

Stormwater Management



Service Areas

- Strategic planning and management
- Engineering and sustainable design
- Mass loading and source identification
- Modeling

Modeling Tools

- EPANET
- HEC-2
- HEC-RAS
- MIKE 11
- MIKE SHE
- SWM-IV
- SWMM
- TR-55
- WWHM

Integral offers a comprehensive approach to stormwater management, addressing planning, design, engineering, and compliance for facilities and drainage basins.

With proven expertise in stormwater management, Integral helps clients comply with regulations through source control, best management practices (BMPs), and engineered stormwater systems. Integral conducts large-scale stormwater sampling programs for basin-wide source control strategies as well as facility-level studies to meet permit compliance. We are recognized for our ability to integrate stormwater chemistry data with fate-and-transport modeling results to evaluate the impact of stormwater on water and sediment quality, ecological receptors, and human health.

Strategic Planning and Management

Integral develops remediation strategies to protect water and ecological resources from chemicals of concern in stormwater pathways. Our scientists provide strategic advice for sampling and mapping of basin-wide stormwater systems to evaluate the potential for recontamination. In addition, we develop all aspects of stormwater management for NPDES permit compliance.

Engineering and Sustainable Design

Integral provides civil, hydrological, geotechnical, and environmental engineering design and support for stormwater systems. Our engineers analyze and prepare designs for stormwater and sanitary conveyance systems, outfalls, retrofits, flow control facilities, and treatment BMPs. Integral specializes in low-impact development design strategies, such as sustainable stormwater infrastructure, for remediation sites and redevelopment projects.

Mass Loading and Source Identification

In support of RI/FS programs and cost allocation, Integral is broadly recognized for high-end quantitative analyses linking stormwater to sediment contamination. Quantitative techniques include spatial analysis; chemical fingerprinting; statistical methods; dating with radioisotopes or pollen; toxicity, exposure, and reconstruction of historical loading; and causation evaluation. Our scientists also design and install stormwater and sediment collection equipment and conduct large-scale stormwater sampling events.

Modeling

Integral develops models to evaluate complex drainage basin systems, floodplains, and large industrial facilities. Based on project needs, a variety of modeling tools are used — ranging from single-event peak-runoff models to dynamic, continuous, rainfall-runoff-subsurface simulation models. Modeling results are used to develop source control strategies, design stormwater management facilities, attain permit compliance, and support project decision-making.

Stormwater Management—Selected Projects

Stormwater Source Control, Willamette River Facility, Oregon

Integral led strategic negotiations with state regulators over proposed modifications to an industrial site's stormwater NPDES permit. Integral also completed preliminary stormwater source control design documents. For the stormwater design, Integral used AutoCAD Civil 3D to create an existing terrain surface based on a combination of ground survey-derived and LiDAR-based 0.5-ft contours. Work involved modeling a stormwater conveyance system that included channels, detention basins, berms, and cut and fill areas across the 50-acre site.

Watershed Stormwater Modeling and Monitoring, Berry's Creek, New Jersey

Integral is performing field monitoring and modeling to quantify stormwater flows and particulate loading in support of the RI/FS for the Berry's Creek study area—one of the first Superfund sites to undergo a watershed-wide investigation. Initial modeling efforts estimated storm flows from area subbasins, supporting the development of a water balance for the estuary and an assessment of the influences of freshwater inputs on system salinity, temperature, and biological habitats. Ongoing work includes developing a model to reconstruct historical stormwater flows and to forecast storm flows during atypical conditions.

Storm Sewer Pipe Investigation, Blackwell, Oklahoma

Integral oversaw a survey of storm sewer pipe inverts in approximately 50 manholes and supervised the cleaning, filming, and smoke testing of a section of storm sewer pipe for the City of Blackwell. This work was conducted to determine the elevation of the storm sewer pipe system, assess the condition of the pipes, and predict the potential vulnerability of the system to infiltration of shallow groundwater contaminated with metals. Results of testing assisted the City in planning the abandonment of this portion of the storm sewer system.

Stormwater Source Control at Slip 4, Lower Duwamish Waterway, Seattle, Washington

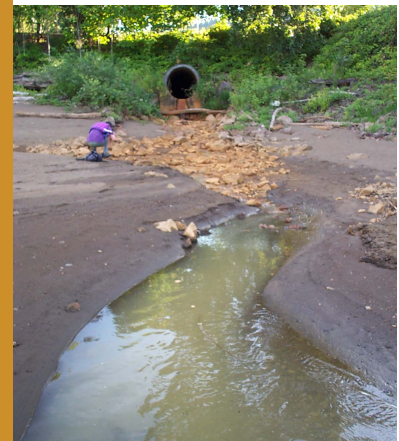
Integral is conducting stormwater source control activities to ensure protection of sediments following remediation of the Slip 4 early action site. Activities include identification of multiple contaminant sources in upland soil and groundwater, design of grade and a cap to reduce stormwater loading, design of green stormwater BMPs to encourage bio-infiltration, hydraulic analysis of outfalls discharging from waterfront properties, and design of scour protection for existing outfalls.

Stormwater Loading Analyses at Portland Harbor Superfund Site, Portland Harbor, Oregon

In support of the Portland Harbor RI/FS, Integral assisted in developing a field sampling plan, authored a quality assurance project plan, and provided field staff for a comprehensive stormwater sampling effort. The sampling approach included collecting flow-weighted composite water samples during three storm events, deploying sediment traps, and continuously monitoring flow at 24 outfalls within this 11-mile-long Superfund site.

Key Personnel

- Reid Carscadden, P.E.
- Betsy Day
- Laura Jones
- Michael Martin, P.E.
- Todd Martin, P.E.
- Eric Pilcher, P.E.
- Ben Starr, P.E.
- Randi Wexler



- Health
- Environment
- Technology
- Sustainability

