# **Watershed Education Plan**





Lower Los Angeles River Revitalization Plan

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#### 1. Introduction

Cities throughout the United States have recognized the value of revitalizing their waterfronts to increase river access and recreational opportunities, and to restore the fragile ecosystems that coexist with urban spaces. Of these communities, only a few have formally recognized the educational opportunities around urban rivers in government planning documents. The jurisdictional nature of most traditional planning efforts means those efforts have occurred within limited boundaries and narrowly focus on water rights and agency management objectives.

Community led efforts often fill the education gap, taking a more comprehensive planning approach to revitalization. Nongovernmental organization (NGO) plans highlight opportunities for field trips, summer camps, mobile educational labs, and river or watershed programming that is often integrated into state learning standards, either formally or through supplemental programs. NGO led efforts also focus on building partnerships with universities and public/private schools (Elizabeth River). NGO led educational curricula along urban rivers have focused on connecting learners to ecology, history, stewardship, and recreation along local rivers (Greenway Foundation), with a handful of organizations posting educational resources online (Hudson River Park, Nature Games-Greenway Foundation). In the Los Angeles River Watershed, the completion of the City of Los Angeles River Revitalization Master Plan spurred the creation of several river-focused educational programs and resources by nonprofit organizations like Friends of the Los Angeles River, the Los Angeles Conservation Corps, and Community Nature Connection that emphasize the ecology and resources of the watershed. The Hudson River Park revitalization efforts have been a notable exception to traditional river planning efforts, featuring a comprehensive education program with schools, field trips, nature walks, career-focused internships, senior programming, and the designation of an Estuarine Sanctuary, creating educational opportunities through learning facilities and programs that instill learners with an understanding of the ecology and social history of the river (Hudson River Park Trust). Programs and future initiatives include the development of educational curricula through university and agency partnerships, teacher training programs, and the development of downloadable and interactive materials.

The Assembly Bill 530 Lower Los Angeles River Revitalization planning process stands in stark contrast to traditional planning efforts by openly embracing a synergistic process including education programming, with NGOs and community-based organizations (CBOs) working as partners with implementing agencies in the development of the Lower Los Angeles River Revitalization Plan (LLARRP) through a Working Group Committee framework. The legislation explicitly called for the development of a Watershed Education Program to engage and educate the Lower Los Angeles River (LLAR) communities about the river and its watershed, while reconnecting these communities and increasing their recognition of the value of the river. The authorizing legislation further called for the development of the education programs through a coordinated effort with the Working Group members, following the principles and guidelines developed by the Working Group.

## 1.1 Framework: Assessment and Plan

The Watershed Education Program sets forth recommendations for a Watershed Education Plan (Plan) to support the implementation of the LLARRP Watershed Education Program objectives, ensuring programs are communitybased and incorporating the needs and goals of socio-economically and geographically diverse neighborhoods along the Lower Los Angeles River. The Education Plan: (1) builds off the existing expertise and resources of dedicated institutions and nonprofit organizations that support the Los Angeles River; (2) identifies gaps that need to be filled in order to strengthen LA River engagement through watershed education; (3) identifies opportunities to leverage resources and expand public and private institutions partnerships; and (4) supports the goals and objectives of the Plan Element Committees<sup>1</sup>. The Plan is not intended to replace targeted curricula at schools and

<sup>&</sup>lt;sup>1</sup> Element Committee Goals and Objectives are set forth in Chapter 1 of the LLARRP.



universities for subsets of the LLAR population (e.g. students), but rather to enhance and supplement existing resources where needs have been identified.

The County and its lead consultant for the LLARRP, Tetra Tech, partnered with the Council for Watershed Health (CWH)<sup>2</sup> to assist the Working Group in the development of the Education Plan. In collaboration with the Working Group, an assessment was conducted to document existing needs and resources that included stakeholder interviews with individuals representing groups with strong ties to the Lower LA River communities and expertise in a variety of fields, surveys, and asset mapping intended to build on broader data collected from the AB530 Community Engagement Process<sup>3</sup> and Working Group surveys.

Three overarching themes emerged when analyzing the data for the development of a Watershed Education Program:

- (1) Interconnectedness of the People, the Culture, the River, and the Watershed.
- (2) Nontraditional Education Pathways and Place-Based Learning, Engaging a Wide Audience.
- (3) Multiple Benefit Thinking, Leveraging Education and Connectedness.

These themes are repeated throughout the recommended implementation strategies and core watershed education learning concepts. Section 2 discusses the research findings that support watershed education program investments. The data collected represents the expertise of local stakeholders and was used to formulate priority education topics and mechanisms for education investments. Section 3 sets forth recommended strategies for the implementation of watershed education programs. The strategies reflect a combination of needs, strengths, and unique assets to support the foundational elements of a LLAR Watershed Education Program. Section 4 provides examples of recommended core watershed learning concepts that can be adapted into a web-based tool and incorporated into existing engagement strategies. A glossary of key terms was developed, along with a Resource List compiled through the research process with Working Group Members and other key stakeholders. The Resource List, Section 5, is intended to be a living document and refined as the Watershed Education Program is further developed and implemented.

<sup>&</sup>lt;sup>3</sup> The Community Engagement Committee data collection process was not specific to watershed education but did speak to institutional assets and opportunities for leveraging resources within the LLAR communities. Therefore, a review of these findings was important to this analysis.



<sup>&</sup>lt;sup>2</sup> The Council for Watershed Health is a nonprofit organization that specializes in applied scientific research, watershed education and inclusive stakeholder engagement that prioritizes the expertise of local residents, families and local organizations, alongside water practitioners, scientists, academicians and policy makers in formulating successful strategies for watershed and community health.

### 2. Research and Findings

#### 2.1 Introduction

The Plan recommendations were developed based on four methods of inquiry. A review of existing Working Group outreach data was conducted, along with interviews of stakeholders in which the core components of the program were discussed through an open-ended set of questions. A survey of a wider group of Working Group participants was conducted. Outreach about this survey was conducted at committee meetings and by e-mail invitation. Finally, there was an Opportunity and Gap Analysis performed on the LLAR to document where education programs could be delivered and where they currently are or have been recently provided (Section 5).

#### 2.2 Demographic Context Research

Evaluating the demographic context of the LLARRP area before starting the survey and interview portions of the research helped to inform surveys and interviews. This process consisted of accessing data from several Census Bureau-based sources including ACS 2011 -2015 data (US Census 2015), the 2011 Language Mapper (US Census 2011), and CalEnviroScreen 3.0 (OEHHA 2017) data for GIS analysis. Based on census block groups within 2 miles of the LLARRP area, there are approximately 838,000 people who could benefit from a Watershed Education Plan. Knowing the level of industrial activity along the river, it was also important to consider that the target populations are often concentrated in densely populated areas interspersed between non-residential land uses. Many of these form distinct neighborhoods and communities. Within these communities there will be further group identifications based not only on demographics but also on local school attendance areas, city boundaries, and the way large transportation infrastructure, including rails and highways, as well as the river itself divide the populations.

The language groups with concentrations in the LLARRP area include Spanish, Tagalog, and Vietnamese. Based on the Language Mapper information, we developed the survey to include these languages in questions about the range of languages current materials are offered in. This was consistent with stakeholder feedback from committee meetings that providing education in a range of languages will be important to educational success along the Lower LA River.

Educational attainment levels are low based on statewide criteria. Using the CalEnviroScreen 3.0 data we found the LLARRP area as a whole was in the 83<sup>rd</sup> percentile statewide for low educational attainment. Though there are pockets of higher educational attainment in the Long Beach area, only 14 of the 119 census block groups used for this analysis were at or above the statewide average for attainment and accounted for only 6% of the LLARRP area population. These few areas also consistently had lower percentages of the population under 10 years old (17%) than the area as a whole.

The racial breakdown (Figure 1) of the LLARRP area, based on CalEnviroScreen 3.0, reflects the linguistic observations from the Language Mapper. The area is primarily Hispanic (72.9%), African American (10.5%), White (not Hispanic (7.9%)) and Asian American (7.1%) with a small population of Native American (0.2%) and Other Races (1.4%) making up the remainder.





