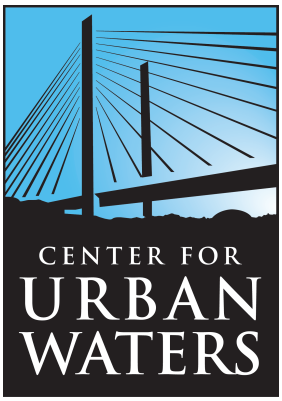
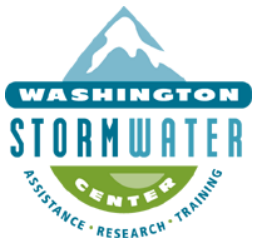


2011
University of Washington
Water Symposium

PROGRAM

18 April 2011
9:00 am – 5:00 pm
Kane Hall ~ Room 225



PUGET SOUND INSTITUTE
UNIVERSITY of WASHINGTON | TACOMA

SCHEDULE

Time		Session Chair
9:15	Welcome/Opening Remarks	Joel Baker
9:30	**SESSION 1**	Joel Baker
9:30	Usha Varanasi, University of Washington Conducting and communicating science in the midst of an environmental crisis (examples from EXXON Valdez to Katrina and Deep Water Horizon)	
10:15	John Stark, WSU Puyallup Pesticides and Pacific Northwest Salmon: An Overview	
10:45	**BREAK**	
11:05	Joyce Dinglasan-Panlilio, University of Washington Tacoma Fate and transport of fluorinated compounds	
11:35	**LUNCH/POSTERS**	
12:30	**SESSION 2**	Andy James
12:30	Steven Chapra. Tufts University Building Environmental Consensus with Data, Science and Modeling: The Great Lakes Case Study	
13:15	Mike Brett, University of Washington Fate and transport of nitrogen discharged from onsite septic systems to the immediate shoreline of Hood Canal	
13:45	John Lenth, Herrera Environmental Consultants Evaluation of a compost-amended biofiltration swale for dissolved metals removal from highway stormwater runoff	
14:15	**BREAK**	
14:30	**SESSION 3**	Kurt Marx
14:30	Derek Booth, Stillwater Sciences Treating the symptoms or curing the disease? Stormwater management in the 21st century	
15:15	Joan Wu, WSU Puyallup WEPP: A Physically-Oriented Hydrology and Erosion Model for Watershed Assessment, Management, and Conservation	
15:45	Monika Moskal, University of Washington Mapping impervious surfaces and canopy cover using object-based image analysis and public domain remotely sensed data	
16:15	John Phillips, King County; Patty Buchanan, SvR Design Company Green stormwater infrastructure	
16:45	**Award Presentation and Wrap Up**	Joel Baker

POSTERS

Effects of Organic Soil Amendments and Plantings on Stormwater Biofilter Performance
Schwartz, Dan*; Stewart, Keith; Kayzar, Theresa; Conlon, Katrina; Li, Bo; Luk, Chris; Peters, John. Brown, Sally (faculty advisor).
University of Washington, Seattle, WA.

Hydrologic Sensitivities to Warming Temperature and Precipitation Change in the Colorado River Basin
Vano, Julie A.*[1], Das, Tapash[2,] Lettenmaier, Dennis P. [1]
[1] University of Washington, Seattle, WA
[2] Scripps Institution of Oceanography, La Jolla, California

Modeling Biodegradation and Accumulation in Ventilated Improved Pits (VIPs)
Wood, Kirsten D.*, Buckley, Chris A., Foxon, Kitty M.
University of KwaZulu-Natal, Durban, South Africa

Perfluorinated Compounds in Surface Waters from the Puget Sound
Shristi S. Prakash*, Joel E. Baker PhD and Joyce Dinglasan-Panlilio PhD
Center for Urban Waters, University of Washington, Tacoma

Spatial and Temporal Microplastic Concentrations in Puget Sound and Chesapeake Bay
Chris LaRocque*, Julie Masura, and Joel E. Baker, Ph.D.
Center for Urban Waters, University of Washington, Tacoma

