	48.89%	94.72%	80.07%	89.33%	89.49%	82.69%	88.44%	94.95%
Percent	NA											
E-Coli	NA	Not analyzed	Present	Not analyzed	Not analyzed	Present	Not analyzed	Not analyzed				

*or site background, whichever is greater.

NA = not applicable

ND-non detect

ppb = parts per billion

ppm = parts per million

TAGMs = Technical Assistance Guidance Memorandum

J = Estimated value

B = Lab blank

N = Presumptive evidence of a compound

VOA-Volatile Organic Compounds

SVOA-Semi-Volatile Organic Compounds

Standard VOC analysis covers 48 compounds. Five (5) samples collected from the Gallo Duck Farm indicated the presence of Acetone. These samples were extracted from sediments collected adjacent to Mud Creek which flows through the farm site. Acetone concentrations above soil cleanup objectives were detected in sample locations 6052701, 6052702, 6052703, 6052704, and 6052707, all of which are uplands samples with the exception of sample location 6052706 which is a sediment sample. These samples were located on the second and third transects going downstream along Mud

Creek, southwest of Gazzola Road. Acetone was detected with concentrations greater than 3-4 times the magnitude of the published TAGMs. Acetone (also known as propanone) is a colorless, mobile, flammable liquid. Acetone is miscible with water and serves as an important solvent. In addition to being manufactured as a chemical, acetone is also found naturally in the environment. Acetone is not representative of contaminants produced from duck farming activities; the most likely source of the presence of Acetone may be lab influenced. There was no obvious pattern to the distribution of detections or levels of VOAs.

Standard SVOA analysis covers 70 compounds plus Tentatively Identified Compounds (TICs). All samples indicated concentrations of semi-volatile organic compounds above TAGM criteria (uplands and sediments) at the Gallo Farm site. When they are compared to the TAGM guidelines, the levels are substantially above the documented thresholds. Concentrations ranged from 16 parts per billion to 1400 ppb. The semi-volatile compounds detected included Diethylphthalate, Di-n-butylphthalate, Di-n-octylphthalate, and Bis(2-ethylhexy)phthalate. The above compounds are all included in the Phthalate family of chemicals. Phthalates, or phthalate esters, are a group of chemical compounds that are mainly used as plasticizers (substances added to plastics to increase their flexibility). Since limited review of historical documentation does not indicate the use of plasticizers in the vicinity of the former Gallo Duck Farm, it could be assumed that the detection of phthalates is from cross contamination introduced by the sampling gloves.

The TICs found in the samples are compounds not usually found. Conducting this analysis can provide further insight into past site activities. Under the TAGM guidelines, TICs are lumped together to provide one total number, or quantity within the sample. TAGMs guidelines provide for 500 Parts Per Million total per sample. One of the samples, Mill Pond (M 1-4) had a TIC count of 1214 ppm; the next highest sample was from Gallo Farm site at 101 ppm. The rest of the samples were below 100 ppm and are not an issue. Additional sampling and background research is needed to evaluate the results from the Mill Pond test.

One other compound was also detected, Pyrene. Pyrene is a colorless solid and its derivatives are used commercially to make dyes, pesticides, pharmaceuticals, and plastics. The origin of Pyrene detected in sediment sample 6052706 at a concentration of 27 µg/kg is unknown.

No Pesticides or Polychlorinated biphenyls (PCBs) were detected in any of the samples (upland or sediment) collected from the former Gallo Duck Farm site. This result is consistent with results that one could expect from the operation of duck farms.

There are 13 Priority Pollutant Metals for which laboratory analysis was conducted for the collected sediment and upland samples. Of the 13 Priority Pollutant Metals, antimony, mercury, selenium and thallium were not detected in any of the Gallo samples.

