UNITED STATES GOVERNMENT

memorandum

DATE: August 29, 2019

REPLY TO ATTN OF: David Alvarez, USGS, 573-441-2970, dalvarez@usgs.gov

SUBJECT: Cost estimate for the analysis of water and sediment samples from Hinkson Creek

TO: Lynne Hooper, Boone County Resource Management, LHooper@boonecountymo.org

Investigation of continued causes of impairment in Hinkson Creek is of interest to the Hinkson Creek Science Team. Some work has been done looking at basic water quality parameters, but little data exists looking at organic and inorganic contaminants which may be related to increased urbanization in the watershed. The Environmental Chemistry Branch was asked to develop a sampling plan which includes potential indicator chemicals that may indicate an increased contaminant loading into the Creek. Below is an estimate for the chemical analysis of water and sediment samples from Hinkson Creek.

The costs below represent totals for the sampling at 5 sites each during an upcoming Fall and Spring season. Options for both water and sediment analyzes are included. Proposed chemicals to be investigated include: a suite of metals typical of urban environments, current use pesticides (CUP) related to agriculture, wastewater indicators (WI), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides, polychlorinated biphenyls (total PCBs), and polybrominated diphenyl ether (PBDE) flame retardants. A tentative list of analytes is provided as an attachment to this memo. In addition to the specific chemical analyses, a screen for total estrogenicity of chemicals will be run using the *in vitro* yeast estrogen screen (YES). The YES assay is a cell-based assay where estrogens or estrogen-mimicking chemicals bind to an estrogen receptor which can be measured. Results from the YES can indicate the presence of potential endocrine disruptors.

Wastewater indicators includes a series of chemicals such as fragrances, surfactants, plasticizers, alternative fire retardants, and industrial chemicals which are indicative of wastewater and septic discharges. PAHs are components of petroleum products and are prevalent in urban environments. Organochlorine pesticides include the mostly banned, legacy pesticides such as chlordanes, endosulfans, and DDTs which along with the PCBs and PBDEs are persistent and are known to have toxicological effects.

For the organics in water, passive sampling devices will be used due to the expected low concentrations and episodic changes in concentrations over time. These devices will be deployed in the Creek for approximately 1 month. Whole water samples will be collected for the metals analysis. Sediment samples will be collected at each site by creating a composite sample from multiple subsamples of surficial sediment collected within a specific area at each site.

Cost estimates 2 sampling events (Fall and Spring) at 5 sites along Hinkson Creek

	Requested Funds	USGS Contributed Funds
Water		
Passive Samplers for Organics		
PAHs, OC/PCB/PBDE, WI, CUP	$ 38,045.48	$ -
(or) PAHs, OC/PCB/PBDE, WI	$ 33,927.40	$ -
YES assay	$ -	$ 3,900.00
Discrete water sample for Inorganics		
Recoverable metals	$ 4,679.64	$ -
General water quality	$ 1,169.92	$ -
Anions	$ 1,091.92	$ -
Cations	$ 1,091.92	$ -
Sediments		
PAHs	$ 9,359.28	$ -
WI/OC/PCB/PBDE (combined method)	$ 15,598.80	$ -
Total recoverable metals	$ 6,005.54	$ -
Quality Control		
All matrices + PI support	$ -	$ 27,088.88
Total (full package)	**$ 77,042.50**	
USGS Contributed		$ 30,988.88

CERC will contribute the YES assay, all QC costs along with the time of 2 principal investigators for project management, field sampling, data review and reporting. Data will be provided to the Hinkson Creek Science Team as an Excel spreadsheet and will also be released as a USGS data release package according to USGS guidelines. Depending on the findings, a publication of results in a scientific journal may be considered.

Appendix – Tentative Analyte List

Total Recoverable Metals
Mercury, Chromium, Lead, Copper, Zinc, Silver, Cadmium, Nickel, Selenium, Vanadium, Cobalt

General Water Quality
Hardness, Alkalinity, pH, Dissolved Oxygen, Ammonia

Anions
Fluoride, Chloride, Nitrate+Nitrite (as nitrogen), Bromide, Sulfate, Phosphate

Cations
Sodium, Magnesium, Calcium, Iron, Manganese, Strontium, Potassium

Polycyclic Aromatic Hydrocarbons (PAHs)
1,2-dimethylnaphthalene
1-ethylnaphthalene
1-methylfluorene
1-methylnaphthalene
2,3,5-trimethylnaphthalene
2-methylfluoranthene
2-methylnaphthalene
2-methylphenanthrene
3,6-dimethylphenanthrene
4-methylbiphenyl
9-methylanthracene
Acenaphthene
Acenaphthylene
Anthracene
Benz[a]anthracene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[b]naphtho[2,1-d]thiophene
Benzo[b]thiophene
Benzo[e]pyrene
Benzo[g,h,i]perylene
Benzo[k]fluoranthene
Biphenyl
Chrysene
Dibenz[a,h]anthracene
Dibenzothiophene
Fluoranthene
Fluorene
Indeno[1,2,3-c,d]pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene

Organochlorines, polychlorinated biphenyls, polybrominated diphenyl ethers (OC/PCB/PBDEs)
alpha-Benzenehexachloride (a-BHC)
beta-Benzenehexachloride (b-BHC)
Chlorpyrifos
cis-Chlordane
cis-Nonachlor
cis-Permethrin
Dacthal
delta-Benzenehexachloride (d-BHC)
Diazinon
Dieldrin
Endosulfan
Endosulfan Sulfate
Endosulfan-II
Endrin
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
Lindane
Mirex
o,p'-DDD
o,p'-DDE
o,p'-DDT
Oxychlordane
p,p'-DDD
p,p'-DDE
p,p'-DDT
p,p'-Methoxychlor
Pentachloroanisole (PCA)
Tefluthrin
trans-Chlordane
trans-Nonachlor
trans-Permethrin
Trifluralin
Total Polychlorined Biphenyls (Total PCBs)
Polybrominated Diphenyl Ether congener 28 (PBDE-28)
Polybrominated Diphenyl Ether congener 47 (PBDE-47)
Polybrominated Diphenyl Ether congener 66 (PBDE-66)
Polybrominated Diphenyl Ether congener 85 (PBDE-85)
Polybrominated Diphenyl Ether congener 99 (PBDE-99)
Polybrominated Diphenyl Ether congener 100 (PBDE-100)
Polybrominated Diphenyl Ether congener 153 (PBDE-153)
Polybrominated Diphenyl Ether congener 154 (PBDE-154)
Polybrominated Diphenyl Ether congener 183 (PBDE-183)

Wastewater Indicator Chemicals (WI)

Chemical	Common Use
1,4-Dichlorobenzene	moth repellant, fumigant, deodorant
4-n-octylphenol	surfactant
Acetophenone	fragrance in detergent and tobacco, flavor in beverages
Anthraquinone	manufacturing dye/textiles, seed treatment, bird repellant
Atrazine	herbicide
Benzophenone	fixative for perfumes and soaps
Bromacil	herbicide, general use pesticide, usage on grass/brush
Bromoform	wastewater ozination byproduct, military/explosives
Caffeine	beverages, diuretic
Camphor	flavor, odorant, ointments, moth repellent, fireworks (nitrocellulose plasticizer)
Carbaryl	insecticide, crop and garden uses
Carbazole	insecticide, manufacturing dyes, explosives, and lubricants
Cashmeran (DPMI)	fragrance
Celestolide (ADBI)	fragrance
Chlorpyrifos	Insecticide
Cholesterol	often a fecal indicator, plant sterol
Cotinine	primary nicotine metabolite
Diazinon	insecticide
Dichlorvos	insecticide, pet collars, flies, also a degradate of naled or trichlofon
Diethyl phthalate	Plasticizer
Diethylhexylphthalate (DEHP)	Plasticizer
d-Limonene	fungicide, antimicrobial, antiviral, fragrance in aerosols
Ethyl citrate	cosmetics, pharmaceuticals
Galaxolide (HHCB)	fragrance
Indole	pesticide inert ingredient, fragrance in coffee
Isophorone	solvent for lacquer, plastic, oil, silicone, resin
Isopropylbenzene (cumene)	manufacturing phenol/acetone, fuels, and paint thinner
Isoquinoline	flavors and fragrances
Menthol	cigarettes, cough drops, liniment, mouthwash
Metalaxyl	herbicide, fungicide, general use pesticide, golf/turf application
Methyl salicylate	liniment, food, beverage, UV-absorbing lotions
Methyl Triclosan	metabolite of triclosan (an antibacterial agent)
N,N-diethyltoluamide (DEET)	insect repellent
N-butyl benzenesulfonamide	plasticizer in nylon production
para-Cresol	wood preservative
Phantolide (AHMI)	fragrance
Phenol	disinfectant, manufacturing of several products
Prometon	herbicide, applied prior to blacktop application
p-tert-Octylphenol	surfactant
Tetrachloroethylene	solvent, degreaser, veterinary anthelmintic
Tonalide (AHTN)	fragrance
Traseolide (ATII)	fragrance
Tributyl phosphate (TBP)	flame retardant
Triphenyl phosphate (TPP)	flame retardant, plasticizer in resins waxes, roofing paper
Tris(1,3-dichloro-2-propyl)phosphate (TDCPP)	flame retardant
Tris(1-chloro-2-propyl)phosphate (TCPP)	flame retardant
Tris(2-butoxyethyl)phosphate (TBEP)	flame retardant
Tris(2-chloroethyl)phosphate (TCEP)	flame retardant
Tris(2-ethylhexyl)phosphate (TEHP)	flame retardant

Current-use Pesticides (CUPs)

2,6-diethylaniline
acetochlor
alachlor
atrazine
benfluralin
butylate
carbaryl
carbofuran
chlorpyrifos
cyanazine
dacthal
deethylatrazine
desulfinylfipronil
diazinon
dieldrin
disulfoton
eptam (eptc)
ethalfluralin
ethoprop
fipronil
fipronil degradate
fipronil sulfide
fipronil sulfone
fonofos
lindane
linuron
malathion
methyl azinphos
methyl parathion
metolachlor
metribuzin
molinate
napropamid
parathion
pebulate
pendimethalin
phorate
prometon
pronamide
propachlor
propanil
propargites
simazine
tebuthiuron
terbacil
terbufos
thiobencarb
triallate
trifluralin