TECHNICAL BRIEFING – 2013 ANNUAL SURFACE WATER & SEDIMENT MONITORING REPORT, GREEN POND BROOK AND BEAR SWAMP BROOK (PICA 193) – JUNE 2014

The document reviewed was an annual monitoring report for surface water and sediment monitoring completed in the Green Pond Brook (GPB) and Bear Swamp Brook (BSB) area – identified collectively as PICA 193. Annual sampling is completed in accordance with the Record of Decision for the site. The sampling event discussed in the report, conducted during the week of October 7, 2013; is the seventh consecutive annual monitoring event completed at the site. Chemical and biological monitoring are completed for the site on an annual basis. GPB and BSB are the longest surface water bodies at the Arsenal. The distinct physical differences between different areas of the water bodies were used as the basis of defining four different regions – Regions 1 through 4. Region 1 is the only one that has been determined not to be adversely impacted by contamination affects.

Sample Locations

Changes to Sampling Program: Modifications to the sampling program were made in accordance with what was proposed in the 2011 annual monitoring report. The year 2011 represented the fifth year of sampling and results of monitoring were to be assessed after that time had elapsed. The results were compared to the exit strategy decision matrix; as a result some sample locations were recommended to be discontinued and others were recommended to be continued. In addition, comments from the NJDEP requested the addition of four sample locations. Those locations were included in the 2012 sampling with the exception of one location (SDBS-23) whereat the NJDEP comments arrived after the sampling had taken place. The recommendations of the 2011 report along with the additional location requested by the NJDEP were implemented in the 2013 sampling.

The following sample locations were discontinued based on the exit strategy in the Bear Swamp Brook Oil/Water Separator and Tributary Stream Sediment Removal Action Work Plan (RAWP):

- Region 2 locations: 31SD-4 and SD52-5;
- Region 3 locations: BSSD-32, BSSD-29, BSSD-15, BSSD-34 and BSSD-1;
- Region 4 locations: SD34-5 and 34SD-7; and
- Area D of Region 3: SDBS-23 and SDBS-24.

The 2011 annual report recommended that the monitoring program be "extended" at the following sample locations:

- Background locations: GPB-2 and 1515R-2;
- Region 2 locations: GPBSD-26 and SD101-1;
- Region 3 locations: SDBS-25;
- Region 4 locations: SD34-4 and SD34-3; and
- Surface-water sample location: 34SW-8.

In addition to the locations retained for sampling (listed above) the program was extended at the following sample locations until the next five-year review in 2016:

- Region 2 locations: 31SD-4 and SD52-5 for both biological and chemical analyses;
- Region 3 locations: SDBS-23 (chemical analyses only) and BSSD-29 (chemical and biological analyses); and
- Region 4 locations: 34SD-7 (chemical and biological analyses).

Surface Water: A single surface-water sample was collected at 34SW-8.

Past Removal Actions

Four removal actions have taken place in Region 3 in the past. Briefly these removal actions are as follows:

1) PCB-contaminated sediment near Site 122 in 2000 – 580 tons removed
2) Sediment from sediment retention basins at Site 193 in 2003 – 632 tons of stabilized sediment (as hazardous waste) and 386 tons of excavated soils (as solid waste)
3) Sediment from oil/water separator in 2007 – 185 tons of sediment; and
4) Mercury-impacted soil from a BSB tributary within Site 128 in 2008 – 9 tons

Also at Region 2, 1700 cubic yards of metal impacted soil was removed in 2009.

Chemical Monitoring

Sediment samples were collected from the following regions:

- Background reference locations: GPB-2 and 1515-R.

- Region 2 locations: 31SD-4, SD52-5, GPBSD-26, and SD101-1.
- Region 3 locations: BSSD-29, SDBS-23, and SDBS-25.
- Region 4 locations: SD34-4, 34SD-7, and SD34-3.

Sediment samples were analyzed for pesticides, PCBs, inorganic constituents, polyaromatic hydrocarbons (PAHs), and semivolatile organic compounds (SVOCs).

A single surface water sample, from Region 4 (34SW-8), was collected and analyzed for the same parameters.

Biological Monitoring

Seven locations were included for biological monitoring as follows: Background - two were the background reference samples collected upstream of the Regions 2, 3, and 4 at locations GPB-2 and 1515R; Region 2 locations – 31SD-4, GPBSD-26, and SD52-5; and Region 3 location – BSSD-29; and Region 4 location – 34SD-7. The biological samples consisted of a benthic macroinvertebrate sample and surface sediment sample.

Biological evaluation consists of several components as follows:

- Habitat assessment is based on ten metrics that include an evaluation of the variety and quality of the substrate, channel morphology, bank structure, and riparian vegetation; an overall habitat score is developed from the metrics.
- Calculation of High Gradient Macroinvertebrate Index (HGMI) relies on seven metrics (total number of genera, percent genera that are not insects, percent of Ephemeroptera/Plecoptera/Trichoptera [EPT individuals – excluding Hydropsychidae, including Diplectrona], number of scraper genera, Hilsenhoff Biotic index [HBI], number of attribute 2 genera [highly sensitive and uncommon taxa], and number of attribute 3 genera [sensitive and common taxa] to identify biological degradation.
- Biological condition characterized as excellent to poor based on maintenance of native taxa and maintenance of the ecosystem with expected range of natural variability. Excellent and good condition meet the regulatory threshold (full attainment).

- HBI also includes a classification of water quality and degree of organic pollution.
- Sediment toxicity is measured through testing (*Hyalella Azteca* 28-day study and *Chironomus dilutus* long-term exposure study). In both studies growth of organisms using certain endpoints is compared to control samples in which organisms are exposed to sediment of known environmental quality. Statistical analysis is employed to determine whether differences between the control batch and the sample are meaningful. For *Hyalella azteca* the end points are mortality and growth. For the *Chironomus dilutus* the end points are adult emergence and total survival.

Monitoring Results

Results for both biological and chemical monitoring are briefly summarized below.

Biological: Table 1 presents a summary of the results for the seven biological samples. Since GPB runs through the center of Picatinny Arsenal and as such, flows through heavily industrialized area, the habitat is generally not of high quality and can thus adversely impact the macroinvertebrate community. Even the background reference locations upgradient of the GPB/BSB study area are not of optimal habitat. However, the biological condition at the background locations was observed to be excellent (at GPB-2 which had been good in the last monitoring event) and good (at 1515R-2 which had been fair). Both locations achieved full attainment of the regulatory threshold. All biological sample locations had less than optimal habitat ratings in 2013 as has occurred in previous monitoring. *Region 2* - Sample location SD52-5 has not had a benthic macroinvertebrate community in any of the monitoring periods and thus could not be evaluated for the biological assessment. This sample contained a number of COCs above the RGs. The three Region 2 sample locations for bioassays "showed potential for acute and chronic toxicity based on a comparison to the control." Except for SD52-5 a macroinvertebrate community was observed although it was impaired. Bioassay results are complicated and may reflect the duration and life span that organisms spend in the sediment. The report notes that: "Acute toxicity,

as measured by the 20-day percent survival of test organisms (*Chironomus dilutus)*, was observed at all sample locations, including both reference locations, in 2013."

Chemical: Table 2 summarizes the chemical monitoring results. The majority of the contaminants of concern (COC) appear to be stable or decreasing. Below average precipitation in September 2013 and low flow conditions are considered to have possibly contributed to adverse water quality and the elevated COC concentrations at some sample locations.

Conclusion

The same biological and chemical sample locations will continue to be monitored for the same parameters as in past years. The next five-year review will be in 2016 at which time sample locations will be re-evaluated.

INDICATOR	Sample Background GPB-2	Sample Background 1515R-2	Region 2 GPBSD-26
Habitat Assessment Reference Values	suboptimal	suboptimal	marginal
NJ High Gradient Macroinvertebrate Index (HGMI)	70.5	45.6	22.3
Hissenhoff Biotic Index	5.8	6.9	7.3
Water Quality Rating	Fair	Fairly poor	Fairly poor
Degree of Organic Pollution	Fairly substantial likely	Substantial likely	Substantial likely
Biological Condition	Excellent	Good	Fair
Regulatory Threshold	Full attainment	Full attainment	Non-attainment

Table 1. Summary of Selected Biological Monitoring Results.

INDICATOR	Region 2 31SD-4	Region 2 SD52-5	Region 3 BSSD-29	Region 4 34D-7
Habitat Assessment Reference Values	suboptimal	suboptimal	suboptimal	suboptimal
NJ High Gradient Macroinvertebrate Index (HGMI)	17	≤ 16.9	56.9	49.9
Hissenhoff Biotic Index	7.6	>10	6.4	5
Water Quality Rating	poor	Very poor	fair	good
Degree of Organic Pollution	Very substantial likely	Severe likely	Fairly substantial	Probable
Biological Condition	Poor	Poor	Good	Good
Regulatory Threshold	Non-attainment	Non-attainment	Full attainment	Full attainment

Table 1. Summary of Selected Biological Monitoring Results.

Region 2	**31SD-4** *chemical & biological sample*	**2 COCs > RGs**	• Copper 305 mg/kg (260.8 mg/kg) • 4,4'-DDT – 254 mg/kg (200 mg/kg)	
	SD52-5 *chemical & biological sample*	**5 COCs > RGs** **2 non-COCs > PELS (not listed)**	• 4,4'-DDD 301 mg/kg (200 mg/kg) • 4,4-DDT 293 mg/kg (200 mg/kg) • Benzo(a) anthracene – 4,340 mg/kg (2,200 mg/kg) • Fluoranthene 5,920 mg/kg (4,000 mg/kg) • Pyrene – 5,190 mg/kg (3,800 mg/kg)	
	GPBSD-26 *chemical & biological sample*	**No COCs > RGs**	NA	
	SD101-1	**2 COCs > RGs**	• Zinc - 616 mg/kg (456 mg/kg) • Copper – 290 mg/kg (260.8 mg/kg)	
Region 3	**BSSD-29** *chemical & biological sample*	**No COCs > RGs**	NA	
	SDBS-23	**2 COCs > RGs**	• Chromium - 699 mg/kg (247 mg/kg) • Copper – 407 mg/kg (260.8 mg/kg)	
	SDBS-25	**No COCs > RGs**		
Region 4	**SD34-4**	**No COCs > RG**	NA	
	SD34-3	**No COCs > RGs**	NA	
	34SD-7	**No COCs > RGs**	NA	
	34SW-8 *surface water sample*	**No COCs > RGs** **6 COCs > LOCs**	NA	

Table 2. Summary of Chemical Monitoring Results for Sediment and Surface-water Samples.

COCs Contaminants of concern
LOCs Levels of concern
RGs Remedial goals
PELs Potential effect level
> greater than

mg/kg Milligrams per kilogram