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The Lakes and Streams Project: A curriculum for elementary and middle grades on a local environmental issue

Linda Mae Alice Gregory

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THE LAKES AND STREAMS PROJECT:
A CURRICULUM FOR ELEMENTARY AND MIDDLE GRADES
ON A LOCAL ENVIRONMENTAL ISSUE

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Environmental Education

by
Linda Mae Alice Gregory
March 2003
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Approved by:

Dr. Darleen Stoner, First Reader

Dr. Kent Schofield, Second Reader

February 24, 2003
ABSTRACT

The local environmental issue of the proposed Lakes and Streams Project for San Bernardino was explored in depth to facilitate use by teachers with their students. The roots of this environmental issue, whether or not to build a lake in downtown San Bernardino using the abundant groundwater resources beneath the city, are laid out so that teachers can become familiar with the problems and players associated with this issue. The water history of the city of San Bernardino, from the hot springs of native American times to the development of the current municipal water system is also detailed.

Two curriculum units teach students how to use environmental issue analysis skills. One focuses on the water history of San Bernardino and is aimed at grades three to five. The other immerses middle grade students directly in the Lakes and Streams issue. Both units are designed to integrate academic standards from across the curriculum in a hands-on, constructivist approach aimed at teaching students skills they can use in their own local communities.
ACKNOWLEDGMENTS

This project resulted from the encouragement and support of Dr. Darleen Stoner, who guided me in pursuing my interests in the lake which historically existed near my employment site at Urbita Elementary School, and the Lakes and Streams Project being considered by the City of San Bernardino. She helped me find resources, edited my work, and assisted me in planning the project. Her teaching has made my time in the master’s program both a challenge and a joy.

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Gregory, a talented artist, who created the original illustrations for this project.
DEDICATION

To my parents and to my husband, Arthur
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"Water nourishes not only our bodies and our lives but our souls" (McClurg, 2000, p. 1).

"The story of California is the story of water" (McClurg, 2000, p. 3). The growth of urban areas and agricultural production rest upon its availability. "For our ancestors, the sight of water meant survival.... Perhaps that old feeling is what draws us to live and work and play near water today" (McClurg, 2000, p. 119). The study of how people interact with water illuminates the past and predicts the future of a community. By looking at how water has influenced people's lives and been used by them, students can learn more about the consequences of human activity in their own and other communities.

"...The skills, aptitudes, and attitudes necessary to industrialize the earth...are not necessarily the same as those that will be needed to heal the earth..." (Orr, 1994, p. 17). How can we educate the next generation to help them cope with looming environmental disasters such as global warming and the pollution of soil and water? These issues will require young people who can work together to understand and solve complex environmental
problems. Environmental education is critical in developing the means to protect the environment while meeting the needs of human society (National Forum for Partnerships Supporting Education about the Environment [NFPSEE], 1994, p. vii). In order for students to become responsible citizens who are motivated and able to take action to solve environmental problems, they must learn ecological concepts, problem solving, issue analysis, and the citizenship skills needed to take action on solutions (Hungerford & Volk, 1990, p. 14).

Purpose

The purpose of this project is to provide an accessible curriculum to assist teachers and their students in exploring an authentic local environmental issue, the Lakes and Streams proposed for downtown in the city of San Bernardino, located in southern California. California educational standards for social science require that students in grades two and three explore the history of their neighborhood and community and those in grades six through eight explore issues in depth. However, curriculum for local issues and history is not readily available.
The Lakes and Streams curriculum uses an environmental issue to integrate social science, science, language arts, and other curriculum areas and to engage students in the world around them. By using a local issue students are more easily able to connect their previous experiences and knowledge of their own community to their studies. Knapp (1999) wrote that exploring your own community can enhance one’s sense of place and help students to “become more aware of issues and problems in their community...” and to “...take collective actions to address them...” (p. 32).

Rationale

The instructional models for the Lakes and Streams issue takes into account the needs of the student population in the San Bernardino area, which is largely low income and has a high percentage of English language learners. Teachers of English language learners will find the techniques of constructivist learning parallel those that are recommended to address the needs of these students. Constructivist teaching is the basis for the curriculum because it is felt that this educational model is best fitted to engage students in learning about their environment. Higher level thinking skills are fostered
through issue analysis, and activities in the unit appeal to several different learning styles. Focusing on their local area may lead students to initiate their own action projects to improve their community. Finally, environmental education is an efficient way to integrate different curriculum areas and meet multiple objectives since it relates easily to social studies and science topics most often used in thematic teaching.

The San Bernardino City Unified School District has a large and diverse student population. The district serves 50,000 students with 58 schools (San Bernardino City Unified School District [SBCUSD], 2000). Over half (54%) of the students are Hispanic, 21% are African American, and the rest are white or other ethnic groups (SBCUSD, 2002). Reflecting the low income areas that make up much of the city, 47% of students in the public schools receive free lunch (CDE: Educational Demographics Unit [EDU], 2001). English language learners, primarily from Spanish speaking backgrounds, comprise a little over 20% of the total student population (CDE: EDU, 2001).

Students from such diverse backgrounds benefit from constructivist educational techniques that take into account their previous experiences. Constructivist learning theorizes that students create their own
knowledge as they integrate new experiences with past experiences and ideas (Klein & Merrit, 1994). To incorporate this theory into the Lakes and Streams curriculum, the units begin with activities to access students' current understanding of their own community and environment, and continue with lessons that integrate this background knowledge. Low income students may often have less varied experiences in the world than students from more affluent families, making it especially important to consider background knowledge when planning lessons. Environmental education, with its focus on the real world, also matches well with the components of constructivist style lessons. Real life problems and group interactions are two important parts of constructivist teaching that are usually included in environmental education lessons (Klein & Merritt, 1994). Such methods, which take "...advantage of the natural curiosity..." that motivates children to learn, are also encouraged by the California State Elementary Grades Task Force, [EGTF]. Using situations from real life in cooperative learning situations engages children because they explore meaningful "...questions of values...and the relationship of self to others..." (EGTF, 1992, p. 3). Current California state guidelines also call for engaging
students in “real life situations...” because “students helped to process new knowledge and skills in ways relevant for them are more apt to acquire deep learning of the material embedded in the content standards” (Middle Grades and High School Networks Office [MGHSNO], 2001, p. 141). Thus, the constructivist model is used for the Lakes and Streams curriculum so that those students will have the opportunity to engage in analysis of a real life environmental issue relevant to them in their own community.

Analysis of environmental issues promotes the use of higher level thinking skills as students compare, interpret, and evaluate information and work together to solve problems (Volk, 1997, p. 50). While investigating the Lakes and Streams issue, students analyze the issue components; evaluate statements to determine the values behind them; interpret scientific, historical, and political information; and work together in groups to come up with possible solutions to the problems. These experiences support teaching to the standards in the elementary grades as recommended by the California Department of Education [CDE] (2000, p. 10), when it states that schools should provide an environment “…that supports academic risk-taking, invites student
participation, and structures cooperative learning experiences."

In middle school, issue analysis increases in importance as higher level thinking skills and problem solving skills gain prominence in the California educational standards for these grades. In Taking Center Stage, published by the Middle Grades and High School Networks Office [MGHSNO] (2001, p. 117), it is recommended that students be "...involved with issues they regard as important and that have meaning in their own lives," and "engage in history-social science,....and science projects that call for a high level of abstractive thought before solutions can be found...." (p. 73). Their active participation in these projects "...stretches adolescent minds into the higher levels of thinking" (p. 25).

Involving students in issue analysis and exploration of their community environment can also have the benefit of appealing to different learning styles. Gardner's multiple intelligence theory, widely accepted by educators, proposes that there are different kinds of intelligence, such as musical, linguistic, intrapersonal, and interpersonal, and that individuals often are strong in one or two areas and not in others (Woolfolk, 1993, p. 112-113). By providing activities that appeal to these
different intelligences, educators can meet the needs of students with differing abilities. The activities in the lessons in the Lakes and Streams units include many hands on science activities, cooperative group work, individual reflection, and some visual art activities. These activities should be intrinsically motivating as they play to the different strengths and interests of the student population. "Those who teach at the middle levels know that active, hands-on learning has strong appeal for young adolescents" (MGHSNO, 2001, p. 25).

Students in these grades must also feel some sense of ownership in the tasks at hand, "...a belief that what they do will make a difference" (MGHSNO, p. 125). Service learning, which "...brings young people into their communities to make positive changes," is recommended for adolescent students by the California State Board of Education because "...it gives young people purpose and nurtures their spirits..." (MGHSNO, p. 197). Environmental action projects give students ownership of the task better than traditional service projects which are planned by adults, because they are investigated and planned primarily by the students. "They are often most successful when they’re focused on the local community" (Stoner, 1995, p. 2). The Lakes and Streams curriculum includes
optional activities and resources to help the teacher in guiding students to devise and carry out their own environmental action projects on the local level. These projects "...depend on group work, and having students interact in groups is one way to cater to different learning styles...." It "...may also lead students to a greater appreciation of cultural diversity...." (Stoner, 1995, p. 9).

Hands-on activities and cooperative learning are also recommended for meeting the needs of English language learners to develop vocabulary and oral fluency (Forster, 2000). These students benefit from the modeling shown by the teacher and other students in hands on activities and from vocabulary introduced with visuals, such as objects and pictures (Diaz-Rico & Weed, 1995, p. 117). Overhead transparency masters are included in the Lakes and Streams units for visuals. Real objects used during hands on science activities help students understand science concepts and vocabulary. Students work in groups for many of the activities, practicing listening and communication skills as they work. Another important element of the units is the use of graphic organizers to determine background knowledge and to organize information as the units progress. "Graphic organizers help students order
their thoughts by presenting ideas visually” (Diaz-Rico & Weed, 1995, p. 126), and are especially helpful for English language learners who can use drawings and transitional English writing with this technique.

Another benefit to using environmental education is the ease with which it can be infused throughout different curriculum areas, allowing for the integration of different learning objectives. The CDE recommends integration of curriculum areas as a method that provides students with “...meaningful learning experiences...” and helps them “...to see connections, apply skills in real-life situations, and become motivated” (2000, p. 41). At the higher grade levels, students can “...develop a broader perspective on the issues...” and develop “...higher-order thought processes, including complex reasoning” (MGHSNO, 2001, p. 132). Using environmental education to infuse different curriculum areas has been shown to have other academic benefits as well. In Closing the Achievement Gap (Lieberman & Hoody, 1998), 40 schools across the United States were examined to compare the effects of using the environment as an integrating context for learning with traditional teaching methods. Students in programs where environmental education was used to integrate the curriculum were found to score higher on
standardized tests, and on other measures also had higher scores in language arts, math, science, social studies, thinking skills, and interpersonal abilities. These findings were confirmed in a follow up study, the State Educational and Environmental Roundtable’s California Student Assessment Project (2000). The Lakes and Streams lessons integrate curriculum areas such as language arts, science, and social studies with environmental education objectives. Standards for the different curriculum areas are listed at the beginning of each unit.

It is hoped that use of the Lakes and Streams lessons will provide an invigorating exploration for students into an important local environmental issue. The project is designed to engage student interest by the use of constructivist learning and the attention paid to different learning styles. The hands on activities, cooperative learning, and student analysis should help students to practice and develop higher level thinking skills while addressing the special needs of the many English language learners in the local area.
Design of Project

The Lakes and Streams units are designed for ease of use by the teacher. The two units are designed for third through fifth grades and sixth through eighth grades respectively. Extensive background information is included for the teacher beginning with an indepth historical overview of the interaction of people with water in the San Bernardino area. The scientific concepts involved in the study are also explained in the teacher background section. California educational standards met by the curriculum are fully written out in a separate section, with the numbers for each standard repeated at the beginning of each lesson for ease of use. Time frames, materials needed, and environmental education objectives are listed at the start of each lesson, along with any additional background information needed for instruction. Teacher procedures for the student activities follow. Student information sheets and activity forms can be in order of use in the Activity Form section. Adaptations for further activities or extensions follow selected units, and resources, such as additional curriculum, agencies, and web sites, are listed in a separate resources section.

The lessons for each unit follow a constructivist design. Each unit begins with an activity designed to
access students’ prior knowledge. As students proceed through the activities, they are asked to reflect on and explain what they have learned so far. Hands on activities and cooperative learning activities are part of each unit and most have been field tested in the classroom. Teachers should be able to adapt the units to the population of their classrooms by selecting appropriate lessons and using the teacher extension ideas when they feel it advisable. Local environmental action projects may be developed as the natural outcome of the unit study.

Definition of Terms

Geological Terms

**Alluvial Plain** - an area where sediments are deposited by surface water because the slope of a stream flattens out

**Erosion** - the wearing down and transport of rock and soil by water

**Fault** - a break in the surface plates of the earth where two rock layers move and rub against each other

**Liquefaction** - a condition in which, in an earthquake, abundant groundwater mixes with soils to form a quicksand-like material into which buildings can sink
Plate - a rocky surface layer of the earth which moves over the more fluid layers beneath

Pressure Zone - a part of the groundwater basin in which an earthquake fault forms a barrier that pools the water and forces the water table upwards

Sediment - soils that are transported and deposited by surface water

Subsidence a condition in which the ground sinks because so much groundwater is extracted, or removed by natural means, that the permeability of the soil is lost and the soil particles collapse together, losing the spaces in which the water was stored

Transform Fault - an earthquake fault in which the two plates move sideways horizontally

Issue Terms

Environmental Impact Report - An environmental impact report is required by the state of California for any new development which may have an impact on the environment. The report must investigate the effects the project would have on the environment and compare this to the effects of not doing the project. Environmental impact reports must include all letters from the public sent to the agency doing the report, along with their answers to the questions asked by
the public (Susan Lein, personal communication, February 2002).

**Environmental Issue** - An environmental issue occurs when those affected by an environmental problem disagree on how to solve that problem.

**Environmental Problem** - a problem that deals with the natural or built environment, such as flooding, groundwater contamination, or urban blight.

**Pass City** - a city built near a mountain pass where travel naturally occurs.

**Urban Blight** - a condition in cities in which buildings in low income areas are in disrepair and tend to be an eyesore.

**Water Terms**

**Acre Foot** - the amount needed to cover an acre of land one foot deep in water.

**Aquifer** - rock or soil in which groundwater is stored.

**Artesian Conditions** - Artesian conditions are present when the water table is at or near the surface so that a well can be dug by barely digging in the soil.

**Artesian Well** - a well which can be made by digging a very shallow hole because the water table is at or near the surface.
Bunker Hill Basin - a large groundwater basin beneath the San Bernardino Valley and the city of San Bernardino which is confined by the San Jacinto and San Andreas faults

Groundwater - water stored beneath the surface of the ground in permeable soils and rocks

Hot Spring - a spring which forms from groundwater which is heated because of the action of earthquake faults

Permeability - the condition in which rocks and soils have porous spaces that allow water to be stored between them and move from space to space

Plume - a part of the groundwater which is contaminated by chemical pollution

Recharge - when surface water naturally, or artificially through spreading, settles into the groundwater basin

Spreading - the practice of spreading surface water in shallow basins that allows it to settle into the groundwater beneath the surface for storage

Surface Water - water that accumulates through the water cycle in streams, rivers, lakes, and ponds on the surface of the earth

Spring - an area where the water table meets the surface of the earth and water emerges naturally in a stream
Wash - the path of a stream or river that flows seasonally such as Lytle Creek and Warm Springs in San Bernardino

Water Table - the top level of the groundwater in an aquifer
CHAPTER TWO
WATER AND THE ENVIRONMENT IN
THE SAN BERNARDINO AREA

Overview

In the library of the San Bernardino Valley Municipal Water District is a poster showing turn of the century Urbita Lake with the slogan, “Back to the future?” Although Urbita Lake is long gone from the City of San Bernardino, controversy swirls around a plan by public agencies to build new lakes and streams in an effort to bring about an economic revival of downtown San Bernardino. A century ago San Bernardino was a tourist destination. People flocked to the area to enjoy the warm springs and the boating on Urbita Lake (Holladay, 1988-9, p. 24). As the city grew and the lake dried up, San Bernardino ceased to be a resort and went through an economic decline. Some groups in the community feel that the city’s abundant groundwater can be used to revitalize the city environment, making it once again a place people want to live and visit (Avalos-Lavimodiere, 1999).

Water has been an important component in the city’s growth but is also part of the problems it faces today. The history of the San Bernardino area can be seen through
the interaction of people with water. It has been a resource for a growing population, a magnet for those seeking recreation, a disaster when floods hit, and a source of worry because of the link between high levels of groundwater and liquefaction in an earthquake (Church, 1997a). People have fought over its use and been affected by both an excess of water and a lack of it during dry years.

To understand the importance of water in the city's history and the reasons given for the Lakes and Streams project, it is helpful to look at the history of water use in the area, as well as the geography and geology of the San Bernardino Valley. The Lakes and Streams project has been developed over a period of years to address long standing environmental problems, but not everyone is convinced that it would deal with them effectively. The project has become an environmental issue because some people in the community feel that other methods would be better suited to solve San Bernardino's problems, or that the project itself would cause new difficulties. To better understand this issue, background for the Lakes and Streams issue includes information on the various players involved and their positions, as well as the historical development of the project.
Geology of the San Bernardino Area

Faults

San Bernardino's current situation is influenced by its unique geology. The city is crossed by two major earthquake faults and is bounded on the north by the San Bernardino Mountains. These faults form a natural dam for groundwater. Seismic activity associated with the faults has heated water in the aquifer beneath the city, resulting in hot springs. Erosion of the mountains from streams over the years has enriched the topsoil of the area and formed the canyon surrounding Lytle Creek.

The San Andreas fault system, which runs roughly north to south through California, is where the Pacific plate and the North American plate of the earth's crust meet in a transform fault, slipping past each other horizontally (Lutgens & Tarbuck, 1999, pp. 132-133). Near San Bernardino, the fault separates the San Bernardino and San Gabriel Mountains, running through the Cajon Pass (Singer, 1998) and along the base of the mountains in the north of town (Jones & Burtell, 2001, p. 10). One can actually walk up to the fault line behind Cal State University in San Bernardino. The mountains were formed by plate tectonic movement where the San Andreas bends westwards and the plates push into each other (Southern
California Earthquake Center [SCEC], 1995). The San Andreas has subsidiary fault lines radiating from it, many of which underly the San Bernardino Valley and the city of San Bernardino itself (Schell, 2001). The San Jacinto fault is the largest of these. It separates from the San Andreas main fault near San Bernardino and crosses the city in a southeasterly direction, passing “...directly underneath the four-level freeway interchange at Colton” (Singer, 1998). The San Jacinto fault has been responsible for 36 major earthquakes in the last 150 years and is currently more active than the San Andreas fault itself (Singer, 1998).

**Liquefaction**

With San Bernardino in the cross hairs of two major faults, it is a prime candidate for a major earthquake. Both of these are shallow faults, which cause more surface damage than faults that lie deeper in the earth’s crust (Singer, 1998). The possibility of a major earthquake causing additional damage from liquefaction is an underlying problem related to the Lakes and Streams project. The U.S. Geological Survey puts San Bernardino at its highest danger level for earthquake hazards, with a greater than 2 times per century chance of incurring damage from a quake (Hudnut, Mori, Prescott & Stauffer, 2019).
Liquefaction is related to sandy soils, abundant in San Bernardino, and high groundwater (Matti & Carson, 1991, p. 1). In an earthquake, these two conditions combine to form soil which acts like gelatin in an earthquake, causing buildings to sink into the earth (Silva, 2001). The U. S. Geological Survey has recommended that the water table be lower than ten feet from the surface within four to eight miles of a fault in order to minimize the danger of liquefaction at ground level (Matti & Carson, 1991, p. 1). A 1991 U.S. Geological Survey study of the San Bernardino Valley’s susceptibility to liquefaction determined that, particularly around the Santa Ana River and Warm Creek areas, San Bernardino had a high to moderately high risk of liquefaction in an earthquake. However, unless the liquefaction occurs at the surface, buildings may not be affected (Matti & Carson, 1991, p. 2, 32).