Figure 1. Map of LLAR Demographics from Council for Watershed Health

## 2.3 Mapping of Locations of Recent Education Activities and Potential Community Connection Points

An important resource for the Watershed Education Plan will be the activities that stakeholders have currently established in the community. To document these connection points we contacted stakeholders and researched their activities over the last year that could relate to watershed education. The locations, where they could be determined, were mapped in GIS with the name of the organization and what the location was used for, e.g. FoLAR River Rover, Beach Cleanup, Heal the Bay classroom activity. This mapping provides an important basis for future implementation of more coordinated education efforts.

Current education and outreach locations only scratch the surface of the potential need of the ~800,000 residents. So, what are the possible connection points? Based on Working Group and Committee feedback CWH sought to find a data source that included parks, recreation centers, schools (all levels from preschool to university) churches, as well as many other locations. The data set used for this is the Los Angeles County Enterprise GIS Location Management System database. This data set is maintained by LA County for multiple uses including emergency management. Given the authoritative nature of the data and the fact that this is a planning level effort we expect that this dataset can form the basis of a system to locate appropriate venues for direct community education activities in future implementation of this Plan.



### 2.4 Surveys

An online survey was circulated to Working Group members to uncover the current state of watershed education on the Lower Los Angeles River and the surrounding areas, and to discover what the respondents thought were the most important needs moving forward. The current state of education activities was measured by asking the respondent to mark all categories that apply to their organization. The current types of activities that organizations offer are shown in Figure 2 as well as program needs, according to respondents.



Percent of Respondents

Figure 2. Graphs of Survey Results

These results identified the need to connect schools as an important element of the Watershed Education Plan. The stakeholders clearly expressed that this is a missing aspect of current activities. They also identified a strong interest in the need for education to be place-based, such as community events and interpretive signage, and culturally relevant. For example, 100% of respondents identified that materials were in or should be available in English and Spanish, with Tagalog and Vietnamese also indicated as important. The least served groups for current activities were also children under age 10 (elementary age) and senior citizens. The current offerings of materials and activities included English and Spanish (both 100% of respondents), Tagalog (21%), and Vietnamese (14%). This fits with the stakeholder feedback from meetings that providing education in a range of languages will be important to educational success along the Lower LA River. Though we provided the opportunity to suggest other language groups from the ones found in the demographic research, none were offered. The demographics of the LLARRP area have long been in a state of change, and future implementation will need to keep this in mind as migration may change the landscape of languages that education should include. Rather than specifying the languages to be used, it is recommended that as programs engage in the community that they self-identify what will be most useful. These findings were then used to prioritize strategies for the implementation of watershed education programs.



## 2.5 Stakeholder Interviews

Interviews were conducted with Working Group stakeholders to develop the range of education subjects, as well as identify the education methods that should be included in the plan. The interviews took the form of asking several open-ended questions to elicit responses that were not prescribed in the same way as the survey. This methodology allowed us to discover the complete range of suggestions and priorities from a wide range of organizational perspectives.

The first question related to the understanding the organization had as it related to the development of the Watershed Education Plan and its scope. The most common response related to the availability of resources to implement a program as laid out in the plan. This is clearly a concern among stakeholders and in some cases questions about funding mechanisms were asked. Other recurring responses included an emphasis that the material should be culturally relevant, and that there is a need for information across the broad audience of community members.

The second question asked: "What elements should a Watershed Education Plan include?" Though the responses were wide ranging from economic development to trail signage, some overall themes emerged.

The first major theme was the interconnectedness of the people, the river and the watershed. This theme developed in several ways from many different participants. One way this theme was approached by the interviewees was from a traditional watershed perspective (it's all connected) but there were also specific suggestions for how to connect the watershed to people's lives. Within the watershed perspective several participants emphasized different scales, including a parcel (individual) scale where people could relate to their home as a watershed that contributed to the flow in the street, and using this to illustrate how the larger watershed contributes to the river. Another perspective was that the water cycle needed to look more like the actual urbanized river and include the concept that some stormwater became drinking water through infiltration and groundwater pumping, it did not just all flow to the ocean. There were many references to the connection of water quality in stormwater and the fact that it infiltrates to be pumped back out as drinking water for residents of the LLARRP area. Connectivity to nature also played out in the interviews, emphasizing habitat and natural space connection to water and water as being critical to habitat. Finally, watershed connectivity to the history of how different generations of residents, from first nations to barrio histories to current residents, interact with the land, river and watershed emerged. This historical perspective included thoughts about how culture, settlement and land use has changed the nature of the watershed and as a result the channel form of the river itself.

The second theme developed around place-based education. This theme encompassed many different recommendations for education activities including field trips, community science, interpretive signage, cultural and natural history, and even understanding the shape of flood control devices. It is clear from this theme that there would need to be a significant customization of education materials for use in diverse settings to connect the residents to the place and the information. Respondents that mentioned this theme also connected it to the context of the place within the watershed, and suggesting that place-based education be activity focused. The desire for activity focus methods of education varied from water testing to active transportation and recreational users understanding the context of different rest-stops. For example, signage at rest areas that described how the flood control system in that location works and ties it to the way the cultural history of the river at that location developed.

A third theme was the importance of engaging a wide range of residents and visitors to the river. Consistent with the theme of "connectedness," the need for education on all levels was noted, from K-12 to workforce development and continuing education, along with the connections to STEAM<sup>4</sup> education. In contrast, another example emphasized the need to move outside school-based environments and engage community members in

<sup>&</sup>lt;sup>4</sup> Science, Technology, Engineering, Arts and Math



the development of LA River and watershed education materials. Priorities within each of these recurring themes were categorized and provide the basis for the implementation recommendations.

#### 2.6 Review of Resources

The educational concepts that are presented in this Plan, along with the gaps that are highlighted, were informed by a preliminary review of existing educational materials and programs. Educational materials that were reviewed include sample curriculum, student workbooks, education plans, lesson plans and the content that informed teacher lesson plans. This review began with scanning the websites of nonprofit organizations and foundations in the Los Angeles River Watershed for environmental or watershed related content. The review was expanded to include museums, parks, water municipalities, private water entities, and local, state, and federal agencies working in a water related field. Educational materials were scanned and categorized according to target audience, accessibility, educational tools, covered concepts, and type of education (event based, short-program or workshop, multi-nodal, classroom, or educational training and support). An initial resource inventory was also developed to help catalog educational resources where they could be identified with a provider and contact information. This initial inventory should be further developed over time and used as a tool to engage and connect local agencies, NGO's and CBO's to educational tools and partnership opportunities.

## 2.7 Analysis

The analysis found that there is a considerable need to provide watershed education beyond the current resources available and additional opportunities to do so. The need for a well-coordinated and funded education program is substantial. The analysis also identified the need for the development of education material that is specific to several discrete audiences such as young students, older youth, and seniors. The education and learning pathway themes identified also provide clear mechanisms to give life to many of the goals and objectives in the Plan Element Committees. For example, the nature walks, equestrian trail rides, and biking activities as tools and venues for education also improve health outcomes by promoting physical activity. The use of community science programs in the field to educate about ecosystem health can improve classroom performance and provide career skill development<sup>5</sup>. Additionally, the analysis found that there is a need for education with culturally relevant materials in additional language groups that are commonly available and are represented in the LLARRP area. Finally, while individual programs exist, there is a need to coordinate, connect, and expand current efforts to under-resourced communities and underrepresented constituencies. Overall, the research validated Committee feedback regarding the need to engage a broader audience.

The specific recommendations are further detailed in the Implementation Section below, but the same needs and opportunities were found in nearly all of the methods of investigation. These are now consolidated into Core Learning and Engagement Pathways and Core Education Concepts in the Plan.