- *Arsenic* was detected in three (3) upland samples: 6052701, 6052705 and 6052707. Levels detected from all samples were below the TAGMs threshold of 7.5 ppm. Please note that Arsenic is commonly found in various agricultural insecticides, poisons and has also been known to be used in animal feed, particularly in the United States as a method of disease prevention and growth stimulation. However, since concentrations of Arsenic detected in the samples were well below the TAGMs threshold, one can assume that these concentrations may be indicative of background concentrations and are most likely naturally occurring.
- *Beryllium* was detected in two samples; 6052705 and 6052707, both upland samples. The detected concentrations of Beryllium were below the TAGMs threshold and most likely naturally occurring
- *Cadmium* was detected in three (3) upland samples; 6052705, 6052707, and 6052710, and sediment sample 6052706. Three of the four samples are below TAGMS threshold of 1 ppm or Site Background (SB). The fourth sample (6052706) exceeded the 1 ppm limit at a concentration of 4.94 ppm.
- *Chromium* was detected in nine (9) of the Gallo site samples. Concentrations ranged from 1.65 ppm to 11.6 ppm. TAGMs threshold is 10 ppm or SB. Two samples (6052702 and 6052707, both of which are upland samples) exceeded 10 ppm at a concentration of 11.4 ppm and 11.6 ppm, respectively. The remaining seven (7) samples detected levels below the TAGMs threshold and did not provide a coherent distribution pattern. Again, the detected concentration of Chromium may be contributed to background conditions.
- *Copper*: Under TAGMS the threshold for copper is 25 ppm or SB. The highest copper number in the Gallo site samples is 5 ppm. Although Copper was detected in all samples collected, concentrations were below TAGMs threshold.
- *Lead*: Lead is was detected in eight of the collected samples. Under TAGMs, lead levels are managed by the SB rule. The highest concentration of lead detected was 9.18 ppm in upland sample 6052706. Lead is present in natural deposits and may also enter soil through leaking underground storage tanks. Limited review of historical operations at the former Gallo Farm do not include industrial operations, the presence of lead may be attributed to natural deposits in the soil.
- *Nickel*: Nickel was detected in seven (7) samples. The distribution was random. TAGMs guideline for nickel is 13 ppm or SB. Sample 6052701 had a concentration of 16.5 ppm. The concentrations of the remaining six (6) samples (five upland and one sediment sample) had no detects above the TAGM

threshold. However, Nickel plays numerous roles in the biology of microorganisms and plants. In fact urease (an enzyme which assists in the hydrolysis of urea) contains nickel which could explain the presence of Nickel in the former Gallo Farm location.

- *Silver*: Silver was detected in two (2) samples (6052705 and 6052707 at 1.17 ppm and 1.60 ppm, respectively) both of which are upland samples. TAGMs guideline for silver is SB. Therefore, it may be concluded, due to the low concentrations detected, that the silver is naturally occurring or of unknown origin. Research did not indicate that the presence of silver indicative to duck farming activities.
- *Zinc*: Was detected in four (4) samples (6052702, 6052708, 6052710, and 6053711). All detects were below the TAGMs limit of 20 ppm. Distribution of sample detections was random. Therefore, it may be concluded, due to the low concentrations detected, that the Zinc is naturally occurring or of unknown origin. Limited research did not indicate the presence of Zinc that could be related to duck farming activities.

Samples were also collected from the former Gallo Duck Farm site for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, Total Solids Percent, and E-Coli which may be considered more indicative of the by-products of duck farming activities.

Kjeldahl Nitrogen: Kjeldahl Nitrogen is measured by the Reporting Limit (RL). The RL is the laboratory's reporting limit. The reporting limit is what the laboratory's analytical equipment are calibrated to measure. All Gallo site samples exceeded the RL. Some upland samples had exceedences of the RL by a magnitude, other upland samples exceeded by only a few parts per million. In both sediment and upland samples there were wide and narrow ranges of exceedences.

The highest concentration of Kjeldahl Nitrogen was detected in upland sample 6052704 at a concentration 5,420 ppm. The lowest concentration was in sediment sample 6052701 at 74.1 ppm. There was no pattern to the distribution of concentrations. It should be noted that the most "upstream" sample collected (6052704) exhibited the highest Kjeldahl Nitrogen concentration. Based on the below discussion, all samples exhibit concentrations higher than what is considered a normal background concentration.

Total Kjeldahl Nitrogen or TKN is the sum of organic nitrogen; ammonia, NH_3 and ammonium, NH_4^+ in biological wastewater treatment. TKN is determined in the same manner as organic nitrogen, except that the ammonia is not driven off before the digestion step.

Total Phosphorus: Phosphorus is measured by the RL also. All samples exhibited exceedences above what is considered “normal” concentrations. The concentrations of Total Phosphorous were highest in upland samples and the distribution of the reported concentrations did not illustrate a conclusive pattern. The highest concentration was detected in upland sample 6052704. This is the same sample location that exhibited the highest Kjeldahl Nitrogen concentration. The lowest concentration was detected in sediment sample 6052701. This is the same sample location that exhibited the lowest Kjeldahl Nitrogen concentration.

Although phosphorus at concentrations found in natural waters is not toxic to humans or other animals, it may still have a significant impact on the living organisms in a lake or stream. This is because phosphorus is often the nutrient that limits how much plant growth occurs in a water body. Therefore, even a small amount of additional phosphorus, especially in its inorganic dissolved form, may lead to excess plant growth.

