Splash Tour Notes

Watershed Diorama

TOUR DIRECTIONS: discuss how the water travels into the aquifer, what each section means and relate the locations to the group by using places with which they are familiar. A good technique at this station is to assign one child to a button, and start by pointing to the rain on the hill country button, and continue by following the drop of water through the different zones. This method helps to prevent the “push all the buttons at once” problem, and helps the children understand what they see.

Aquatic Habitats

Habitats from the Hill Country to Matagorda Bay

The Barton Creek watershed is brought to life with a series of aquariums that trace the path of the hydrologic cycle from central Texas to the Gulf of Mexico.

<u>Upper Barton Creek Tank</u>

In the first aquarium, rain falling on the upper reaches of Barton Creek flows over riffles and through pools filled with darters, and then down into a sinkhole as it reaches the recharge zone of the Edwards Aquifer.

Species: Green-throated darter *Etheostoma lepidum*
Mosquito Fish *Gambusia affinis*

<u>Springs Tank</u>

The next aquarium depicts a spring outlet similar to those in Barton Springs pool that together discharge an average of 30 to 50 million gallons of fresh water per day from the aquifer into lower Barton Creek. In cooperation with the U.S. Fish and Wildlife Service and with the support of the Texas Parks and Wildlife Department, this tank features a refuge population of endangered Barton Springs salamanders.

Species: Barton Springs Salamander *Eurycea sosorum*

<u>Lower Barton Creek Tank</u>

Water from the springs flows into the next habitat, which exhibits the fauna and flora of lower Barton Creek. Because it receives cool, constant temperature water from the spring year-round, this section of Barton Creek, is home to unique aquatic ecosystem.

Species: Bluegill *Lepomis macrochirus*
Mexican Tetra *Asyanax mexicanus*

<u>Town Lake Tank</u>

In the following aquarium, lower Barton Creek appears to empty into the Austin’s Town Lake, which is a dammed reservoir on the Colorado River that is home to native species of catfish, bass, and other aquatic species.

Species: Spotted Gar *Lepisosteus oculatus*
Redbreast Sunfish *Lepomis auritus*

A mural along the wall depicts the flow of the Colorado River from Austin towards the Gulf of Mexico. The exhibit culminates with a diorama of Matagorda Bay that illustrates how moisture from the Gulf evaporates into the atmosphere and then returns to central Texas as rain.

TOUR DIRECTIONS: Discuss the change in habitat from upper Barton Creek to the Colorado River. This is good area to talk about how habitats and therefore flora and fauna can vary even along the same creek, and relate the different habitats to the different sections of the aquifer i.e. contributing, recharge and confining. This is also a good place to talk about the water cycle starting with rain in the hill country to evaporation and condensation over the Gulf of Mexico.

Non-point Source Pollution Tubes

This exhibit focuses on the effects of non-point source pollution on the quality of our region's water supply. Four large, clear tubes filled with water convey working definitions of some of the terms we use to describe water quality. The differences between clean water, toxic water, eutrophic, or water with algae blooms, and turbid, or water with suspended sediments are emphasized by the presence of pollution-related artifacts within the tubes.

Background Information
Non-point source pollution is the term used to describe many small, individual instances of water pollution that cannot be easily traced to a single point. Some examples of non-point are 1) toxicity from urban development-oil and grease from parking lots, leaky petroleum storage tanks, pesticides, cleaning solvents, and other toxic chemicals can contaminate our creeks and kill natural aquatic organisms.

TOUR DIRECTIONS: Before discussing anything, encourage the group to tell you what they see in the tubes. This is also a good place to gather the group together, and go over the rules for the rest of the exhibit. Since it is hands-on and interactive, encourage touching and thinking. Try not to explain everything first. Let the group experiment, and then highlight different activities and make suggestions.

Real Time Aquifer Water Quality Data and Weather Station

Actual real-time readings of the quantity of the aquifer water flowing into Barton Springs Pool, as well as local weather conditions, are displayed on monitors overhead as you enter the Water Science section of the Splash exhibit. An electronic probe fitted with special sensors transmits data from a flow gauge in Barton Creek to USGS, and on to the monitor. The data displayed in the exhibit is the amount of current flow as cubic feet per second, compared to the historic average flow for that time period. Weather data, such as rainfall, air temperature, humidity, and wind speed, is taken directly from sensors atop a pole in Barton Springs Pool, and then displayed in the exhibit.