Core Watershed Learning & Engagement Pathways

K-12 Education | Interpretive Signage | Community Language | Parks as Connection Point Art and Science Integration | Placed-Based Learning | Learning By Doing

#### Core Watershed Education Concepts

Watershed | River System Functioning | Hydrology | Hydraulics | Flow and Flood Groundwater Flood Control | Habitat | Restoration | Water Sources and Challenges | Sources of Water | Drought | Pollution Climate Change | Connecting People to Water People and Cultures | Land Use | Health Recreation and Active Transportation

<sup>&</sup>lt;sup>5</sup> See Community Economics, Health and Equity Plan Element, Goals for Promoting wellness and workforce development.



#### 3. Implementation Recommendations

The goals of the LLARRP Watershed Education Program as set forth in the AB 530 legislation are to educate, engage, and reconnect. The LLARRP Watershed Education Program presents an extraordinary opportunity to prioritize and invest in strategies that achieve these objectives, while diversifying how we teach about the LA River and its watershed. Based on the research findings and feedback of Working Group participants, seven strategies are recommended to achieve these goals. As the research has documented, there are more needs and opportunities than there are resources to support at the present time. The LA River is both an education focal point and unique tool for engagement in and of itself and as such, will inspire a larger community conversation about its relationship to water and its connection to the health and vitality of LLAR communities.

The strategies recommended prioritize options for investment based on: maximizing the public space and the LA River as the teaching asset; an analysis of both the data gathered and priorities articulated from the Working Group participants; leveraging existing programs and providers; and the best opportunities to support implementation of LLAR watershed education with existing partners and new financial resources. Just as three key themes for *what* should be included in a Watershed Education Program emerged through the research process, three themes for *how* watershed education should be implemented to reconnect local communities to the LLAR also emerged. The implementation strategies for the Plan are guided by these themes.

It should be noted that there is presently no dedicated source of funding for the implementation of these recommendations, nor a specific entity identified to champion this work moving forward. Recommendations to address this important issue are set forth in Section 3.4.7.

## 3.1 Diversity in Teaching Methods

First, a robust program should use watershed education concepts and supporting tools through a variety of learning pathways (digital, community-based, school-based, artistic storytelling) to connect communities to the River at three scales: *individual, neighborhood and watershed*. By supporting a variety of educational touch-points, residents, public institutions, businesses and students of all ages will see themselves, their interests and unique opportunities to connect with the LLAR and each other – using water education and the river as the catalyst. Diversifying how messages are communicated also provides the opportunity to expand *who* is telling the stories. For example, artistic storytelling through murals, plays and interpretive signage provide older residents an opportunity to infuse core education concepts with personal histories of LLAR communities, stories that might otherwise be lost. Approaching watershed education at each of these scales also creates redundancy in learning concepts. Over time, this will result in whole communities that share a deeper understanding of the LLAR as an asset, the importance of the health of its watershed, and the role each individual can contribute toward restoration, conservation, and revitalization.

## 3.2 Capacity Building

Second, the program should support strategies that invest in building the capacity of local communities, businesses and organizations to deliver and sustain watershed education to a broader audience. This can occur through a variety of strategies including: financial support for effective existing programs; formalizing partnerships with public and private institutions to help expand reach and fill gaps; and supporting training and technical skill building as needed. The LLAR communities and local stakeholders can use this unprecedented opportunity of investment in river revitalization funds, new resources to support parks, open space and water, to establish strategic partnerships with other organizations and entities that can help expand impact and knowledge on river revitalization and local water issues. LLAR stakeholders can also help educate new partners about the issues specific to LLAR communities and improve the depth of watershed education to all residents.



### 3.3 Diversity and Nontraditional Partnerships

Finally, the Watershed Education Program should support strategies that build a network of nontraditional water partners, such as active transportation groups, health-based organizations and faith-based institutions, to not only

expand the reach of watershed education but to expand the narrative and voices that are informing the message of the history, vitality and importance of the LLAR and its watershed to local communities. This approach creates a framework for both the elevation of community knowledge and "multi-benefit" thinking into educational tools and programs.

Local history, community member stories should be reflected and inform what we are teaching.

- mark! Lopez, Executive Director, East Yard

## 3.4 Education Plan Strategies

As noted above, the goals for the Watershed Education Program set forth in AB530 are to educate, engage, and reconnect the LLAR communities to the LA River and its watershed. The Plan strategies also incorporate the overall goals of the Working Group Plan Element Committees. For example, the Public Realm Committee objective is to enhance connectivity by expanding local access to the river including neighborhood streets, multi-use trails and bikeways. This Plan recommends utilizing these same "routes to the river" as place-based education opportunities. Each strategy set forth below is supported by Committee member feedback, and the research conducted and relate back to Plan Element Committee Goals and Objectives.

#### 3.4.1 Information Accessibility

Watershed education resources should be accessible to a broad audience through the use of multiple communication and learning pathways – web-based, traditional (schools, parks, public meetings) and integrated with other proven engagement tools (art and nature-based education). This will ensure that the LLARRP Watershed Education Program meets its audience *where they are* and *how they interact* with their environment and community in their daily lives. For example, many LLAR residents do not receive their primary source of information from a home-based computer. While we recommend the use of a web-based tool, overreliance on this form of communication for education will only meet a subset of the population. Similarly, school-based investments should not be made to the exclusion of other populations, such as older youth and seniors. Building a Watershed Education Program through a variety of learning pathways also increases the likelihood that LLAR residents young and old will have multiple points of engagement with watershed education, reinforcing key learning objectives and building multigenerational watershed literacy. Finally, by focusing on investments that are delivered through multiple scales and communication pathways the program will embrace equity principles prioritized by the Working Group participants in its design, ensuring that hard to reach or less resourced populations are not left behind and more specifically, that they are intentionally engaged and served.

Accessibility also means that education tools should be offered in multiple languages (research identified at least 5 languages in the LLAR communities) and is offered in a variety of forms: public art, storytelling, project-based, and traditional classroom lessons. For example, schools provide a high reach opportunity to integrate LLAR River specific and local ecology lessons with State Core curriculum. However, this focus on school-age children and youth is somewhat constrained by the flexibility of a local school to supplement proscribed content in existing lesson plans. By prioritizing variety in teaching methods such as including public art, community science, and service learning- the LLARRP also opens up the door for local residents to inform the narrative of watershed education through personal history and experience, engaging older populations as well children and youth. This approach engages whole communities and builds social cohesion.



#### Recommendation

It is recommended that funds sought to implement watershed education programs prioritize resources in a manner to support information accessibility: diversity in both *where* it is provided and *how* it is provided, in language and method. The Watershed Education Plan process resulted in an initial scan, with a list of resources and programs serving the LLAR communities. Further consideration of the effectiveness of individual programs identified and materials will be needed as funding plan is developed and implementation resources become available. This recommendation speaks to the guiding principle of prioritization of resources for implementation and calls attention to the need be diverse in approach to insure all constituencies are included.

## 3.4.2 Web-based Tools and Resource Connectivity

There was broad consensus among the Working Group participants that readily accessible, watershed education resources in the LLAR communities need to be delivered in a manner that speaks to a broad audience. It was also beyond the scope of this process to develop "curriculum" that covered all topics. Based on the research collected from existing watershed educational resources we identified the following strengths and gaps:

Education efforts need to speak to a broad audience and connect with their experiences.

- Viviana Franco, Executive Director,

- There are several State approved curriculum resources for elementary and middle school children in general environmental education. There are also general resources to support professional development for educators, although more limited. For example, the California Regional Environmental Education Community (CREEC) Network coordinates regional partnerships throughout the State to promote environmental education. The Region 11 Coordinator for the entire Los Angeles Region is hosted by TreePeople. CREEC also helps provide environmental literacy resources for teachers and students. There are several local organizations in the LLAR who are listed as partners in environmental education resources with CREEC.
- There are fewer resources incorporating River specific education lesson activities in the classroom or afterschool programs at parks or schools [e.g. Watershed Wonders: The LA River and the Adventures of the Cola Kayak; FoLAR and Algalita Marine Research Foundation 2009, for elementary students] and even fewer that incorporate lessons specific to watershed concepts such as water supply, water quality and industrial pollution, in the LLAR.
- Similarly, there are too few mobile learning resources that bring supplemental and engaging learning to parks, school programs or other community learning spaces (e.g. special events, after school, park programs and camps) such as FoLAR's River Rover, Wyland Foundation Water Lab, LA Conservation Corps Sea Lab, Wildwoods Foundation Drop in the Bucket program, LA Audubon, all serving a County with a population larger than 40 other states.
- There are several unique learning experiences that incorporate river and watershed education but too many reside far outside the LLAR boundaries, challenging regular accessibility for LLAR residents. For example, the California Science Center in South LA, the Long Beach Aquarium and the Heal the Bay education program through field trips to the Santa Monica Aquarium.
- There are still fewer watershed education resources, River focused or otherwise, that speak to a broader audience of community learners (younger adults, seniors). Most lessons, guides, publications are issue/project specific or provided as a component of work training (Los Angeles Conservation Corps and Conservation Corps of Long Beach.)