KEYNOTE SPEAKERS

Dr. Usha Varanashi
Dr. Varanasi recently retired as director of the Northwest Fisheries Science Center (NWFSC) in Seattle, WA, part of the National Marine Fisheries Service (NMFS). The NWFSC conducts basic and applied research to support the management and conservation of the Pacific Northwest region's anadromous and marine fishery resources and their habitats. Dr. Varanasi's leadership and management have resulted in increased communication and partnerships with constituents, and new research programs that address current and future science and management needs, including the Cumulative Risk Initiative, and the marine groundfish research program, which is dramatically improving stock assessments and resource surveys in the Pacific Northwest. For her achievements, she was awarded the prestigious 2000 Presidential Rank Award for Meritorious Service, the Department of Commerce Gold Medal, the NOAA Distinguished Career Award, and an honorable mention as one of NOAA's History Makers.

Dr. Steven Chapra
Dr. Chapra teaches at Tufts University, where he holds the Louis Berger Chair in Computing and Engineering. Dr. Chapra worked for EPA, NOAA, Texas A&M and the University of Colorado. He has also served as the Associate Director of the Center for Advanced Decision Support in Water and Environmental Systems (CADSWES), and has been a visiting professor at Duke University and the University of Washington. His general research interests focus on surface water-quality modeling and advanced computer applications in environmental engineering. He has authored five textbooks including Numerical Methods for Engineers, which has been used at over 150 universities since it was first published in 1985.

Dr. Derek Booth
Dr. Booth is an Affiliate Professor at the University of Washington and the Senior Geologist of Stillwater Sciences, a 60-person environmental consulting firm in California, Oregon, and Washington. He has studied geomorphology, hydrology, and watershed management for the past 30 years, first with the US Geological Survey and then with the Basin Planning Program for King County (Washington), as a full-time University of Washington research professor as the director of the Center for Urban Water Resources Management and its successor, the Center for Water and Watershed Management, and now in private practice.

ABSTRACTS – ORAL PRESENTATIONS

CONDUCTING AND COMMUNICATING SCIENCE IN THE MIDST OF AN ENVIRONMENTAL CRISIS: EXAMPLES FROM EXXON VALDEZ TO KATRINA AND DEEPWATER HORIZON

Varansi, Usha. Affiliate Professor, School of Fisheries and Aquatic Sciences (CoENV) & Department of Chemistry (CA&S) University of Washington, and Former Science and Research Director (1994-2010), Northwest Fisheries Science Center National Marine Fisheries Service, NOAA

Over past twenty years, United States has experienced several natural or anthropogenic environmental crises of epic proportions. Environmental catastrophes such as the *EXXON Valdez* oil spill in pristine waters of Prince William Sound to more recent events such as Hurricane Katrina and Deepwater Horizon oil spill in the Gulf of Mexico raised deep concerns over human safety, seafood contamination, damage to marine life and economic losses. Conducting good and objective science, being responsive to public fear and distress, and communication of scientific findings in response to environmental disasters remains challenging but critically important. In all these events, it was necessary to identify and use relevant scientific techniques, as well as develop new methods, to rapidly respond to critical questions about the presence in seafood of polycyclic aromatic hydrocarbons (PAHs), the toxic components of petroleum that are the compounds of public health concern. It was a challenge to communicate our scientific findings that showed PAHs do not accumulate in vertebrates (e.g., fish, marine mammals) because of efficient metabolism and excretion, and that invertebrates (e.g., shellfish, molluscs) tend to bioacculmulate these compounds. Also it was difficult to explain that organisms with efficient metabolism can still be at risk of PAH toxicity, especially during early developmental stage. Applying as many of the lessons learned in terms of clean up methods and application of detection techniques in response to *EXXON Valdez* to the Hurricane Katrina and Deepwater Horizon disasters advanced our knowledge, but also proved to be challenging because of physical ocean differences (i.e., water temperature, natural oil seepages), causes of the disaster and cultural differences of communities affected. Nonetheless, it is imperative that communication of scientific results to a wide range of audiences be independent, accurate, reliable and consistent in order to rebuild confidence in seafood advisories and to assess ecological damage after an environmental crisis in a politically charged and media intensive atmosphere. This presentation will cover challenges of advancing science in the midst of environmental emergencies.