TOUR DIRECTIONS: Since these monitors are small and in a busy area, it may be better to go over them with a few students at a time. Discussion about the meaning of the different readings should be encouraged. This stop is a good place to emphasize the importance of weather to water quality.

Water Quality Hands-On Exhibits

Spectrophotometer Water Tester

This exhibit demonstrates how scientists use a spectrophotometer to measure the levels of dissolved contaminants in our water. A map of the greater Austin area displays 24 lighted button switches that represent sampling sites along many of our local creeks. By pushing any one of the buttons on the map, the visitor can initiate a simulated testing sequence of the water quality for that particular site. A large clear tube, representing a spectrophotometer cuvette, fills with water and then shines brightly when illuminated by dazzling lights of different wavelengths. Overhead, a computer monitor describes various aspects of spectrophotometric testing, and then displays actual results for that sampling site from tests conducted at City of Austin and LCRA water quality laboratories. In this way, the visitor sees that we can use light to test the water for things that we can't see with our eyes alone. By sampling the water quality at different sites around Austin we can observe how the quality of the water in our creeks varies in urbanized and rural areas.

Background Information

A spectrophotometer measure the number of molecules of a specific chemical in a sample of water by illuminating the water with light that is tuned to a single wavelength that is efficiently absorbed by those molecules. By subtracting the amount of light that is absorbed from the total amount of light that the sample is illuminated with, an estimation is made of the number of molecules of that particular chemical in the water sample. Water is a lot more than just H2O; many different chemicals occur naturally in water, while others are present due to human activity.

Nitrogen and phosphorous are important nutrients for the water plants and algae that form the base of aquatic food webs. Although they are naturally found at low levels in most natural waters, excessive levels of N and P can cause algae blooms and encourage eutrophication. Minerals such as calcium, magnesium and sodium, and metals such as copper, iron and zinc dissolve into the water from limestone and other rocks in the aquifer and in creek beds, as well as from the soil as rain filters through it. If elevated levels of heavy metals such as lead, arsenic, and cadmium are found in surface or ground water, it is usually from a man made source, such as runoff from roadways and urban areas.

TOUR DIRECTIONS: Encourage students to sample creeks from different land use areas and compare the results.

Aquifer Mini-Submarine Activity Station

Visitors are invited to navigate a virtual submarine through the underground channels of an aquifer to track down the source of bacterial contamination in the watershed. A vast network of water-filled caves, typical of a karst aquifer environment, is simulated in a multimedia kiosk using high resolution computer animations. The kiosk has a joystick controller for steering though the animated subterranean passages, and has other controls to convey the feeling of operating an underwater laboratory ship. When the operator comes to branching waterways, they are prompted to take a water sample to trace the bacteria. When the Mini-Sub operator passes under a sinkhole, he or she will be able to extend a virtual periscope to scan the surface for pollution-causing events that may be occurring above ground.

Background Information

Bacteria are essential for the healthy functioning of our aquatic ecosystems. They decompose the organic matter from dead animals and plants so that minerals and nutrients can be taken up by other organisms in a new cycle of life. They also break down toxic waste products, such as ammonia, from animals into simpler molecules, such as nitrates, that can be safely consumed by other organisms.

One of the bacterial microbes that are carried out of our bodies and into the sewage systems is fecal coliform. If there are elevated levels of fecal coliform bacteria in our creeks, it might indicate that a nearby sewer pipe may be leaking or a septic tank may be malfunctioning. Fecal coliform also comes from other mammals besides humans. High concentrations of livestock in feedlots, or parks that are littered with excessive amounts of dog feces can generate high levels of fecal coliform as well. Fecal coliform bacteria are harmless to humans, but their presence can indicate the likely presence of other bacteria, viruses, fungi, or parasites that can cause human diseases.

Water is tested for fecal coliform bacteria by taking a known amount of water and filtering it through a thin paper pad. The pad is placed into a petri dish with growth media that provides food for the bacteria, and then the Petri dish is placed into an incubator at 44 degrees Celsius for 24 hours. During this time any fecal coliform bacteria present will take advantage of these ideal growth conditions and multiply in a process called binary fission. After 24 hours, individual bacteria on the filter paper will have multiplied into colonies that can be seen as spots on the paper with very little magnification. If an average of more than 200 colonies from a sample of 100 ml of water is counted, the water is considered to be unsafe for swimming.