Simply stated, there are not enough resources to meet the existing need and many of the existing materials do not incorporate the LA River and interrelated water resource concepts (e.g., how stormwater capture can recharge groundwater supplies and reduce pollution in the LA River or the role of nature-based systems and improving water quality).



#### Recommendation

It is recommended that *as a first step*, a web-based platform be developed to address one gap in these existing education programs by providing online access to watershed education (Section 4) in core river and watershed learning concepts aimed at the broader set of community learners, that can be adapted for schools, nonprofits and community groups to access independently, as needed. A web-based platform or "home" for basic materials will allow a wide variety of groups and institutions to independently access information to adapt to their own needs. This is a simple and cost effective approach to begin the process of broader, more diverse forms of education. This watershed education tool would *supplement* existing curriculum resources immediately and in some instances assist those with existing resources in updating materials and connecting to new partnership opportunities. One Working Group participant emphasized the need to support teachers and online tools that are simple to use, with river specific education concepts, are a cost effective way to address this outstanding need. A web-based tool could be developed with core learning concepts adapted for specific age groups (e.g. a drop down menu for elementary, middle school, general community). Teachers and other educators could access the resources and recommended activities online to supplement school curriculum. Similarly, community organizations and programs could access information that would be used for non-school based programming.

Additionally, a database or interactive resource library could be created and regularly populated by users and provide easily accessible information about program resources for local stakeholders. An initial research on existing watershed education programs and resources has been compiled as a part of this research and included in Section 5. Therefore, it is also recommended that a web-based resource inventory be maintained as a tool for core watershed learning concepts that would support an online learning community for the LLAR. Recommended core learning topics have been provided in the Watershed Education Program, along with examples of water concept visualization graphics that can be further developed to help convey more complicated watershed education concepts.

To be clear, not all users are engaged by web-based tools. However, many individuals, institutions and organizations regularly use online resources to educate constituencies and build independent program resources. Therefore, it is one method that can serve multiple target populations rapidly and in a cost effective manner.

## 3.4.3 We Learn Outside! Learning By Doing

Experiential learning is well documented in research to be one of the most effective methods for delivering education. It accelerates learning by using critical thinking, problem solving and decision making skills to deliver a lesson. This form of education delivery is one of the most robust opportunities for resource investment in the LLAR communities. For example, a team of young adults actively monitoring the effectiveness of nature-based systems in a park or green alley to reduce pollutants in stormwater runoff to adjacent storm drains will help them understand not only the science and functionality behind system, but also their relationship in upstream pollution and River water quality far more effectively than a classroom lecture. The project development in and around the LLAR presents a new opportunity to incorporate more experiential educational projects through the design and monitoring process of parks, trails, green streets, and distributed water projects. LLAR identified projects that can be mapped and planned to incorporate more students and community members in project design and performance monitoring. One of the feature projects of the LLARRP, the Urban Orchard, is a perfect example of this kind of learning opportunity - to integrate experiential education into design, performance monitoring and ongoing maintenance of the project. Consistent with the goals and objectives of all Plan Element Committees, this kind of teaching method builds on the use of green or nature-based infrastructure to enhance science learning.

Similarly, extraordinary experiences with nature, such as local field trips to LLAR for a trail hike, the Los Cerritos Estuary or the Dominguez Gap Wetlands, reinforce watershed education concepts and are an effective return on investment. Experiential learning influences emotion (connection to place) while enhancing knowledge and skill. Field trips along the River can be increased and enhance not only knowledge around water science and habitat restoration opportunities but increase understanding of connectivity of communities in the LLAR region. The



utilization of the river as the outdoor classroom has been used effectively by the Hudson River Park Trust and the Upper LA River communities and can be expanded in the LLAR. Another unique opportunity to invest in outdoor learning experiences on the LLAR will be through the implementation of the LA River Ranger Program [AB1558]. Rangers along all 51 miles of the LA River will be able to engage community members in conservation and preservation education while providing public safety services. The Ranger Program could develop, similar to the Hudson River, a career-path internship program.

Finally, nature happens everywhere, even in the heart of densely populated, urban environments. The LLAR community has a unique opportunity to utilize community science (also known as "citizen science") initiatives to learn about the LA River and its watershed. Community science refers to research collaborations between scientists and community volunteers, to expand opportunities for data collection and provide access to scientific information for community members. One example of this kind of program is the Natural History Museum of LA County Citizen Science initiatives where inquiries are designed to engage large regions in data gathering on a particular subject of study. Another example is the The Nature Conservancy BioBlitz. These initiatives connect individuals from communities throughout LA County and nationally in a collective action.

However, community science initiatives can be more localized and focused on the LA River and adjacent neighborhoods through water quality monitoring (CWH LA River Watershed Monitoring Program, Waterkeeper RAFT program, Heal the Bay River monitoring) and performance monitoring of low impact development through nature-based systems in parks, schools, alleys and streets. These efforts teach not only the interconnectedness of the LLAR to its surrounding watershed, but people and their behavior to the health of their river, watershed and community. Finally, community-based action research or participatory action research can also be effective methodologies for engaging residents in monitoring negative environmental impacts (spills, industry BMP compliance) and in formulating action steps and policies for change (East Yard Communities for Environmental Justice). Community-based participatory research is multi-generational, and has proven effective in connecting community members through targeted collective inquiry and action.

#### Recommendation

We recommend that the LLARRP Watershed Education Program prioritize resource investments in local watershed education through experiential learning opportunities that reinforce both proven engagement principles and learning objectives - recreation, restoration, connectivity and science education. Investing in experiential learning also builds on the strengths of existing programs – expanding field trips, a strong network of community science providers and watershed educators to increase the reach of programs. It also provides the unique opportunity to invest in the "outdoor classroom" approach to science education – whether monitoring performance of green infrastructure at a local park, river field trips, or guided trail tours. This approach enhances science learning for students, improves health and mental health, and connects community members to the river and each other. This approach furthers the goals and objectives of both the Water & Environment Plan Element Committee and the Community Economic, Health & Equity Plan Element Committees.

## 3.4.4 Placed-Based Learning

Place-Based Learning is the pedagogy of learning where you are, literally translated - learning happens everywhere. In the context of this, the LLARRP Watershed Education Program, neighborhood connectivity to the LLAR and educational opportunities on the River itself including -signage, wayfinding and public art installations are examples of how foundational education concepts can be delivered in nontraditional ways and engaging methods such as hiking, trail tours and biking tours, neighborhood nature hunts, or connecting a block of residents to a community science documentation project that teaches residents of biodiversity in their own back yard. In sum, activating local spaces as teaching spaces. A vacant lot can provide a powerful teaching space about the impact of the built environment on not only the quality of stormwater runoff into the river and out to the ocean, but how pavement itself impacts human health by increasing heat.



Placed-Based Learning for watershed education also maximizes the opportunity to invest in nontraditional partners, organizations engaged in activities that are not primarily "environmental" such as health-based organizations, active transportation coalitions, and those focused on community safety to partner on place-based activities that will bring watershed education to a wider audience and enhance multi-benefit thinking with respect to water resources and their connection to the LA River. The Active Transportation coalitions (e.g. LACBC) provide powerful opportunities for place-based learning in neighborhoods and along the river. One example of this kind of learning integration is East Yard's Annual LA River Youth Bike-In Art Exhibit. Place-based learning is inclusive of larger, community wide activation events, such as the LLARRP Movie Night on the River, or FoLAR's Annual River Clean Up. These activities emphasize collective action and awareness around the LA River and in many instances, can be a resident's first exposure to the LA River.

