A Working Model of a Stream

This simple, easy-to-create model helps children understand stream dynamics and the impact of human activities on water quality

by William F. Hammond

Grade levels: 2-5

Subject areas: science, ecology

Key concepts: watershed, riparian zone, runoff, erosion, point-source pollution

Skills: experimenting, observing, predicting, manipulating materials

Location: outdoors or indoors

Is there anything more captivating to children of any age than a stream of running water? Children will mess about for hours building and breaking dams, changing the direction of the water, making pools, and racing floating-leaf boats or sticks. A stream, it seems, tempts the "beaverness" deep in our human spirit. Yet in urban neighborhoods, streams are often converted into conveyances hardened with cement or rock riprap, or even sent underground into systems of culverts that are out of sight and mind of children. With these changes, children lose powerful learning opportunities that come from exploring a local stream in a joyful, experimental manner.

We want students to learn about watersheds and stream riparian conservation. We want to enhance their appreciation of the subtle relationship of streams to the landscapes through which they flow. We want them to recognize the complex interaction between aquatic and terrestrial life that is intimately woven into the seasonal rhythms of the water. Yet when children lack a foundation of personal experience, it can be difficult to interest them in learning about streams and water issues. In an ever more urbanized environment we must find new ways to create the "Velcro for the mind" — experiences that stimulate children to want to learn about streams, rivers, lakes, and estuaries.

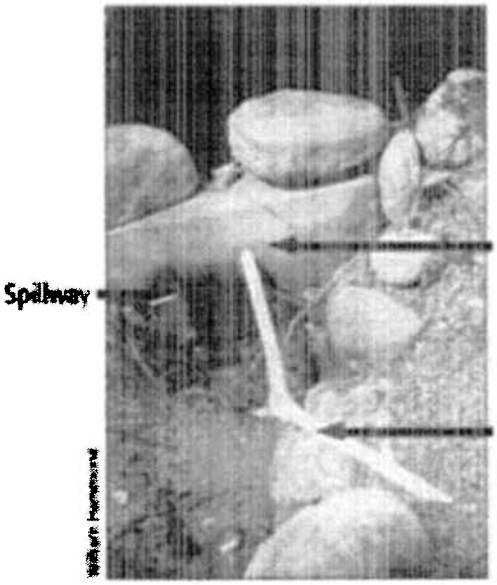
Schoolyard explorations

One way to begin to engage children in stream studies is to go on a mini field trip to investigate how water flows on the school grounds and in the local neighborhood (this may also be a homework assignment). During or after a heavy rain, students can follow the flow of water as it is pulled by gravity off the school roof, across sidewalks and parking lots, through pipes and gutters and along curbs, forming puddles (mini ponds and lakes) in low spots until it finds a storm drain or a stream. Have students visualize where it goes from there: on to a bigger river, possibly to a lake, and eventually to the ocean or back to the atmosphere as vapor that will condense as clouds. Tracing the flow of water locally in this way is a first step toward understanding the concept of a watershed.

An interactive stream model

A very successful yet simple model for learning more about watershed and stream dynamics has been implemented at the Kingfisher Environmental Interpretive Centre in Enderby, British Columbia. The model origi

nated when director Neil Brookes and his staff of volunteers were faced with the arrival of an unexpectedly large group of schoolchildren. Under pressure to create an additional learning station, the staff had the idea of creating a small model stream in the woods adjacent to the center. Using a pump and a fire hose, they brought water from a nearby river and let it run off the bank of the parking lot into the woods. One of the volunteers paddled home and brought back a children's toy village made of wooden blocks, along with a set of toy farm animals and fences.