Hot Springs

The faults around San Bernardino are also responsible for the area’s hot springs. Cracks in the earth’s crust associated with faults allow groundwater to warm up after reaching heated rock layers, and then to emerge on the surface as hot springs of heated water (California Energy Commission [CEC], 2001). Arrowhead Hot Springs, located in
Waterman Canyon north of San Bernardino, has been used for recreation for over 100 years (Jones & Burtell, 2001, p. 11). Historically there have been three other hot springs within the city of San Bernardino: Rabel Hot Springs and Harlem Springs, both around Baseline Avenue, and Urbita Springs, near the current Orange Show grounds (Holladay, 1988-9, pp. 8-9, 24). These springs dried up as the population increased and the water table went down (Stoebe, 1986, p. 13). The heated water remains underground, however. Its geothermal energy is used to heat public buildings in downtown San Bernardino, including the Radisson Hotel (CEC, 2001).

River System

Water from the mountains north of town has also had its affect on the city. San Bernardino is not only situated between two earthquake faults, it also lies between two washes, one for Cajon Creek and the other for the Santa Ana River (Raup, 1940, p. 11). The land is an alluvial plain in which sediments are washed from higher ground. During seasons of heavy snowpack, streams from the mountains bring sediments that enrich the soil (Raup, 1940). Lytle Creek is one of these mountain streams. The erosion that enriched the soil of San Bernardino also
carved the canyon through which Lytle Creek flows (Harshman, 1992, pp. 8-9).

The streams that flow from the mountains end up in the Santa Ana River south of the city. Lytle Creek and Warm Creek are the principal streams that run through San Bernardino, but they are seasonal. During the summer, Warm Creek seldom flows and Lytle Creek has an intermittent flow. This was true during historic times as well as today (Raup, 1940, p. 30), although the Lytle Creek channels have "...changed several times" over the years (Stoebe, 1986, p. 7). During wet years, Cajon and Lytle Creek washes may overflow and flood the area (Raup, 1940, p. 11). In 1862 a great flood hit San Bernardino and along with many homes, it washed away much of the rich topsoil. This had a long lasting effect on agriculture in the city, because "...by the time the soil started to come back," much of the easily available water at or near the surface "...was being diverted for irrigation..." (Stoebe, 1986, p. 7). Prior to that time, there had also been a large island between two branches of Lytle Creek, extending from Ninth Street to Mill Street on which some families had built homes (Stoebe, 1986, p. 4). The floods washed away much of the island along with homes and buildings on the island and along the creek. Floods also washed through the
lower parts of the city in 1916 (Miles, 1997, p. 20), 1937 and 1938 (Raup, 1940, p. 11). The 1938 flood was particularly significant, isolating the town for several days (Stoebe, 1986, p. 18).

**Bunker Hill Basin**

Because of its location on an alluvial plain bounded by earthquake faults, San Bernardino has a large supply of ground water in its underground aquifer, the Bunker Hill Basin. This basin is a sub basin of a larger aquifer, the San Bernardino Groundwater Basin, which underlies much of the valley (Martin, 1979, p. 9). The Bunker Hill Basin currently holds about 3.5 to 5 million acre feet of water (City of San Bernardino Municipal Water Department [CSBMWD], 2000) with the capacity to hold 5.5 million (J. Harlan Glenn Engineers [JHGE], 1999, p. XV-1). The CSBMWD considers that only about a fifth of the available water can be extracted (2000).

Water from the mountains flows to the plain, where it sinks into the ground and saturates rock, gravel, and sand layers. The water is stored in small spaces throughout the soil or rock layers and does not flow as it would in a stream (Kenski, 1990, p. 2-3). San Bernardino has both a confined aquifer, in which the water is surrounded by impermeable layers of rock or clay (Kenski, 1990, p. 3)
and shallower reserves of free ground water above this aquifer (Carson & Matti, 1986, p. 3). The San Jacinto and San Andreas fault lines bounding San Bernardino provide a partial barrier for the ground water, helping to contain the water in the valley area (Carson & Matti, 1986, p. 1). Around the 215 freeway this natural barrier pools the underground water, forming a pressure zone, or higher levels of water reaching close to the surface (JHGE, 1999, p. XV-2). Historically, these pressure zones created artesian conditions under which natural springs would flow from the surface or artesian wells could easily be drilled (JHGE, 1999, p. SV-7). However, as the population increased, the water table dropped and these "...springs and artesian wells dried up..." (Stoebe, 1986, p. 7).

Geography of the San Bernardino Area

The geography of the San Bernardino Valley is a contributing factor to its urban growth. One reason that the City of San Bernardino's population has increased is because of its unique location on different transportation routes. The availability of water made the location attractive for settlement. The topography of the city is a cause of high groundwater in certain city locations and
helps make it possible that the Lakes and Streams Project could be successful.

**Mountain Passes**

The earthquake faults that bisect the city also form two major gaps between the mountain ranges around the valley (Raup, 1940, pp. 2, 4). These passes provide natural gateways between the desert areas to the north and east. The Cajon Pass has been the most important historically because it merged with the Santa Fe Trail and opened the way from the coast to the desert as well as northwards along the mountains (Raup, pp. 1-3). Through the years the pass was used by the native tribes of California, later by the Spanish, and then by the Mormon pioneers who arrived in 1851 (Haenszel, 1992, pp. 11-12). By 1887, San Bernardino was connected to Los Angeles and areas beyond the Cajon Pass by railroad and became a major transportation center (Raup, 1940, p. 38), greatly increasing the population of the city (Stoebe, 1986, p. 8). In more recent years, the San Gorgonio Pass has also increased in importance because it connects southern California cities through highways to San Bernardino (Raup, 1940, p. 5).
Topography

San Bernardino's topography varies considerably. Along the north side of town, the highest elevation is 1140 feet, sloping downwards towards the east to 1100 feet as far as the San Bernardino airport, formerly Norton Air Force Base. The surface also "...falls to the south and west to a low point of approximately 980 feet...." where Warm Creek and Lytle Creek meet (Urban Spaces Team, [UST] 1999, p. III-I). The low lying areas coincide with areas of higher groundwater, where "...underground water has risen high enough to flood basements (Polakovic, 1986, p. B-1). However, the changes in elevation also make it possible to use the flow of gravity for streams in two directions, east and south-west, for the Lakes and Streams project (UST, 1999).
CHAPTER THREE
WATER HISTORY OF THE SAN
BERNARDINO AREA

The interaction of people with water resources in the San Bernardino area provides a fresh look at the city's different historical periods. Beginning with the native Americans, water was a crucial factor in understanding the population patterns and growth in the area. Abundant water made settlements possible, but it also affected people adversely during flooding and was a source of contention during periods of drought and overuse. An historical overview also provides important background for understanding the water issues involved in the Lakes and Streams project.

Native Americans
The San Bernardino Valley was occupied by two different groups of Shosone Indians before the Spanish arrived (Lerch & Haenszel, 1981, p. 38). Natives called the valley "guachama," meaning "land of plenty to eat" (Smith, 1957, p. 7). Abundant water in the area's springs, creeks, and rivers provided sites for the native groups to live, since "...most California Indians went to the water sources and settled near them ...." (Hundley, 2001, p. 5).
The Serrano group of Shosone Indians lived near springs at the foot of the San Bernardino mountains, while Gabrielinos are thought by some ethnographers to have settled along the Santa Ana River in the south of what is now the city. A related group lived along Lytle Creek (Harshman, pp. 26-27). Some Cahuilla Indians from the desert moved into the valley as well when they were displaced by settlers.

California Indians were known to have included an entire watershed area as part of their territory, rather than using a river or stream as a boundary (Hundley, 2001, p. 45), so this would have made it possible for more than one group to share the valley. Villages had been noted near what were once Harlem and Urbita Springs (Holladay, 1988-9, p. 28), as well as near Warm Creek (Lerch & Haenszel, 1981, p. 45). All these Indian groups were closely related, and intermingled with each other through ceremonies and trading. Because of the mountain passes, they were also in contact through trade routes with other Indian groups further away (Lerch & Haenszel, 1981).

Mission Period

This period was marked by irrigation projects organized by the mission fathers to make it easier to
conduct agriculture in the area. Although there was no mission in San Bernardino, a nearby mission, San Gabriel, established an outpost in the area.

In 1810, a missionary was sent from San Gabriel to look for a site for a rancho, or mission auxiliary, that would help to support the main site. He found a native village near a spring and chose this as the site. Historians do not agree for certain where this village was, citing Urbita Springs or De Siena Hot Springs in the south of San Bernardino or in Colton as likely possibilities (Holladay, 1998-9). However, in 1812, an earthquake shook the valley and geothermal activity related to the quake caused the appearance of more hot springs, including releases of steam. The Indians near the site believed that this was "...a sign of anger of their gods," and destroyed the outpost (Smith, 1957, p. 6).

When the Spanish missionaries reestablished their site, they moved it into what is now Redlands, away from the springs. Today the site is preserved as the San Bernardino Asistencia, or mission extension. Since this site was not near water, the mission fathers organized a waterworks project to benefit the community of converts in the area. The Indians dug a ditch, called a Zanja, or Sankey by locals today (Lerch & Haenszel, 1981, p. 33),
from Mill Creek, 10 miles to the east of the Asistencia (Stoebe, 1986, p. 1). Cottonwood trees were planted along the creek to help cool the water, giving it the name, Cottonwood Row (Lerch & Haenszel, 1981, p. 47). "Legend has it that the Indians dug the ditch using shoulder blades of cattle for shovels" (Lerch & Haenszel, 1981, p. 45). The mission fathers began teaching the local Indians how to grow crops irrigated from the Zanja. Today the Zanja is an historical landmark and much of it is still visible in the city of Redlands.

Rancho San Bernardino

Barely had the Indians begun to use the Zanja than the missions were ordered closed in 1834. The Asistencia, the area in what is now central San Bernardino, and surrounding land, was granted to the Lugo family (Stoebe, 1986). The Indians worked on the Rancho but the Lugos raised cattle and did not bother much with crops (Lerch & Haenzel, 1981, p. 35), so the irrigation system was little used. One Lugo brother worked the land from the Asistencia, but the main ranch was built by Warm Creek where the courthouse now stands and water was available for the household (Smith, 1957, p. 11).
Mormons

A company of about 500 Mormons settled the San Bernardino area in 1851, buying the San Bernardino Rancho from the Lugos and settling in the same area by Warm Creek to build a fort (Haenszel, 1992). Arriving from Utah, they crossed the desert through the Cajon Pass and were greeted by the sight of a lovely stream and green trees at Lytle Creek, which they named after their leader, Captain Andrew Lytle (Stoebe, 1986, p. 2). The availability of water and the fertile land made the area attractive to the settlers. The Mormons used the Indians' Zanja for irrigation and also built their own ditch from Waterman Canyon to carry water to wheat fields near Little Mountain. Water from Warm Creek was used to power a mill to grind wheat on what is now Mill St. (Haenszel, 1992, p. 21-22). The Mormons also used the creeks to power sawmills for the lumber they cut from forests in the San Bernardino mountains. In 1857, most of the Mormons abruptly returned to Utah, leaving behind a much reduced population in the town they had built (Stoebe, 1986, p. 5).

Gold Rush and Railroads

In 1862, gold was discovered in the San Bernardino mountains, bringing many people through the valley
(Stoebel, 1986, p. 7). Some stayed and worked to provide supplies for the miners. Up until this time, the only water used for irrigation was from surface water. However, in 1868, it was discovered that artesian wells could be dug with holes just a few feet deep. Within a year several artesian wells were built and agricultural crops in the area began to include citrus fruits which required more water than crops like wheat and barley (Raup, 1940, pp. 30-31). Water use increased so much as the population and agricultural use grew that the marshy areas around Baseline Avenue dried up. Eventually citrus farming in the town area proved unsuccessful because of the high water table and soil types, so farmers in the area turned to dairy farming and vineyards (Raup, 1940, p. 31).

The population continued to grow with the completion of a railroad line through the Cajon Pass in 1887. People from around the southland area visited San Bernardino’s orange groves and the thermal springs at Arrowhead Hot Springs, Urbita Springs near the present Orange Show, and Harlem Springs and Rabel Hot Springs on Baseline (Holladay, 1988-9). By then, there were over 500 artesian wells in the area, with the result that the water table lowered and the wells did not work year round (Raup, 1940, p. 31).
San Bernardino Sparks Change in Water Law

Urban growth and the failing of artesian wells in the city made it necessary to consider a more organized water system delivery in the city, both for domestic needs and to fight fires. By 1889, the city council was investigating plans for a water system (Finkle, 1980, p. 38). One year later the city had constructed a reservoir, waterworks, and pipe system using artesian wells as a source (Finkle, 1980, p. 39). However, this system soon began to prove inadequate for the growing city’s needs because more and more people used artesian wells to gain access to the groundwater basin.

Up to this time, English common law and practice had been the rule in California and throughout the United States. In England, the common law tradition was that landowners owned whatever was beneath the land surface, including minerals and water. In England, water was abundant and its removal did not harm others dependent on a shared groundwater basin. In southern California’s arid climate, removing large amounts of groundwater meant that others who also depended on water in the same area could find their wells running dry as the water table went down.
Owners of small plots of land could decimate a shared resource (Finkle, 1980).

San Bernardino was the victim of just such a tactic. A woman named Margaret Walkinshaw had used artesian wells to remove and export water for sale to the Riverside Water Company. As a result, nearly all the wells in the city of San Bernardino dried up. Under English common law, the people of San Bernardino could do nothing about it. The city council decided to fight this exportation after studying case law involving water rights. They felt that their best bet was to sue on behalf of a citizen whose well had dried up rather than on behalf of the city, because in a similar case in New York, the court had sided with landowners, setting aside the English common law. Hoping to use this case as a precedent, the city found a citizen named Marcus Katz and filed a lawsuit on his behalf in 1899. Although they lost the case in the superior court, the city appealed to the state supreme court and in 1900, they won.

This landmark decision, Katz et al. vs. Walkinshaw, affects groundwater use even today and set up a new "correlative rights doctrine" (Finkle, 1980, pp. 44-49). The new doctrine stated that landowners in a basin area could use what they themselves needed from an aquifer, so
long as there was enough for everyone. If not, the water was to be “...apportioned among them without favor...” (Fingle, 1980, p. 49). Only if there was a surplus of water could any be exported outside the area of the groundwater basin.

This doctrine influences debate on the Lakes and Streams issue today, since part of the plan is to export excess groundwater from the basin. The importance of the decision cannot be overstated in San Bernardino’s history. According to Fingle, a key water engineer involved in the lawsuit, without this decision, the city would not have had sufficient water to “…be the large and growing city it is today, nor would the surrounding communities in the artesian basin be what they are” (1980, p. 52).

San Bernardino Grows

Beginning in the late 1800s and during the early part of the century, the citizens of San Bernardino enjoyed the development of water systems to serve the growing city and protect it from flooding, as well as a water resort at what was Urbita Hot Springs. Hydroelectric power was part of the overall use of the Santa Ana River system. Wet and dry years affected the aquifer beneath the city, sometimes
precipitating floods, and other times lowering the water table significantly.

Water Resorts

Surface water, as well as groundwater, was at first abundant in the growing city, allowing the development of water resorts for the entertainment of the population. In the 1880s, two amusement parks were built around Warm Creek with warm water pools and picnic areas. The first, Harlem Springs, was near Baseline and Victoria, while the second, Rabel Springs, was nearby and also on Baseline. The most popular and largest of these resorts was Urbita Springs, which had a lake surrounded by trees and a dance hall. Urbita Springs was located just north of what is now the Inland Center Mall. As San Bernardino grew, the ground and surface water was used more and more. Dry years speeded up the downfall of the resorts, which all finally closed in the 1920s when springs disappeared (Stoebe, 1986, p. 13). "...The lake at Urbita was paved over for a parking lot" (Sears, 1982).

Control of The Santa Ana River

Surface water from the Santa Ana River and its tributaries, Warm Creek, Mill Creek, and Lytle Creek, were the first sources of water to be controlled for city use.
The first waterworks, beginning in the middle to late 1800s, were ditches and small dams built to divert water from the river and streams (Scott, 1977, p. 11). Though the Spanish missionaries were the first to do this with the Zanja, the Mormons and later settlers continued the trend of controlling the area's surface water for human use. An example was Rabel's Dam built by the Mormon settlers in 1854 on a tributary of Warm Creek (Scott, 1977, p. 54). By the turn of the century, small water companies gained control of these ditch systems, often building their own, and sold water to different areas around the valley. There were many of these small companies, such as the City Creek Water Co. serving the Baseline area, and the Del Rosa Mutual Water Co. which used water from East Twin Creek (Scott, 1977, p. 107). Eventually many of the small companies merged or had their water rights bought out by larger companies until two large water districts served most of the San Bernardino area. The East San Bernardino County Water district was formed in 1940 and the West San Bernardino Water District in 1954 (Scott, 1977, p. 115, 134).

**Hydroelectric Plants**

Hydroelectric power was also developed along the Santa Ana River system during the same period. The first
power plant in the area was built on Mill Creek in 1893 (Southern California Edison, 2002). By 1911 there were three hydroelectric plants along the river system (Scott, 1977, p. 27).

**Water Spreading**

Santa Ana River water was also used to replenish the aquifer so that wells could pump water. The process of collecting water where it will sink into the ground water is called spreading (Scott, 1977, p. 221). The San Bernardino Valley Water Conservation District continues "spreading" today in special percolating basins. The practice began in 1909 by collecting Mill Creek water for this purpose. Instead of storm runoff going into the river system, it was conserved to recharge the groundwater basin. Communities downstream from San Bernardino saw their share of the Santa Ana River water disappearing because of the spreading activities and fought in court to gain access to the water for their own growing cities (Scott, 1977, p. 223).

In 1942, the communities agreed to protect the river flow and the aquifers by allowing spreading only when there was enough water in the river system. Sometimes the Water Conservation District has been forced to replenish the river with water from the Colorado River so that these
other communities had a share of the water. Since the 1970s, water from the California water project has been used for this purpose instead (Scott, 1977, p. 223).

Flood Control

The City of San Bernardino also moved to secure water supplies for itself while working to protect the city from the flooding that devastated the city during 1937 and 1938. Along with the building of flood control facilities like flood channels and levees, the city built reservoirs to store water and to divert it to prevent flooding. Land was bought along Cajon Creek, and water rights for Lytle Creek were purchased to help insure enough water for the population (Scott, 1977, pp. 2, 121, 134).

Present Water System

Today the City of San Bernardino Municipal Water Department serves and bills 185,000 residents for water it provides from the groundwater basin. The department maintains 60 wells to pump water from the aquifer and has 30 covered reservoirs to store water for peak periods. Not only does the groundwater serve all of San Bernardino, but half a million surrounding people share it through a mix of 20 private and public water agencies (City of San Bernardino Municipal Water Department [CSBMWD], 2000).
After using the water, the city treats it through a reclamation facility before releasing it into the Santa Ana River system (CSBMWD, 2002).