Neighborhood connectivity to the river and adjacent parks through signage, dedicated biking routes, mapping nature paths to the river, greenway and green street projects all provide the LLAR communities with new opportunities to invest in place as a way to teach watershed education: bringing watershed education home. More investment in neighborhood streets as "routes to the river" can engage multiple sectors to map and redesign neighborhood streets with educational signage, public art and water saving low impact development features.

#### Recommendation

It is recommended that resources be prioritized to support place-based watershed education: Signage, activation of nontraditional spaces and partners, investments Active Transportation coalitions and public art. The use of nontraditional spaces and educational signage and wayfinding will expand the reach of watershed education, a top priority of the Committee Members and supports the goals and objectives of the LLARRP.

#### 3.4.5 Signature Approach: Arts Integration

Communities throughout the United States are embracing "creative tools": arts and culture for effective community engagement. The research to support their effectiveness is well documented. Baltimore, Philadelphia and New Mexico all provide examples of robust public art programs, from murals and installations to history documentation through local storytelling. Engaging communities through arts improves social connections and enhances economic development. However, integrating art into watershed education is a signature opportunity for the LLAR communities to teach effectively about water and the LA River through art. Not only has art been proven effective as a tool for community engagement, research has shown us that it improves science learning in classrooms. Art integration in STEAM helps develop a growth mindset in students and improved cognition. As Los Angeles County is re-engineering its water systems for resilience, integrated arts education builds resilience in children and youth.

One example of success, the Two Rivers Charter School in the Anacostia community of Washington, D.C., used the art of Jackson Pollock to teach the concepts of flight to children. Students also created and performed plays to learn about river history in Massachusetts and applied it to their own revitalization efforts on the Anacostia River. However, integrating art in schools has a multigenerational impact. Art and environmental values are a big part of many cultures. Art can help connect family members from immigrant communities to schools. Arts integration in science education has been embraced by the John F. Kennedy Center for the Performing Arts and Edutopia as a core educational strategy to improve struggling schools. California was one of 14 localities selected for a public-private partnership through the Kennedy Center Turn Around Arts Program to leverage art to improve achievement and increase student engagement.

No other form of education speaks to the power of place-making like art. As recommended in Section 3.4.3, placebased learning opportunities for watershed education through creative space activation is an effective tool for education on the LLAR and its watershed. The opportunities are endless. One of the gaps identified was the lack of river and watershed specific education in existing programs and resources. This presents an opportunity for



LLAR community members to be re-engaged in telling their history and incorporating cultural values into the design of watershed education resources such as:

- Signage along the LA River that documents history, along with key educational elements of native vegetation or how water flow is managed by a particular feature of a river segment.
- School mural competitions along the LLAR, engaging whole communities in River education and the arts.
- Directly engaging residents in mapping spaces for art in public places can mobilize whole communities in revitalization efforts, while delivering key lessons on water and the LLAR.
- Public art installations along the LLAR that represent the people, history and culture of LLAR communities.
- Using art to support STEAM programs and water science specifically in schools and parks
- Linking health to physical activity along the river corridor
- Linking human health to watershed health

#### Recommendation

There has never been a better time to invest resources in the LLAR communities for watershed education with public art as a tool for engagement and water science education. Public art can reintroduce and engage a diverse constituency in the LLAR in a way few other methods can. School-based arts integration into science learning can connect children and youth to the "science" of the LA River and the watershed. It can have a significant impact on student performance and community connectivity to the river and its watershed. However, watershed education through art can also maximize the underutilized resources of community including parks and senior centers as venues for engaging residents about the LLAR, and reach underrepresented constituencies in current programming – older adults and seniors. Therefore, it is recommended that resource investments be prioritized for public art and art integration in schools as a core implementation strategy for teaching about the river and watershed in the LLARRP Watershed Education Program. Moreover, State and local arts commissions should be engaged and consider core partners for implementation.

#### 3.4.6 Priority Focus Area: Schools and Parks

As noted in the Section 2, the data collected identified schools and parks as a priority for investment by Working Group participants and asset mapping. Schools and parks also happen to be the venues of highest population reach impact for watershed education delivery. As noted above in Strategy 5, Arts Integration, how river and watershed education is delivered in schools can not only impact students' performance but engage entire families and neighborhoods. Watershed education can be delivered by curriculum enhancements or supplemental activities in after school programs, and living laboratories on school campuses through green infrastructure investments. Coordination with educators and school administrators will be a critical factor in making this strategy a success. Therefore, a coordinating group that engages these stakeholders is recommended in Section 3.4.7 to help formulate specific steps for implementation in schools and parks along the LLAR.

Integration of school curriculum and after school programs to watershed wide community science initiatives is another way to use the education method to engage students, teachers and parents with broader communities around the LLAR. School and park-based investments also provide an opportunity to better leverage existing resources either from State or local water agencies that routinely support water conservation programs in schools and parks. School curriculum can be integrated with experiential learning opportunities such as field trips and strategic partnerships with schools by watershed educators or stakeholders specializing in water science, engineering and the LA River.

Consistent with the Working Group principles of advancing equity for LLAR communities, there is a great need to strengthen outdoor learning opportunities and STEAM education for schools in under-resourced communities. Investments in watershed education through STEAM experiential learning opportunities bridge the achievement gaps noted in math and science for low-income communities and specifically girls and students of color. Targeting watershed education investments toward schools and parks with the highest number of children and youth and



their families promotes equity not only in the distribution of resources but also invests in STEAM pipeline that will help prepare students for higher education and jobs in STEAM fields.

As noted in Section 3.4.2, Web-based Tools and Resource Connectivity, there are gaps in river and watershed resources for schools. There is also the opportunity to rapidly fill some of these gaps through supplementary web-based learning tools and supporting guest educators and field trips with schools. An investment in watershed school and park based education maximizes venues with a large reach and enhances the pipeline to jobs in STEM fields for students where science-based education has not received adequate funding.

While there is a great opportunity to expand watershed education that specifically uses the LA River as a tool to educate, the complexity of the number of cities and parks departments, as well as the number of different school districts and level of resources within each school, make this subcategory in need of further analysis for implementation. A comprehensive list of the schools within a two-mile radius of the LLARRP communities is included in the Watershed Education Program as a planning tool for the implementation group. They include but are not limited to:

- 1. LAUSD
- 2. Paramount Unified School District
- 3. Lynwood Unified School District
- 4. Long Beach Unified School District

#### Recommendation

Given the capacity to serve a high volume of LLAR constituents (children, youth and their families) through multiple methods (traditional classroom and after-school, camps and field trips, arts-integrated and project-based) it is recommended that schools districts and parks be engaged in the next phase of implementation and considered a priority investment for the delivery of river and watershed education. Schools and parks are a critical partner to sustain comprehensive watershed education. This form of dynamic, STEAM education can help school districts attract more students and achieve success in science learning, and help prepare students for jobs in the hard sciences therefore achieving multiple solutions through one integrated strategy. A more detailed analysis will be necessary for existing resources within individual schools and should be supported in the next phase of implementation.

#### 3.4.7 Sustainability: Watershed Education Coordination

None of the recommendations outlined above can be implemented without additional resources and further development. As the Working Group finalizes its strategies for the LLARRP, it should consider the value of supporting a coordinating committee or group to carry forward the Plan recommendations. This effort would need to expand to include representatives from County and City schools, parks, and State and local arts commissions, transportation/street services departments and other key stakeholders such as public health and community-health focused organizations. Assessment of potential funding sources included the Prop 1 Disadvantaged Communities Involvement Program, Measure A, and philanthropy and potential new resources in State bonds and local measures that set aside funds for education and engagement would need to be conducted and aligned to support activities in Plan strategies.