ABSTRACTS – ORAL PRESENTATIONS

PESTICIDES AND PACIFIC NORTHWEST SALMON: AN OVERVIEW

Stark, John. Washington State University, Puyallup, WA.

Wild salmon populations in the Pacific Northwest have been in decline for some time. This decline has been attributed to several factors, one of which is exposure of young and pre-spawn adult salmon to pesticides and pesticide mixtures in streams. Results of recent studies have indicated that exposure of young salmon to low concentrations of certain insecticides (chlorpyrifos, malathion, and diazinon) results in both lethal and sublethal effects. Furthermore, mixtures of these products act synergistically. These data along with a lawsuit in 2001 have led to a biological opinion on the use of pesticides that have the potential to enter our freshwater ecosystems. EPA has taken action to reduce noncrop uses of chlorpyrifos and diazinon, made modifications to maximum labeled application rates, reductions in the number of applications, and specification of minimum application intervals. In this talk, I will discuss the history of pesticides and their effects on Pacific Northwest Salmon, go over the Biological Opinion and present new information about the potential effects of a new generation of insecticides on both salmon and aquatic invertebrates.

ABSTRACTS – ORAL PRESENTATIONS

FATE AND TRANSPORT OF PERFLUORINATED COMPOUNDS

Dinglasan-Panlilio, Joyce. University of Washington, Tacoma.

Perfluorinated chemicals such as perfluorinated sulfonic acids (PFSAs) and perfluorinated carboxylic acids (PFCAs) are a synthetic class of compounds widely used in the carpet, paper and textile industries to render surfaces both oil and water repellant. These compounds are considered to be persistent organic pollutants (POPs) as they are resistant to degradation, potential toxic and bioaccumulative. The widespread detection of these chemicals in various environmental matrices, including human blood, has prompted investigation into their sources. Release of these contaminants to the environment is currently believed to be a consequence of both direct and indirect input. Direct sources of these compounds refer to the discharge of the contaminants themselves from manufacturing or industrial applications and indirect sources refer to the release of precursors to the environment that then degrades forming the perfluorinated acids. This talk will provide a brief overview of environmental monitoring data for these emerging contaminants worldwide as well as highlight research efforts investigating the indirect sources of these compounds.

ABSTRACTS – ORAL PRESENTATIONS

BUILDING ENVIRONMENTAL CONSENSUS WITH DATA, SCIENCE AND MODELING: THE GREAT LAKES CASE STUDY

Chapra, Steve. Professor and Berger Chair, Civil & Environmental Engineering, Tufts University Medford, MA.

During the 1960s water quality issues in the Great Lakes first became a concern to the general public. Lake Erie was perceived to be "dying" as excessive nutrients entering the lake resulting in eutrophic conditions. As reported in Time magazine: "The Cuyahoga River, emptying into Lake Erie, was so laden with oil and debris that it twice caught fire. Masses of dead alewives washed ashore in Lake Michigan, fouling beaches. Tangles of Cladophora, a smelly freshwater seaweed, clogged other beaches." In the following decade, a huge program of data collection, scientific study and decision-support modeling was mounted. As a result, major reductions in phosphorus loadings were implemented through a combination of point-source controls, a detergent phosphate ban and best-management practices for non-point sources. The present talk describes these efforts and reports on the resulting water-quality improvements that have been observed over the ensuing 30 years. An effort is made to draw some general lessons from this experience. In particular, the importance of close collaboration between scientists, data collectors and modelers is illustrated. The talk ends with some thoughts on how such lessons can presently be applied to enhance the management of other complex environmental systems.

ABSTRACTS – ORAL PRESENTATIONS

THE FATE AND TRANSPORT OF NITROGEN DISCHARGED FROM ONSITE SEPTIC SYSTEMS TO THE IMMEDIATE SHORELINE OF HOOD CANAL, WASHINGTON

Brett*, M.T.; Atieh, Bryan G.; Horowitz, Julie D.; Leque, Garrett R.; and Benjamin, Mark M
University of Washington, Seattle, WA 98195.

