GLOBAL VERSION / MODULE 6

DROPS OF KNOWLEDGE FOR RIVERS OF CHANGE

GLOBAL TEACHING AND LEARNING MATERIAL

A hands-on guide to teaching
and learning about
water, sanitation, hygiene,
and the environment

SWAROVSKI
WATERSCHOOL

BACKGROUND INFORMATION

Water is not only a product we buy or sell. Like the air we breathe, it is a natural resource that is essential for life. Because water is an element we share with our families, our communities, and every living thing on Earth, respect for all others is very important to consider when using water.

DID YOU KNOW? Globally, 90% of power generation is "water intense," requiring large quantities of water to produce energy. By 2030, energy consumption will increase by 50 %. [1]

Already, the increased severity of droughts, heat waves, and local water scarcity has interrupted electricity generation, with serious economic consequences. At the same time, constraints on available energy have limited the delivery of water. [2]

SOURCE: **(1)** Water for Life, International Decade for Action, "Water and Energy," United Nations Department of Economic and Social Affairs and UN Water, 2015, www.un.org/waterforlifedecade/water_and_energy.shtml.

(2) UNESCO, et al., United Nations World Water Development Report 2015: Water for a Sustainable World, Paris: United Nations Educational, Scientific and Cultural Organization, 2015. Available at: www.unwater.org/publications/publications-detail/en/c/281166, p. 56.

Just as we may be challenged by our neighbors' use of water, our neighbors are impacted by our actions. We share water with those who live both near and far from us. The same is true for trees and plants and animals of all kinds: we all share the same rainwater, surface water, and groundwater.

The same river can run by houses and through communities, countries, and continents—carrying everything that was left behind for many months (upstream and downstream)—until it finds a bigger body of water, which could be another river, a lake, a sea, or an ocean. If the community close to the river does not have a good water treatment system, all the other communities along the way will be affected and can face severe consequences.

Water is considered sacred in many religions, and many cultures have legends related to water. Sometimes water is the most prominent element in a community's life. In other cases, people do not realize the importance of having clean water to drink, or recognize how their water use is directly connected to other people and the environment. Many communities around the world rely on water to survive, not only to drink, but also to provide food and transportation. Also, this precious element can generate energy for the entire community.

"Shared waters" governance is one way to reduce risks of poor water use and to distribute the benefits of water equitably. In some countries, watershed committees include every person or institution involved with a specific body of water. As they all share the same water, they all come together to discuss the impacts and the potential for managing this resource. After identifying and reaching out to the stakeholders in a particular area, the watershed committees discuss crucial issues, work to develop the best possible solutions, and then take action to preserve water quality and correct water-related problems.

MODULE 6

"I understood how water is closely related to trees and air and consequently us. It helped me become more conscious of how my actions are not just limited to immediate consequences. It affects a variety of things."

— STUDENT, SWAROVSKI WATERSCHOOL INDIA

THEMATIC CONCEPTS

Shared waters – A cooperative approach to advance peace, secure environmental protection, and enhance better water management to promote sustainable development in communities worldwide.[27]

Hydropower – Hydropower refers to harnessing the energy of water to generate electricity, and is used to supply about 20% of the world's electricity.[28] Small hydropower development can be very effective for many communities. Larger hydropower dams, however, can potentially cause negative social and environmental impacts.[29]

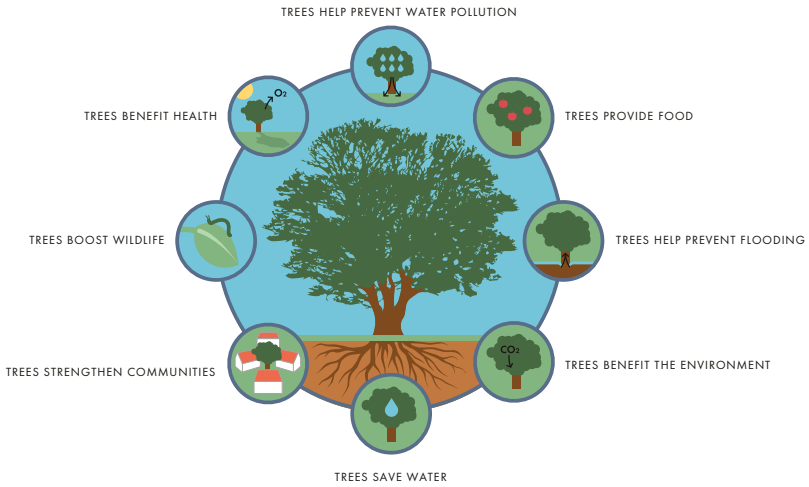
Upstream and downstream – Because most rivers cross community boundaries, cooperation is necessary to share the water resources of a trans-boundary river basin between upstream and downstream users with different and sometimes conflicting needs, claims, and cultures.[30]