#### Recommendation

The LLARRP Implementation Committee should review the Plan findings and recommend how the plan can move forward and be sustained financially. Housing this effort under an umbrella organization whether that entity is a public agency, private organization or a partnership between the two, will be essential for success. A coordinating entity could then identify and seek funding to implement the identified strategies, convene and engage additional partners and then develop specific proposals for funding. Public water agencies have a vested interest in helping educate the broader public in watershed education and the LA River and should be considered a key partner in



financing these efforts. The difficulty with many water revenue sources is generally their restricted use for "project development and implementation". However, they are not the only source of revenue. Arts, education, public safety, parks and transportation resources can all be sought to support this effort. We recommend the Implementation Committee prioritize seed funding for this effort, a dedicated source of funding, so an appropriate finance plan can be finalized and proposals submitted to leverage resources. Without knowing where this effort will be carried out, costs cannot be properly estimated.

A coordinating entity could also help identify opportunities for strategic partnerships between organizations and public institutions and recommend necessary policy changes to help strengthen the capacity of nonprofit organizations to deliver watershed education programs in the LLAR. This can be as simple as speeding up grant timelines or adopting a grant making process specific to nonprofits. A coordinating group could also ensure that gaps within existing resources are being prioritized. For example, the majority of individual stakeholders surveyed identified their organization as conducting public outreach, a coordinating group could assess the training needs or public outreach organizations to provide watershed education and prioritize those resources for implementation.

Finally, it was clear from stakeholder input that the need to involve teachers and carefully navigate school systems for partnership are important factors, and should be prioritized in any effort to expand watershed education programs. Other public institutions including parks and arts commissions need to be engaged directly as well. Further iterations of river and watershed education tools may need to be developed to complement State curriculum. Therefore, it is recommended that a coordinating body be established to seek to continue this important work and implement the LLARRP Watershed Education Program.



## 4. The Los Angeles River Watershed: Core Educational Concepts and Learning Objectives



Figure 3. Watershed Education Concepts

## 4.1 Introduction

It is important to understand that the Los Angeles River has a unique urban context. The channelization of the LA River has protected Angelenos from dangerous floods that 79 years ago caused the death of 115 people and led to \$78 million in damages. The concrete lined river captures stormwater in wet seasons and dry weather runoff and shuttles this vital resource out to the ocean. As communities grew around the river so did negative impacts of urbanization. Freeways segregated communities and as development grew, so did the pavement around them, further carving up and reducing natural spaces and habitat. Over the last 20 years, water managers, environmentalists, scientists and community groups began to envision a healthier river and healthier communities alongside the river and called for the removal of the concrete in some parts of the river, restoration, for more river adjacent parks and pocket parks, and for greenways and bikes paths and connected communities to each other and to the river.

Yet the L.A. River is only one component of the Los Angeles Watershed and its 3 sub-regions. Its interconnectedness with water management and land use practices around the river is an important component of understanding revitalization opportunities and connecting residents in the surrounding communities to the river. This is a difficult task when most people are not regularly exposed to terms like "watershed" and many other hydrological terms.

## 4.1.1 Misconceptions

It will also be important for the implementation of this Plan to address the following misconceptions, as well as others, when developing materials and where appropriate, the concepts applied to each learning pathway and specific location.

- That's a river? It's all concrete.
- My drinking water comes from the river.
- The water in the storm drain flows to the water treatment plant, so it does not matter what I dump there.



- My drinking water comes from far away.
- My tap water is unsafe (because it was in my family's country of origin) only bottled water is safe.
- Water in a natural river is clean and water in a concrete channel is dirty.
- It doesn't matter where I leave trash it is cleaned up by the wind and rain.
- There is nothing I can do personally to reduce flooding/pollution/etc. it is out of my control.

#### 4.1.2 How to Use these Concepts

The following concepts and learning objectives are designed to be examples for use as a palette of resources that feed into the many diverse education opportunities present in the LLAR. This palette is in response to the stakeholder input identifying many education pathways and that the LLAR is a high need region for this type of material.

Combined with the strategies outlined above they form a "kit of parts" that can be leveraged to develop a wide range of education initiatives and programs.

The recommended process for using this information starts with identifying 4 things:

- 1. What education pathway or strategy are you planning to employ? E.g. Interpretive signage, K-12 school visit, field trip or art integration.
- 2. Age, education level and language of your target audience.
- 3. What are the issues at or near the location of the education or engagement activity and which concepts are appropriate?
- 4. What are the appropriate resources for the learning objectives for that set of concepts and the chosen learning pathway/strategy?

#### Examples

- Interpretive signage at the Rio Hondo Confluence Park Signature project. This type of learning pathway
  has a broad audience. Because the surrounding community is linguistically diverse the signs may be most
  useful if offered in 4 appropriate languages. The concepts that could relate to the new park could include Watershed, Hydrology, Hydraulics, Flow and Flood, Groundwater, Flood Control, Habitat, Restoration,
  Pollution Climate Change, People and Cultures, Land Use, Health, Recreation and Active Transportation.
  The signs would choose elements of the park (e.g. the terraced river banks, the wetland, the multi-use
  path or trail) and use the learning objectives from those concepts to connect people using the current and
  past history of the place. This could include cultural elements about the agrarian and Rancho history, the
  flooding and hydraulic forces that the new park is designed to withstand and protect the community from,
  the habitats and plant materials in the wetland, etc.
- Urban Orchard field trips. The target audience would be school age children. The Urban Orchard would relate to the following concepts: Watershed, River System Functioning, Hydrology, Hydraulics, Flow and Flood, Groundwater, Flood Control, Habitat, Restoration, Sources of Water, Drought, Pollution, Climate Change, Connecting People to Water, People and Culture, Land Use, Health. The learning objectives from these concepts that directly relate to the Low Impact Development [LID] and other features of the Urban Orchard site would guide the use of curriculum and information providers that could include FoLAR's River Rover, Watershed ambassadors from Amigos de los Rios, materials from the Water Education Foundation or Groundwater.org for teachers to use before and after the trip.

This system encourages education to be activity focused, location specific, relevant to the audience and learning objective based to increase the uptake of information that will connect community members to the river in a culturally integrated way. Within each concept, terms with a \* are recommended for further explanation in both curriculum and interactive media.



### 4.2 Introduction to Water Concepts

All systems within a watershed interact with each other. This section focuses on the interrelated water aspects of this program. The surface water in our water has two major sources; 1) rain and 2) water that has been used in or around our homes, parks and businesses. This used water is the source of water in the Los Angeles River during the dry times between rainstorms. Though this dry season water is important to the revitalization of the Los Angeles River, it has not had a large influence on the way the river looks and acts now. What has had a large effect is rain, especially winter rainstorms.

#### 4.2.1 Watershed Perspective

It is important to understand the interconnectedness of all of the elements that follow in the context of the watershed. A watershed is commonly defined as the upstream land area where the water in a lake, bay or river originates. This traditional view is very rainfall centric. In the context of the Los Angeles River, this includes not only the water from rain that falls in the area but also water introduced from faraway places and water captured to soak into the ground ("replenishing" groundwater) and subsequently pumped out and used for drinking water, before it is again discharged again to the river.

In this urban watershed the people and their activities like industry, driving cars, recreation and health are interwoven with the water cycle (Figure 4). Each personal choice we make has an impact on the water cycle and the way it changes the water cycle has an impact on us the residents. These impacts on the water cycle affect health, economy, future water security, safety, and even the social structure of our neighborhoods.



Figure 4. Graphic of the urban Los Angeles River watershed



People don't see the effect we have on the water cycle and how the changes we make to it have affected us because the feedback the water cycle gives is clouded by the way we have organized ourselves. Many of the concepts discussed below are fields of expertise in and of themselves. Government structures have divided these fields of expertise across departments, levels of government, (federal, state, county, and city) based on the idea of jurisdiction (who has the legal standing with a court to represent part of the natural or manmade system). Add to this the concept that water (as well as many other resources) are "owned" by the first person to use them or extract them, and we as local residents rarely can understand the impact of everyday activities like driving, littering/picking up pet waste or even how we use the water from our tap and how rainwater flows away from our house down the street and into the storm drain. These are just a few of the activities people make choices about every day. Each choice affects the cleanliness of the water in the river, cleanliness of the water in the wells we receive drinking water from, how quickly it floods in a rainstorm, whether we can create a new park that is safe for

us to recreate in. The water cycle in the Los Angeles Watershed is a huge gift to the millions of residents, but to improve the quality of life in the watershed everyone needs to understand a little about how it works and how to care for it.