Nitrogen (N) loading from onsite septic systems (OSSs) to coastal marine ecosystems can cause or exacerbate eutrophication. This study focused on the fate and transport of N emanating from OSSs located at private residences immediately adjacent to Hood Canal, a nitrogen limited estuary in Washington State where hypoxia is a frequent problem. Three field experiments were conducted at two sites to assess the extent of N removal occurring in the drainfields of near-shore OSSs. Our results demonstrated that the ammonium in the OSS effluent was oxidized to nitrate within 2 m of the drainfield and tidally infiltrating seawater within the sub-surface diluted the OSS effluent by a factor of 100-200 within 7 m of the drainfield. At seven wells located immediately above and below a shoreline bulkhead, our mass balance calculations indicated 99.3 ± 0.2% of the water had a marine origin, whereas 75 ± 7% of the dissolved inorganic nitrogen (DIN) originated from the OSS discharge. Nitrogen and conservative tracer (*i.e.,* bromide ions) concentrations in our sampling wells were strongly correlated with tidal phase. Mixing model calculations indicated DIN removal averaged 42 ± 26% in seven sampling wells. Our results also suggest DIN removal was highly dependent on the effluent flow path and varied considerably on a small spatial scale. Our conclusions were quite sensitive to the assumed conservative tracer concentration for the marine water that tidally inundated the OSS drainfield. These results indicate OSSs located along the immediate shoreline of some estuaries are particularly problematic from a water quality perspective and may function as almost direct inputs to the near shore habitat.

ABSTRACTS – ORAL PRESENTATIONS

EVALUATION OF A COMPOST-AMENDED BIOFILTRATION SWALE FOR DISSOLVED METALS REMOVAL FROM HIGHWAY STORMWATER RUNOFF

Dugopolski, Rebecca A.[1]; Lenth, John W.[1]*; and Maurer, Mark[2]
[1]Herrera Environmental Consultants; Seattle, Washington
[2]Washington State Department of Transportation; Olympia, Washington

The Washington State Department of Transportation (WSDOT) currently has limited options for meeting end-of-pipe enhanced treatment for stormwater runoff. This project was designed to evaluate the effectiveness of compost blankets in biofiltration swales to remove pollutants from stormwater runoff compared to standard biofiltration swales. This project involved constructing two biofiltration swales in the median of State Route 518 near SeaTac Airport. One biofiltration swale received a 3-inch compost blanket and the other served as a control. Flow monitoring for the project occurred over a 19-month period starting in March 2009 and ending in September 2010. Water quality sampling for the project lasted 13 months from May 2009 through June 2010. Monitoring data from the compost-amended biofiltration swale demonstrated the following median removal efficiencies: 94 percent removal for total suspended solids (TSS), 83 percent removal for dissolved zinc, 25 percent removal for dissolved copper, and 84 percent for total petroleum hydrocarbons (TPH). In comparison, the median removal efficiencies for the control biofiltration swale were 86 percent removal for TSS, 20 percent removal for dissolved zinc, and 62 percent for TPH. The control biofiltration swale also exported dissolved copper (-6.7 percent median removal). Due to low influent dissolved copper concentrations, the removal efficiency measured in the compost-amended biofiltration swale was not as high as expected; however, the dissolved zinc removal surpasses another highway stormwater treatment technology (Media Filter Drain or Ecology Embankment) that is currently approved for enhanced treatment in the state of Washington. Based on the results of the compost-amended biofiltration swale evaluation, compost-amendment of standard biofiltration swales shows promise for dissolved metals treatment in highway stormwater runoff and could also be a useful technology that can be readily applied in retrofit situations.

ABSTRACTS – ORAL PRESENTATIONS

TREATING THE SYMPTOMS OR CURING THE DISEASE? STORMWATER MANAGEMENT IN THE 21ST CENTURY

Booth, Derek B., Stillwater Sciences and University of Washington, Seattle, WA.