The Seven Oaks Dam in the upper Santa Ana River Canyon was planned by several water agencies, including the San Bernardino Valley Municipal Water District, and the U.S. Army Corps of Engineers. It was designed to conserve Santa Ana River water and control flooding (SBVMWD, n.d.). The dam was just completed in November of 1999 in only five years (U.S. Army Corps of Engineers, 2002).

Subsidence

Historically the water table beneath San Bernardino has varied considerably, affected not only by wet and dry periods but by increasing human use and spreading to store water. In such conditions, where there are clay rich soils, the ground can actually sink. This condition is called subsidence, and is caused by the loss of groundwater in these soils. Since the water is stored in spaces between the soil, as the water leaves, the soil can compact and lose that space permanently (Harden, 1998, p. 227). In a 20 year period between 1950 and 1970 the ground subsided in one area in town about twelve inches after the
water table fell about 160 feet (Leifert, 2001). However, much of San Bernardino has sandy rather than the clay rich soils susceptible to subsidence (Matti & Carson, 1991, p. 1).

The State Water Project

In the latter part of the century, the city benefited from the state water project bringing northern California water to the area. Large scale water projects were undertaken by the area’s water agencies as different cities clamored for water for their growing populations. The state water project is "...the largest state built water development project in the United States..." (California Department of Water Resources [CDWR], 1996, p. 2), with the primary goal of bringing water from northern California’s Feather River system to drier and more populated southern California. Most people think of the California Aqueduct when they think of the state water project. Although the aqueduct is a major part of the project, it also has 29 storage basins, 18 pumping plants and several power plants to provide recreation, flood control, and hydroelectric power (CDWR, 1996, pp. 2-3). Fifty years ago the project began with a study in the
state legislature and today the project is still being expanded.

Major parts of the state water project in the San Bernardino area are Silverwood Lake and the Devil Canyon power plant. Silverwood Lake is a large constructed reservoir fed by the California Aqueduct and located 30 miles north of the City of San Bernardino in the San Bernardino National Forest. Area residents use it for recreation and it attracts many water birds (CDWR, 1997, pp. 1, 4, 5). Since the city of San Bernardino does not need state water project water for its residents at this time, this water is transported to other communities such as Redlands (San Bernardino Valley Municipal Water District [SBVMWD]a, Summer 1999, p. 1). The Devil Canyon power plant, on the south end of the lake, is a hydroelectric plant that generates electricity to run the water project and to export for sale (CDWR, [n.d.]). Although the City of San Bernardino does not currently need water from the state water project, it is entitled to project water since the city is part of the service area of the San Bernardino Valley Municipal Water District. The district is allowed up to 103,000 acre feet of water a year from the state water project (SBVMWD, 1999, p. 2).
CHAPTER FOUR

THE LAKES AND STREAMS PROJECT

Lakes have been proposed for beautification in San Bernardino since the 1960s (Valenzuela, 2000a, p. A-1), but the current Lakes and Streams project has made headway because it has brought together different agencies with contrasting agendas for a common purpose. This time around, the lake idea was promoted not just for beautification and recreation, but as a possible solution to three environmental problems. Firstly, high groundwater in the southern parts of the city has led to periodic flooding of area buildings and also poses a danger of damage from liquefaction in the event of an earthquake. Secondly, chemical plumes of pollution from former industries, such as those at Norton Air Force Base, are contaminating the groundwater and require action to keep them from spreading. Finally, the City of San Bernardino is concerned about blighted low income areas in the center of town which affect the tax base and discourage investment that could help redevelop the city's core. An additional reason for the project, not related to an environmental problem, is that the San Bernardino Valley Municipal Water District needs more storage area for water.
and could use a lake for this purpose (San Bernardino Regional Water Resources Authority [SBRWRA], 2001).

In its current form, the Lakes and Streams Project would consist of two lakes, a northern one for water storage around Baseline and E Streets, and a southern lake near the baseball stadium on Mill Street for recreation and urban renewal. The streams portion of the project has been rejected because of the problems it would create for traffic and the costs of changing existing utility structures below ground. Instead gardens and water features like fountains are being considered. A specific plan is expected has been proposed but not yet approved. This design is on the City of San Bernardino web site, which updates information on the project regularly, according to the mayor’s director for the project, Tim Cook (personal communication, April 2002). The design has gone through a variety of changes since it was first considered. The north lake was first proposed to be 120 acres (Yingst, 1998), but has now been shrunk to less than half that size, 40 acres (Bothner, 2002a). The present lake design, though smaller in surface area, would be deeper to accommodate water storage (Cook, personal communication, 2002).
Timeline

The Lakes and Streams Project was first proposed five years ago, caught the attention of various agencies, and has been discussed through a variety of public forums as the idea has progressed to its current form today. The project is closer to becoming a reality than ever before, but it could still fail to become a reality, according to San Bernardino city councilwoman and San Bernardino Regional Water Resources Authority member Susan Lien (personal communication, February 2002). Before the project can commence, "...studies must be completed, locations need definition, and financing must be found" (Valenzuela, 2000b, p. A-1). Though several studies have been completed, no environmental impact report has yet been done as the specific plan must still be chosen first. The timeline begins with recent groundwater problems which led to the current lakes concept being considered.

1984: Flooding in South of the City

After several wet years and continued spreading of water into the aquifer by the San Bernardino Valley Water Conservation District, areas of south San Bernardino had flooding in buildings, new marshy areas, and old artesian wells flowing again as the water table reached the surface. The mayor at the time, W.R. Holcomb, contacted
the state Department of Water Resources to see if the
Water Conservation District was breaking any codes (Sears, 1984).

1985: Excess Water Pumped Down the Santa Ana River

The high groundwater continued to cause problems in
south San Bernardino. It resulted from heavy rains and
imported water from the state water project being
percolated into the aquifer for storage. The San
Bernardino Valley Municipal Water District (SBVMWD) pumped
excess water into the Santa Ana River to flow downstream
(Sears, 1985).

1996: Lake Concept is Proposed

Duke Hill, a local real estate agent, suggested to
the SBVMWD that excess groundwater could be pumped to the
surface and made into a lake that would beautify the
downtown blighted areas and help solve the flooding and
liquefaction problems that the water district was
struggling to solve. The water district hired consultants
to see if a lake could help with the high groundwater and
with cleaning the contaminated plumes of chemically
tainted water that were spreading in the aquifer. The
consultants determined that a lake could help solve the
water problems (Church, 1997b).
1997: Support Builds for Lake Concept

Patrick Milligan, at the time vice president of the SBVMWD, began promoting the lake idea to different city groups such as the Chamber of Commerce (Mauel, 1997) and the City of San Bernardino's Economic Development Agency. The Economic Development Agency voted to support the plan for a 120 acre lake in September (Church, 1997b), followed in the same month by the San Bernardino City Council (Church, 1997a).

1998: Joint Powers Authority Formed

Despite initial resistance from the San Bernardino Valley Municipal Water District Board's Advisory Commission and some San Bernardino city officials, a joint powers authority representing three area agencies was formed to investigate the possibility of the lakes project. Initial resistance from the water board centered on the idea that the lake project was primarily urban renewal, not a water project (San Bernardino County Sun, 1998a), while city officials were concerned about sharing power with other agencies on a matter of such importance to the city (San Bernardino County Sun, 1998b). Under the agreement, San Bernardino's concerns were appeased by making the city mayor chair of the commission and guaranteeing the city 50% of the agency's votes (Perkes,
1998). On November 9, 1998, the commission, officially titled the San Bernardino Regional Water Resources Authority but most often called the Joint Powers Authority [JPA], met for the first time. Three agencies were represented on the JPA: The San Bernardino Valley Municipal Water District, the City of San Bernardino, and the Inland Valley Development Agency. There is also a member of the County Board of Supervisors on the JPA (Anderson, 1998).

1999: Urban Spaces Chosen as Lake Project Designer

In May of 1999, Urban Spaces, a group of engineers and urban planners, was chosen by the JPA to design the Lakes and Streams Project (Valenzuela, 1999). The company was responsible for parts of the famous River Walk in San Antonio, Texas (Valenzuela, 2000a, A-6). By December Urban Spaces had come up with a plan for two 20 acre lakes and a river walk (Frazier, 1999), hence the title, “Lakes and Streams.” The plan was at that time entitled Vision 2020 and had several variations (Urban Spaces Team [UST], 1999).

2000: Opposition Builds

Opposition to the Lakes and Streams plan built in the neighborhoods where people would have to move. Although many people were not unduly concerned about moving
(Szymkowski, 1997), others were desperate to save their homes and neighborhoods. Over 200 residents in the proposed lake area protested at a JPA meeting on June 26, 2000 (Wall, 2000a). To better oppose the project, a political action group called the Neighbourhood Action and Preservation Association was formed from members of the Feldham Neighborhood Association Preservation Committee, representing people who lived in the project area (NAPA, 2002).

**May 2000: Feasibility Study**

In May of 2000 the Natelson Company presented a feasibility study on the lakes project to the JPA (Valenzuela, 2000c). The study recommended a mix of townhouses and single family homes in the area and noted that although the market for the development was feasible, it would be expensive financially because land would have to be bought by the city and offered to developers at a low price in order to promote renewal (Natelson Company, 2000).

**June 2000: Water Sales Agreement**

After 30 years of feuding, the Metropolitan Water District in the greater Los Angeles area and the San Bernardino Valley Municipal Water District reached an agreement allowing the SBVMWD to sell excess water to
other southern California districts, including Metropolitan. In the past, the Metropolitan Water District refused to accept deliveries from the San Bernardino district, making it very difficult to sell excess water and making the high groundwater situation worse because of this. Now the SBVMWD expects to sell over $100 million worth of water over the next 20 years (Frazier, 2000a). The Lakes and Streams Project would be part of the mechanism for selling the water if it is actually built, since water could be brought to the surface for storage and transport.

September 2000: Historical Survey

A five month long historical resources survey was completed in September of 2000 by CRM Tech. Over 200 historical structures were listed in the downtown San Bernardino project area (Wall, 2000b), though the buildings varied greatly in significance. The California Theater was listed as was the Sturges Theater for the Fine Arts. Homes listed were picked for historical or architectural significance, or for being representative of a certain historical period. It was noted that many homes were in disrepair (CRM Tech, 2000).
2001: Public Meetings

Public meetings were held to inform residents of the goals of the lake project and to gather input from the community. Meetings were held on almost a monthly basis prior to and through 2001 and into 2002 (Cook, 2001). Both considerable support and considerable opposition were voiced at these meetings.

October 2001: New Design Team

Ehrenkrantz, Ekstut, and Kuhn Architects (EE&K) were retained to design a new concept for the Lakes and Streams project after the JPA became dissatisfied with the Urban Spaces team. It was felt that they do not know how to deal with the high groundwater problem, which was quite different from their experience in Texas (Cook, personal communication, February 2002). EE&K is a firm with experience in California and with urban renewal projects (City of San Bernardino, 2002a).

March 2002: New Concept

EE&K unveiled the newest lakes design, and the one most likely to be chosen as the specific plan (Tim Cook, personal communication, March 2002 and Susan Lien, personal communication, February 2002). A specific plan is necessary before the environmental impact report required by state law can be done. The current design eliminates
streams because of traffic flow and cost (Cook, personal communication, March 2002), and because, according to consultant Vaughan Davies, the hot climate could affect the consistency of water flow (Bothner, 2002). A 40 acre lake for water storage at Base Line would be connected to another lake on Mill Street near the baseball stadium with gardens and water accents such as fountains and ponds. One series of gardens would also stretch east to incorporate Seccombe Lake. The designers envision different districts throughout the redevelopment area, including a downtown nighttime district near the Cinema Star and a museum garden district just south of the lake (City of San Bernardino, 2002b).

What’s Next?

Should the specific plan for the Lakes and Streams project be approved soon by the JPA, then the next step will be to do an environmental impact report. This report would look into what the consequences would be of completing the project, comparing these consequences to what would happen if everything was left as is, making the decision on whether to proceed clearer. Possible consequences that should be included are such possibilities as liquefaction, subsidence, and the effect
on the chemical plumes in the groundwater of pumping water for the lake.

Issue Analysis

An environmental problem becomes an issue when there is disagreement over how to solve it. The different agencies and individuals involved in debating the value of the lakes project generally agree that San Bernardino has problems with:

1. high groundwater
2. groundwater contamination
3. urban blight

However, they do not agree on how to address these problems. Those against the lakes project feel that it will add to San Bernardino’s problems or is not the best way to deal with the present problems. They are also concerned about those people being displaced and the high cost of the project. Those people in favor of the lakes project are excited about the possibility of dealing with several environmental problems at once, while at the same time, beautifying the city. They feel the cost, while considerable, is worth it for the end result. The following sections explore each side’s arguments surrounding the three environmental problems, and the
resulting financial costs and displacement of homes that would accompany such a project.

**High Groundwater**

*Arguments for the Project.* The recurrent flooding and danger of liquefaction make it necessary to lower the groundwater level. Many businesses in the south of town are affected by the flooding and these areas are also in danger of liquefaction during an earthquake (Valenzuela, 2000b). The groundwater could be lowered by simply building large wells to pump the water and tanks to store it. However, tanks, though utilitarian, would be unattractive (Ascenzi, 2002, p. 1). The San Bernardino Valley Municipal Water District needs storage, whether in tanks or a lake, but is willing to cooperate with the city to build a lake for storage that will add to the city's beauty (Aguilar & Milligan, 1997). Not only can the groundwater be lowered with the lakes project, but the area will benefit from water sales (Aguilar & Milligan, 1997). The beauty of this plan is that it turns a problem into a solution.

During those times when the groundwater is lower, the lake will not be a further drain on the water table. Instead, water from the state water project can be used to supplement the lake without further lowering the water
table. The lake would be part of a dynamic system which would continually move water to the surface for treatment and sale while the aquifer also is recharged naturally and when necessary, artificially (Bill Greenburg, personal communication, November 2001).

Arguments against the Project. San Bernardino has not seen flooding since the 1980s and no one can say exactly when an earthquake will occur, or whether it will actually result in liquefaction damage. Some residents are willing to take their chances, since it may not happen "...for another decade or two" (Valenzuela, 2000b, p. A8). Even if the worst happens and an earthquake occurs, pumping the groundwater out for a lake would not necessarily lower the water table enough to make a difference. The lake, with 18,000 acre feet of water would be a "...drop in the bucket" compared with the 5 million acre feet of water in the aquifer (Bartleman, 1997).

Some residents are also concerned that water interests in Orange County and Los Angeles County want an excuse to drain the Bunker Hill Basin. The Neighborhood Action and Preservation Association [NAPA], representing residents in the affected area, warn that the city may be drained dry like Owens Valley in order to expand development in other counties (NAPA, 2002).
In addition, some opponents protest the location of the proposed lake in the downtown area. Noting that high groundwater is more of a problem in the south of town, Cal State San Bernardino professor James Mulvihill warned that placing pumps in the center of town would not have as much effect on the water table as placing them where the groundwater is highest (Mulvihill, personal communication, April 2002). Some citizens, including Mulvihill, have also expressed concern that in the event of an earthquake, a lake in the center of town could burst and create flooding (Mulvihill, 1997; VaNderWoude, 1997).

**Groundwater Contamination**

**Background.** There are four chemical plumes of pollution from various industrial and military sources that are slowly making their way through the valley's groundwater. They were caused by burying or pouring chemicals in the soil over many years (JHGE, 1999). Three of the plumes are being monitored by, and are the responsibility of, Lockheed Corporation, the Santa Fe Railroad, and Norton AFB, managed by the U. S. Air Force. These plumes are not in the direct area of the planned lake project (JHGE, 1999).

The U. S. Environmental Protection Agency (EPA) monitors the worst area, actually two adjacent plumes
called the Newmark and Muscoy plumes, north of the proposed lake (Tim Cook, personal communication, April 2002). The EPA estimates it will take 90 years to clean up the groundwater affected by this plume. Currently, the only way to clean contaminated groundwater is to pump it out and treat it (Harden, 1998, p. 231), which is presently being done with barrier wells maintained by the EPA north of the proposed lake on 11 St. (JHGE, 1999, pp. XV 4-5).

Arguments for the Project. As part of the lake project, more wells could be installed to pump the water out to be cleaned and mixed with purer water. This would cut down on the time it will take to clean the groundwater, a goal of the SBVMWD. Of course, the wells would be constantly monitored to ensure that pumping is not forcing the plumes of contamination to move faster into the aquifer (Tim Cook, personal communication, 2002).

Arguments Against the Project. Despite assurances to the contrary, there is concern by opponents such as James Mulvihill that pumping the water out for treatment will force the chemical plume to migrate south faster. Mulvihill pointed out that wells draw from a cone shaped area around the well and that pumps for the lake could draw the nearby EPA monitored plume into this area, mixing
it faster into the purer water of the basin (personal communication, April 2002).

**Urban Blight**

**Arguments for the Project.** San Bernardino needs to do something drastic to attract investment into the city. The city core is crucial to redevelopment since this is where previous efforts at urban renewal have begun with the Cinema Star theater, Radisson Hotel, Seccombe Lake, and City Hall. This is also where some of the most rundown homes and businesses are. Without a vision that improves the city's image, the city's downward spiral will continue, according to City Councilperson and JPA member Susan Lien (personal communication, February 2002).

Previous efforts to revitalize the blighted areas of the city through repair and resale of foreclosed homes have been "...too slow and random to stabilize any single neighborhood" (Husing, 1998).

Water is currently the city's problem, but it should be viewed as a valuable resource. San Bernardino Mayor Judith Valle stated, "We have this abundance of water, why not use it?... This really is an opportunity, but it's camouflaged as a major problem" (Associated Press, 2000).

In the past, San Bernardino was seen as a water resort and could be again (Macduff, 1998). Steve Henthorn, director
of the San Bernardino Convention and Visitors Bureau, has envisioned the city using water as the attraction to market itself as a tourist destination and to bring in new businesses (Associated Press, 2000).

The Joint Powers Authority [JPA] has been careful to invite community involvement so that concerns of different parties can be addressed. The lake project as envisioned today skirts around such landmarks as the Sturges Theater and would displace residents of about 200 homes, "...taking out the worst part and keeping the historic structures" in the words of designer Al Groves (Avalos-Lavimodiere, 1999, p. B-1). Displaced residents will be treated as fairly as possible, according to Councilwoman Susan Lien. "We can't do what's fair. We have to do what's just for people..." (Valenzuela, 2000c, p. B-3). Lien thinks it may even be possible to move their homes or to give them residences near Seccombe Lake that are more attractive than the homes they will give up (personal communication, February 2002). The use of eminent domain to require a homeowner or renter to move also requires fair compensation for their property and "...frequently people come out ahead" according to Jay Natelson, whose firm did the feasibility study for the Lakes and Streams project (Valenzuela, 2000c, p. B-3). The law requires that
fair market value plus moving expenses be paid to displaced residents (Tim Cook, personal communication, April 2002).

To those who say that the Lakes and Streams project is elitist, proponents note that the latest consultant recommends against a gated community. Instead of an exclusive lakefront residential area, the current design showcases both high end and middle income homes with a berm of soil to hold the water. The berm would be at road level so that drivers could see the lake, rather than impeding the view as at Seccombe Lake (Tim Cook, personal communication, April 2002).

Arguments Against the Project. Although opponents agree that San Bernardino suffers from urban blight, they disagree on how to solve it. Residents such as Lillice Andreson, head of NAPA, argue for preservation of historic homes, such as her own. NAPA members want the city to pursue efforts to enforce building codes and repair already existing homes with historical value (NAPA, 1997). Andreson worries that many historic structures would be irreplaceably lost if the lakes project goes through (Wall, 2000b).

James Mulvihill, Cal State geography professor, also argues against large scale removal of homes for urban
renewal, since the poor who are displaced will have to move elsewhere, exporting the blight (Mulvihill, 1997). He feels that the days of such whole neighborhood clearances are gone, and that the better method is to "...repair neighborhoods in place," as NAPA also proposes (Anderson, 2000, p. A-3).

Displacement of Residents. Susan Lien notes that the displacement of many poor and elderly residents for the lakes project brings up the issue of economic justice (personal communication, February 2002). Though she feels the lakes project will help the city, she recognizes that people who are forced to move are paying the price for the city's progress and is concerned that they be treated with dignity and fairness (Frazier, 1999, p. B-5).

Opponents of the project have seized on the issue of displacement as placing an unfair burden on low income and elderly people. "It's all about money... It's all about poor people being exploited and not able to defend themselves," says Anderson of NAPA (Anderson, 2000, p. A-3). Some elderly residents complain that they have lived in the neighborhood for many years and love the area, which cannot be replaced by any other home. They resist the stress of moving. Some residents also protest that
their neighborhoods are being unfairly destroyed for outside interests (Bothner, 2000b; Frazier, 1999).

Costs. Another area of controversy circles around funding for the lakes and streams project. No one knows for sure how much the 20 to 25 year project may actually cost, but it will certainly be in the millions of dollars and is currently estimated at about $120 million (Ascenzi, 2002) to $200 million (Mulvihill, personal communication, April 2002). The Natelson economic feasibility study stated that the city will incur considerable expenses for the project in buying and reselling land for redevelopment, since it will need to be sold at a loss in order to spark investment (Valenzeula, 2000c). The SBVMWD has agreed to pay for part of the project and water sales could offset some of the cost (Valenzuela, 2000b). In addition, money may be available through state bonds (Ascenzi, 2002), federal grants, private investment, and other public agencies (Tim Cook, personal communication, 2002), but these sources have not been identified (Frazier, 2000b).

Though funding for the project has not been secured yet, and may take a number of years to come about, proponents of the project feel that the wait and the cost will be worth it. Mayor Judith Valle is quoted as saying,
"I know it’s going to cost a lot of money, folks—millions and millions... but divided over 25 years, it ain’t so bad" (Bothner, 2002a).

Opponents to the project, such as Mulvihill, are concerned about where the funding will come for the project. He notes that although grants are available for such urban renewal projects, San Bernardino would have to compete with other cities to get them. He also notes that the water district has not guaranteed a share of water sales monies for the project. He wonders if the project is worth doing if it can only be partially funded. He feels that planners must consider whether half the project is worth doing, since it may not receive full funding (personal communication, April 2002). Others worry that the city will be left with the bill for a massive project it can ill afford (Bartleman, 1997).

Major Players Involved in the Lakes and Streams Issue

Each of the following agencies have differing beliefs and positions on the lakes and streams issue. Some have been involved since the idea was first discussed, while one opposition group was formed in response to the issue.
City of San Bernardino

Mayor. Judith Valle, the mayor of San Bernardino, is a member of the Joint Powers Authority and a proponent of the Lakes and Streams project. She is committed to beautifying and revitalizing the city and sees this project as the best way of fighting the urban blight problem in San Bernardino.

City Council. In 1997 the city council voted to approve the then 120 acre lake concept as a means of fighting urban blight and the high groundwater problem (Church, 1997a). The city council continues to support the idea of the Lakes and Streams project as a way to redevelop the city core area, as does the mayor. Susan Lien, council member, represents the city council on the Joint Powers Authority.

Inland Valley Development Agency

The Inland Valley Development Agency is a county group charged with developing the five mile area around the now closed Norton Air Force Base. The agency has eminent domain powers which would be used if the lakes project moves forward. The county supports the efforts of the city in redevelopment and is also represented on the Joint Powers Authority (Lien, personal communication, February 2002).
Neighbourhood Action and Preservation Association

This political action group was formed by residents and business owners in the area where the lake may be built. Members of this group are concerned about the possibility of losing their homes and businesses. Lillice Anderson, an often quoted spokesperson for the group, complains that the feelings of residents for their homes and neighborhood, their friendships and social connections, are being ignored for the good of outside interests (Bothner, 2002c). The historical structures within the project area are also a concern of the group, which asserts that many beautiful homes and other buildings will be lost if the downtown lake is built.

San Bernardino Valley Municipal Water District

The SBVMWD is in charge of providing water to the City of San Bernardino and other surrounding cities in the valley. The SBVMWD is also responsible for dealing with the high groundwater problem and wants to develop more water storage. In addition SBVMWD is concerned about the chemical pollution threatening the groundwater basin. When the lakes idea was first suggested by Duke Hill, the water district was interested in whether it would help with these problems and commissioned a study to investigate this. When the study confirmed that a lake could meet the
water district's need for water storage and also lower the water table, support built within the agency for the idea (Church, 1997b). SBVMWD wants the lake project to go through to solve the high groundwater problem, help with cleaning chemical pollution, and to facilitate the delivery of water for storage and sale.

San Bernardino Regional Water Resources Authority

Also called the Joint Powers Authority (JPA), the San Bernardino Regional Water Resources Authority was formed in 1998 to explore the possibility of constructing a lake or lakes in San Bernardino to solve the problems of high groundwater, urban blight, and chemical pollution of the groundwater basin, as well as to provide water storage. The Joint Powers Authority is made up of representatives from the San Bernardino city government, San Bernardino Valley Municipal Water District, and the Inland Valley Development Agency. This group has called for community involvement to discuss the issue and address citizen concerns as they pursue planning for the Lakes and Streams project. Although the JPA has not yet decided for certain whether or not to go ahead with a plan for the Lakes and Streams project, members of the board, which include Patrick Milligan of the SBVMWD, Mayor Judith Valle, and San Bernardino City Councilperson Susan Lien, have all
expressed support for the project for different reasons. The JPA as a whole, in its Vision 2020 statements, has promoted the idea of turning the liability of high groundwater into an asset for the city through the Lakes and Streams Project. It is committed to using the political process to reflect citizen concerns regarding the Lakes and Streams plan and to facilitate the cooperation of the agencies it represents to bring the lake concept to fruition.

United States Environmental Protection Agency (EPA)

The EPA is involved because it is responsible for cleaning the Newmark/Muscoy chemical plume contaminating the groundwater of the Bunker Hill Basin. This plume is a Superfund site. Since the EPA has barrier wells north of the proposed lake, any lake project will have to be carefully planned so as not to interfere with cleaning of the contaminated water (JHGE, 1999). The wells planned for the Muscoy plume will also need to be coordinated with any lake project so that the plume does not migrate south.
APPENDIX A

UNIT ONE

URBITA LAKE THEN AND NOW

A CURRICULUM UNIT FOR THIRD TO FIFTH GRADES
URBITA LAKE THEN AND NOW

A CURRICULUM UNIT FOR THIRD TO FIFTH GRADES

Unit Overview

Urbita Lake Then and Now is an environmental education unit on the water history of the Urbita Elementary School neighborhood of the city of San Bernardino. The Lakes and Streams Project is linked to the historic Urbita Lake, once a feature of the city.

Unit Environmental Issues

1. When people change the environment, there are consequences.
2. The changes we make to the environment reflect our values.

Unit Environmental Concepts

1. People and animals need food, water, shelter, and space.
2. Over time people change their environment and this changes the way that they live.
3. Groundwater is a resource that affects the lives of people in San Bernardino.

Third Grade Standards Met in This Unit

Reading:
1.3 Read aloud narrative and expository text fluently and accurately and with appropriate pacing, intonation, and expression.
3.1 Distinguish common forms of literature.

Writing:
San Bernardino City Unified School District (SBCUSD)
Make use of a variety of pre-writing strategies such as frames, patterns, webs, or story maps.
1.1 Create a single paragraph.
2.2 Write descriptions that use concrete sensory details to present and support unified impressions of people, places, things, or experiences.
Listening and Speaking:
1.2 Connect and relate prior experiences, insights, and ideas to those of a speaker.
1.4 Identify the musical elements of literary language.
1.5 Organize ideas chronologically or around major points of information.
1.9 Read prose and poetry aloud with fluency, rhythm, and pace, using appropriate intonation and vocal patterns to emphasize important passages of the text being read (Curriculum Development and Supplemental Materials Commission, [CDSMC], 1999).

Science:
3.b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
3.c. Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.
3.d. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations (California State Board of Education [CSBE] 1998a).

Social Studies:
3.12 Trace the ways in which people have used the resources of the local region and modified the physical environment.
3.22 Discuss the ways in which physical geography, including climate, influenced how the local Indian nations adapted to their natural environment.
3.3 Students draw from historical and community resources to organize the sequence of local historical events and describe how each period of settlement left its mark on the land.
3.42 Discuss the importance of public virtue and the role of citizens, including how to participate in a classroom, in the community, and in civic life (CSBE, 1998b).

Fourth Grade Standards Met in This Unit

Reading:
1.1 Read narrative and expository text aloud with grade-appropriate fluency and accuracy and with appropriate pacing, intonation, and expression.
Writing:
1.1 Select a focus, an organizational structure, and a point of view based upon purpose, audience, length, and format requirements.
1.3 Use traditional structure for conveying information.
1.7 Use various reference materials as an aid to writing.

Listening and Speaking:
1.2 Summarize major ideas and supporting evidence presented in spoken messages and formal presentations.
2.4 Recite brief poems, soliloquies, or dramatic dialogues, using clear diction, tempo, volume, and phrasing (CDSMC, 1999).

Science:
3.a. Students know ecosystems can be characterized by their living and nonliving components.
3. b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
5.a. Students know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes (CSBE, 1998a).

Social Studies:
4.15 Use maps, charts, and pictures to describe how communities in California vary in land use, vegetation, wildlife, climate, population density, architecture, services, and transportation.
4.47 Trace the evolution of California’s water system into a network of dams, aqueducts, and reservoirs (CSBE, 1998b).

Fifth Grade Standards Met in This Unit

Reading:
1.1 Read aloud narrative and expository text fluently and accurately and with appropriate pacing, intonation, and expression.
3.1 Identify and analyze the characteristics of poetry, drama, fiction, and nonfiction and explain the appropriateness of the literary forms chosen by an author for a specific purpose.

Listening and Speaking:
1.3 Make inferences or draw conclusions based on an oral report (CDSMC, 1999).
Science:
3.d. Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
3.e. Students know the origin of the water used by their local communities (CSBE, 1998a).

Lesson Format

Each lesson has standards, time frame, and materials printed at the beginning of the lesson. Standards are fully printed out in the standards section but are referred to by number in the lesson itself for ease of use with weekly plan books. Any forms needed for activities can be found in Appendix D.

Although the lessons are designed to be used sequentially as a unit, they can be adapted and shortened to fit classroom time constraints. Most lessons contain two or more activities so that if one activity is dropped, the concepts can still be introduced with the activities that are left. Also, these lessons have been taught to grades lower than third with success. Simplifying the activities through such techniques as using a pocket chart for group activities rather than assigning individual work can adapt the lessons to a lower grade level.

Although this unit refers specifically to the neighborhood around Urbita Elementary School, the unit
lessons can be adapted to other neighborhoods in San Bernardino by referring to a San Bernardino city map and locating the nearest stream or body of water to a particular school. The introduction on water history should provide enough information to adapt the lessons to any San Bernardino school's neighborhood. For instance, both Lytle Creek and Warm Springs Elementary Schools are named for nearby streams that are mentioned in the water history section. These streams have changed their flow and appearance through the years because of human activities just as Urbita Lake did as described in the following unit.
Lesson One

Water Literature

Time Frame: 40 minutes

Objectives: Students will share what they already know and think about the subject of water.
Students will write a list poem based on a literature model on the subject of water.

Materials:

- A poem about water on transparency or chart paper
- Large pieces of paper for each group
- Chart paper
- Glass of water
- Picture of a lake or stream
- A poem about water on transparency or chart paper
- Any poem on the subject of water will do for the focus activity, but The Sound of Water by Mary O’Neill is an excellent choice.

Standards:

- Third grade.
  Reading 1.3, 3.1
  Writing SBCUSD prewriting strategies
  Listening and Speaking 1.2, 1.4, 1.9
- Fourth grade.
  Reading 1.1
  Writing 1.1
  Listening and speaking 2.4
- Fifth grade.
  Reading 1.1, 3.1

Procedure

Focus: Hold up a glass of water and a picture of a body of water. Ask students what they know about water and what they think about it. Write their responses on a
spider map to group responses together. Introduce the title of the poem and ask students to predict what words might be in it. Add their guesses to a spider map graphic organizer. See the Spider Map Example in Appendix D for a graphic of what a spider map looks like.

**Comprehension ("through" activity):** Read the poem, Sound of Water (or other selected poem), to the students. Then show the poem transparency on the overhead or on chart paper and read it again together. Ask what sound words could be added to the poem, or adapt this portion to the poem you selected using the pattern of that particular poem. Add a verse to the poem together.

**Response ("beyond" activity):** In groups, use the list poem format to write poems about how water tastes, feels, looks, and smells. Then share them and add any other ideas about water to the group spider map.
Lesson Two

Introduction

Time Frame: One hour and fifteen minutes

This lesson can be spread over two periods with a break before the History Activity.

Objectives:

Students will predict how their neighborhood environment has changed.

Students will summarize and represent aspects of their local environment.

Materials:

Pictures of San Bernardino, past and present
(You can find these at the Chamber of Commerce, on the internet, and at the Feldham Library California Room.)
Clipboards
Crayons or markers
Chart paper
K/W/L chart (See example in Appendix D.)
Note paper

Activity Forms:

Copies of Environment Walk form for all students
Copies of Long Ago Prediction form for all students

Standards:

Third Grade:
Science 3.d.
Social Studies 3.12

Fourth Grade:
Science 3.a., 3.b.
Social Studies 4.15

Fifth Grade:
Science 3.e.
Procedure:

Display pictures of San Bernardino and together list things in the environment you see that people need, such as water and homes. Give each student a piece of paper, pencil, and clipboard for an environment walk. Then take a walk around the school yard and ask students to list things they see that are important to people and to animals that live in and around the school yard.

Back in the classroom ask each student to draw a picture of the local environment on the Environment Walk activity form, listing the elements they include. Have students share their responses. Use student lists to add to your chart paper list.

Look back at the original pictures of San Bernardino and list any important things students may have missed earlier such as food, water, shelter, and space. Then students compare their pictures to the list and finish the Environment Walk form by listing what they did not include.

History Activity:

Ask students to predict what they think the environment looked like before the school and other buildings like Inland Center Mall were built. They draw,
write, and share their responses, using the Long Ago Prediction form.

Closure:

Ask students to think about what they want to learn about their local environment. Guide students to think about such things as how environment has changed and why. Share their responses on the K/W/L chart.
Lesson Three
Urbita Lake

Time Frame: 50 to 60 minutes

Objectives: Students will identify causes and effects relating to human use of the local environment. Students will compare the present environment to the past environment in the local area.

Standards:

Third Grade:
Listening and Speaking 1.5
Science 3.c., 3.d.
Social Studies 3.22, 3.3

Fourth Grade:
Listening and Speaking 1.2
Science 3.b.
Social Studies 4.47

Fifth Grade:
Listening and Speaking 1.3
Science 3.d., 3.e.

Materials:

index cards with answers from Cause and Effect Form B
pocket chart or transparencies
crayons
chart paper
Venn diagram on butcher paper
map of the school neighborhood (You could use the SBCUSD schools map and enlarge the portion showing your school.)

Activity Forms:

Overhead transparency of the Urbita Lake Transparency Masters A through D
Overhead transparency of the Urbita Lake Photo Master
Copies of Then and Now Venn diagrams for each group of two to four students
Copies of Cause and Effect Form A for all students
Focus:

Show the photo transparency of Urbita Lake from the turn of the century and ask what students notice about the environment in the poster. List what they see in it on the board or chart paper and ask what animals might have liked this environment and why.

Instruction:

Explain that the transparency shows what the Urbita neighborhood looked like 100 years ago. Find the location of the lake on a posted map of the neighborhood to show that it was near the current site of Inland Center Mall. Use the overhead transparencies A through D showing changes over the century to pictorially represent the changes in the neighborhood. Show in this order with the following comments.

Transparency A: Many years ago there was a Native American village around a natural spring of warm water. It was later called Urbita Hot Springs.

Transparency B: (Lay over Transparency A). Settlers came to the area and built homes around it. They dammed up the springs to form a lake, Urbita Springs Lake. It was so beautiful that a resort and park was built around it too and more and more people came.
Transparency C: Lay Transparency C over A and B. The area grew and grew. Streets and businesses were built as well as homes. Birds continued to come to the wetlands formed by the spring but the lake dried up after some dry years and with so many people using its water (Remove transparency B).

Transparency D: Lay Transparency D over A and C. Eventually Inland Center Mall and the freeway were built in the area where the spring had been (Remove Transparency A). However, when there is a lot of rain, the water rises and floods the ground levels of some of the stores in the mall.

History in Brief:

Reread the Water History in the Introduction for more complete information. When the Spanish settlers came to San Bernardino 200 years ago, they found a Native American Indian village around Urbita Hot Springs, which was north of what is currently the Sears building at Inland Center Mall. Urbita Hot Springs was a natural hot spring formed from the warm ground water that is still pumped from underneath San Bernardino by the San Bernardino Valley Municipal Water District. Settlers around the turn of the century dammed up the spring to form Urbita Lake. There was a resort built around the hot springs and a park
around the lake, which attracted people for recreation. As more and more people came to San Bernardino, they used up so much ground water that the lake dried up. There was also a drought which contributed to this. Until the 1950s the area south of Urbita Elementary School was a wetlands and a refuge for migrating birds, according to a photograph in the San Bernardino Feldham Library California History room and the archivist there. After that, Inland Center Mall and other construction went on and the refuge was no more. However, recent wet years have brought the ground water level up and sometimes the lower level of one of the mall stores has flooded.

**Activity A:**

Review the events that were shown in the instruction activity by writing each event from the Cause and Effect Form B on an index card. Put them in a pocket chart and have students work together to put them in the correct order. You may have volunteers draw an illustration for each event that could be used as a center matching activity. An alternative is to write each event on a piece of transparency and put them in order together using the overhead screen. Students should follow up by filling in their individual cause and effect chains for evaluation.

**Activity B:**
Look again at the photo transparency of Urbita Lake and compare it to the neighborhood now. Ask students to think about the differences in the neighborhood then and now. Students use the Then and Now Venn diagrams to compare and contrast the past and present environments. After the diagrams are done, share them together and record student responses on a poster sized Venn diagram. Then ask students to think about the consequences of the changes made. What were the consequences of making Urbita Lake? What about building the mall where there was previously a wetlands? Record student responses in each appropriate circle and guide students to note that there are less animals around than when we had a lake or wetlands.

Closure:

Look back at the goals written in the preparation part of the unit on the K/W/L chart. Ask students if they would change any of their original goals or add any. Give them a few minutes to review their lists and do as a think/pair/share activity with a partner. List changes and additions on the chart as they share them.
Lesson Four

Groundwater

Time Frame: One hour and 30 minutes

This lesson can be divided into sections based on the hands on activities.

Objectives:
To recall and generate reasons for controlling groundwater underneath San Bernardino
To represent how groundwater can come to the surface

Materials:

Groundwater poster (If you do not have one, put the Bunker Hill Basin Map on an overhead transparency or use pictures from the Magic School Bus book.)

Materials are noted separately for each hands on science activity in the lesson.

Activity Forms:

Groundwater Activity Form for each student or student group
Liquefaction Activity Form for each student
Overhead transparency made of the Proposed Lakes and Streams Plan
Fishbone Map for each student group on large piece of paper (See example in Appendix D.)

Standards:

Third Grade:
Listening and Speaking 1.2, 1.5
Science 3.c., 3.d.
Social Studies 3.12
Preparing:

Remind students of the flooding that happens at Inland Center. Ask where they think the water comes from. List their ideas on the board.

Finding Out:

Show a groundwater poster to illustrate where surface and groundwater goes and comes from. Read portions of The Magic School Bus At the Waterworks to further illustrate the concept of groundwater.

Brief Background:

In 1997, the San Bernardino Valley Municipal Water District proposed using groundwater to form a lake or lakes in downtown San Bernardino. Although bringing back Urbita Lake is not in the current proposal, the plan under consideration calls for a lake near the Stampede Baseball Stadium. The water district and the City of San Bernardino want to build the lake to protect against earthquake liquefaction, to make water accessible for water system use and sale, to help clean up toxic chemical flumes working their way through the ground water, and to improve
the problem of urban blight in downtown San Bernardino. Added benefits would be the recreational and wildlife uses as well as the beauty of the lake. The idea is controversial, principally because of the costs involved and because of the consequences to residences and current businesses in the affected area. For more information, read through the introduction section of this project.

**Hands On Activity 1:**

**Materials needed**
- plastic soda bottles cut in half for each student group
- cardboard TP tubes
- gravel
- soil
- container of water
- turkey baster
- plastic tray for each student group

**Procedure**

Students should be put into groups of three or four for this activity. Each student should have a Groundwater Activity Form to record observations for the activity. Students may be given the materials and directions for assembling their models or, to save time, the bottles may be set up as follows ahead of time. Materials should be used over the plastic tray.

Using the bottom half of the soda bottle, hold the cardboard tubes in the middle and pour gravel around them.
Pour the soil over the gravel. Using the top half of the bottle to direct the flow of the soil helps avoid messes.

At the beginning of the activity, pour water around the tube in the soil, using the top half of the bottle to direct the water around the tube. Watch the inside of the tube to see the "groundwater" appear in the "well" made by the tube. First it disappears in the soil and can then be seen pooling in the tube. Explain that this works like groundwater.

Then, using the baster, take one of the student group's bottles and demonstrate overuse of ground water, removing the water until no more shows in the tube. Guide students to relate this to the original drying up of Urbita Lake.

**Hands on Activity 2:**

**Materials:**
- clear plastic tub
- blocks
- soil
- container of water
- small square of thin cardboard

**Procedure:**

Demonstrate the problem of earthquake liquefaction by making a model of the neighborhood with blocks on top of soil in a large clear plastic tub. Put the cardboard in the middle of the soil before adding the rest of the soil.
and blocks. Do not place blocks over the cardboard. Remind students that the soil has ground water and that underneath the Urbita neighborhood, the groundwater is nearly at the surface of the soil. Begin to add water cup by cup to the model. Ask students to complete a diagram on the first part of the Liquefaction Activity Form at this point. Then simulate an earthquake by shaking the model. Say that during an earthquake, rock layers can be moved. Move the cardboard "rock layer" so that water reaches the blocks and they sink in the mud. Ask students to finish the Liquefaction Activity Form to show what happened with the ground water in this "earthquake" to assess their comprehension of the model. Have them share their responses.

Show the transparency of the Proposed Lakes and Streams Plan and explain that one reason that city and water officials want to build a lake is to control the groundwater. so that if we have an earthquake, the city will be protected from liquefaction. Ask if they can think of any other reason to build a lake. Students may come up with ideas such as that it would be good for recreation, wildlife, and use in the water system.
Closure:

In small groups, students recall and think of reasons for controlling the city’s groundwater. They fill in Fishbone Map graphic organizers on large sheets of paper with the reasons they may come up with for making lakes from some of our groundwater. Share the results and post them.

Evaluation: Use the student response sheets to evaluate how well the objectives were met.
Lesson Five
Lakes and Streams

Time Frame: One hour for activities A and B with another hour to hour and a half for the closing Activity

Materials:
Completed Venn diagram from Urbita Lake lesson
Completed Fishbone Maps from Groundwater lesson
News article or information from the Neighborhood Action and Preservation Association web site about homeowner’s feelings towards the Lakes and Streams Project
Spider map on chart paper or transparency (See sample.)
Lined paper
Stapler
Scissors
Glue
Construction paper
Crayons or markers

Activity Form:
copies of Ideal Neighborhood Activity form for all students

Standards:

Third Grade:
Listening and Speaking 1.2, 1.5
Writing 1.1, 2.2
Science 3.b, 3.c, 3.d
Social Studies 3.12, 3.22, 3.3, 3.42

Fourth Grade:
Writing 1.1, 1.3, 1.7
Listening and Speaking 1.2
Science 3.a., 3.b.
Social Studies 4.15, 4.47

Fifth Grade:
Listening and Speaking 1.3
Science 3.d., 3.e.
Objectives:

To generate ideas to improve the environment around our school

To analyze the differing view points of people involved in the downtown lake proposal

To develop concepts about what is important for our local environment

Focus:

Refer to the large Venn diagram from the previous lesson on Urbita Lake, comparing the local area then and now. Add a circle to the diagram for future changes and ask students what changes they see happening in the future in this area and the downtown environment. Record their answers as they indicate where they should go on our chart. Then refer back to the Fishbone Maps students did in the Groundwater lesson on reasons for building a downtown lake. Ask if students can think of any reasons why a lake should not be built and list those reasons.

Activity A:

Ask students to list their feelings about having or not having a lake in their neighborhood and their reasons for feeling that way. Responses might include the opportunity for recreation, beauty, danger of drowning, or that animals could live there. Then share a summary of the
news article about home owners feelings towards the lake project or ask them how they would feel if their home or school was torn down or moved in order to build a lake. Ask them how they think a child whose home would be removed for the lake would feel about it.

Have students fold a piece of paper lengthwise. On one side they should write how they would feel about having a lake if they did not need to move, and on the other side how they would feel if their home was torn down to build the lake. Share responses by making a list of feelings on both sides of the issue. Then have students list what is important to each side based on their responses. For example, those who want a lake may find safety (because of the danger of liquefaction) is important, or beauty and recreation. Those who do not want a lake may find that their neighborhood and homes are most important.

Activity B:

Using the Ideal Neighborhood Activity form, ask students to draw a future neighborhood environment which they think would be ideal, listing what they would change from the present environment. As students share their ideas, write their responses on the spider map, grouping like ideas together. Have students help you group the
ideas and name the concept that links them. For example, "more trees" and "parks" could go together under the concept of nature while "no criminals" and "no drugs" might go together under the concept of "people." Try relating some ideas to more than one group. For example, people would plant the trees, so there is a connection between people and nature. Then help students come up with a summarizing sentence about what future changes are needed in the neighborhood environment.

Closing Activity and Evaluation:

As a culminating activity, have students apply what they have learned in an art and writing activity. Have each student (or divide students into groups of three) make a set of three triaramas depicting the previous, present, and possible future environment in their neighborhood. Students should write a descriptive card to go with each 3-D scene. Staple them together in order and let each student or group of students share their work. Finally, finish the "What We’ve Learned" section of the K/W/L chart from the introductory lesson.

Possible Action Project:

If desired, this is an excellent point at which to have students consult on an action project to improve their local or school environment. After having shared
their triaramas, students could list projects that they could carry out themselves in order to help bring about a more ideal environment. Possibilities could include a clean up day, planting a garden, painting a mural, a letter writing campaign, or an educational display to teach other students about the environment. For more ideas, consult Dr. Darleen Stoner’s *Taking Action: An Educator’s Guide to Involving Students in Environmental Action Projects*, published by Project WILD (1995).

**Alternative Activities:**

Role playing would be an alternative or additional way to explore the feelings of the people involved in the Lakes and Streams issue. Students could be assigned the parts of a homeowner who would need to move, a city official concerned about liquefaction and improving the look of the city, or a reporter assigned to interview them. This could be done in groups to avoid stage fright, or if a particular class is used to dramatic activities, a group could perform in front of the class, which would then discuss what happened in the role play.

Another possibility is to further analyze the issue of whether to build a lake downtown or not by having students work with partners to complete the Decision Matrix (in the Activity Form section). Students would
discuss what the results would be of either action, building or not building the lake, and would be asked to come up with a decision based on how they analyzed the issue using the activity form. The Decision Matrix would also work as an alternative closing and evaluation activity.
APPENDIX B

UNIT TWO

THE LAKES AND STREAMS PROJECT

A CURRICULUM UNIT FOR SIXTH

THROUGH EIGHTH GRADES
THE LAKES AND STREAMS PROJECT
A CURRICULUM UNIT FOR SIXTH
THROUGH EIGHTH GRADES

Unit Overview

The goals of this unit are to instruct students in issue analysis by engaging them in an exploration of the real life issue of the Lakes and Streams project. To familiarize students with the process of issue analysis, one lesson deals with the values of different characters in the book, *The Great Kapok Tree* by Lynne Cherry. Subsequent lessons help students to understand the history of the issue and science concepts, such as groundwater pollution, that are part of the Lakes and Streams issue.

California academic standards addressed in this middle grades unit are listed by grade level and subject area in the California Standards section of this unit. The standards are also listed by number only at the beginning of each lesson to make it easier for teachers to include them in lesson plans.

Each lesson begins with a time frame, standards and objectives, and a listing of materials needed for that lesson so that teachers can more easily prepare. Any activity masters that will be needed are listed after the materials and can be found in the Activity Form section.
Some lessons can be taught over two or more periods and are so noted at the beginning of the lesson. Possible adaptations are listed at the end of selected lessons.

**Sixth Grade Standards**

**Reading:**

1.1 Read aloud narrative and expository text fluently and accurately and with appropriate pacing, intonation, and expression.
1.4 Monitor expository text for unknown word or words with novel meanings by using word, sentence, and paragraph clues to determine meaning.
2.3 Connect and clarify main ideas by identifying their relationships to other sources and related topics.
2.4 Clarify an understanding of texts by creating outlines, logical notes, summaries, or reports.
2.8 Note instances of unsupported inferences, fallacious reasoning, persuasion, and propaganda in text.

**Listening and Speaking:**

1.2 Identify the tone, mood, and emotion conveyed in the oral communication.
1.4 Select a focus, an organizational structure, and a point of view, matching the purpose, message, occasion, and vocal modulation to the audience.
2.4 Deliver persuasive presentations.
2.5 Deliver presentations on problems and solutions.

**Writing:**

1.2 Create multiple-paragraph expository compositions.
2.2 Write expository compositions (e.g. description, explanation, comparison and contrast, problem and solution) (CDSMC, 1999).

**Science:**

1.d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
1.e. Students know major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
1.f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics (CSBE, 1998b).
2.d. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.
5.e. Students know the number and type of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.
6.b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.
7.d. Communicate the steps and results from an investigation in written reports and oral presentations.
7.f. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map (CSBE, 1998a).

Visual and Performing Arts:

Visual arts.
2.4 Create increasingly complex original works of art reflecting personal choices and increased technical skill.
2.5 Select specific media and processes to express moods, feelings, themes, or ideas.
2.6 Use technology to create original works of art.

Theater.
2.1 Participate in improvisational activities, demonstrating an understanding of text, subtext, and context.
2.2 Use effective vocal expression, gesture, facial expression, and timing to create character.
5.1 Use theatrical skills to communicate concepts or ideas from other curriculum areas, such as a demonstration in history-social science of how persuasion and propaganda are used in advertising (CSBE, 2001).
Seventh Grade Standards

Reading:
1.3 Clarify word meanings through the use of definition, example, restatement, or contrast.
2.1 Understand and analyze the structure and purpose between various categories of instructional materials.
2.2 Locate information by using a variety of consumer, workplace, and public documents.
2.3 Analyze text that uses the cause and effect organizational pattern.
3.3 Analyze characterization as delineated through a character's thoughts, words, speech patterns, and actions: the narrator's description; and the thoughts, words, and actions of other characters.

Listening and Speaking
1.1 Ask probing questions to elicit information, including evidence to support the speaker's claims and conclusions.
1.2 Determine the speaker's attitude toward the subject.
1.3 Respond to persuasive messages with questions, challenges, or affirmations.
2.2a Include the main ideas of the event or article and the most significant details.
2.3 Deliver research presentations.
2.4 Deliver persuasive presentations.

Writing:
1.1 Create an organizational structure that balances all aspects of the composition and uses effective transitions between sentences to unify important ideas.
2.4 Write persuasive compositions. (CDSMC, 1999).

Science:
7.d. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge.
7.e. Communicate the steps and results of an investigation in written reports and oral presentations (CSBE, 1998a).

Visual and Performing Arts:
Visual arts.
2.6 Create an original work of art, using film, photography, computer graphics, or video.
Theater.
2.3 Create characters, environments, and actions that exhibit tension and purpose.
5.1 Use theatrical skills to communicate concepts or ideas from other curriculum areas, such as creating a musical based on a piece of literature (CSBE, 2001).

Eighth Grade Standards

Reading:
1.3 Use word meanings within the appropriate context and show ability to verify those meanings through definition, restatement, example, comparison, or contrast.
2.6 Use information from a variety of consumer, workplace, and public documents to explain a situation or decision, or to solve a problem.

Listening and Speaking:
1.2 Paraphrase a speaker’s purpose and point of view and ask relevant questions concerning the speaker’s content, delivery, and purpose.
1.7 Use audience feedback.
2.4 Deliver persuasive presentations.

Writing:
1.1 Create compositions that establish a controlling impression, have a coherent thesis, and end with a clear and well-supported conclusion.
2.3.d Organize and display information on charts, maps, and graphs.
2.4 Write persuasive compositions (CDSMC, 1999).

Visual and Performing Arts:
Visual arts.
2.3 Create an original work of art, using film, photography, computer graphics, or video.
Theater.
2.2 Perform character-based improvisations, pantomimes, or monologues, using voice, blocking, and gesture to enhance meaning.
5.1 Use theatrical skills to present content or concepts in other subject areas, such as creating a video on cellular mitosis (CSBE, 2001).

Social Studies:
8.84 Examine the importance of the great rivers and the struggle over water rights.
Sixth Through Eighth Grade Social Studies Standards

Historical and Social Science Analysis Skills:
Chronological and spatial thinking 3. Students use a variety of maps and documents to identify physical and cultural features of neighborhoods, cities, states, and countries and to explain the historical migration of people, expansion and disintegration of empires, and the growth of economic systems.

Research, Evidence, and Point of View 4. Students assess the credibility of primary and secondary sources and draw sound conclusions from them (CSBE, 1998b).
Lesson One: Introduction

Time Frame: 50 to 60 minutes

Standards:
Sixth grade-
Reading 1.1, 1.4,
Writing 1.2, 2.2
Seventh grade-
Reading 2.2
Writing 2.4a,
Listening and Speaking 2.2a
Eighth grade-
Reading 2.6
Writing 1.1, 2.4,
Social Studies 8.84
Sixth through eighth grades.
Historical and Social Sciences: Chronological and Spatial Thinking 3

Objectives: Generate students’ background knowledge on the topic of what makes an ideal community.

Students will consult together to come up with a preliminary idea of what an ideal community might be like.

Students will compare the community now to what it was 100 years ago.

Materials:

Chart paper or overhead transparency divided into three parts
Overhead transparency of Urbita Lake Photo Master

Activity Forms:

Copies of Lakes and Streams Student Summary for all students
Procedure:

Begin by asking students what they think is most important in making their community a good place to live. Have them do a five minute quick write on this topic and then share their ideas while listing them on chart paper under the title “Good things about our community.”

Next, ask what has been done in the past to make their community better or worse. What changes have taken place over the years and what has been the impact on the community? This could be done as a “think-pair-share” activity in which students are paired and have one minute to think quietly about the topic, two minutes to talk about and list their ideas with their partner, and finally all partners share with the class. List the ideas generated under the second section titled “Changes in our community.”

Show students the overhead transparency of Urbita Lake and explain that this is what the area looked like 100 years ago. Have them read the Lakes and Streams Student summary and then add any other changes they have noted in the community to the classroom chart.

Closure: Finally, read this quotation from Al Groves, a consultant on the Lakes and Streams project (Wall, 2000a):
“Water is magic. Water can transform communities into
something new." Ask students to think about this quotation in light of what they have read in the Lakes and Streams Student Summary. Ask them whether they think water can help make an ideal community or not and why. What else, if anything, do they think would be required to make a real difference in a community? Students could do this as another quick write, or write a short essay on this topic as a homework assignment. Whichever way is chosen, have students share their ideas to list on the third part of the chart with the title "Ideal community."
Lesson Two: Science Concepts in the Lakes and Streams Project

Time Frame: two one hour periods

Objectives:
Students will demonstrate an understanding of the concepts of liquefaction, groundwater, and contamination.

Students will cooperate together in performing a science experiment.

Standards:

Sixth grade.
Reading, 1.4

Seventh grade.
Reading 1.3, 2.2
Science 7.d., 7.e.

Eighth grade.
Reading 1.3, 2.6
Writing 2.3.d.

Social Studies 8.84
Sixth through eighth grades.

Historical and Social Sciences Skills: Chronological and Spatial Thinking 3

Materials for Part One:

For each group of 4 students-
Plastic milk carton or soda bottle with top cut off
Cardboard tube
Cup of gravel
Cup of soil
Pack of dry Koolaid
2 cups of water
Eye dropper
Activity Forms for Part One:

Overhead transparency of Urbita Lake Photo Master
Overhead transparency of Bunker Hill Basin Map
Overhead transparency of Groundwater Diagram
Copies of Groundwater Science Activity forms for each student
Copies of Science Concepts Student Summary for each student

Procedure for part 1.

Focus. Show students the picture of Urbita Lake and ask if they know where it was taken. Let them know that this was what the area around Urbita Elementary School in the City of San Bernardino looked like 100 years ago because of the water beneath the city, which emerged to the surface.

Instruction. Show the Groundwater Diagram transparency and discuss how rain and surface water fill the groundwater basin while wells empty it. Students read the Science Concepts Student Summary, highlighting the most important details and sharing them in a short class discussion. Show students the transparency of the Bunker Hill Basin, noting that this underlies the city of San Bernardino.

Groundwater activity. Explain that students are going to demonstrate how water can be present underground and fill wells, such as those used in the City of San Bernardino. Divide students into groups of four. Students
place the tube in the middle of their container. Using the top of the bottle as a funnel, they pour gravel around the tube so that about half the tube is in the gravel. Then they pour the soil over this to within an inch of the top of the tube. Next, they pour about 1/2 cup of water over the side of the container and watch in the middle of the tube "well." They pour about a cup of water altogether. Water should begin to gather in the bottom of the tube. Students can then use the eyedropper to bring it up to examine.

Next students will investigate contamination of ground water. They bury the Koolaid in the soil of their container and look again at the water. They fill in a prediction on the Groundwater Activity form. Next they pour more water over the soil and look again at the water in the tube. They should use the eyedropper to look at the water closely. It should have been colored by the dissolving Koolaid.

**Evaluation:** Discuss what this shows about how chemicals can contaminate groundwater and have students write on their Groundwater Activity sheets what they found out about groundwater. They should make a diagram and write to show their understanding.
Part Two:

Materials.

A copy of *The Magic School Bus at the Waterworks* by Joanna Cole
Large plastic tub
Blocks
Soil
Pitcher of water
Small square of cardboard

Activity forms.

Copies of Lakes and Streams Vocabulary Match Up for all students
Copies of Lakes and Streams Vocabulary-Science Terms section for all students
Copies of Bunker Hill Basin Map for all students
Copies of Bunker Hill Basin Map Activity for all students

Procedure:

**Focus.** Begin by reading part of *The Magic School Bus at the Waterworks* to review the concept of groundwater. Then explain that today we will look at the concept of liquefaction. Ask if they remember what it said about liquefaction in the Science Concepts Student Summary.

**Liquefaction activity.** Fill the tub with gravel and cover the gravel with soil. On top of the soil put the cardboard. Have students volunteers build a model city with the blocks, but not over the cardboard. Then begin to pour in water as the groundwater. When there is water only about an inch deep in the tub, jerk the container to simulate an earthquake. Although the blocks may fall,
will not sink into the earth. Now explain that when groundwater is close to the surface of the earth, the mixing of soil with water can cause the earth to move like jello. Add water until it can clearly be seen in the gravel and soil up to the surface. Ask students what will happen to the buildings in an earthquake if there is liquefaction. Jerk the container again to simulate an earthquake. Tell students that during an earthquake rock layers may move and move the cardboard to simulate this. Water should then reach the blocks so that some sink in the mud.

**Closing and evaluation:** Ask students to draw and write what they learned about liquefaction from this demonstration. Using the Bunker Hill Map Activity forms, have them look at the Bunker Hill Basin Map and color the areas that would be most subject to liquefaction, remembering that San Bernardino is built on two earthquake faults and that when water is closest to the surface, liquefaction is a possibility.

**Extension for homework:** Assign students to read the Lakes and Streams Vocabulary and complete the Vocabulary Match Up. See the answer key for the Vocabulary Match Up and the Bunker Hill Basin Map Activity to correct student work.
Lesson Three:
The Lakes and Streams Project

Time Frame: 50 to 60 minutes

Objectives: Students will identify the problems addressed by the Lakes and Streams project.

Students will identify reasons for and against the project.

Students will locate the area affected by the project on a local map.

Standards:

Sixth grade.
Reading 1.4, 2.4
Science 7.f.

Seventh grade.
Reading 1.3, 2.1, 2.2, 2.3

Eighth grade.
Reading 1.3, 2.6
Writing 2.3.d.
Social Studies 8.84
Sixth through eighth grades.
Historical and social sciences skills: Chronological and spatial thinking 3

Materials:

Pictures showing rundown homes and yards (If possible, take Polaroids in the City of San Bernardino showing blighted and well kept areas. Otherwise make a transparency of the Blighted Areas and Well Kept Areas Pictures in the Activity Form section.).
San Bernardino city map for each group of 4 students (available from Chamber of Commerce, AAA, or off the Mapquest web site)
Large piece of white construction paper or chart paper for each student group
Markers for each student group
Activity Forms:

Overhead transparency of Proposed Lakes and Streams Plan
Copies of Lakes And Streams Student Summary for all students
Copies of Lakes and Streams Vocabulary for all students

Procedure:

Focus. Show the students the pictures of well kept homes and ask what they have in common. Next show the pictures of rundown areas and ask what these have in common. List their ideas and guide them to notice specific differences (old tires and trash in lots, weeds, lack of paint in blighted areas). Explain that the rundown areas are what is called “urban blight.” Ask why urban blight can be considered a problem. List their ideas and if no one has come up with this, explain that blighted areas cause problems for cities as a whole, not just the people who must live in them. Cities provide services based on taxes and fees. Property taxes in blighted areas generate less income than in well kept areas (Public Policy Institute of California, 1998), causing a drain on the city budget. Businesses tend to locate in well kept areas, bringing jobs, so redevelopment in blighted areas is often linked to business outreach efforts in the hope that more jobs can be created for local citizens (City of Riverside,
2001). The City of San Bernardino’s downtown revitalization program is aimed at increasing property values, cutting down on vacant properties, and enhancing the image of the city to lure new businesses and hence, new jobs (Tim Cook, personal communication, 2001).

**Instruction.** Show the overhead transparency of the Proposed Lakes and Streams Plan and tell them that this shows how the government of the City of San Bernardino proposes to change the community and solve the problem of urban blight by removing rundown buildings and replacing them with a lake, park, and new buildings. The San Bernardino Valley Municipal Water District also wants to build a lake so that it can solve the groundwater problems learned about in the previous lessons. Show on a map where the project is being planned and ask if anyone has been there. Ask if anyone can think of reasons why this lake should not be built. List ideas and make sure that cost and the need for people to move are included.

**Exploration.** Divide students in to small groups and have them reread the Lakes and Streams Student Summary. Students should then discuss what they have learned and find the area planned for the lake on the city map. Next students make fishbone maps in groups to explain reasons for building the lakes and streams project and reasons not
to build it. If time is a factor, student groups might work on a pro or a con team. See example on the Fishbone Map activity form.

**Closure.** Have student groups share their fishbone maps and make a master map on an overhead transparency of chart paper that includes all their ideas.

**Answer key for Fishbone Map.** Possible answers could be:

**Reasons for building the lake-**
- groundwater contamination or pollution
- liquefaction
- flooding
- urban blight
- water storage
- recreation
- beauty
- more taxes for the city

**Reasons not to build the lakes-**
- cost
- people will lose their homes
- not enough homes for poor people
- loss of historical buildings
- fairness (Why should those people have to move?)
- Maybe it won’t help groundwater problem
Lesson Four:
The Great Kapok Tree

Adapted from issue analysis curriculum by Hagenbruger and Hungerford (1993, pp. 54-73)

Time Frame: 50 to 60 minutes

Standards:

Sixth grade.
Reading 1.4, 2.3, 2.8,
Writing, 2.2,
Science 5.e., 6.b.

Seventh grade.
Reading 1.3, 3.3,
Writing 2.4

Eighth grade.
Reading, 1.3,
Writing 2.3.d., 2.4

Sixth through eighth grades.
Historical and Social Science Skills: Research, Evidence, and Point of View Skills

Objective: Students will learn to analyze statements of players in an environmental issue for the beliefs they reveal.

Materials:

A copy of the book, The Great Kapok Tree by Lynne Cherry

Activity Forms:

Copies of Values Chart for all students
Copies of Kapok Tree Issue Analysis for all students
Overhead transparency of Value Chart
Overhead transparency of Kapok Tree Belief Statements
Procedure:

**Focus:** Remind students of their previous ideas from lesson one and state that today they will be investigating the values that underly the opinions of people in their community so that they can better understand how to solve problems such as the Lakes and Streams issue, for which people disagree on solutions. Ask them what they think a value is and list ideas on the board.

**Instruction:** Hold up the book, *The Great Kapok Tree*, to show its illustrations of the rain forest. Introduce the book by telling the class that this book deals with an environmental problem, the decline of rain forests. This is also an environmental issue, because although there is general agreement that the disappearance of rain forests is a problem, there is a difference of opinion on what to do about it. A problem becomes an issue when there is disagreement on how to solve it. Ask students what they know about this environmental problem and who they think might be involved in the problem. Examples could be, native people and animals who live in the forest, loggers, farmers, or tourists. Ask what they think would be most important to each of these “players.” Show the transparency of the Value Chart and read over and discuss it. Explain that as you read the book, they will be trying to assign a value or values from this chart to each of the characters.
Guided Practice: Next, read the book and ask students to list the characters as you read. When done, ask students to share what they feel were the values shown by two or three of the characters and why they felt that. Show the overhead transparency of the Kapok Tree Belief Statements and work together to assign values to each statement.

Independent practice: Give students the Kapok Tree Issue Analysis form and ask them to proceed as you did as a group and assign values for each statement. When most are done, share answers, referring to the Answer Key for the analysis form. If students can back up their answer, it should be accepted even if it is not on the answer key.

Evaluation: Ask students to pick one of the players listed at the beginning of the lesson and write a quotation, or belief statement, that might come from that player. Have them follow this by writing the value or values linked to that statement along with their reasoning in choosing them.

Adaptation: For homework, ask students to find a newspaper article dealing with any issue. Find a statement in that article by someone involved with it and list the value or values associated with the statement along with their reasoning.
Lesson Five:
The Lakes and Streams Issue

Time frame: 45 minutes to 1 hour

Objectives:

Students will identify major players in the Lakes and Streams issue and their positions.

Students will chart connections between players identified in the Lakes and Streams issue.

Standards:

Sixth grade.
Reading 1.4, 2.3, 2.4, 2.8
Listening and Speaking 2.4, 2.5
Science 2.d, 6.b.

Seventh grade.
Reading 1.3, 3.3
Listening and Speaking 2.4

Eighth grade.
Reading 1.3, 2.6
Writing 2.3.d.
Listening and Speaking 2.4
Social Studies 8.84

Materials:

Chart paper
Marker

Activity Forms:

Overhead transparency of Lakes and Streams Organization Chart
Copies of Lakes and Streams Players for all students
Copies of Values Chart for all students
Copies of Lakes and Streams Quotations Match Up for all students
Copies of Organization Chart Activity for all students
Procedure:

Focus. Show students an overhead transparency of the Organization Chart of the players involved in the Lakes and Streams issue. Discuss each section of the chart and how the different groups connect together.

Instruction. As students go over the chart with you, have them read the descriptions of each player in the Lakes and Streams Players student summary.

Practice. Using the Values Chart, students could share predictions and their reasoning on what the values of each group may be. Ask students to fill in the blank Organization Chart Activity to reinforce the connections between each group.

Exploration. Next, using the answer sheet, give an example of matching a quotation to the player and identifying a value on the Lakes and Streams Quotations Match Up. Remember that although the Answer Key will give expected answers, students may come up with answers that can also be acceptable if they explain their reasons. If students can justify their answers, the answers should be acceptable since they are practicing their skills of analyzing and identifying issues.
Have students work in pairs to discuss and match the quotations and identify values. Then get back together and share their answers.

**Closure:** Finally, have students brainstorm ways that different groups might come to a point of agreement in a meeting and list them on chart paper. Explain that there have been and will continue to be many citizen meetings addressing this issue to try to bring about some sort of agreement that addresses as many of the concerns as possible.
Lesson Six:
Decision Making

Time Frame:

One hour, or two hours if students do their own research

Objectives:

Students will work together to consult on the issue and try to come up with possible solutions, practicing environmental issue analysis.

Students will role play a player in the lakes and Streams issue.

Standards:

Sixth grade.
Writing 1.2, 2.2
Listening and speaking 1.2, 1.4, 2.4, 2.5
Theatre 2.1, 2.2, 5.1

Seventh grade.
Writing 1.1
Listening and speaking, 1.1, 1.2, 1.3, 2.3, 2.4
Theater 2.3, 5.1

Eighth grade.
Writing 1.1
Listening and speaking, 1.2, 1.7, 2.4
Social Studies 8.84
Theater 2.2, 5.1

Sixth through eighth grades.
Historical and Social Science Skills: Research, Evidence, and Point of View Skills 4

Materials:

Chart of possible solutions from Lesson Five
Chart paper
Markers
Preparation: You will need up-to-date information on the Lakes and Streams project printed from the web sites for the City of San Bernardino, San Bernardino Valley Municipal Water District, and Neighborhood Action and Preservation Association listed in the Resource section. If you have access to internet ready computers for your class, you could assign students to research their role themselves using the internet.

Activity Forms:

Overhead transparency of Organization Chart
One Role Play card for each student
Copies of Lakes and Streams Players for each student
Copies of Lakes and Streams Student Summary for each student

Procedure:

Remind students of the players involved in the Lakes and streams issue by showing the Organization Chart. Explain that they will be given a card that gives them one of the players to role play in a citizen meeting. The goal of the meeting is to come to an agreement, if possible. Show them ideas they listed last meeting on the chart paper. Tell them that in a role play, they are pretending to be the person on the card and to hold the values that person has. Give students time to review the Student Summary and Lakes and Streams Players from previous lessons, as well as any new information researched, so
that they can plan how to play their characters. If time and computers are available, assign an extra class period for students to research their own roles.

The role play should be conducted with the stated goal of coming to some sort of negotiated solution to the issue. Therefore, it is important to go over some guidelines before the role play begins to focus student energy on learning about the issue and how to solve problems related to environmental issues. Students should be reminded that although they are playing roles, there is no excuse for rude behavior that intimidates others. Although feelings related to the role play can be expressed, they should be related to the values held by the character played and not be an excuse for name calling of any sort. If conflict arises that prohibits issue solutions, an additional class period could be used in which students switch characters to better understand other values involved in the issue.

The teacher should chair the “citizen meeting” so that students may be engaged with questions. If there are not too many students, they can all participate in one meeting. If there are more students than cards, have more than one group or more than one student role playing for some cards. Let students continue the role play as long as
there is time and it is productive, with the goal of coming up with a solution to the issue. Then end the lesson by having students share their conclusions.

**Closure:** End the lesson by having students share any insights they gained by playing the role of someone involved in this issue. Have them share what values they feel their character showed in the role play.

**Evaluation:** For a homework assignment, students should write a short essay demonstrating what they learned about the Lakes and Streams issue and about solving other environmental issues.
Lesson Seven:
Community Action Project

**Time frame:** three 50 minute sessions

**Objectives:**

Students will survey their neighborhood for urban blight.

Students will apply what they have learned about environmental issues and neighborhood needs to plan improvements for their own community.

Students will produce a visual representation of their improvement ideas and will use it to give an oral persuasive presentation.

Optional—Students may design and carry out an action project to improve their community.

**Standards:**

**Sixth grade.**
Listening and speaking 2.5
Visual arts 2.4, 2.5, 2.6 (2.6 if technology is used)

**Seventh grade.**
Visual arts 2.6 (if technology is used)
Listening and speaking 1.1, 1.3, 2.4

**Eighth grade.**
Listening and speaking 2.4
Visual arts 2.3 (if technology is used)
Writing 2.3.d.

**Materials:**

Blank overhead transparency
Maps of the neighborhood
Clipboards
Piece of butcher paper and markers for each group
Permission slips for a walking field trip around the neighborhood
Construction paper
Writing paper and pencils
Art supplies such as pastels, colored pencils, tissue paper, glue

Activity Forms:
Overhead transparencies of Blighted and Well Kept Area Pictures

Procedure for part one:
Focus. Show the Blighted and Well Kept Areas Pictures on the overhead and ask which show signs of blight and why. Remind students that one of the reasons proponents give for building the lake downtown is to fight blight. The lake is a possible solution for the environmental problem of blight, a problem the government of the City of San Bernardino is struggling to solve. Ask students whether they would rather live in a blighted area or one that looks well cared for. Have them give their reasons.

Instruction. Have students do a quick write activity on the topic of “What I can do to fight blight.” The purpose of the activity is to focus students on their own role in improving the community. Have students share their ideas, or lack of them as some students may feel they do not have much power to solve this problem. If this has not been brought up in discussion, lead students to focus on the neatness of their classroom and school as something
they can have some effect over through simple things such as cleaning up after themselves.

**Exploration.** Next, tell students that they are going to carry out a blight survey of their neighborhood. Pass out clipboards, maps, and paper. Ask students to draw a line down the middle of the paper and write blight on one side and beauty on the other. Students may share maps and clipboards, working in pairs so that each student is only carrying one thing. Explain that they are to work together to point out examples of blight, marking this on the map and listing it on their paper. They should also note examples of beautiful homes or areas in the same way. Begin the walk and continue until about 10 minutes before the end of the class period.

**Closure.** Have students share their examples for as long as time permits, listing them on an overhead transparency under the titles "blight" and "beauty" for part two.

**Procedure for part two:**

**Focus.** Show the overhead transparency from part one to review what students found on the neighborhood blight survey.
Have students get out their lists and maps to share a few more ideas if there was not sufficient time in part one.

Procedure: Remind students that they can make a difference in their communities and that today you want them to discuss with their partners how they could change one or more of the blighted places on their list so that it becomes beautiful. Ask students to come up with a plan that they feel could work. If their plan requires the help of other people, have them include ways to get that help, such as writing letters or a press release, or giving a talk. Finally, tell them that they are to make a poster which includes a visual representation of the changes they wish to make and a message designed to persuade people to help make the changes. These could be done on computers using a paint or graphics program if these are available.

Students should work for the remainder of the class period on their projects. If necessary, they could finish them in another class period or for homework. They should plan on a short oral presentation to persuade other of the value of their idea. Examples of possible ideas might be to weed and plant a flower garden, to clean up a vacant lot, to paint a run down house, or to clean up graffiti.

Procedure for part three
**Evaluation.** Students take turns giving their short oral presentations using their posters. They should be prepared to answer questions. Student presentations can be used for evaluation of the lesson and unit objectives.

**Adaptation:**

If your class circumstances permit this, students could choose one or more action projects from the ideas presented to actually carry out. This would give students practice in citizenship and action skills and would reinforce the sense that they can actually make a difference in their own community. Action projects could also take place on the school grounds, with such projects as a clean up, painting a mural, or planting a garden.
APPENDIX C

RESOURCES
RESOURCES

Agencies

Asistencia

26930 Barton Rd.
Redlands, CA 92373
909-793-5402

The Asistencia, a San Gabriel Mission extension, is a great site for field trips relating to state and local history. The zanja, or irrigation ditch, which the Mission fathers built with native labor, runs a block behind the Asistencia. Displays in the small museum also reflect the Native American, mission, and Mormon periods.

CSUSB Water Resources Institute
California State University, San Bernardino
550 University Pkwy.
San Bernardino, CA 92407
909-880-7681
http://wri.csusb.edu

The institute maintains a library of water related materials.
California Department of Water Resources

Office of Water Education
1416 9th St., Room 1104-1
Sacramento, CA 95814
916-653-6192
http://wwwowe.water.ca.gov/

The Office of Water Education publishes free curriculum materials for teachers. An especially helpful source is their book, *All About Water*, which contains copyable activity sheets on many water topics.

Environmental Education Resource Center
California State University, San Bernardino
5500 University Pkwy.
San Bernardino, CA 92407
909-880-5681

Located in the library building, this resource center has curriculum available on water education for teachers.

Feldham Library California Room
555 W. 6th St.
San Bernardino, CA 92410
909-381-8208

The library has collected resources dealing with San Bernardino history that are available in the California room. Water history is covered in depth, there are
historical photographs which can be copied to illustrate changes in your neighborhood school area, and the staff has collected newspaper clippings dealing with the lakes and streams project, the water district, and other local agencies.

San Bernardino County Museum
2024 Orange Tree Ln.
Redlands, CA 92410
909-307-2669

The museum bookstore has references for sale on local history, while the displays in the history room illustrate local historical periods. The museum has teacher kits with realia which can be checked out to use in the classroom. There is a Cahuilla Indian kit with tools that reflect the native American period of state and local history. Field trips or on site speakers focusing on your area of study can be arranged for your class.

San Bernardino Valley Municipal Water District
1350 South E St.
San Bernardino, CA
909-387-9200
http://www.sbvmwd.com/

The San Bernardino Valley Municipal Water District maintains a library dealing with water issues and history.
Their web site contains a great deal of information on water resources in the area as well as information on the lakes and streams project.

San Bernardino Valley Water Conservation District
1630 W. Redlands Blvd.
Redlands, CA 92373
909-793-2503
http://www.sbvwcd.dst.ca.us

The San Bernardino Valley Water Conservation District’s main purpose is to conserve surface water by recharging, or spreading, it into the Bunker Hill Basin so that it is available for agriculture, residents, and businesses in the San Bernardino Valley (SBVWCDa, n.d.). The agency also works to maintain the water table to manage high groundwater and to use the resources of the Santa Ana River wash while protecting habitat for plants and wildlife in the area (SBVWCDb, n.d., pp. 8-11). The district has brochures with graphics on the groundwater basin and historical pictures of water history in the area printed in their calendars. They also have detailed information available on the BunkerHill Basin. Field trips of their settling basins can be arranged.
The Water Education Foundation offers water related materials for teachers to purchase. The foundation provides a state coordinator for Project WET, water education curriculum for teachers.

U.S. Geological Survey
Box 25286
Denver Federal Center
Denver, CO 80225
303-236-7477

This government agency has produced a free series of colorful informative posters on groundwater, with activities for teachers printed on the back.

Books
For Teacher Background


This is an excellent introduction to the history of the San Bernardino area for this period and includes
photographs. The Society also publishes a series called "Heritage Tales" which preserves oral histories of the 1800s and 1900s.


For those interested in a very complete introduction to water history in California, this is the book to read.


Written by a teacher, this is a readable text about the early days of the city.

For Elementary Age Children


Grades: 4-8

This is the true account of a school environmental action project in which students cleaned up a stream to help the salmon return to their habitat.


Grades: 2-3
The story follows a group of boys having fun as they spend a day on the river and encourages appreciation of the river environment.


Grades: 2-4

Modeled after the popular _Where's Waldo_ books and written in rhyme, readers follow the adventures of a water drop around the world and through the water cycle.


Grades: 2-5

This book is available in big book and regular size editions. In this title of the popular series, Ms. Frizzle takes her class through the water cycle and purification process, showing how water ends up in your home.


Grades: 2-6

The environmental history of the Nashua River is described from the time of the Indians to a clean up of the polluted waterway. This could be compared to the Santa Ana River to localize the theme.

Grades: 2-3

A family goes on a canoe trip down a river, camping along the way. They encounter rapids, waterfalls, and eventually end up at the lake where the river ends.


Grades: 2-8

Through beautiful illustrations, the book explores the topic of the water cycle.


Grades: K-2

The accumulation of water is beautifully described in a poem full of verbs as a brook runs into a stream, a river, and finally the sea.


Grades: 1-6

The different states of matter are explored in a story of a boy who is eager for the snow to fall so he can use his sled.
Curriculum


This, as with other Project Learning Tree guides, is a curriculum offered free to teachers who go through the training session that accompanies the guide. Focus on Risk is a secondary curriculum that provides teachers with lessons that guide students in assessing environmental issues. Project Learning Tree staff can be contacted at:

American Forest Foundation
1111 19th St., NW, Suite 780
Washington, DC 20036
202-463-2462
http://www.plt.org

The CSUSB Environmental Education Resource Center should also have information on training sessions.

Water, Precious Water (1988) from AIMS Education Foundation:
Fresno, CA.

AIMS produces curriculum for teachers integrating math and science. This guide includes chemistry, physics, and earth science topics with reproducible masters. The activities are for elementary level students.

Project Wild Aquatic is available when teachers go to the free training sessions Project Wild periodically offers. The activities deal with animals that live in water habitats and span grades K through 12. The Environmental Education Resource Center may have information on local training sessions, or contact Project Wild at:

State of California
Department of Fish and Game
Project WILD
1416 9th St., Room 1326
Sacramento, CA 95814
http://www.dfg.ca.gov/coned/projectwild/aboutpw.html

Water Clearly Wonderful! (Spring 2000).

http://www.acs.org

This is the volume 14, number 6 issue of WonderScience, a publication for teachers of the American Chemical Society. It includes several interesting water experiments dealing with water purity and is suitable for elementary and middle school grades.
Newspapers

The Press-Enterprise

The Riverside paper has covered the Lakes and Streams issue but in less depth than in the Sun. However, they usually have articles after public meetings. Also, their archives are available on line. You can access articles for your students using the archives and using the search words “lakes and streams” or “Vision 2020.”

San Bernardino County Sun

The local newspaper has been consistently covering the Lakes and Streams issue. Articles of particular depth are the six day series of articles entitled “Lakes & Streams: A tale of three cities” by Cerise Valenzuela that ran from June 25 to June 30, 2000 in section A. This series compared the lakes and streams plan that was current two years ago with its inspiration, the San Antonio Riverwalk, and investigated the liquefaction problem. Arguments for and against the lakes project were explored. The articles are not yet available on-line.

Web Sites

City of San Bernardino

http://www.ci.san-bernardino.ca.us/

The city posts up to date material on the Lakes and Streams issue on its web site.
Federal Resources for Educational Excellence

A myriad of links for science related sites are listed for teachers and students. This is a great place to start exploring sites on earthquake faults and groundwater.

Groundwater Foundation
http://www.groundwater.org/

Free and inexpensive resources for teachers on the subject of groundwater are available through this website. The site also has lots of information on groundwater as well as activities for students of different grade levels.

USGS Earthquake Hazards Program
http://earthquake.usgs.gov/4kids/

This kid friendly site has all sorts of activities and information on earthquakes.

USGS Water Resources Education Resources
http://water.usgs.gov/education.html

Links to information, teacher materials, and student activities are included, all relating to water.
Watershed Game

http://www1.umn.edu/bellmuse/mnideals/watershed/watershed2.html

Located on the Bell LIVE web site and copyrighted 1998 by Minnesota IDEALS, this is an interactive on line game that instructs 4th grades and up on how to conserve and keep pure the fresh water in a watershed.
APPENDIX D

ACTIVITY FORMS
Students should use blank paper and begin by drawing a circle with water written in the middle. They add lines for each water related main idea and put details that relate to these ideas on lines connected to the main idea.
Unit One: Lesson Two

Environment Walk

Name ______________________ Date ______________

Draw what is important in your school environment below.

List the important things you included in your drawing.

List the important things you did not include in your drawing.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
Unit One: Lesson Two

Long Ago Prediction Form

Name __________________________ Date __________________

Draw what you think the area around the school looked like years ago. List what your picture includes.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

Listen to the predictions of other students. What changes would you make in your prediction? Why?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
Unit One: Lessons Two and Three

**K/W/L CHART**

A K/W/L chart is designed to help students construct knowledge by eliciting prior knowledge and engaging students in the topic by asking what they want to learn about a subject. Finally, students evaluate what they have learned. At the beginning of a unit of study, students complete the We Know and We Want to Know sections, although the middle section can be added to during the course of study. The first section is for what students already know. If their "knowledge" is a misconception, it can be included anyway with a question mark and lead to questions for the middle section. As part of closure, the What I’ve Learned section is completed. These charts can be done as a whole class, or each student can fill out their own independently.

**OUR ENVIRONMENT**

<table>
<thead>
<tr>
<th>WE KNOW</th>
<th>WE WANT TO KNOW</th>
<th>WE’VE LEARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

150
URBITA LAKE TRANSPARENCY MASTER B
Unit One: Lesson Three

URBITA LAKE TRANSPARENCY MASTER C
Unit One: Lesson Three

URBITA LAKE TRANSPARENCY MASTER D
Unit One: Lesson Three

Unit Two: Lessons One and Two

URBITA LAKE PHOTO MASTER
Then and Now Venn Diagram

List aspects of the school environment that were present in the past and in the present. For those things that are present in both time periods, list them in the middle of the Venn diagram.

THEN

NOW

Partner names ________________________

________________________
Unit One: Lesson Three

Cause and Effect Form A

[Blank boxes with arrows pointing downwards]
Urita Hot Springs attracts settlers

Hot Springs is dammed to form lake and resort

The city grows and there is a drought

The lake dries up

Inland Center Mall is built in the former wetlands

The basement of the mall floods during heavy rains
Bunker Hill Basin Map
Unit One: Lesson Four

Groundwater Activity Form

Name ___________________________ Date ______________

Draw and label a diagram of your set up below.

What do you predict will happen when you pour water over the soil?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What did happen? Was your prediction correct?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Look in the cardboard tube, the "well." What do you see? How did it get there?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Liquefaction Activity Form

Name __________________________ Date __________

Draw and label a diagram of the liquefaction model below. Be sure to label the “rock layer” and “groundwater” parts of the diagram.

After the “earthquake” what happened to the model? Write your answer below.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

How was this like liquefaction?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Unit One: Lessons Four

Unit Two: Lesson Three

Proposed Lakes and Streams Plan
Fishbone Map

Students write reasons for building or not building a lake on diagonal lines on the appropriate map. Details or related ideas can go on lines sprouting from the main idea. Students add lines as needed.

Possible answers might be as shown.

Reasons to build a lake

- Swimming
- Boating
- Recreation
- Flooding
- Beauty
- Earthquakes
- Buildings could sink

Reasons not to build a lake

- Cost too much
- Pretty buildings would be gone
- People must move
- Don’t need it
Unit One: Lessons One and Five

Spider Map
Unit One: Lesson Five

Ideal Neighborhood Activity

Name ___________________ Date _______________

Draw below what you think our neighborhood should look like in the future.

List what is important to this future environment that you included in your picture.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What are some changes you would make from the present environment to improve it?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Unit Two: Lessons Three and Six

LAKES AND STREAMS STUDENT SUMMARY

Problem areas: An environmental issue, such as the Lakes and Streams project, starts with an environmental problem. Three environmental problems in the City of San Bernardino are addressed by the Lakes and Streams project. The high level of groundwater beneath the city threatens some areas of the city with flooding and with damage from liquefaction during an earthquake. The groundwater has been contaminated with plumes of chemicals from the old Santa Fe railway yard and Norton Air Force Base. Parts of downtown San Bernardino are suffering from urban blight.

Issue: An environmental issue involves a problem for which people cannot agree on the solution. The Lakes and Streams project has become an environmental issue because there are differing opinions on whether building a downtown lake will solve the problems of high groundwater, urban blight, and groundwater pollution. Some of the people affected by the project argue that already existing beautification programs can take care of urban blight and that the lake may have little affect on the level of the groundwater. Others argue that the cost of the lake will be more than the benefits gained from building it.

Background: The city of San Bernardino has a large aquifer of groundwater underneath the city in the Bunker Hill Basin. This aquifer is an important source of water for the population of the city, but also causes problems in south San Bernardino where high groundwater can cause flooding. The high groundwater level may also cause liquefaction whereby buildings would sink into the ground if there was an earthquake. An additional problem arises from plumes of chemicals from industry and the military that are contaminating the groundwater. Since it cannot be cleaned underground, water is being pumped to the surface for treatment. Some people argue that adding wells to the lake would speed up the process of cleaning the contamination, which now is estimated to take about a century. Others argue that this might make the chemicals move through the groundwater even faster.

About five years ago, the San Bernardino Valley Municipal Water District suggested pumping extra groundwater out and bringing it to the surface to form lakes and streams. The water district felt that this would help us solve all of the city’s groundwater problems, as well as providing storage for the water district to make it easier to sell the water. If the groundwater level was kept low enough there would not be flooding in south San Bernardino (which is where the water district has its office and it has been flooded!). Also, there would be less danger that liquefaction would sink.
buildings in an earthquake with lower groundwater levels, because if the water table is low enough, liquefaction does not affect the ground surface. Finally, the contaminated water could be brought to the surface and treated so that it could be used.

The water district also felt that extra water should be sold to cities who don't have enough of it. In the past, the groundwater level was brought down by simply pumping it into the Santa Ana River. Cities downstream from the river could use it for free while the district paid for the pumping costs. Recently, the water district serving Los Angeles, another big city which is always in need of water, agreed that the San Bernardino Valley Municipal Water District could sell them extra water brought in from northern California. Before this, the water district in Los Angeles refused to allow San Bernardino's water district to sell their extra water to them. The San Bernardino Valley Municipal Water District argues that this agreement would allow the district to sell water which in turn would help pay for the Lakes and Streams project.

The city government of San Bernardino, including the mayor and city council, are also interested in the Lakes and Streams idea. The mayor and council assert that the project would help to make the downtown area more beautiful. Some parts of downtown San Bernardino have very run down houses and businesses. When cities become blighted, with the buildings looking dirty and uncared for, new businesses do not like to locate there. Without businesses, there are few jobs and the poverty and blight get worse. The city would like to renew the blighted areas by investing in the Lakes and Streams project. It wants to locate the lakes and streams downtown, where the elevation is higher than in south San Bernardino, and let gravity help bring the water through the city. The city's position is that walkways by rivers, streams, and small lakes will be beautiful, and that businesses and homes will be built that will help bring more jobs to people in the city. In turn, they will pay more taxes and help the city budget so that more can be done to help other areas of the city.

There has been a lot of discussion on how and where to build the lakes and streams. An early proposal for a large lake was discarded because more people would lose their homes than if there were several small lakes or a river. Some people wanted the lake built near the Orange Show where the high groundwater has caused flooding, but the city government wanted it in the downtown area to help solve the blight problem there. Also the elevation downtown is higher than in south San Bernardino, so gravity could help bring the water south through the city in streams. Currently, the streams part of the project has been abandoned in favor of fountains, because of concerns that streams would block traffic. However, most groups involved think the lake
should begin downtown between Baseline and 9th Streets. If all goes well, the project might grow and add other lakes and streams in other parts of town. The city envisions water becoming not only a way to beautify San Bernardino, but a symbol of the city and a draw for tourists.

Some homeowners in the part of town where the Lakes and Streams project may be built disagree with the idea of the project. A group of these people have formed the Neighborhood Action and Preservation Association to work against the project, arguing that it costs too much and that other methods would reduce blight more effectively. This group feels strongly that it is unjust to make them move from their beloved homes and neighborhoods. They point out that there are many historic structures in the area that would be lost, although there are plans to preserve some of these buildings when and if the lake is built. Other residents want to be sure they are paid enough for their homes that they can find another place to live that they will like as well.

Critics of the Lakes and Streams project who are not residents of the affected area have also voiced concerns about the costs of the project. Geography Professor James Mulvihill at Cal State San Bernardino, worries that the city and water district have not made sure of where to find the money to build the project. He wonders if it may end up partly built and then left unfinished for lack of funds. He and others have also voiced concerns about whether or not the lake would truly affect the groundwater level or help reduce chemical pollution.
Unit Two: Lesson Two

Groundwater Diagram

Recharging by rain and surface water replenishes the groundwater.

A well pumps groundwater to the surface.

Water table

Groundwater is stored in permeable layers of soil and rock.

Clay layers

Bedrock forms another barrier for the groundwater.

San Jacinto earthquake fault forms a barrier for the groundwater.

adapted from a diagram by the San Bernardino Valley Water Conservation District
Unit Two: Lesson Two

Groundwater Science Activity

Name ___________________________ Date ______________

Directions

1. Stand the tube in the middle of the plastic container.

2. Pour the gravel around the tube and stop when it gets about halfway up.

3. Pour the soil over the gravel. Be careful not to get any in the tube. Stop when the tube is about one inch above the soil.

Draw and label your set up below. The tube is your “well.”

Hypothesis: What do you think will happen when you pour water over the soil. Will any go in the tube? Discuss this in your group and write your hypothesis, or prediction here.
Next:

4. Pour 1/2 cup of water over the soil and wait a minute. Look in the tube. Is there any water there? ______________________

5. Pour the other 1/2 cup of water over the soil and look again in the tube. Is there water now? ______________________

6. Use the eyedropper and take a water sample. What does the water look like?

________________________________________________________________________

________________________________________________________________________

Results: What was the result of your investigation?

________________________________________________________________________

________________________________________________________________________

Conclusion: Was your hypothesis correct? Why or why not?

________________________________________________________________________

________________________________________________________________________

Next, you will perform another short experiment to explore what happens when chemicals contaminate groundwater.

Procedure:

1. Open the packet of Koolaid. (This is your "chemical contamination.")

2. Bury it in the soil in your container.

3. Take another water sample with your eyedropper.
What does it look like?

Hypothesis: What do you think will happen when you pour more water over the soil? Discuss this with your group and write your hypothesis, or prediction here.

4. Pour the other cup of water over the soil and wait a minute.
5. Take another water sample from your tube "well" with the eyedropper.

Results: What does the sample look like?

Conclusions: Was your hypothesis right or wrong? Why?

On the back of this paper, draw a diagram to show groundwater, contamination, and a well. Write what you have learned about groundwater with your diagram.
Bunker Hill Basin

The City of San Bernardino is built over a large underground basin of water called the Bunker Hill Basin. An underground water basin is also called an aquifer. Water from mountain streams and rain collects underground between bits of rock and soil. There are over 5 and a half million acre feet of water in the underground basin when it is full, enough water for all the cities from San Bernardino to Los Angeles for a whole year! It is a vital resource for the City of San Bernardino, as well as for many surrounding cities.

San Bernardino’s water history

Years ago when the Serrano Indians lived in the area, they lived around warm springs where the groundwater naturally came to the surface. One was near where Urbita Elementary School is today. Later, settlers came and lived near the water. They dammed the springs to make a lake where many people came to boat, swim, and picnic. However, during the 1920s, many more people came to San Bernardino and there was a drought, a dry period with very little rain. The springs dried up.

In case of another drought, water is diverted from northern California and stored at Silverwood Lake, a reservoir, or human made lake for storing water, in the San Bernardino Mountains. The water table goes up during wet years and down during dry years. During wet years, groundwater has come to the surface, flooding streets and buildings. This is especially true in the parts of the city of San Bernardino that are at a low elevation, near the 10 and 215 freeway interchange in the south of the city.

Groundwater contamination.

San Bernardino’s groundwater has also been affected by pollution. Plumes of chemicals, polluted streams of groundwater, are reaching the Bunker Hill Basin. At the former Norton Air Force Base and the Santa Fe railroad, chemicals were poured into the ground to get rid for disposal. Years later the chemicals are sinking down into the water table, polluting it. Currently some of the polluted water is being pumped to the surface for treatment, but the plumes continue to travel through the groundwater.
Liquefaction.

The City of San Bernardino straddles two major earthquake faults. The San Andreas fault runs at the base of the San Bernardino Mountains while the San Jacinto fault runs north and south just west of the 215 freeway. Earthquake faults are formed when two plates of land meet. As pressure builds they can slip against each other, causing an earthquake. Because the city's groundwater is close to the surface of the land, scientists are concerned that it might mix with silty soil in an earthquake to make a substance that acts like quicksand, a process called liquefaction. Tall buildings could sink into the jello-like soil during an episode of liquefaction.
Unit Two: Lesson Two

Lakes and Streams Vocabulary Match Up

Name ___________________________ Date ________________

Match the definition on the left with its correct term on the right by writing the letter of the correct definition by its matching term.

A. An underground basin of water  _____ 1. groundwater
B. pollution  _____ 2. fault
C. an underground stream of polluting chemicals  _____ 3. reservoir
D. an above ground man made lake for storing water  _____ 4. aquifer
E. the ground water basin under our city  _____ 5. contamination
F. where two plates of land meet  _____ 6. plume
G. water stored between bits of soil and rock underground  _____ 7. Bunker Hill Basin
H. when ground water mixes with soil in an earthquake  _____ 8. liquefacion
Unit Two: Lesson Two

Answer Key for Lakes and Stream Vocabulary Match Up

1. G  
2. F  
3. D  
4. A  
5. B  
6. C  
7. E  
8. H
Bunker Hill Basin Map Activity

The geography of San Bernardino is highest near the San Bernardino Mountains. It slopes downwards towards the south of town and the Santa Ana River and westwards towards the 215 freeway. In these areas at lower elevations, the ground water is closer to the surface than in land that is higher. This makes it more likely that areas at low elevation will flood in our city. Look at the Bunker Hill Basin Map. Where is Urbita Elementary School on the map? Is it in a flooding area?

Next, shade in the area on the map where it is most likely that ground water may flood buildings and streets.
Unit Two: Lessons Two and Three

Lakes and Streams Vocabulary

*Science Terms*

**Acre Foot** - the amount needed to cover an acre of land one foot deep in water

**Aquifer** - rock or soil in which groundwater is stored

**Bunker Hill Basin** - a large groundwater basin beneath the San Bernardino Valley and the city of San Bernardino which is confined by the San Jacinto and San Andreas faults

**Contamination** - a condition in which soil or water is polluted with chemicals that make it impure

**Fault** - a break in the surface plates of the earth where two rock layers move and rub against each other

**Liquefaction** - a condition in which, in an earthquake, abundant groundwater mixes with soils to form a quicksand-like material into which buildings can sink

**Permeability** - the condition in which rocks and soils have porous spaces that allow water to be stored between them and move from space to space

**Plate** - a rocky surface layer of the earth which moves over the more fluid layers beneath

**Plume** - a part of the groundwater which is contaminated by chemical pollution and is slowly moving through the aquifer

**Reservoir** - a human made basin for storing surface water, such as Lake Silverwood

**Water Table** - the top level of the groundwater in an aquifer
Lakes and Streams Vocabulary

*Issue Terms*

**Environmental Issue** - An environmental issue occurs when those affected by an environmental problem disagree on how to solve that problem.

**Environmental Problem** - a problem that deals with the natural or built environment, such as flooding, groundwater contamination, or urban blight

**Players** - those people or groups of people who have a direct interest in an environmental issue and whose position on that issue stems from their interest and beliefs

**Urban Blight** - a condition in cities in which buildings in low income areas are in disrepair and tend to be an eyesore

**Values** - what people see as of the most importance, such as health or beauty
Unit Two: Lessons Three and Seven

Blighted Areas Pictures
Unit Two: Lessons Three and Seven

Well Kept Areas Pictures
Values Chart

Those people involved in an environmental issue have different beliefs that come from the values they think are important. This is a list of some of the most common values that may be held by individuals.

<table>
<thead>
<tr>
<th>Value Name</th>
<th>Those Holding This Value Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td>beauty</td>
</tr>
<tr>
<td>Ecological</td>
<td>the connections between living things</td>
</tr>
<tr>
<td>Economic</td>
<td>making money, helping people get jobs</td>
</tr>
<tr>
<td>Educational</td>
<td>learning about the world, schools</td>
</tr>
<tr>
<td>Egocentric</td>
<td>themselves and what they need to be happy</td>
</tr>
<tr>
<td>Environmental</td>
<td>the earth and its resources, wildlife</td>
</tr>
<tr>
<td>Ethical/Moral</td>
<td>doing what is right for others</td>
</tr>
<tr>
<td>Health</td>
<td>keeping people healthy</td>
</tr>
<tr>
<td>Legal</td>
<td>the law and following laws</td>
</tr>
<tr>
<td>Political</td>
<td>how governments work</td>
</tr>
<tr>
<td>Recreational</td>
<td>having fun</td>
</tr>
<tr>
<td>Social</td>
<td>other people and how they feel</td>
</tr>
</tbody>
</table>

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Unit Two: Lesson Four

Kapok Tree Issue Analysis

Name __________________________ Date ____________

What is the environmental problem described in *The Great Kapok Tree*?

An environmental problem becomes an environmental issue when there are different opinions on how to deal with it. Let’s take a look at the characters in the book and their values. Using your Value Chart, decide which value or values are revealed by each statement. Be able to tell why you picked these values.

<table>
<thead>
<tr>
<th>Character</th>
<th>Statement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author</td>
<td>“I wrote <em>The Great Kapok Tree</em> to let the world know what happens...to the...planet when rain forests are destroyed.”</td>
<td></td>
</tr>
<tr>
<td>Jaguar</td>
<td>“...The Kapok tree is home to many birds and animals. If you cut it down, where will I find my dinner?”</td>
<td></td>
</tr>
<tr>
<td>Porcupines</td>
<td>“If you cut down the forests you will destroy that [oxygen] which gives us all life.”</td>
<td></td>
</tr>
<tr>
<td>Sloth</td>
<td>“If you destroy the beauty of the rain forest, on what would you feast your eyes?”</td>
<td></td>
</tr>
</tbody>
</table>
The man in the story does not speak, but his actions make a statement of their own. At the beginning of the story, he is cutting down a tree and does not notice the animals. What value or values do you think these actions reflect?

_________________________________________________________________________________________________

Why?

_________________________________________________________________________________________________

What value or values does the man show at the end of the story? Explain your answer.

_________________________________________________________________________________________________

_________________________________________________________________________________________________

_________________________________________________________________________________________________

_________________________________________________________________________________________________
Kapok Tree Belief Statements

The different animals in *The Great Kapok Tree* whispered their thoughts to the sleeping logger. Use the value chart to help your class come up with values that match these statements.

<table>
<thead>
<tr>
<th>Animal Character</th>
<th>Statement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Example</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boa constrictor</td>
<td>&quot;This tree...is my home where generations of my ancestors have lived. Do not chop it down.&quot;</td>
<td>Social Ethical/moral</td>
</tr>
<tr>
<td>Monkey troupe</td>
<td>&quot;The roots of these great trees will wither and die, and there will be nothing left to hold the earth in place... The forest will become a desert.&quot;</td>
<td></td>
</tr>
<tr>
<td>Tree frog</td>
<td>&quot;You will leave many of us homeless if you chop down this great Kapok tree.&quot;</td>
<td></td>
</tr>
</tbody>
</table>
Unit Two: Lesson Four

Kapok Tree Answer Sheet

Accept any answers that students can back up with sound reasoning even if they are not on the answer sheet.

Kapok Tree Belief Statements

Monkey Troupe  *environmental*
Tree Frog       *ethical/moral, ecological*

Kapok Tree Issue Analysis

Environmental problem: the destruction of rain forests

Author: educational, environmental

Jaguar: ecological, egocentric

Porcupines: health, environmental

Sloth: aesthetic

Man: In the beginning of the story his motives could be seen as economic, since he is working for a living or egocentric, since he is using the trees for his own needs.

At the end of the story his viewpoint changes more to the ecological and environmental.
Unit Two: Lessons Five and Six

Lakes and Streams Organization Chart

San Bernardino Regional Water Resources Authority or Joint Powers Authority

City of San Bernardino

San Bernardino Valley Municipal Water District

Inland Valley Development Authority

San Bernardino City Council

Mayor of San Bernardino
Lakes and Streams Players

These are the groups most directly concerned with the Lakes and Streams issue. Read each description to find out the interests of each group.

San Bernardino Valley Municipal Water District

This is the agency in charge of getting water to those in the San Bernardino area. It first proposed the idea of the Lakes and Streams project. For years the water district has tried to deal with flooding caused by high groundwater. At first the district wanted to build large wells to pump it out and down the Santa Ana River, but other agencies told them they could not do this. The United States Geological Service had also warned of the dangers of liquefaction in an earthquake wherever the groundwater was not at least 10 feet below the surface. In parts of south San Bernardino the groundwater is just below or at the surface, raising the danger of liquefaction damage. The district is also concerned about contamination of the groundwater from chemical plumes. Currently one well is run by the Environmental Protection Agency to pump out and clean contaminated water, but it is estimated that it may take 100 years to clean it. Wells for clean up could be part of the Lakes and Streams project, helping the district to deal with both problems at once and also to sell water to earn money for the district. This could help pay for building the Lakes and Streams project, according to the district. The SBVMWD also wants to replace some old pipes and pumps. Building the lakes and streams downtown would give them a chance to do this. The district believes it is their job to deal with the problems caused by the high groundwater and to do their best to economically get water to people who need it.

City of San Bernardino: Mayor

The current mayor of San Bernardino, Judith Valle, wants to fight blight downtown. She thinks the only way to solve the blight problem is to tear down the blighted area because it is in a downward spiral of continued disrepair. The city water district (a different agency than the San Bernardino Valley Municipal Water District) which reports to the mayor, agrees with her. The city water district is in charge of billing us for the water we use and maintaining city water systems.
San Bernardino City Council

The city council, which has representatives from different areas of the city, agrees with the mayor on the whole and have voted with the mayor and the San Bernardino Valley Municipal Water District to pursue plans for building a lake downtown. Candidates running in the last city election on a platform against the lake lost the election to those who were for the lake. Some of the representatives on the council have expressed concern about being sure to deal fairly with the people who would lose their houses. There is some concern expressed by council representatives about where people will move, because the city doesn’t have much affordable housing to spare. The city council believes it is their job to help the city become a better place to live for all the citizens of San Bernardino.

Inland Valley Development Authority

The purpose of this agency is to promote development of the old Norton Air Force Base so that it can attract businesses that will give jobs to San Bernardino citizens. It is also concerned with a wider area in San Bernardino and is in favor of the Lakes and Streams Project because the group feels it will help get rid of blighted areas and will bring jobs to people in the city who need them.

San Bernardino Water Resources Authority

This is a group formed by the city of San Bernardino, the Inland Valley Development Authority, and the board of the San Bernardino Valley Municipal Water District. It is called a Joint Powers Authority because all three groups got together to discuss the Lakes and Streams project and how to bring it about. This group is trying to find a way to pay for and develop the Lakes and Streams project to solve the groundwater and blight problems. They do want to involve citizens in the city in the planning and have changed some of their ideas, such as the large lake initially planned, because of what people have said in meetings.

Neighborhood Action and Preservation Association

This is a group of people, mostly home owners and business owners, in the area where the Lakes and Streams project would be built. They do not want the project because they are concerned that their neighborhoods will lose beautiful buildings and that their community will
be ruined when people have to move. They are also worried that if they do have to move, they will not get paid enough for their homes to find another home as good as the one they had. This group also includes people in other parts of the city who think the project would cost too much money and would not bring businesses and jobs to the city. The group has had meetings to talk about reasons why we should not build the Lakes and Streams project and to teach people who might have to move about how they could get fair prices for their homes. They maintain a web site to air their views and express beliefs about how a community is more than mere homes. It is also a network of people.

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a federal agency concerned with the health of U.S. citizens. The EPA maintains a pumping well to clean groundwater contaminated in large part by the military when they were at Norton Air Force Base. The EPA is responsible for seeing that the chemicals in the groundwater are cleaned. Since this is one of the problems addressed by the Lakes and Streams project, the EPA will be involved in that aspect of the project.
Use the Lakes and Streams Players notes to match the quotations to the player. List the value(s) shown by the quotation. There is more than one right answer. Remember to review the Values Chart.

1. "You are building the project on the backs of poor people."

2. "Bringing business back to the area is important since Norton Air Force Base was closed."

3. "We need to beautify the downtown area."

4. "If we don't build the lakes and streams project, we are in danger of flooding and having our buildings sink into the ground in an earthquake."

5. "I love this neighborhood and I don't want to move."

6. "If we don't clean the contaminated water, people could get sick."

7. "We should save buildings like the Sturges Theater. We don't want to lose our historic buildings."
8. "Letting the groundwater flood out into the river is a waste."

9. "Fountains and streams are so beautiful people will want to move here and build homes."

10. "What a waste of money! Where will the money come to build this project?"
Unit Two: Lesson Five

Answer Key to Quotation Match Up and Issue Discussion

Lakes and Streams Quotation Match Up

1. Neighborhood Action and Preservation Association
   Values could be social, political, and ethical/moral.

2. Inland Valley Development Authority
   Other possible answers could be the mayor of San Bernardino, the
   mayor, or the San Bernardino city council.
   Values could be economic and political.

3. The mayor or city council of San Bernardino
   Other possible answers could be the Inland Valley Development
   Authority or the San Bernardino Water Resources Authority.
   Values could be aesthetic or political. The quotation could also
   involve economics since beautifying the city should improve
   economics.

4. The San Bernardino Valley Municipal Water District or the San
   Bernardino Water Resources Authority
   Values could be environmental, economic, health, and
   ethical/moral.

   Values could be social, egocentric, and legal (if the student notes
   that the person may be trying to get better compensation).

6. The Environmental Protection Agency
   Values might be health, ethical/moral, environmental, or legal.

7. Neighborhood Action and Preservation Association
   Values could be aesthetic, educational, recreational, and legal.

8. San Bernardino Valley Municipal Water District
   Values could be economic, political, or environmental.

9. The mayor or the city council
   Values could be aesthetic, economic, social, or environmental.

10. Neighborhood Action and Preservation Association
    Values could be economic or political.
Possible Solutions to Lakes and Streams Issue for Class Discussion:

Students may come up with other solutions to the lakes and streams issue, but some possible solutions could be:

1. Leave things as they are and don’t build anything. No money would be lost on the project and no one would need to move.

2. Compensate those who must move for more than their property is actually worth and help them find alternative housing.

3. Build the project on a smaller scale so that as few people as possible have to move. The size of the project has already been adjusted as a compromise.

4. Make sure that the people who have to move can have housing around the project when it is built. That is, include low income housing in the project. However, this would reduce the income for developers and they might not want to invest in it.

5. Separate the problems. Solve the blight problem by rebuilding a little at a time and allowing residents to move back. Solve the groundwater problem by building a lake or riverwalk in an area with less people.
Unit Two: Lessons Five and Six

Organization Chart Activity

Name _________________________ Date ____________

Fill in the organization chart with the names of the players in favor of the Lakes and Streams Project.

Below name a group opposed to the Lakes and Streams Project.
Role Play Cards

You are a renter in the area where lakes may be built. You have lived there about a year in a house that is pretty run down. You can’t fix it because you don’t have enough money and the landlord won’t count your work on the house against the rent, so you would just as soon move if there was another place to go. You are worried that you might not find another place you can afford.

You own a business selling tires in the area where the lakes may be built. You make a living there and just moved in two years ago. It would be a lot of work for you to move, and you don’t know where you would go, so you don’t like the idea of the lakes project. Also, you think you should be paid for moving expenses even though you don’t own the building you are in. You pay rent. Still, it would cost you to move your business.

You are a homeowner in the area where the lakes may be built. You have lived there all your life and like your neighbors. You know that some of the homes are run down, and you have a hard time keeping your house up because you are very old. Still, you don’t want to move because you love your home.
You are a member of the Neighborhood Action and Preservation Association. The people in your association do not want to move from their homes or want to be sure that they will be well compensated if they must move. Some don’t want to move because they have lived there a long time. Others don’t think they can afford another place. You want to stop the project or at least get enough money to help the people in the neighborhood move and get help finding another place.

You are an engineer with the city water department. You understand the problem of high groundwater and how it can be dangerous because of floods and liquefaction. You also think that the mayor is right about getting rid of the blight downtown.

You are a citizen living in San Bernardino and are concerned that the city is getting divided. Already the 215 freeway cuts the town in half. You think that the Lakes and Streams Project will make it worse and that people won’t think about the needs of those on the other side of the freeway. Maybe poor people will just get poorer. You are worried about them.

You are a citizen living in San Bernardino who is worried that the city is going to spend too much money on the lakes project. It sounds like a crazy idea to you. How can they be sure that lakes and streams
will bring businesses and jobs to the area? They could spend millions of dollars and end up with nothing but some lakes where people used to live. They might not even be able to finish the project if they run out of money.

You are a citizen living in San Bernardino who loves boating and fishing. You find Silverwood Lake is too far to go. You think it is a great idea to have a lake in San Bernardino. Maybe you will be able to use a boat on the lake and go fishing.

You are a citizen in San Bernardino who loves to watch birds. You know that water birds come where there are lakes and streams. You are looking forward to having a place to watch birds down town. You hope that everyone can go walking by the lakes and streams when they are built.

You are a builder of homes and are interested in the Lakes and Streams Project. You think that you can make some money building houses around the lake. You want to get a good deal for the land if you decide to do this.
You work for the San Bernardino Valley Municipal Water District and are aware of the scientific reasons for building the Lakes and Streams Project. The high groundwater worries you. You remember when it flooded your office and you also worry about the contamination of the water and liquefaction during an earthquake. You are impatient with people who act like these worries make no sense. You also feel that the abundant groundwater beneath the city is an economic resource that should be used.

You are an urban planning professor at an area college. You work on planning areas of cities to help make them more beautiful and useful. The idea of the Lakes and Streams Project sounds too hard to carry out. You think way too many people are going to have to move and there is no other housing for them right now. How can this be handled?

You are also a member of the local historical society and are very interested in the history of your city. You know that there are a number of buildings in the area that have been listed as possible historical structures. This means that they are important in history or are especially beautiful. You want to make sure that these buildings are saved and that the lakes project will not endanger them.
You are a member of the San Bernardino City Council and in favor of the Lakes and Streams Project because you think it will be good for the city as a whole. You are more concerned about urban blight than about liquefaction, but you are also interested in seeing that residents who must move are treated fairly.

You are a member of the San Bernardino Water Resources Authority and are promoting the idea of the lakes project. You feel it is a great idea whose time has come. It will solve urban blight, liquefaction, and may even help to clean contaminated groundwater. You will work hard to find a way to build the lake, but are willing to compromise on a final plan.

You are a member of the Inland Valley Development Authority. Your main concern is helping to redevelop the city, especially around the old Norton Air Force Base. You think that the Lakes and Streams Project will help accomplish this by encouraging businesses to come to the downtown and surrounding areas. You think the City of San Bernardino needs more jobs and businesses to fight urban blight. Redevelopment will be an economic boost to the city and its citizens.

You work for the Environmental Protection Agency. Your job is to clean the contaminated plumes in the Bunker Hill Basin. You want to do this in the most economical and least difficult way. Right now your agency operates one well that pumps the water out to clean it. If the
lakes project includes more wells, you might be in favor of it. You would want to be sure that the wells would not cause the chemical plumes to further contaminate the water by moving them faster.

You are a citizen of San Bernardino who dislikes change, especially for big projects that seem to be more than the city can handle. You remember when the city almost went bankrupt a few years back and a time when Seccombe Lake sat half finished because the city did not have the money to complete it. How can the city expect to find the money for a big lake downtown? The city may be biting off more than it can chew!
Unit One: Lesson Five

Decision Matrix

Fill in the effects that would be caused by each decision. Then decide which effects would be better to make your decision.

Write the consequences for each decision below.

<table>
<thead>
<tr>
<th>A downtown lake is built.</th>
<th>A downtown lake is not built.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the consequences listed above, write the decision that you feel is best below.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
REFERENCES