TOUR DIRECTIONS: This area is self-explanatory. Encourage the students to be gentle with the joystick, and complete the activity before moving on.

Bug Inspector
Biomonitoring Activity Station

The use of small invertebrates as indicators of creek water quality is explored in the Biomonitoring Activity Station. A display case with a magnifying glass on a rolling track houses several small animal specimens such as mayflies, dragonflies, or worms. The students are invited to examine the specimens closely and identify them by using the key on the touch screen computer. Included in the interactive presentation is information on what kind of water quality is indicated by each particular species.

Background Information
In an urbanized watershed, there may be a wide variety of contaminants that can disrupt natural aquatic ecosystems. Testing for each contaminant by using a spectrophotometer or other laboratory equipment can be time-consuming and expensive, especially when many sites within a watershed require regular monitoring. To address this concern, the City of Austin has been refining a system called Rapid Biological Assessment, or simply, biomonitoring, to detect where contaminants might be present in an aquatic ecosystem. This method, instead of relying mainly on chemical analyses, examines the numbers and kinds of organisms that are present at different points along a creek. Certain types of water animals, known as macroinvertebrates, as well as algae such as diatoms, are collected regularly at designated sampling sites. Because some aquatic species are very sensitive to pollution, while others are more tolerant, noticeable declines or increases in specific aquatic species can alert a biologist to a possible source of nearby pollution. The biologist can then take a water sample from the site to the laboratory for more rigorous analysis to identify exactly what specific contaminants may be causing the shift in aquatic species composition.

TOUR DIRECTIONS: Direct the student to follow the directions on the screen, and look closely at the animals.

Barton Springs CD-ROM Kiosk

This station features a multimedia kiosk that provides visitors a chance to play with the "Barton Springs Interactive" CD-ROM. The CD provides an in depth look at Barton Springs from a cultural perspective. Historical photos and anecdotes, along with interviews with longtime swimmers and other patrons of the Springs will show how this 1000 foot-long spring-fed pool in the heart of the city has become one of our community's most treasured natural resources. The CD-ROM was produced by Texas Environmental Center, and can be purchased online.

TOUR DIRECTIONS: Encourage students to sit and explore the CD-ROM.

Aquifer Periscope

This station features a large copper periscope that has a viewer for the student to look into and watch underwater footage.

TOUR DIRECTIONS: This is an individual activity. Encourage taking turns. Please don't allow the students to hang on the periscope.

Find Your School in the Watershed

The City of Austin lies at the confluence of many creeks that drain into the Colorado River, which runs through the center of town. By using the Find Your School in the Watershed activity station, visitors to the Splash exhibit are able to identify which watershed they inhabit. A large 31-inch monitor displays a map of the greater Austin area divided by school districts. Clicking on any of the districts will bring up a map of the area with the school locations marked. When the student clicks on their school, another map appears that shows the boundaries of the watershed that the school ides within.

TOUR DIRECTIONS: It is interesting to find your watershed then go to the spectrophotometer and find out what the water is like where you live.

Pollution Prevention Pond

In the Austin area, water quality ponds are widely used for the mitigation of non-point source pollution. Although they are becoming a common sight in community parking lots, many area residents may not understand what they are and how they work. This station features a neighborhood model with houses and streets and figures producing non-point pollution. Pushing the button causes rain to land on house roofs and run down the driveways, across the street and into the settling pond. After a short time, the water moves off into the creek.

Background Information
Structural controls, generally, are of two types – ponds which hold run off for short periods of time in order to control peak flow rates (flood detention ponds) and those which hold water for longer periods of time for water quality treatment (water quality ponds). Often a site will have both types of ponds. A flood detention pond usually is a large basin into which storm water from a parking lot, roadway, rooftops, and other areas of impervious cover flows when it rains. The storm water collects in the pond and then is released slowly into the storm water drainage system and eventually flows into the local stream. Because the water released into the creek has been detained until the heaviest rainfall has passed, peak flows are decreased and damage to stream banks from erosion is reduced. A water quality pond is designed to collect and hold run-off for longer periods of time in order to remove pollutants. There are many different methods in use such as a

sand filtration or newer “wet pond” designs, which utilizes a permanent pool of water and aquatic plants as the treatment mechanism.
TOUR DIRECTIONS: Remind students to take turns.