Managing runoff from developed land is an ever-growing cost to municipalities, private developers, and (ultimately) the general public. Despite nearly half a century of effort, flooding and pollution remain common conditions downstream of urban areas, while the declining health of aquatic resources seems inescapably linked to the nearby presence of cities and suburbia. Changing paradigms and new approaches offer hope that degradation need not be an inevitable consequence of urbanization—the recent emphasis on spatially distributed management of runoff, particularly through retention and infiltration, can recover or otherwise mimic hydrologic processes in the urban environment that are critical to the functioning of healthy watersheds. Despite these technological advances, however, true progress in reducing the downstream consequences of urban stormwater runoff appears to be limited most severely by necessary social and regulatory changes that have not yet followed suit.

ABSTRACTS – ORAL PRESENTATIONS

WEPP: A PHYSICALLY-ORIENTED HYDROLOGY AND EROSION MODEL FOR WATERSHED ASSESSMENT, MANAGEMENT, AND CONSERVATION

Wu, Joan Qiong. Washington State University, Puyallup, WA.

The Water Erosion Prediction Project (WEPP) model is a physically-oriented, distributed-parameter, continuous-simulation, watershed hydrology and erosion prediction model. WEPP was first developed in the late 1980s by the US Department of Agriculture National Soil Erosion Research Laboratory as a new generation erosion prediction technology for use by action agencies and others involved in conservation planning and environmental assessment. During the last decade, researchers at Washington State University, in collaboration with the USDA and US Forest Service scientists, have made significant improvements to the WEPP model. These improvements included improved algorithms to simulate hydraulic structures as well as converging subsurface flows to represent variable-source-area runoff, the addition of Penman-Monteith ET algorithms, improved canopy biomass routines for forested applications, incorporation of an energy-balance-based winter hydrologic routine for improved snow and frost simulations, and incorporation of numerical solutions for streamflow routing in permanent channels. WEPP has been broadly used by university scientists and researchers, regulatory agencies, and private consultants within and outside the US. Several case studies demonstrating the use of the WEPP model for watershed assessment, management, and conservation will be presented in this paper.

ABSTRACTS – ORAL PRESENTATIONS

MAPPING IMPERVIOUS SURFACES AND CANOPY COVER IN SEATTLE OLYMPIA AND TACOMA USING OBJECT-BASED IMAGE ANALYSIS AND PUBLIC DOMAIN REMOTELY SENSED DATA

Moskal, L. Monika* and Styers, Diane M. University of Washington, Seattle, WA

Urban impervious land cover has been shown to have negative impact on the ecosystem, and thus, ecosystem services. In contrast, urban forest ecosystems provide a range of social and ecological services. Understanding the relationships between these two ecosystem indicators are key to successful and sustainable management for ecosystem services. Due to the heterogeneity of these urban land covers their spatial extent is difficult to quantify and monitor. Traditional per-pixel classification methods have been used to map impervious surfaces and urban canopies, however, such techniques are not generally appropriate for assessing these highly variable landscapes. Landsat imagery, historically used for per-pixel driven land use/land cover (LULC) classifications, limits our ability to map small urban features due to the 30 m per pixel resolution. In cases where more detail is required, hyperspatial resolution imagery such as aerial or satellite imagery with a resolution of 1 meter or below is preferred. Object-based image analysis (OBIA) allows for use of additional variables such as texture, shape, context, and other cognitive information provided by the image analyst to segment and classify image features, and thus, improve classifications. We demonstrate a 1m per-pixel resolution, LULC classifications of Seattle, Olympia and Tacoma, WA, USA, using OBIA techniques using eCognition software and freely available public aerial photography and LiDAR data. We extract impervious surfaces and canopy cover from our LULC classification. We analyzed the differences in accuracies which can be achieved with OBIA using multispectral imagery and show the improvements when LiDAR data are implemented. We also compare our results to a satellite based OBIA LULC and discuss the implications of per-pixel driven versus OBIA-driven impervious surfaces and canopy assessment for ecosystem services applications. We demonstrate that the OBIA approach can generate good and repeatable LULC classifications suitable for impervious surfaces and canopy cover assessment in urban areas.