Total Organic Carbon: Total Organic Carbon is also measured by the Reporting Limit (RL). All Gallo site samples exceeded the RL with the exception of two (2) upland samples; (6052701 and 6052707). The remaining samples had exceedences ranging from one half to fifty times higher than the RL. No obvious pattern was realized for the distribution of the reported exceedences. However, the highest concentration was detected in upland sample 6052704 at concentration of 121,000 ppm. This is the same sample location that exhibited the highest Kjeldahl Nitrogen and Total Phosphorous concentration. The lowest concentration was detected in sediment sample 6052701 at non-detect. This is the same sample location that exhibited the lowest Kjeldahl Nitrogen and Total Phosphorous concentration.

Total organic carbon (TOC) is the amount of carbon bound in an organic compound and is indicated by material derived from decaying vegetation, bacterial growth, and metabolic activities of living organisms or chemicals. The above concentrations of Total Organic Carbon indicate relatively high organic soils.

Total Percent Solids: Percent solids ranged from 48.89% to 94.95%. The sediment samples had the lower percentages, as expected. Upland soil samples were averaging 80% and higher.

E-Coli: Two samples from the Gallo site were analyzed for the presence of e-coli (6052706 and 6052709) and confirmed its presence in Mud Creek which flows through the former Gallo Duck Farm site. The laboratory results do not quantify the amount of colony forming units (CFUs).

Based on the above referenced results, it may be concluded that historical and existing duck farming activities have impacted the biological balance in the vicinity of the former Gallo Duck Farm site. However, priority pollutant metals detected in samples collected at the former Gallo Duck Farm site may be indicative of naturally occurring metals that are bound in an organic soil. Further, the semi-volatile contaminants detected in samples collected at the former Gallo Duck Farm site may be attributed to chemicals

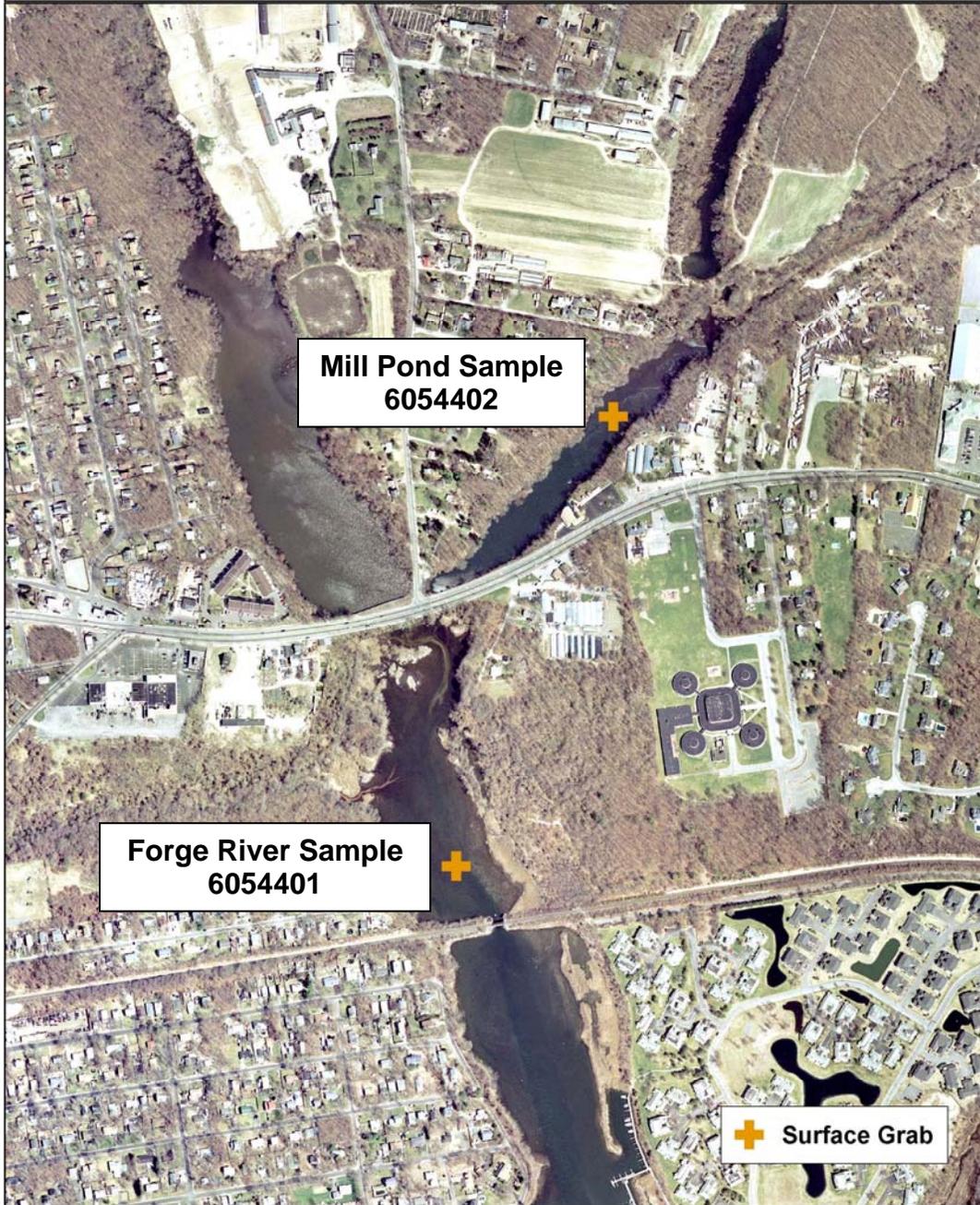
introduced during sampling activities from the sampling gloves. However, additional sampling efforts should be conducted to confirm/deny the presence of the above referenced contaminants and to laterally and vertically delineate the extent of contamination, accordingly.