Learning Objectives

- Build an understanding of what a watershed is and the water cycle in the context of the Lower Los Angeles River.
- Inform residents about the interconnectedness of our lives and the water in the watershed.
- Connect personal and social actions to both positive and negative impacts on the water cycle.
- Reveal how water cycle disruptions from human activity impacts us on personal, neighborhood and local levels.
- Inform residents about the agencies that are responsible for decisions that affect the water cycle and the impacts they have on their lives.

Resource Examples

- Basins of Relations, <u>https://oaec.org/wp-content/uploads/2014/09/Basins-of-Relations.pdf</u>, resource guide for community-based organizations, teachers and other groups
- Science Activity Guide, <u>Waves Wetlands and Watersheds</u>, 3rd to 6th grade, California Coastal Commission
- Resource Guide, Watershed Academy Web, High School and College, EPA
- Field Trip, <u>Floating Lab Program</u>, 4<sup>th</sup> to 6<sup>th</sup>, Think Watershed
- Curriculum, Source to Sea Watershed Education Program, 2<sup>nd</sup> to 12<sup>th</sup>, FoLAR
- Beneficial Uses of the Los Angeles and San Gabriel Rivers, Council for Watershed Health, resource for water managers, nonprofits and college students.

## 4.3 River System Functioning

This group of concepts brings together the most technically challenging material in this plan but the concepts are critical to understanding the evolution of the river, why the river was channelized, and the constraints that bind revitalization projects, explaining why projects will look the way they do.

## 4.3.1 Hydrology and Hydraulics (River System Functioning)

Hydrology<sup>\*</sup> and hydraulics<sup>\*</sup> describes how water flows, where it goes, and how much water there is (Figure 5). These concepts are important because the amount of water the watershed receives, how that water is distributed, and where it flows affects living organisms, the likelihood of flood, and the communities that live next to the river and depend on the watershed's resources.





Figure 5. Schematic of water movement in a watershed and the water cycle. (Delta Stewardship Council)

Historically, the majority of precipitation that fell on the San Gabriel Mountains would infiltrate into groundwater, sustaining the flows that fed the streams and rivers of the watershed. As Los Angeles grew, large storm events and a growing amount of pavement would send dangerous flows rushing to the coasts, prompting the construction of flood control projects.

The hydrology<sup>\*</sup> and hydraulics<sup>\*</sup> of the Los Angeles River has changed with urbanization and the construction of flood control and water delivery projects. Historically, the Lower Los Angeles River would trickle or even run dry, reaching the ocean only after storm events. Today, the Los Angeles River has a yearlong flow of water. These flows are not from the San Gabriel Mountains. A large part of flow is stormwater that fell on the neighborhoods of the watershed and water that was imported from wetter faraway watersheds, used in homes and businesses, and transported to the river via storm drains or the treated discharge of water reclamation plants. Now, the majority of precipitation that falls on the San Gabriel Mountains is captured, held behind dams, and infiltrated into groundwater basins\*(groundwater basins still only receive a fraction of water that was once infiltrated).

Learning Objectives

- Understand how precipitation in the watershed varies from year to year and as you move upstream from coast to mountains.
- Understand how hydrology of the Los Angeles region has changed with urbanization.
- Understand basic hydrology and hydraulics concepts related to storage, flow, slope, and roughness using Los Angeles River Watershed examples.



Related Topics

- Flow and Flood
- Climate Change
- Drought
- Sources of Water

Resource Examples

- Activity Book and Lesson Plans, <u>All About Water: The Water Cycle</u>, K to 3rd Grade, Department of Water Resources
- Lesson Plan, When Rain Hits the Land, Experimenting with Runoff, 3rd to 6th Grade, Save the Bay

## 4.3.2 Flow and Flood (River System Functioning)

A river's flow is important because it carves and defines a landscape through erosion, transport, and deposition of sediments. Flow determines the plants and animals that can survive in and along the river. Flow along with geomorphology<sup>\*</sup>, the natural shapes or forms of an area, define what areas of a river flood, are fast flowing, and travel belowground.

The Los Angeles River was called an upside down river because it largely flows underground, appearing at the surface only when shallow soils or impenetrable landforms, like solid bedrock, push water to the surface. The dry Mediterranean condition of the Los Angeles region and belowground flows also meant there was often not enough flow to carve the well-defined channels that could contain the river during a storm. As a result, South of present day Griffith Park, the river's channels would often shift and change direction. Floods occurred when runoff could not be contained within the lightly carved channels of the river. The quickly moving storm flows and impermanent channels created the flood conditions that would sweep communities away. Following a series of catastrophic floods, the Los Angeles River was channelized and straightened in the areas where fast surface flows threatened life and property during a storm.

As the Los Angeles River watershed became increasingly paved, the flow varied significantly from that of a natural watershed (Figure 6). Stormwater ran off paved surfaces, instead of infiltrating into soils, flowing quickly along smoothly paved streets, to the river, and along smooth channels to the ocean. The quickly moving storm flows and impermanent channels created the flood conditions that would sweep communities away unexpectedly. Following a series of catastrophic floods, the Los Angeles River was channelized and straightened in the areas where fast surface flows threatened life and property during a storm.





Figure 6. The hydrograph showing the changes in timing and amount of discharge\* in urban and natural landscapes. Discharge\* describes the flow rate of water through a given area (Source: USGS)

#### Learning Objectives

- Understand how water moves through the watershed and how geomorphology impacts the path water takes.
- Understand the impact of urbanization on flow.
- Understand the relationship between flow and other aspects of river system functioning.

#### Related topics

- Habitat
- Groundwater
- Flow and Flood
- Channel Morphology
- Restoration

**Resource Examples** 

- Curriculum, <u>The Geography of Where We Live</u>, 3rd Grade, Environmental Education and Environment Initiative
- Activity, Exploring USGS Peak Streamflow Data in the Classroom, Undergraduate, SERC
- Lesson Plan, <u>Using Data to Teach Earth Processes</u>, Undergraduate, SERC

## 4.3.3 Channel Morphology (River System Functioning)

Channel morphology, or channel shape, is important because it controls the behavior of a river.

The shape of a channel is determined by the relationship between flow and sediment, the materials that makes up stream banks and bed, how erodible those materials are, and whether stabilizing structures like vegetation are present. The materials that are deposited alongside rivers and streams vary as you move from mountains to coast (Figure 7). Coarse heavy materials, like boulders and cobble, do not travel far, while fine silts and sand move farther into the coastal plain. Course materials and water help carve the steep banks that confine river flows. Flows spread out and meander along flat valleys and the silty or sandy coastal plain. Identifying historical channel morphology can also inform decisions to restore a river system to more natural forms.





Figure 7. The shape and type of channel that is formed over time as a river travels from its headwaters to where it empties depends on the distance a river travels and the type of materials it carries and deposits along the way. (Must get permission for use from shorelandmanagement.org. Suggestion for channel morphology to also depict engineered channel).

Learning Objectives

- Understand how river flow and sediment erosion and deposition can change the course of a river
- Understand how different channel morphologies impacts river behavior
- Understand how channel gradient, roughness, and depth impact river flow

#### Related Topics

- Flow and Flood
- Habitat
- Hydrology and Hydraulics

#### **Resource Examples**

- Lesson Plan, A Meandering Story: <u>An Introduction to Stream Geomorphology</u>, 4<sup>th</sup>-8<sup>th</sup> Grades, Great Lakes Aquarium
- Lesson Plan, Stream Table Models of Erosion and Deposition, 7th Grade, University of Arizona

#### 4.3.4 Groundwater (River System Functioning)

Groundwater is an important part of our watershed's hydrology because it feeds the rivers and streams of the watershed and provides communities in Los Angeles with 20-100% of their drinking water. Groundwater is the water found at depth and stored in the spaces between soil particles. Groundwater comes from stormwater soaking into the ground. Water and its interaction with soils and land features of the watershed determine when water travels underground or rises to the surface (Figure 8).