ABSTRACTS – ORAL PRESENTATIONS

GREEN STORMWATER INFRASTRUCTURE USE TO CONTROL COMBINED SEWER OVERFLOWS

*Phillips, John[1] and Buchanan, Patty[2], P.E., LEEP AP
[1]King County, Seattle, WA
[2]SvR Design Company, Seattle, WA

Combined Sewer Overflows (CSO) are identified as a primary cause of environmental degradation in our nearshore environments. Many combined sewer systems were built years ago and need repairing. Other pressures, such as repeated flooding during storm events, increased urbanization, and stricter regulations are all adding to municipalities and utility districts need to address combined sewer overflows. King County is evaluating a *demand management* approach to manage stormwater in the combined sewer system and evaluating the use of the green stormwater infrastructure to reduce the peak of the stormwater hydrograph entering the combined sewer system in CSO basins in Seattle, Washington. GSI refers to *engineered* infrastructure in relation to stormwater management practices such as rain gardens and green roofs. These practices make use of soils and vegetation, in combination with other decentralized storage and infiltration approaches such as rain barrels and permeable pavement, to infiltrate, evaporate, capture, and reuse stormwater. EPA's Office of Water states that GSI "can be both a cost effective and an environmentally preferable approach to reduce stormwater and other excess flows entering combined or separate sewer systems in combination with, or in lieu of, centralized hard infrastructure solutions." This presentation will go over the process that King County has gone through to evaluating the choice of basin, locations for green stormwater infrastructure, and the modeling effort to support the design. The process includes a multidisciplinary approach using geographic information system (GIS) modeling to evaluate the land use, existing pipeline infrastructure, geotechnical considerations; field investigations; and preliminary modeling (mass- balance, SBUH and SWMM) efforts to properly size the facility to control the CSO.

PRINCIPAL POINTS:
1. Tools and techniques to evaluate urban drainage basins for CSO control
2. Assumptions and criteria to properly locate GSI in an urban drainage basin
3. Field investigation information and criteria
4. Different approaches to sizing GSI for CSO control

ABSTRACTS – POSTER PRESENTATIONS

EFFECTS OF ORGANIC SOIL AMENDMENTS AND PLANTINGS ON STORMWATER BIOFILTER PERFORMANCE

Schwartz, Dan*; Stewart, Keith; Kayzar, Theresa; Conlon, Katrina; Li, Bo; Luk, Chris; Peters, John. Brown, Sally (faculty advisor). University of Washington, Seattle, WA.

Biofiltration is an emerging technique for treating stormwater runoff. Relevant academic literature and reports by agencies that have used biofiltration indicate that it has considerable promise. This project assesses existing biofiltration practices for efficiency in removing common contaminants of concern from stormwater runoff and considers the possibilities for using organic soil amendments (biosolids compost and wood mulch) to enhance biofilter performance. A greenhouse experiment was conducted to compare combinations of soil amendments, as well as to elucidate the roles of plants and soil media in contaminant removal. Six replicates were used for each of five soil media, with three replicates left unplanted to demonstrate the effects of planting. Experimental units were dosed weekly over a period of two months with synthetic stormwater. Effluent was collected and analyzed for volume, total suspended solids, copper, total nitrogen, soluble reactive phosphorus, and fecal coliform bacteria. Findings indicate that planting significantly reduces effluent volume and total suspended solids. Compost amendments improved removal of fecal coliform bacteria but have the potential to cause leaching of nitrogen and phosphorus.

ABSTRACTS – POSTER PRESENTATIONS

HYDROLOGIC SENSITIVITIES TO WARMING TEMPERATURE AND PRECIPITATION CHANGE IN THE COLORADO RIVER BASIN

Vano, Julie A.*[1], Das, Tapash[2], Lettenmaier, Dennis P. [1]
[1] University of Washington, Seattle, WA
[2] Scripps Institution of Oceanography, La Jolla, California

The Colorado River is the primary water source for much of the rapidly growing southwestern United States. Recent studies have projected reductions in Colorado flows by mid-century ranging from less than 10% to almost 50%, a range that has clouded the potential for management responses. These differences are attributable to variations in climate model projections, but also reflect variations in hydrologic model sensitivities to changes in precipitation and temperature. We evaluate the second contribution to the overall uncertainty, specifically, variations in runoff change sensitivities to changes in precipitation and temperature. We compare multi-decadal simulations from five commonly used semi-distributed hydrological models (Catchment model, Community Land Model, Noah land-surface scheme, Sacramento Soil Moisture Accounting Model, Variable Infiltration Capacity model) all applied over the entire basin at 1/8-degree latitude by longitude spatial resolution. We find that the annual elasticity of model runoff to precipitation (percent change in annual runoff divided by percent change in annual precipitation) ranges from about two to six depending on the hydrological model and reference climate. Elasticities generally are higher in lower precipitation and/or runoff regimes, hence some of the highest values are for models that are biased low in terms of runoff production. As temperatures increase, streamflow timing shifts to earlier springtime peaks and lower overall annual flow values. However the magnitude of annual temperature sensitivity (percent change in annual runoff for an imposed increase in annual temperature) differs depending on the particular hydrological model, ranging from basin-wide declines in flow of about 3%-10% per °C increase in annual average temperature, but on rare occasion, small areas show increasing flows with increasing temperature. Generally, spatial resolution in complex terrain plays an important role in the range of results and subsequent uncertainty because the basin's runoff is strongly controlled by the relatively small (less than 25%) headwaters area.

ABSTRACTS – POSTER PRESENTATIONS

MODELLING DEGRADATION AND ACCUMULATION IN VIPS

Wood, Kirsten D.*, Buckley, Chris A., Foxon, Kitty M. University of KwaZulu-Natal, Durban, South Africa

Ventilated improved pit (VIP) latrines are used by innumerable people in urban and rural settings in developing countries, however little is known about the condition of pit contents. A more detailed understanding of the biodegradation processes occurring in VIPs will allow for more efficient and cohesive management of pits. The contents of two VIPs in Durban, South Africa were sampled at 4 depths. Each layer was analyzed for total solids (ash), moisture content, alkalinity, phosphorous, fractionated chemical oxygen demand (COD), and fractioned nitrogen species. Using assumptions regarding the average mass of excreta produced per person per year, that data were analyzed to assess the degradation and fill rate in the VIP. The results showed that without degradation an average sized pit will fill in approximately 7 years and with degradation the pit will fill in over 25 years. However, in practice about a quarter of the pit volume is composed of unbiodegradable household solid waste. With rubbish and degradation, the VIP fills in about 15 years. The bottom most stabilized material in the VIP reduces to about a quarter of the volume of fresh excreta. A conceptual model was developed for VIP filling rate, degradation, and content maturity. It models the volume available and the percentage of biodegradable material in the VIP. The parameters can be adjusted depending on the unbiodegradable material input and the rate of biodegradation based on moisture content, soil porosity, temperature and the ratio of time the content is aerobic and anaerobic. The more we know about VIP content behaviour, the better we can prevent soil and water contamination.

ABSTRACTS – POSTER PRESENTATIONS

PERFLUORINATED COMPOUNDS IN SURFACE WATERS FROM THE PUGET SOUND

Shristi S. Prakash*, Joel E. Baker PhD and Joyce Dinglasan-Panlilio PhD
Center for Urban Waters, University of Washington Tacoma

Perfluorinated acids or PFCs are ubiquitous in the environment due to industrial production and widespread commercial usage. They are synthetic chemicals applied in carpet, paper and textile industries to render products water and oil repellent. The widespread detection, bioaccumulation and toxicity are of concern at chain lengths greater than 8 carbons. Studies have shown PFOA to cause cancer, immune system failure as well as developmental and reproductive toxicity in various organisms. The Washington State Department of Ecology (ECY) recently published a priority list of Chemical Action Plans (CAPs) as a way to evaluate presence and impact of persistent bioaccumulative toxins within the state and ultimately propose reduction initiatives. The two most commonly detected PFCs in environmental samples, Perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA) are included in the CAPs. To date, there have been limited studies done to measure the concentration of perfluorinated compounds in Washington State. In a recent study by the ECY, water samples from selected rivers and lakes within the state were analyzed for these contaminants. The objective of this study was to measure the concentration of various chain lengths (C4-C13) of PFCs in surface water samples from different locations within the Puget Sound region to enhance the pool of data that can be used to evaluate the occurrence of these contaminants within the region.

Water samples were collected in the spring, summer and fall of 2009 and 2010 during sampling cruises along Thea Foss, Quartermaster Harbor, Whidbey Island, Portage Bay, Hood Canal, San Juan de Fuca, and Clayoquot Sound. The samples were extracted using solid phase extraction (SPE) and analyzed by liquid chromatograph mass tandem spectrometer using negative electrospray multiple reaction monitoring mode LCMSMS. PFCs were found at concentrations near or less than 9.16 ng/L. The most commonly detected acid in the water samples was PFOA. Future work will investigate potential sources of these contaminants to the region.

ABSTRACTS – POSTER PRESENTATIONS

SPATIAL AND TEMPORAL MICROPLASTIC CONCENTRATIONS IN PUGET SOUND AND CHESAPEAKE BAY

LaRocque, C.J*, Masura, J., Baker, J.E., University of Washington, Tacoma, WA.

Plastic debris is found in coastal and marine waters worldwide. The sources and fate of microplastic debris, defined as particles composed of synthetic polymers between 0.3 and 5 mm, in the ocean are unclear. Microplastics may remain buoyant or neutrally buoyant, become fouled and sink, or become bioavailable to benthic fauna. Reports of microplastics in the oceans have increased around the globe. The main issues causing concern are possible ingestion, transfer of pollutants from plastics to organisms and the slow biodegradation of plastics. The objective of this study is to develop and characterize the spatial and temporal variation of microplastics in the Puget Sound and Chesapeake Bay. Samples were obtained with a Manta Net, sieved in the field between 5 and 0.285mm, and dried in the lab. Samples were then processed with a wet peroxide oxidation and picked for microplastics. It was found that the net tows collected between 0.1 and 25 µg-dry weight/L of material. Microplastic concentration ranged from 0 to 0.3 µg-plastic/L with the highest values found in the Thea Foss Waterway in Tacoma, Washington. As mass of plastic per mass of collected solids, Puget Sound data ranges widely from 0.02% to 22%. The highest maximum concentrations were found at areas classified as industrial and urban. Spatial and temporal data is needed to begin to understand the sources and fate of microplastics in the ocean.

SYMPOSIUM SPONSORS

UW Tacoma Center for Urban Waters
www.urbanwaters.org

Research conducted by University of Washington Tacoma scientists at the Center for Urban Waters seeks to understand and quantify the sources, pathways and impacts of chemical pollutants in urban waterways. UW students work side-by-side with Urban Waters colleagues, contributing to research teams while gaining valuable training and experience.

The research is led by Professor Joel Baker, Port of Tacoma chair in Environmental Science at UW Tacoma and Science Director for the Center for Urban Waters.

Washington Stormwater Center
www.wastormwatercenter.org

Washington Stormwater Center offers stormwater management assistance to Washington NPDES permittees and stormwater managers by providing access to information, training, permit assistance, research and emerging technologies.

The mission of Washington Stormwater Center focuses on protecting Washington's waters through improvements in regional stormwater management. The need for strong and consistent stormwater management is evident in our waterways and imperative to the future of Washington waters.

Puget Sound Institute

A cooperative agreement between the University of Washington, the U.S. Environmental Protection Agency, and the Puget Sound Partnership, the Puget Sound Institute seeks to catalyze rigorous, transparent analysis, synthesis, discussion and dissemination of science in support of the restoration and protection of the Puget Sound ecosystem.

The institute will bring together scientists, engineers and policy makers working on the restoration and protection of Puget Sound and will provide expert advice based on the best-available science.