Storm water Run Off Simulator

The storm water simulator station demonstrates how high levels of impervious cover can change the way rainfall run-off flows through a watershed. Two watershed models are presented side by side: the one on the left is a natural landscape, while the one on the right is an urbanized area with many parking lots, streets, rooftops, etc. Above each watershed, equal amounts of “rain” will be suspended in cloud-like reservoirs. Under the student’s command, the rain falls first on the natural watershed, and then on the highly developed one. “A flow meter in each of the creek channels graphs the pattern of discharge as the run-off flows through each watershed. The flow meters then send their readings to a computer equipped with LabVIEW software from National Instruments. Overhead, the computer’s monitor presents a multimedia display of overlapping graphs of the speed and duration of the flow of water through the two watersheds in order to help the student see how higher levels of impervious cover can alter a creek’s natural appearance and its capacity to support native wildlife.

Background Information:
When we build our homes, work places, and play areas within a watershed, we inevitably affect the way water flows through that watershed. In natural areas, rain water normally seeps into the ground then slowly flows through soil to the nearest creek. The flow of water that is held in the soil and slowly released is called base flow. Storm flow occurs when the soil is saturated and can no longer absorb additional rainfall. During storm flows, the water flows swiftly on top of the soil towards the creek instead of through the soil. When we cover the natural landscape with roads, buildings, and parking lots, the rain runs rapidly off of these impervious surfaces and into storm drains that often empty directly into a nearby creek, rather than soaking into the soil. Accordingly, increases in impervious cover can increase the frequency and intensity of storm flows in a watershed. Also, because the rain cannot reach the soil beneath the impervious cover to seep slowly towards the creek, the amount of base flow is reduced. Research by civil engineers, biologists and hydrologists has shown that when 10-15% of a watershed is covered by impervious surfaces, the natural functioning of its aquatic ecosystem may begin to degrade. The faster flowing water that comes off of the developed areas with higher impervious cover levels can increase the rate of erosion and flooding in the creek downstream, and disrupt the habitats of animals and plants that live there. In addition, runoff from streets and parking lots may contain levels of petroleum hydrocarbons (oil and grease) and other toxic materials that are harmful to aquatic life. In many of the urban watersheds studied so far, high impervious cover levels have led to losses of the natural pool and riffle structure of the creeks, to a significant widening and deepening of each creek’s channel, and to a dramatic decline in the diversity of native aquatic wildlife. Community planners try to balance the man-made and natural environments to arrive at a level of impervious cover that the watershed can handle without compromising the quality of the water, without creating erosion and flooding problems downstream.

Exhibit ends at bubble doors.

Conservation and preservation of the Barton Springs/ Edwards Aquifer
Pollution Discussion Information

For thousands of years, the springs of the Edwards Aquifer have provided the peoples of Texas with clean fresh water. The introduction of the Aeromoter windmill to Texas in the 19th century, as well as later improvements in water well technology and irrigation, facilitated the growth of farms, ranches and towns up and down the Edwards Aquifer region, from Belton to Uvalde.

In our portion of the Edwards Aquifer- the Barton Springs segment- 41,000 people live in areas that have no other source but the aquifer for drinking water. The Austin area's growth in the last decade has begun to strain the region's water supplies. Since 1985, the number of people living over the contributing, recharge, and artesian zones of the Barton Springs Edwards Aquifer has more than doubled. Using ground water supplies to meet demands form future growth will require careful planning and cooperation from all of the members of the community who have a stake in the continued health of the aquifer and Barton Springs.

Barton Springs is a tremendous natural and cultural resource for the people of central Texas. It is one of Austin's main tourist attractions, second only to the state capitol. Each year, over 300,000 people pass through its gates to enjoy the pools cool, fresh water, where they can swim alongside fish and explore a native aquatic ecosystem. But if too many wells are drilled into the aquifer and more and more water is pumped out for human use, the flow at Barton Springs could be reduced to the point where swimming there is no longer feasible. Also, expanding areas of urban development in the contributing and recharge zones of the Barton Springs Edwards Aquifer may threaten groundwater supplies and Barton Springs Pool with non-point source pollution. Although the overall health of the aquifer is currently excellent, scientists have already begun to detect races and, on rare occasions, unsafe levels of man-made chemicals or heavy metals in water wells. If continued urban development in the contributing and recharge zones causes significant declines in water quality in the creeks that replenish the aquifer, non-point source pollution might one day make Barton Springs unsafe for swimmers and cause the loss of the aquifer as a source of clean, safe drinking water.