In the past, stormwater would spread out and cover large areas of land, soaking and infiltrating into the ground. In areas like the San Gabriel and the San Fernando Valleys, fractured materials and coarse soils from the mountains were deposited by rivers and streams creating a belowground bowl like basins that holds water, called aquifers\*. Here water can infiltrate easily, moving between the spaces of coarse soils. The groundwater basins of the Los Angeles River Watershed can hold about 3.2 million acre feet\* of water!





Figure 8. Groundwater comes from stormwater soaking into the ground. Water soaks into the ground more easily in areas with course sediments that water can easily pass through. Clay and other fine particles cam form an impermeable layer that makes it difficult for water to soak deep into the ground. (Source: Government of Canada, https://www.canada.ca/en/environment-climate-change/services/water-overview/sources/groundwater.html, permission requested)

As communities in Los Angeles were paved, covering the soils that could infiltrate rainwater, the Los Angeles Watershed went from infiltrating the majority of stormwater to about 16%, (Water Replenishment District of Southern California, 2012). Stormwater that would have soaked and infiltrated into the ground, and could be used as drinking water, now runs off neighborhood streets and into the river. Though increasing the amount of rainwater that infiltrates into the ground can be limited in some areas of the watershed, like the Lower Los Angeles River where impermeable\* materials lie on top of drinking water aquifers (also known as confined aquifers)\*, LID and the removal of the pavement that lies on top of coarse soils can enhance groundwater recharge\*.

Learning Objectives

- Understand the conditions that allow for groundwater infiltration and some of the reasons why groundwater infiltration may be limited.
- Understand why the river flows below ground in some areas of the watershed.
- Understand how land-use development has impacted groundwater recharge.

#### **Related Topics**

- Pollution
- Habitat
- Sources of Water
- Hydrology and Hydraulics
- LID
- Land Use
- Flow and Flood



**Resource Examples** 

- Classroom Activities, Groundwater, The Groundwater Foundation
- Lesson Plan, Make Your Own Ground Water Model, 8th grade, The National Groundwater Association
- Lesson Plan, <u>Will There Be Enough Fresh Water? How can we preserve supplies of fresh water for the future</u>, 5<sup>th</sup>-12<sup>th</sup> grade, National Geographic

## 4.3.5 Flood Control (River System Functioning)

The storm drain system was designed to quickly move stormwater away from houses and businesses and transport that water to the Los Angeles River where steep, smooth concrete channel walls quickly moved water out from the neighborhoods of Los Angeles Watershed to the ocean. The flood control system of Los Angeles County is important because it keeps communities safe and was designed to protect the residents and their properties from a 100-year flood, an extreme flood event that is likely to occur once in a hundred years. The flood control system within the Los Angeles Watershed, including storm drains and dams (like Big Tujunga, Pacoima, Lopez, Hansen, Devil's Gate, and Sepulveda Dam) are designed to hold the flows generated by mountain storms, and various channel features designed to slow the speed of water and prevent high flows from damaging bridges, dams, and other channel structures (Figure 9).



Figure 9. Flood control structures are designed to change the waters speed moving it quickly in narrow channels and slowing it down where vegetation is present.



Learning Objectives

- Understand how the current river shape was designed to solve a flooding problem and that future designs will need to tackle the same problems.
- Develop concepts of how flood control uses both speed and volume of water to be safely move water away from the urban areas, rather than letting it spread out (flood) as in a natural system.
- Become familiar with the ideas of detaining and storing flood water vs conveying it.
- Become familiar with some of the basic elements of the system. e.g. how water speed and volume are controlled by energy dissipaters, bridge pier shapes, channel shapes, concrete vs. vegetation on the banks and how these change the width of the river.

**Related Topics** 

- Pollution
- Hydrology and Hydraulics
- Watershed Management
- Land Use
- Flow

**Resource Examples** 

- Lesson Plan, <u>Flood</u>, 6-8th grade, Discovery Education
- Lesson Plan, Flood Barrier Design Challenge, 3rd grade, UCSB
- Curriculum, Hands-on Floodplain Modeling Activity, 6th grade, Teach Engineering

## 4.3.6 Habitat (River System Functioning)

Habitat is an important component of river system functioning because it helps stabilize soils, reduces erosion<sup>\*</sup>, and slows down, cleans, and infiltrates stormwater after it rains. Habitat is also important because it provides food, shelter, or a place to rest for birds, reptiles, and the small mammals living in the Los Angeles River watershed. The plants and animals of the Los Angeles River watershed have traits that help them survive the unique conditions found in the watershed, that span from the cool coast to the arid valleys, and to the mountains that intercept many of the region's winter storms. Habitat types found in the Los Angeles region include coastal sage scrub, chaparral, estuaries, floodplain forest, and freshwater marshes.

Habitat area and the number of habitat types found in the watershed have shrunk due to human activities (Figure 10). For example, the habitat communities that were found near the river and depended on river overflow and shallow groundwater have largely disappeared. Less habitat area and a lower number of habitat types means the uniquely adapted organisms of the watershed have less places to feed, rest, and live, and the diversity of plants and animals has declined.

Habitat restoration and the creation of habitat in parks and backyards throughout Los Angeles can enhance biodiversity<sup>\*</sup> and create a passageway for plant and animal movement. Pockets of habitat spread the benefits of natural areas to the animals living in the watershed, enhance river system functioning, and, for communities of Los Angeles, provide shade on a hot day and a quiet resting place to view wildlife.





Figure 1-5 Comparison of Los Angeles River Habitat Covers 1896-2010. (1897 Map obtained from Huntington Library, developed by C.S. Compton and J.H. Dockweiler, City Engineers)

Figure 10. The habitat types along the Los Angeles River were once diverse and included many plant communities that depended on shallow groundwater or existed along the river's flood plain (Source: USACE Los Angeles River Feasibility Study, 2013)

Learning Objectives

- Understand the role habitat plays in enhancing river system functioning and the benefits habitat provides to plants, animals, and people.
- Describe Southern California plant communities and biological adaptations for living in a Mediterranean climate.
- Understand the human causes of habitat degradation and how creating habitat in open spaces and backyards can help restore river system functioning, enhance biodiversity, and provide the ecosystem services\* communities value.

Related topics

- Pollution
- Hydrology and Hydraulics
- Restoration
- Channel Morphology

Educational Resources

- Lesson Plan, Los Angeles River Past and teacher resource guide, FoLAR
- Curriculum, <u>Plant and animal adaptations in different environments</u>, 1st grade, California Education and Environment Initiative



## 4.3.7 Restoration (River System Functioning)

Restoration is important because it helps revitalize an ecosystem that is threatened, disappearing, or in the need of rehabilitation. Restoration mimics the structure and function of natural areas, often aiming to return an ecosystem\* to historical conditions (Figure 11). In the Lower Los Angeles River, river system functioning is drastically different than historical conditions. Restoration efforts that want the river to resemble the shape and form of a natural river by removing the concrete channels are often limited by the need to protect communities from flood during intense storm events. Many of the functions of the Los Angeles River system have been lost because of human activities, which have reduced infiltration, increased both the volume and speed of water flows, degraded water quality, and drastically reduced habitat area.

Attentive engineering, design, use of native plants and LID strategies can help restore the river by slowing and capturing flows, improving water quality, and re-introducing the plant communities that were once common in the watershed. In communities that lack green space and the habitats that resemble those of historical conditions, restoration is an opportunity to create spaces that benefit both communities and the environment. Restoration can also create and rehabilitate the pockets of habitats that are critical to increasing local biodiversity\* and supporting migratory species. Green spaces\* also provides beneficial services to communities by providing shade, recreational opportunities, and even improving the physical and mental health of people.



Figure 11. Comparison of Los Angeles River Habitat in 1896 and 2010. (Source USACE 2013 Feasibility Study).



Learning Objectives

- