

Advanced Urban Hydrology
Grades 7-12

Enduring Understandings

1. Understand that there are three basic, interconnected paths of water movement in developed areas: from source to tap, from use to treatment and beyond, and from rainfall through stormwater systems and beyond.
2. Understand that urban areas fit into and impact natural water cycling processes, including runoff, recharge, evapotranspiration rates, condensation, and precipitation.
3. Understand the sources, impacts, and mitigation of urban water quality issues, including both point and non-point source pollution and drinking water quality.
4. Understand how urban flooding occurs and how infrastructure mitigates flooding.
5. Understand water-related best management practices for urban residents, including conservation of water resources and reduction of contribution to non-point source pollution.

Enduring Understanding(s)	Concepts	Activities	Arizona Education Standards	Materials Needed
1, 2, 5	A simulation of the movement of water within and between natural and constructed systems. Understanding water's movement on the planet supports water conservation measures.	The Blue Traveler (Discover a Watershed: Watershed Manager)	<p>Language Arts Reading: Strand 1: Concept 4</p> <p>Science Strand 2: Concept 1 Strand 3: Concepts 1 & 2 Strand 5: Concept 1 Strand 6: Concept 1</p> <p>Social Studies 3SS-E7, P4</p>	<p><u>Provided in kit</u> 9 Natural system game boards and explanation cards 9 Natural system station cards 19 natural/constructed system game boards and explanation cards 19 natural/constructed system station cards 19 dice <i>The Water Cycle</i> (Master and Transparency) <i>Water Journey Map, Part I</i> (Master) <i>Water Journey Map, Part II</i> (Master) <i>Water Molecule Movement</i> (Master)</p> <p><u>Provided by school/class</u> One copy per student of: <i>Water Journey Map, Part I</i> <i>Water Journey Map, Part II</i> <i>Water Molecule Movement</i></p>
2, 4	Human impact on regional water cycle.	Southwest Water Cycle Diagram (SPLASH)	<p>Science Strand 3: Concepts 1 & 3 Strand 6: Concepts 1 & 2</p>	<p><u>Provided in kit</u> CD of water sounds <u>Provided by school/class</u></p>

			Social Studies 3SS-E5, E7, P2, P3, P4	Markers Masking tape Poster size pieces of paper
1, 2, 3, 4, 5	Survey sections of watershed near school/neighborhood. Record and report observations. Assess pollution sources. Research local pollution. Present research.	Walking in the Watershed (Stormwater Coalition)	Science Strand 1: Concepts 1, 3, 4 Strand 3: Concepts 1-3 Social Studies 3SS-E7, P2, P3, P4, P5	<u>Provided in kit</u> <i>Stream Walk Survey</i> (Master) <i>Watershed Walk Survey</i> (Master) <u>Provided by school/class</u> Copies: <i>Stream Walk Survey</i> (1 per 3-4 students) <i>Watershed Walk Survey</i> (1 copy per student)
2	Compare and contrast facts about the development, history, and importance of several rivers in the state. Thoroughly research the history and development of one particular river. Describe deltas and their formation.	Biography of a River (Water Environment Federation)	Language Arts Writing: Strand 1: Concepts 1 & 5 Strand 2: Concepts 1-3 Strand 3: Concepts 1 & 6 Science Strand 1: Concepts 1 & 4 Strand 3: Concepts 1 & 3 Strand 4: Concept 3 Strand 6: Concept 2 Social Studies 1SS-E8, P1, P2 3SS-E7, E8, P2, P3, P4, P5	<u>Provided by school/class</u> Resource materials from school or local library, internet, etc.
1, 3	Define wastewater and list components of wastewater. Describe the function of a wastewater treatment plant. Create a wastewater treatment model and use it to clean wastewater. Describe some primary and secondary wastewater treatment methods.	Wastewater Treatment (Water Environment Federation)	Science Strand 3: Concept 1 & 3 Social Studies 3SS-E2, E7, P4	<u>Provided in kit</u> <i>Typical Wastewater Treatment Facility</i> Student Copy Page (Master and Transparency) <i>Typical Wastewater Treatment Facility</i> Teacher Copy Page (Master and Transparency) <i>Municipal Sewer Systems</i> Student Copy Page (Master and Transparency) <u>Provided by school/class</u> One copy per student of: <i>Typical Wastewater Treatment Facility</i> Student Copy Page <i>Municipal Sewer Systems</i> Student Copy Page
1, 2, 3, 4	Recognize that population	Color Me a Watershed	Science	<u>Provided in kit</u>

	<p>growth and settlement cause changes in land use.</p> <p>Analyze how land use variations in a watershed can affect the runoff of water.</p>	(Project WET)	<p>Strand 2: Concepts 1 & 2 Strand 3: Concepts 1-3 Strand 6: Concepts 1-3</p> <p>Social Studies 3SS-E4, E5, E7, E8, P1, P2, P3, P4, P5</p>	<p>8 boxes of colored pencils <i>Area of Land Coverage Chart and Volume of Rain and Volume of Runoff Chart</i> (Master and Transparency) <i>Area of Land Coverage Chart and Volume of Rain and Volume of Runoff Chart</i> (Answer Key and Transparency) <i>Map A, B, C</i> (Masters)</p> <p><u>Provided by school/class</u> One copy per student of: <i>Area of Land Coverage Chart and Volume of Rain and Volume of Runoff Chart</i> <i>Map A</i> <i>Map B</i> <i>Map C</i></p>
1, 2, 3, 4, 5	<p>Sequence water-related occupations involved in transporting water to and from the house. Describe various water resource careers.</p>	Wet-Work Shuffle (Project WET)	<p>Science Strand 2: Concept 1</p> <p>Social Studies 3SS-E2, E7, P4</p>	<p><u>Provided in kit</u> 8 sets of laminated <i>Water Career Cards</i> and <i>Category Cards A Water System</i> (Master and Transparency)</p> <p><u>Provided by school/class</u> Poster sized paper Markers</p>
1, 2	<p>Calculate the costs involved in supplying clean water to consumers and removing wastewater. Recognize that cost and environmental considerations influence the planning and construction of water projects.</p>	The Price is Right (Project WET)	<p>Science Strand 3: Concepts 2 & 3</p> <p>Social Studies 3SS-E7, E8, P3, P4, P5</p>	<p><u>Provided in kit</u> <i>Student Data and Instruction Sheet</i> (Master) <i>Water Development System Map</i> (Master and Transparency) <i>Water Development System Map Answer Key</i> (Master and Transparency) <i>Components of Municipal Water and Wastewater Treatment Systems</i> (Master and Transparency)</p> <p><u>Provided by school/class</u> One copy per student of: <i>Student Data and Instruction Sheet</i> <i>Water Development System Map</i></p>

				<i>Components of Municipal Water and Wastewater Treatment Systems (optional)</i>
3, 5	Analyze data to trace the flow of contaminants in ground water. Conclude that past solutions, developed with the best of intentions, may create contemporary problems.	A Grave Mistake (Project WET)	<p>Science Strand 2: Concepts 1 & 2 Strand 3: Concept 1-3</p> <p>Social Studies 3SS-E4, E7, E8, P1, P5</p>	<p><u>Provided in kit</u> Plastic Tray Spray Bottle <i>Community Map</i> (Master and Transparency)</p> <p><u>Provided by school/class</u> Sand Grape-flavored drink powder Copies of <i>Community Map</i> (one per student)</p>
4	Analyze how rainfall and storm events result in runoff over the surface of the earth and how streamflow is particularly influenced by urbanization. Students create design elements that incorporate more permeable surfaces into their own environments.	Streams in the City (EPA) Exercise I and IV (Exercise II and III optional)	<p>Science Strand 3: Concepts 1, 2, &3 Strand 6: Concept 2</p> <p>Math Strand 4: Concept 4</p> <p>Social Studies 3SS-E4, E7, P3, P4</p>	<p><u>Provided in kit</u> <i>Exercise I and IV Activity Sheets</i> (Masters) <i>It's a hard (surface) life</i> (Masters)</p> <p><u>Provided by school/class</u> <i>Exercise I and IV Activity Sheets</i> (one copy per student) <i>It's a hard (surface) life</i> (one copy per student)</p>