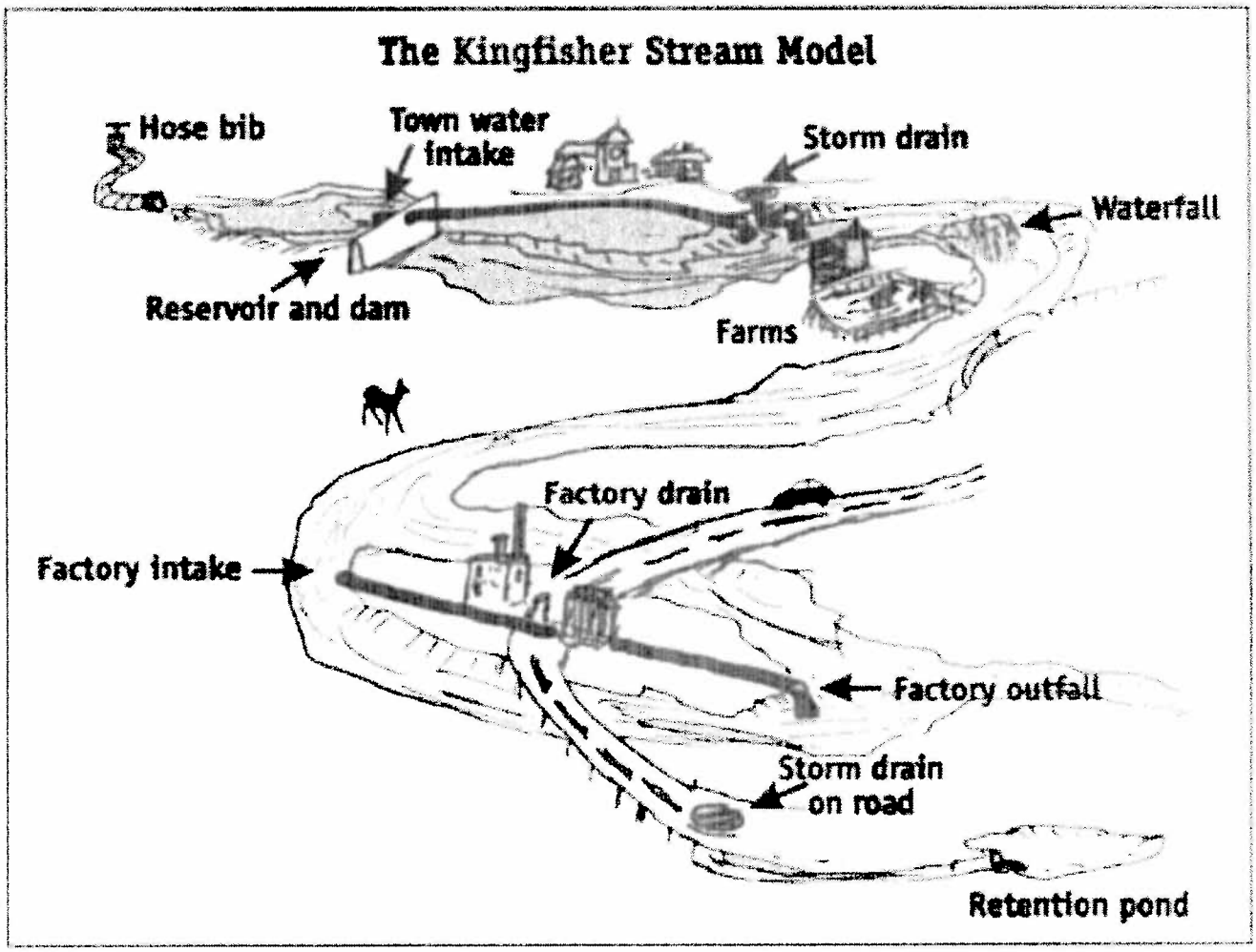
A model dam creates a reservoir that supplies the town's water through a PVC pipe.

The visiting students were instructed to build a village with a bridge, a dam, a farm, a factory, and anything else they would like, along the banks of the model stream. When they had completed their work, after about 30 minutes, the flow was increased so that the miniature stream flooded the toy dams. As the village's bridges, homes, farms, and factories were washed out, the amazed and dismayed students were told, "Floods happen! Now, rebuild the village so that if a flood comes again things won't get washed out."

After being rebuilt, most of the structures in the students' new village withstood the next flood. A lesson in biology was then added as Brookes walked up the little stream with a plastic salmon on the end of a wire. As he walked, he told the story of "Salmon Ella" coming home to lay her eggs, and described the kind of stream bottom and conditions she was searching for after her three-year journey in the Pacific Ocean.

Model enhancements

Over the past ten years the model stream at the Kingfisher Centre has become far more sophisticated. A water intake pipe now flows through a dam to provide water to the toy village. It then runs underground into



the stream to simulate the village's sewer outfall. Other additions to the site include storm drains, a factory with an intake and outfall pipe, a variable-level dam system, and models of wildlife along the stream's wooded edges. A "good farm" has protective fencing to keep livestock out of the stream, while a "bad farm" has pigs and cattle roaming freely. Bags of pebbles are used for riprap, and twigs or Lincoln logs with strings or small chains simulate stream erosion diverters. Baskets made of hardware cloth and filled with gravel serve as gabions for erosion control, stones are used as check dams, and there are trowels for digging ponds near the town and on the farm.

Food coloring is used so that children can trace the flow of contaminants introduced to the system. It can be put into the village's water intake and traced to the sewer outfall. It can be used to trace runoff from roads as it enters storm drains on roadways and goes into the village's storm sewers. And poured down the factory drain, it can be seen coming out of a downstream outflow, forming a plume that is eventually diluted in the stream.

Children are encouraged to discuss and compare the real creeks and streams they have observed and the model stream. They begin to understand that a native stream is a very complex set of communities and wildlife habitats sensitive to water quality, flow rates, and temperature, and that when humans reconfigure a stream, many of these natural values are lost.

Top: Students constructing a town, farm, and factory. Bottom: At a "bad farm" that has no riparian buffer or protective fencing, livestock wander freely into the stream and old cars rust on the bank.

Explorations and experiments

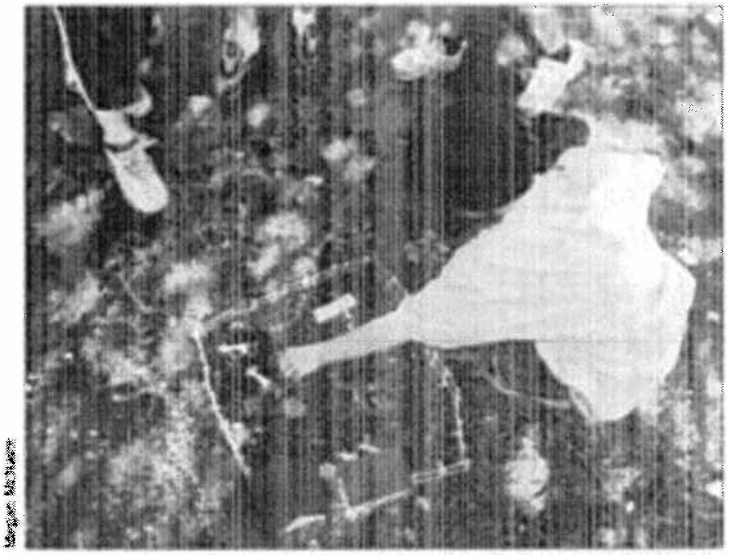
The Kingfisher Model has terrific potential for helping students refine their concepts of streams and of land use in riparian zones along stream floodplains. Students can experiment to discover the best management practices for maintaining or improving water quality and for controlling erosion, flooding, and other watershed problems. They can try to implement management ideas such as detention and retention facilities without destroying the natural functions of the stream or turning it into an urban water conveyance. They can have fun while manipulating the stream with dams and diversions. In doing so, students can also learn about the formation and operation of cut and depositional banks, of deltas, gravel beds, rapids, waterfalls, oxbows, riffles, and pools. They can simulate ponds and examine the connection between the water table and the level of the stream or reservoir above the dam. They can bring in their own toys and objects to use in creating new model stream projects.

Making a model

Models similar to the one at the Kingfisher Center can be built on school grounds, and even in classrooms. Outdoors, an optimal size for a stream model is about 5 to 7 meters long (15 to 20 feet) and about 1 meter (3 feet) wide, with a slope or drop in elevation of about 1 to 1.5 meters (3 to 4 feet). A basic model can be built by simply running a garden hose down an embankment, or by making a

large sloping sandbox bordered by logs, cement parking lot car stops, or donated lumber. Grow cloth or weed fabric placed under the sand stops the sand from migrating and the weeds from growing in the sandbox. For the water supply, use an ordinary garden hose with a hose bib to control the flow. Indoors, a model can be built by laying construction-grade plastic sheeting over a frame of boards and filling the area with sand on a 20-degree pitch. Use your imagination and innovation to adapt building materials, and invite parents to give advice and assistance in constructing the model stream.

The Kingfisher Model has many possibilities for making learning authentic and experiential. It has been used as an interactive stream model with participants ranging from preschoolers who just need exploratory time to graduate students in environmental education who found that the model helped them to conceptualize the workings of larger stream watersheds that they were studying.



A "good farm" has protective fencing to keep livestock out of the stream.

Excited by the Kingfisher Model, many teachers who have attended summer institutes in environmental education at Simon Fraser University in Vancouver are now building model streams on their school grounds using garden hoses and sandboxes. Some have proposed that their towns install a similar model at a local water park so that students can experiment before engaging in studies of actual streams around their communities. At Florida Gulf Coast University in Fort Myers, the Family Resource Center is building an expanded Kingfisher-type model where children ranging in age from six months to five years can "mess about" in a learning mode. The model will include two miniature stream systems and a boardwalk through a forest.

Exploratory play with a model stream cannot replace idle hours spent beside natural local creeks. However, in urban areas where this childhood experience is now nearly extinct, a model can stimulate thinking and nurture the generation of questions and experiments while building children's sense of "streamness." ∞

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The author thanks Neil Brookes and the volunteer staff of the Kingfisher Interpretive Centre Society whose work on the model stream was the inspiration for this article. They can be contacted at: Kingfisher Interpretive Centre Society, 2550 Mabel Lake Road, Enderby, BC V0E 1V5.

Resources

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Project WILD. *Project WILD K-12 Curriculum and Activity Guide*, available to participants in Project WILD workshops. In the U.S., contact Project WILD National Office, 5555 Morningside Drive, Suite 212, Houston, TX 77005 <www.projectwild.org>. In Canada, contact WILD Education, Canadian Wildlife Federation, 350 Michael Cowpland Drive, Kanata, ON K2M 2W1, <www.wildeducation.org>.

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