Forge River and Mill Pond

At Forge River and Mill Pond on the Forge River, sampling was designed to test in-water, sediment sample locations only. One sample was taken at each site, (lab sample identification number 6054401 for Forge River and lab number 6054402 for Mill Pond).

Both samples were analyzed for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, and Total Solids Percent. However, neither sample was collected to be laboratory analyzed for E-Coli. In addition, both samples were collected and analyzed for Volatile Organics, Semi-Volatile Organics, Pesticides, PCBs and priority pollutant metals.

Forge River 2006 Sediment Sampling Locations



ANALYTICAL RESULTS

LAB ID	TAGMS	6054401 Forge River	6054402 Mill Pond
Units	ppb	ppb	ppb
VOA+15 Acetone TIC	.0002	6	
SVOA + 25 Diethylphthalate Di-n-butylphthalate Bis(2-ethylhexy)phthalate TIC	.0071 .0081 .050	25 J 880 JB 150 J 36,285 JN	7700 JB 1,187,700 JN
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Units	ppm	ppm	ppm
Arsenic	7.5*	1.44	
Beryllium	0.16*		1.98
Chromium	10*	1.92	18.3
Copper	25*	2.61	30.7
Lead	Background	4.15	18.7
Nickel	13*	157	16.3
Zinc	20*	15.5	17.4
Units	ppm	ppm	ppm
Kjeldahl Nitrogen	NA	126	9640
Total Phosphorous	NA	24.7	3140
Total Organic Carbon	NA	1580	213,000
Total Solids Percent	NA	65.91%	13.69%

*or site background, whichever is greater.

NA = not applicable

ND-non detect

ppb = parts per billion

ppm = parts per million

TAGMs = Technical Assistance Guidance Memorandum

J = Estimated value

B = Lab blank

N = Presumptive evidence of a compound

VOA-Volatile Organic Compounds

SVOA-Semi-Volatile Organic Compounds

VOCs: Both samples collected from the Forge River and Mill Pond were analyzed for VOCs. Only the sample collected from Forge River (6054401) detected the presence of VOCs. The volatile organic compound detected was Acetone at a concentration of 6 ppb, greater than the TAGM threshold of 0.0002 ppb. This sample is located downstream of Mill Pond whose sediment sample did not detect the presence of Acetone. There was no obvious pattern to the distribution of detections or concentrations of Acetone. Acetone is not representative of contaminants produced from duck farming activities; the most likely source of the presence of Acetone may be lab influenced.

SVOAs: Both sediment samples had concentrations of semi-volatile organic compounds above TAGM criteria. When compared to TAGMs guidelines, levels are substantially above established thresholds. Concentrations ranged from 25 parts per billion to 7700 ppb. The semi-volatile compounds detected included Diethylphthalate, Di-n-butylphthalate, and Bis(2-ethylhexy)phthalate. The above compounds are all included in the Phthalate family of chemicals. As stated in the discussion of the sampling results for the former Gallo Duck Farm site, Phthalates are often detected in laboratory results from latex sampling gloves utilized by the personnel collecting the samples for analysis. Since review of historical documentation does not indicate the use of plasticizers in the vicinity of the Forge River or Mill Pond, it may be assumed that the detection of phthalates is from cross contamination introduced by the sampling gloves.

No Pesticides or Polychlorinated biphenyls (PCBs) were detected in either of the sediment samples collected from the Forge River or Mill Pond site. This result is consistent with results that one could expect from the operation of duck farms.

There are 13 Priority Pollutant Metals for which laboratory analysis was conducted for the collected sediment and upland samples. Of the 13 Priority Pollutant Metals, antimony, mercury, selenium and thallium were not detected in either the Forge River or Mill Pond samples.

- *Arsenic* was detected in the Forge River sediment sample at a concentration of 1.44 ppm. The concentration detected in the sample was below the TAGMs threshold of 7.5 ppm. As stated in the former Gallo Duck Farm discussion, Arsenic is commonly found in various agricultural insecticides, poisons and has also been known to be used in animal feed, particularly in the United States as a method of disease prevention and growth stimulation. However, since concentrations of Arsenic detected in the samples were well below the TAGMs threshold, one can assume that these concentrations may be indicative of background concentrations and are most likely naturally occurring.
- *Beryllium* was detected in the Mill Pond Sediment sample at a concentration of 1.98 ppm. The detected concentration of Beryllium is above the TAGMs threshold of 0.16 ppm. The origin of Beryllium at the Mill Pond is unknown and would require further investigation.
- *Chromium:* Chromium was detected in both sediment samples for Forge River and Mill Pond. Concentrations were reported to be 1.92 ppm for Forge River and 18.3 ppm for Mill Pond, respectively. TAGMs threshold for Chromium is 10 ppm or SB. The Mill Pond sediment sample, located upstream of the Forge River sediment sample exceeded the 10 ppm threshold concentration. Again, the detected concentration of Chromium could be contributed to background conditions, not the results of duck farming activities.

- *Copper:* Under TAGMS the threshold for copper is 25 ppm or SB. Copper was detected in both sediment samples for Forge River and Mill Pond. Concentrations were reported to be 2.61 ppm and 30.7 ppm for Forge River and Mill Pond, respectively. The Mill Pond sediment sample, located upstream of the Forge River sediment sample exceeded the 25 ppm threshold concentration. Again, the detected concentration of Copper could be attributed to background conditions, not the results of duck farming activities.
- *Lead:* Lead was detected in both of the sediment samples. Under TAGMs, lead levels are managed by the SB rule. The highest concentration of lead detected was 18.7 ppm in the Mill Pond sample. The Forge River sample indicated the presence of Lead at a concentration of 4.15 ppm. As indicated above, lead as a soil contaminant is a widespread issue, since lead is present in natural deposits. Since limited review of historical operations on the Forger River and Mill Pond sites did not indicate industrial operations, the presence of lead may be attributed to natural deposits in the soil.
- *Nickel:* Nickel was detected in both Forge River and Mill Pond sediment samples above the TAGM threshold of 13 ppm at a concentration of 157 ppm and 16.3 ppm, respectively. As stated in the above former Gallo Duck Farm discussion, urease (an enzyme which assists in the hydrolysis of urea) contains nickel which could explain the presence of Nickel in the Forge River sediment sampling location. However, Nickel is the only metal out of all the priority pollutants that exhibited higher concentrations at the Forge River site than the Mill Pond site. The Mill Pond site has consistently exhibited higher concentrations of priority pollutant metals. Please note (as indicated in the Figure) that Mill Pond is located upstream of the Forge River sampling site.
- *Zinc:* Was detected in both the Forge River sediment sample and the Mill Pond sediment sample at a concentration of 15.5 ppm and 17.4 ppm, respectively. Both reported Zinc concentrations were below the TAGMs limit of 20 ppm. It may be concluded, due to the low concentrations detected, that the Zinc is naturally occurring or of unknown origin. Limited research did not indicate the presence of Zinc relating to duck farming activities.

Samples were also collected from the Forge River sampling location and the Mill Pond site for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, and Total Solids Percent. These biological compounds may be more indicative of the by-products of duck farming activities. However, E-Coli laboratory analysis of sediment or upland samples was not conducted.

Kjeldahl Nitrogen: Both sediment samples exceeded the reporting limit for Kjeldahl Nitrogen at concentrations of 126 ppm and 9640 ppm, respectively. It could be noted that the upstream sediment sample (Mill Pond) exhibited a higher concentration than the downstream sediment sample (Forge River). However, the difference in concentrations does not provide a conclusive determination. Based on the below discussion, both samples exhibit concentrations higher than what is considered a normal background concentration for surface water (versus sediment) samples.

Total Phosphorus: Phosphorus is measured by the RL also. Both the Forge River and Mill Pond samples exhibited exceedences above what is considered “normal” concentrations at 24.7 ppm and 3,140 ppm, respectively. The concentrations of Total Phosphorous were highest in upstream sample. Please note that the highest concentration was detected in the upstream Mill Pond sediment sample. This is the same sample location that exhibited the highest Kjeldahl Nitrogen concentration. The lowest concentration was detected in the Forge River sediment sample. This is the same sample location that exhibited the lowest Kjeldahl Nitrogen concentration.

Total Organic Carbon: Total Organic Carbon is also measured by the Reporting Limit. Both site samples exceeded the RL. The two (2) sediment samples indicated Total Organic Carbon in the laboratory results at a concentration of 1580 ppm for Forge River and 213,000 ppm Mill Pond sites, respectively. The highest concentration was detected in upstream sample (Mill Pond). This is the same sample location that exhibited the highest Kjeldahl Nitrogen and Total Phosphorous concentration. The lowest concentration was detected in the downstream sediment sample (Forge River). This is the same sample location that exhibited the lowest Kjeldahl Nitrogen and Total Phosphorous concentration.

Total organic carbon (TOC) is the amount of carbon bound in an organic compound and is indicated by material derived from decaying vegetation, bacterial growth, and metabolic activities of living organisms or chemicals. The above concentrations of Total Organic Carbon indicate relatively high organic soils.

Total Percent Solids: Total percent solids were reported to be 65.91% for the Forge River site and 13.69% for the Mill Pond Sediment sample. Additional data is required to interpret this result. The Mill Pond sample exhibited higher concentrations of chemical and biological contaminants. However, additional data is required to interpret this result.

Based on the above referenced results, it may be concluded that historical and existing duck farming activities have impacted the biological balance in the vicinity of the Forge River sampling site and Mill Pond sampling site. However, not quite as appreciably at the Forge River site than the Mill Pond site. Priority pollutant metals detected in samples collected at the Forge River site and the Mill Pond site may be indicative of naturally occurring metals that are bound in an organic soil. Further, the semi-volatile contaminants detected in samples collected at the Forge River and Mill Pond site may be attributed to chemicals introduced during sampling activities from the

sampling gloves. However, additional sampling efforts should be conducted to confirm/deny the presence of the above referenced contaminants and to laterally and vertically delineate the extent of contamination, accordingly.

ROBINSON DUCK FARM

At the Robinson Duck Farm, sampling was designed for an upland soil sample location and a sediment sample location. The two (2) samples (lab sample identification nos. 6054403 and 6054404) are the sediment (upstream) sample and composite (downstream) upland sample.

Both samples were analyzed for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, and Total Solids Percent. However, neither sample was collected to be analyzed for E-Coli. In addition, both samples were analyzed for Volatile Organics, Semi-Volatile Organics, Pesticides, PCBs and priority pollutant metals.

Robinson Duck Farm 2006 Sediment Sampling Locations



ANALYTICAL RESULTS

LAB ID	TAGMS	6054403 Robinson (sediment sample)	6054404 Robinson (composite sample)
Units	ppb	ppb	ppb
VOA+15 Acetone TIC	.0002	7 4	14
SVOA + 25 Diethylphthalate Di-n-butylphthalate Bis(2-ethylhexy)phthalate TIC	.0071 .0081 .050	680 JB 120 J 88,790 JN	900 JB 140 J 38,872 JN
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Units	ppm	ppm	ppm
Arsenic	7.5*		1.29
Beryllium	0.16*		
Chromium	10*	2.87	4.96
Copper	25*	7.31	8.46
Lead	Background	20.7	5.36
Nickel	13*	1.79	4.72
Zinc	20*	41.2	31.6
Units	ppm	ppm	
Kjeldahl Nitrogen	NA	198	419
Total Phosphorous	NA	1450	275
Total Organic Carbon	NA	2480	18,700
Total Solids Percent	NA	81.51%	80.97%

*or site background, whichever is greater.

NA = not applicable

ND-non detect

ppb = parts per billion

ppm = parts per million

TAGMs = Technical Assistance Guidance Memorandum

J = Estimated value

B = Lab blank

N = Presumptive evidence of a compound

VOA-Volatile Organic Compounds

SVOA-Semi-Volatile Organic Compounds

VOCs: Both samples collected from the Robinson Duck Farm were analyzed for VOCs. Both samples collected from the Robinson Duck Farm detected the presence of VOCs. The volatile organic compound detected was Acetone at a concentration of 7 ppb

and 14 ppb from 6054403 (sediment) and 6054404 (composite), respectively. These concentrations exceed the TAGM threshold of 0.0002 ppb. The composite sample is located downstream of the sediment sample and may indicate that the upland area is more impacted by Acetone than the saturated areas. As stated in the above sampling result discussions, in addition to being manufactured as a chemical, acetone is also found naturally in the environment, including in small amounts in the human body. Although Acetone is not representative of contaminants produced from duck farming activities, the origin of this contamination is most likely attributed to lab influence.