Energy and water – Producing all sources of energy, including electricity, requires water in various processes, including the extraction of raw materials, cooling and cleaning, cultivation of crops for biofuels, and powering turbines. In turn, energy is required to make water resources available for humans to use, for example, for pumping, transportation, treatment, or desalination.[31]

27 UNDP Water Governance Facility, "Shared Waters Partnership," www.watergovernance.org/sharedwaters. **28** World Water Assessment Programme, "Facts and Figures," UNESCO, www.unesco.org/new/en/natural-sciences/environment/water/wwap/facts-and-figures/all-facts-wwdr3/fact-6-hydropower. **29** International Rivers, "Environmental Impacts of Dams," www.internationalrivers.org/environmental-impacts-of-dams. **30** UN Water, "What is Water Cooperation?," 2013, www.unwater.org/water-cooperation-2013/water-cooperation/water-cooperation/en/. **31** UN Water, "Water and Energy," United Nations Department of Economic and Social Affairs, www.un.org/waterforlifedecade/water_and_energy.shtml.

ACTIVITY 6.1: WATER AND TREES

This activity has two parts. Part 1 is the script for a role-play on how it would feel to be a tree, moving and growing in response to and in harmony with your neighbor. Part 2 involves the students in preparing a nursery and planting trees. For this part of the activity, all the tools and materials should be at hand, and teachers are encouraged to prepare integrated lessons using the tree nursery as an outdoor laboratory. Apart from the practical tree-growing activities, such as seedbed and pot preparation, sowing and planting seedlings, and watering and transplanting, you might also consider ways for the students to monitor and keep records of the process.



Source: https://www.treepeople.org/resources/tree-benefits

Before planting the trees, help the students learn about growing trees in your region, with consideration for what tree species you will want to plant. Consider what benefits the trees could bring to your community. How will they affect the soil where you are planting? Can these trees survive and thrive in the local climate conditions?

Time: 50 minutes / **Thematic Areas:** Science, Mathematics, Social Studies, Environmental Education / **Goal for Learning:** Understand and see each tree as a member of the community that provides shade, cleans the air, preserves soil quality, and is home to many forms of life.

Materials: ☐ Tree seeds or saplings / ☐ Shovel / ☐ Water

ACTIVITY STEPS:

PART 1: "Be a tree" role-play. Read the text below as you lead the students in this role-play.

1. Trees, like people, are the connection between sun and water and soil ... we both need to reach for the sun ... Can everybody reach up toward the sun like a tree waving its leaves around? [Encourage students to make a big stretch.] ... Oops, did you bump into the person next to you? What happens when trees bump into each other? Sometimes they hug ... sometimes they turn and stretch out the other way. Try this out with the people standing around you.

2. Now, grow roots ... How would it feel to be rooted into the ground where you are standing? Put your feet together tight and straighten up ... you might be a little wobbly ... What if we spread out our roots? (Move your feet apart as if they were roots.)

3. Pretend you have a small tree that is about to be planted. Look at it before we put it in the ground. Now, we know about the roots growing into the soil and the branches stretching out to the sun. (Ask the participants what all of this has to do with water.)

4. Trees hold water ... they distribute it into the ground and into the atmosphere ... and they also help to keep it clean ... these roots connect us through the water to every other person and every other tree in the world ... they are acting locally, with global results.

MODULE 6

5. There are 2.2 billion kids under the age of 18 on Earth today, and if everyone plants a tree, that will be a lot of trees! Each tree that we plant today is part of this community of girls and boys around the world who believe in peace and happiness for everybody, everything, and every drop of water on Earth.

PART 2: "Planting the trees

1. Trees, like people, are the connection between sun and water and soil ... we both need to reach for the sun ... Can everybody reach up toward the sun like a tree waving its leaves around? [Encourage students to make a big stretch.] ... Oops, did you bump into the person next to you? What happens when trees bump into each other? Sometimes they hug ... sometimes they turn and stretch out the other way. Try this out with the people standing around you.

2. Prepare the site. Young seedlings will grow best if they are in healthy, well-draining soil, and in a 50% shaded area, away from burning sun and protected from strong winds, rainwater runoff, and nibbling animals.

3. Obtain seeds or seedlings. Seeds can be collected from "parent trees" or bought if there are no good local seed sources for a particular species. When buying seeds, it is important to ask the supplier about the requirements for storage and pretreatment methods. As an alternative to planting seeds, cuttings can be used to produce new trees.

4. Prepare the seedbeds or pots. In wetter areas, it is best to use seedbeds: the seedbeds should be prepared and the seeds sown and kept moist. When they are large enough, they should be transplanted to a transplant bed. For drier areas, the method for potted seedlings is best: the pots or containers should first be prepared, and the seeds sown and kept moist. The pots should be moved every two weeks to prevent taproots from growing out of the pots.

5. Prepare an action plan. Work together to decide who will do what and when for the upcoming weeks' nursery activities. The calendar of activities should consider the seedlings' growth cycle so that planting and caring for

the young trees fits within the school term. If needed, volunteer helpers could be mobilized to cover holidays and months when school is not in session.

6 Before planting, ask each student to hold her or his tree. Ask students to close their eyes for a moment, and feel themselves as part of the tree and the tree as part of them.

7 Put the trees into the ground. Protect the saplings with soil and let each child pour a small cup of water to nourish the trees.

OBSERVATION AND DISCUSSION:

Ask students to reflect on the activity and share their experiences with the group. Prompt discussion by asking if anyone knows why trees are so important as our partners for life on Earth.

Ask if anyone feels a personal connection with a tree, and encourage students to share stories about these connections.

ADDITIONAL RESOURCES:

Gizmos, "Photosynthesis Lab," Charlottesville, Virginia: ExploreLearning, www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=395

Ketcham, Sandra, "Teaching Photosynthesis," LoveToKnow, http://home-school.lovetoknow.com/Teaching_Photosynthesis

Pearson Education, "Photosynthesis Worksheet," 2007. Available at: www.teachervision.com/photosynthesis/printable/52371.html

SWAROVSKI WATER TREATMENT, AUSTRIA WATTENS

CASE STUDY: SWAROVSKI'S WATER TREATMENT IN WATTENS, AUSTRIA

Efficient and sustainable use of water and energy, one of Swarovski's fundamental principles, is seen in a number of its initiatives, and the company is continuously working to reduce its water consumption and optimize its water treatment and recycling facilities.

In Wattens, Swarovski has implemented an extensive wastewater treatment program that includes a "closed-loop" system. Complex water treatment facilities have been set up to process the water that has been used for grinding, polishing, and other processes. Up to 98% of the grinding water remains in the production circuit, while up to 95% of the polishing water is retrieved and recirculated into the production circuit. An operational wastewater treatment plant handles the remaining 2% and 5%, respectively, of the grinding and polishing water. After municipal water treatment is completed, clean water is returned to the Inn River.

Swarovski also runs several small hydropower plants that generate electricity from local rivers. The heat produced by the turbines is then used to heat water for domestic and industrial purposes. Today, the company produces more than 16% of its energy requirements at Wattens through hydropower produced on-site. In addition, in its Männedorf office in Switzerland, water from Lake Zurich is used to heat and cool the building, as required.

ACTIVITY 6.2: INTRODUCTION TO WATER AND ENERGY – CREATING A WATERWHEEL

"Energy" is defined as the capacity for doing work or "usable power," such as heat and electricity, and also refers to the resources for producing such power. As explained by UN Water, "Water and energy are closely interconnected and highly interdependent. Choices made and actions taken in one domain can greatly affect the other, positively or negatively. Trade-offs need to be managed to limit negative impacts and foster opportunities for synergy." [32]

Because water has a high density, pumping and flow require a lot of energy. [33] In natural systems, water travels from a source at a higher elevation (such as a waterfall) to another location due to gravity, which works in "partnership" with air pressure to move the water with relatively low energy expenditure.

There are two kinds of energy: stored (potential) energy and working (kinetic) energy. In many types of energy generation, large amounts of water are used for cooling and to obtain raw materials such as coal or uranium. Hydropower is a clean, renewable, and reliable energy source that converts kinetic energy from falling water into electricity, without requiring that more water be used to power the system.

In this activity, students will build a miniature waterwheel to show how electricity can be made – leading to a discussion of how water is provided to people, the energy it takes to supply water, and ways to produce energy with water.

Time: 50 minutes / **Thematic Areas:** Science, Social Studies / **Goal for Learning:** Provide knowledge on how water generates energy.

Materials: ☐ 8 small plastic spoons, thin, straight stick, or Popsicle sticks / ☐ A large ball (Styrofoam or organic material of similar round shape, i.e.: orange, apple) / ☐ A 45-centimeter (18-inch) wooden dowel or skewer / ☐ Tape or Glue / ☐ Two 2.5-centimeter (1-inch) pieces of plastic drinking straw / ☐ A sink

32 UN Water, The United Nations World Water Development Report 2014: Water and Energy, Vol. 1, Paris: UNESCO, 2014, p. 9. Available at: www.unwater.org/wwd14/home/en. **33** Ibid., p. 24.

MODULE 6

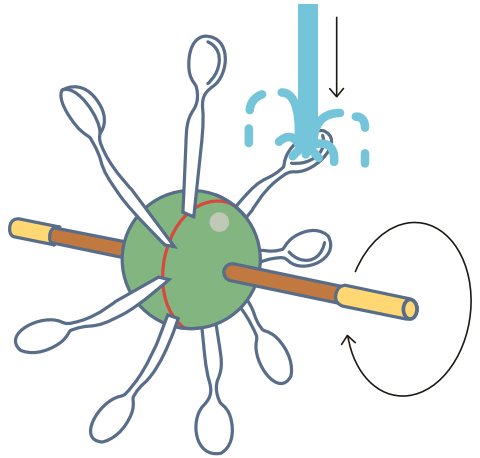
ACTIVITY STEPS:

1. Draw a line around the diameter of the ball, then push spoons into the line, like spokes on a bicycle wheel. The bowls of the spoons should all be facing in the same direction in a line around the middle of the ball. They will represent the blades of the waterwheel.

2. Insert the wooden dowel all the way through the center of the ball and out the other end so that there is an equal amount of dowel on either side of the ball: this is the axle. Tape or glue the axle in place. You have made a waterwheel!

3. Slide a piece of the straw onto each end of the axle. Hold the waterwheel by the straws so that you can see the inside of the bowls of the spoons. Blow on these blades. The blades will catch the wind and turn the wheel.

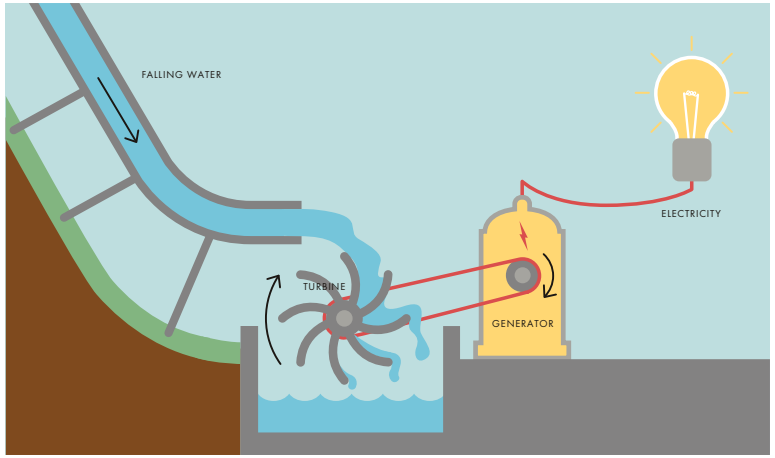
4. Hold your waterwheel by the straws on both ends under running tap water in your sink to see how water moves the blades.



OBSERVATION AND DISCUSSION:

What is the energy source for the waterwheel? How does it work? Discuss how the movement of the water is influenced by the experiment and how it generates energy.

If possible in your area, schedule a class trip to a modern hydropower station, or visit a historic waterwheel that shows how water was used to generate energy in earlier times.



Source: http://water.usgs.gov/edu/hyhowworks.html

ADDITIONAL RESOURCES:

eSchoolToday, "Renewable Energy Sources: Water Power," http://www.eschooltoday.com/energy/renewable-energy/hydro-energy

Hansen, Roger D., "Water Wheels," www.waterhistory.org/histories/waterwheels

TVA Kids, "About Dams," Tennessee Valley Authority, www.tvakids.com/river/aboutdams.htm

U.S. Energy Information Administration, "Energy Kids: Hydropower," Washington, DC: U.S. Department of Energy, www.eia.gov/kids/energy.cfm?page=hydropower_home-basics

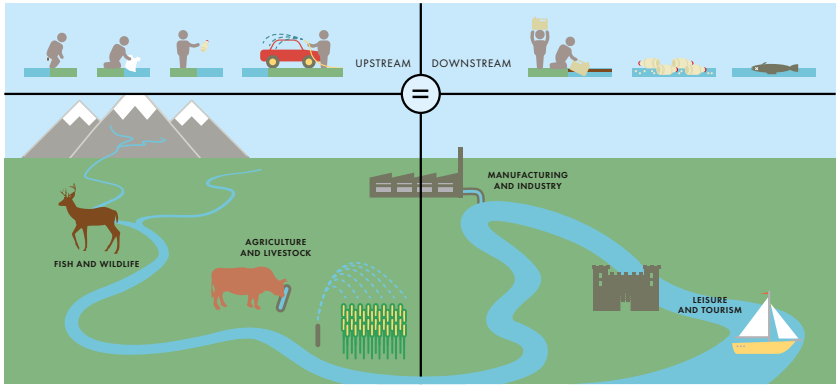
MODULE 6

"Student representatives gave a report on campus, introducing all aspects of what they saw, heard and felt on their expedition to the Han River. Through sharing their experiences, they called on all students to take action in saving water resources and protecting local rivers. One student wrote in his diary, 'If only all people living on the river banks were to take action, those living downstream would have access to clean water."

— SWAROVSKI WATERSCHOOL CHINA STUDENTS AT DAXING ROAD PRIMARY SCHOOL, AFTER THE INVESTIGATION OF THE HAN RIVER

ACTIVITY 6.3: THE WATERSHED

A watershed can be defined as "the area of land where all of the water that is under it or drains off of it goes into the same place. ... Watersheds come in all shapes and sizes. They cross county, state, and national boundaries." The source of the water is always at a higher elevation, or "upstream," and by the force of gravity and the force of the flowing water itself, the water travels "downstream" to a lower level. The destination of this water could be a river, a river system, a pond, a lake, or an ocean.



Source: https://www.epa.gov/cleanwaterrule/why-clean-water-rules

As the water runs from one place to another, it collects debris from the surface and absorbs chemicals or waste products that have been dumped into the watershed by humans, as well as minerals and other elements that occur naturally. In this activity, students will be "building" a river and tributaries made by people holding hands and illustrating how rain and dirty water travel from upstream to downstream in a watershed. This will help students feel and understand the connectedness between all the communities in a watershed.

To carry out this activity, you will need a larger group, with enough students to form three lines, and a space that is big enough to accommodate the formation. The materials to be passed along the lines can be adapted according to local availability and will represent living things such as fish and plants (beans), pollution (paper), and debris (flower petals). Recycled shopping bags or grocery bags can be used to hold the materials.

MODULE 6

Time: 50 minutes / **Thematic Areas:** Science, Social Studies / **Goal for Learning:** Show how all communities in a watershed are interconnected through the water.

Materials: ☐ 1 paper bag filled with beans / ☐ 1 paper bag filled with small pieces of paper / ☐ 1 paper bag filled with flower petals / ☐ 1 large bucket / ☐ 3 sturdy chairs or footstools

ACTIVITY STEPS:

1. The goal is to organize students into three lines: one that represents a major river or waterway, and two others that represent smaller streams or tributaries that flow into the larger waterway.

2. Ask three students to be the materials carriers, giving one of the bags to each of them. Explain that the beans are like natural materials that flow into and down the river, such as living things (fish and plants) and gravel, while the paper represents pollution, and the flower petals represent waste debris.

3. Form a group of students into one large line, at least two students wide. This line represents the river or waterway. The student at the beginning of the line will stand on a chair or footstool to represent the elevated water source in the mountains or hills.

4. Form the rest of the students into two smaller lines (one student wide) to represent tributaries, or streams feeding into the river. These two tributaries should connect to the river at different places on either side, and the student who is farthest away from the main river should stand on a chair or footstool to show that the water is flowing downward toward the main river.

5. Place the empty bucket at the feet of the last two students in the "main river" line. This represents the water basin (the water's destination as it flows downstream).

6. Ask the students to imagine it is raining lightly. Tell the group that when there is a light rain, they should pass the beans, paper, and flower petals slowly

down the stream. The students holding the bags will move around to the students at the beginning of the lines, where the student on the chair will grab a handful of material to be passed from student to student along the tributaries and the river, then dropped into the bucket at the end.

7 Next, ask the students to imagine that it is raining very hard and that the beans, paper, and flower petals are all moving at a very rapid pace.

8 In the end, demonstrate how the bucket, which represents the watershed basin, is full of beans, paper, and flower petals. It may even be overflowing because so much material entered the water rapidly during the "heavy rain" part of the exercise.

OBSERVATION AND DISCUSSION:

Discuss how what happened to the bucket might happen with the basin of a river. Ask students to think about the small streams or other waterways that flow through their communities and gather waste materials on a rainy day. Have they considered the connection between local waste materials and the way they end up in a river, lake, or ocean?

Inform students that water always moves downward due to the force of gravity. Gravity is an invisible force on Earth that holds everything and everybody to the planet. If you jump up, you must come down ... ask them to try it. To this day, scientists do not know why gravity works, just that it does exist and that it is constant across the globe.

ADDITIONAL RESOURCES:

Children's Water Education Council, "Teacher's Notes: Down the Hill – Your Watershed" and "The Rain Recipe." Available at: www.cwec.ca/Educ_Teachers

National Geographic, "Mapping the World's Watersheds," http://education.nationalgeographic.com/education/activity/mapping-watersheds/?ar_a=1

Project Wet: Water Education for Teachers, www.projectwet.org

WATERSCHOOL ACTIVITY, SWS INDIA

CASE STUDY: GRAVITY FLOW SCHEME, SWAROVSKI WATERSCHOOL UGANDA

"Being here is a humbling feeling. It makes you feel grounded and grateful. It has a positive effect on your mind. You see the basics of life – like water. You think about how you can get it right, how privileged we are at home." –Robert Buchbauer, Member of the Swarovski Waterschool Executive Board

Swarovski Waterschool Uganda celebrated the success of its Banyara Gravity Flow Scheme on August 19, 2012. The scheme succeeds in making clean water available to local communities, in particular, by improving the supply of clean water in schools. Robert Buchbauer, Member of the Executive Board, was in Uganda for the occasion and joined the honorable Prime Minister of Uganda, Amama Mbabazi, other dignitaries, and local people for the official commissioning. While on-site in Uganda, Mr. Buchbauer had the opportunity to experience the entire project in a detailed tour, which allowed him to see the results it is achieving.

Around 15,000 local people benefit from the Gravity Flow Scheme, which includes approximately 43 kilometers (26.7 miles) of pipeline, four reservoir tanks, five break pressure tanks, and 56 tap stands. This system has a huge impact on reducing the amount of time women and children must spend searching for clean water. Instead of

fetching water, children can now go to school, and their parents have more time for employment and to be with their families.

Safe water is also being supplied to local schools, health units, churches, and households. A number of schools have been supplied with water-boiling equipment to purify water, resulting in a significant drop in school absenteeism due to waterborne diseases. This in turn improves literacy and opens up opportunities for a better future for the next generation.

Water, sanitation, and hygiene (WASH) clubs in schools and community-based creative dance and drama help to educate members of the local community and lead by example regarding the importance of using water in a sustainable way. The children become "water ambassadors," sharing their gained knowledge on the responsible and sustainable use of water with their families and communities.

In support of this and other Swarovski Waterschool projects, members of the Swarovski Crystal Society purchase special crystal figurines to make a direct contribution to Swarovski Waterschool programs all over the world.

WATER BOILING FACILITY AT SCHOOL, SWS UGANDA

NEW WATER TAP AT SCHOOL, SWS UGANDA

MODULE 6

WASH CLUB, SWS UGANDA

ACKNOWLEDGMENTS

Swarovski Waterschool gratefully acknowledges the contribution of all partners that have led to the development of this global teaching material.

Art Direction & Design:
Swarovski, Global Corporate Creative Services (Wattens)
Editor:
Catherine Rutgers

SWAROVSKIGROUP.COM