SVOAs: Both samples indicated concentrations of semi-volatile organic compounds above TAGM criteria at the Robinson Duck Farm site. When they are compared to the TAGMs guidelines the levels are substantially above thresholds. Concentrations ranged from 120 parts per billion to 900 ppb. The semi-volatile compounds detected included Di-n-butylphthalate, and Bis(2-ethylhexy)phthalate. The above compounds are all included in the Phthalate family of chemicals. As stated in the discussion of the sampling results for the former Gallo Duck Farm site, the Forge River site and the Mill Pond site, Phthalates are often detected in laboratory results from latex sampling gloves utilized by the personnel collecting the samples for analysis. Since review of historical documentation does not indicate the use of plasticizers in the vicinity of the Robinson Duck Farm site, it could be assumed that the detection of phthalates is from cross contamination introduced by the sampler's gloves.

No Pesticides or Polychlorinated biphenyls (PCBs) were detected in the samples collected from the Robinson Duck Farm site. This result is consistent with results that one could expect from the operation of duck farms.

There are 13 Priority Pollutant Metals for which laboratory analysis was conducted for the collected sediment and upland samples. Of the 13 Priority Pollutant Metals, only Arsenic, Chromium, Copper, Lead, Nickel and Zinc were detected in the Robinson Duck Farm samples.

- *Arsenic* was only detected in the Robinson Duck Farm composite, upland sample at a concentration of 1.29 ppm. The concentration detected in the sample was below the TAGMs threshold of 7.5 ppm. As previously stated, Arsenic is commonly found in various agricultural insecticides, poisons and has also been known to be used in animal feed, particularly in the United States as a method of disease prevention and growth stimulation. However, since concentrations of Arsenic detected in the sample was well below the TAGMs threshold, one can assume that these concentrations may be indicative of background concentrations and are most likely naturally occurring.
- *Chromium:* Chromium was detected in both samples for the Robinson Duck Farm. Concentrations were reported to be 2.87 ppm and 4.96 ppm for the sediment sample and the composite sample, respectively. TAGMs threshold for Chromium is 10 ppm or SB. Neither sample, exceeded 10 ppm threshold

concentration. Again, the detected concentration of Chromium could be contributed to background conditions, not the result of duck farming activities.

- *Copper:* Under TAGMS the threshold for copper is 25 ppm or SB. Copper was detected in both samples for the Robinson Duck Farm. Concentrations were reported to be 7.31 ppm and 8.46 ppm for sediment sample and composite sample, respectively. Neither sample exceeded the 10 ppm threshold concentration. Again, the detected concentration of Copper could be contributed to background conditions, not the result of duck farming activities.
- *Lead:* Lead was detected in both of the Robinson Duck Farm samples. Under TAGMs, lead levels are managed by the SB rule. The highest concentration of lead detected was 20.7 ppm in the sediment sample. The composite sample indicated the presence of Lead at a concentration of 5.36 ppm. As indicated above, lead as a soil contaminant is a widespread issue, since lead is present in natural deposits. Limited review of historical operations on the Robinson Duck Farm site does not indicate industrial operations. Therefore, the presence of lead may be attributed to natural deposits in the soil.
- *Nickel:* Nickel was detected in both the sediment sample and the composite sample at a concentration of 1.79 ppm and 4.72 ppm, respectively, well below the TAGM threshold for Nickel of 13 ppm. As previously stated, urease (an enzyme which assists in the hydrolysis of urea) contains nickel which could explain the presence of Nickel detected in the samples.
- *Zinc:* Zinc was detected in both the sediment sample and the composite sample collected from the Robinson Duck Farm site at a concentration of 41.2 ppm and 31.6 ppm, respectively. Both reported Zinc concentrations were above the TAGMs limit of 20 ppm. It may be concluded, due to the low concentrations detected, that the Zinc is naturally occurring or of unknown origin. Research did not indicate the presence of Zinc related to duck farming activities.

Samples were also collected from the Robinson Duck Farm site for Kjeldahl Nitrogen, Total Phosphorous, Total Organic Carbon, and Total Solids Percent. These biological compounds may be more indicative of the by-products of duck farming activities. No sediment or upland samples were collected for the laboratory analysis for E-Coli.

Kjeldahl Nitrogen: Both the sediment sample and the composite sample exceeded the reporting limit for Kjeldahl Nitrogen at concentrations of 198 ppm and 419 ppm,

respectively. It could be noted that the upstream sediment sample exhibited a lower concentration than the downstream composite sample. It is noted that the composite sample was taken in an effluent settling lagoon. However, the difference in concentrations does not provide a conclusive determination. Both samples exhibit concentrations higher than what is considered background concentrations.

Total Phosphorus: Phosphorus is also measured by the RL. Both the sediment sample and the composite sample exhibited exceedences above what is considered “normal” concentrations at 1,450 ppm and 275 ppm, respectively. The concentrations of Total Phosphorous were highest in upstream sediment sample.

Total Organic Carbon: Total Organic Carbon is also measured by the Reporting Limit. Both site samples exceeded the RL. The sediment sample and the composite sample indicated Total Organic Carbon in the laboratory results at a concentration of 2,480 ppm and 18,700 ppm, respectively. The highest concentration was detected in the composite sample.

Total organic carbon (TOC) is the amount of carbon bound in an organic compound and is indicated by material derived from decaying vegetation, bacterial growth, and metabolic activities of living organisms or chemicals. The above concentrations of Total Organic Carbon indicate relatively high organic soils.

Total Percent Solids: Total percent solids were reported to be 81.51% for the sediment sample and 80.97% for the composite sample. Interesting differences in the relative concentrations of VOA’s, SVOA’s and metals can be noted. However, additional data is needed to interpret these results.

Based on the referenced results, it may be concluded that historical and existing duck farming activities have impacted the biological balance in the vicinity of the Robinson Duck Farm site. Priority pollutant metals detected in samples collected at the Robinson Duck Farm site may be indicative of naturally occurring metals that are bound in an organic soil. Further, the semi-volatile contaminants detected in samples collected at the Robinson Duck Farm site may be attributed to chemicals introduced during sampling activities from the sampler’s gloves.

CONCLUSIONS & RECOMMENDATIONS:

The majority of the results are consistent with the area’s history of duck farming activities.

In addition, the results do not indicate appreciable concentrations of volatile or semi-volatile organic compounds, with the exception of compounds of Acetone and the Phthalate family. Phthalates are often detected in laboratory results from latex sampling gloves utilized by the personnel collecting the samples for analysis. Since limited review

of historical documentation does not indicate the use of plasticizers in the vicinity of the Robinson Duck Farm site, it may be assumed that the detection of phthalates is from cross contamination introduced by the sampling gloves. Further sampling and documentary research should be conducted to confirm/deny the presence and/or extent of Acetone and Phthalates.

Priority Pollutant Metals were detected in all samples collected from the former duck farms. Only Beryllium, Cadmium, Copper, Chromium, Lead (SB) Nickel, and Zinc were detected above the TAGMs threshold. However, conjecture on these concentrations that exceed the TAGMs threshold is most probably due to the result of run-off over the years from the private homes and yards lining the pond and tributary stream(s) that flow into the sampling areas, as well as from roads that traverse the streams. The exceedences could be assumed to the Site Background levels. However, further sampling may need to be conducted to confirm/deny the presence and concentrations of these metals especially at the Forge River site. The Forge River sample with its unexpectedly high level of Nickel may be an anomaly or there may be a pocket of elevated metal in that part of the river. Nonetheless, this concentration should be investigated further as it may inhibit potential plans on the Forge River.

Samples were collected for the laboratory analysis for the presence of E-Coli in only two (2) samples. These samples were collected from the Former Gallo Farm site. Based on the above referenced results, it may be concluded that historical and existing duck farming activities have impacted the biological balance in the vicinity of the former Gallo Duck Farm site. However, please note that samples should be collected from the Forge River site, Mill Pond site, and the Robinson Duck Farm site to determine if E-Coli is present in these areas.

Analytical results from the laboratory analysis for Kjeldahl Nitrogen, Total Phosphorus, Total Organic Carbon and Total Solids Percent are consistent with duck farming activities. The Mill Pond sample at 13% indicates very soft sediment. Nitrogen levels are still high years after operations ceased. Considering the duration of time operations were conducted and the magnitude of the operations, the presence of biological indicators may be considered reasonable. The same reasoning holds true for Phosphorus. Based on the former and existing duck farming activities, the high organic content is more than likely due to duck farming operations. These results may indicate the long term impact duck farm operations had/still have on the local environment.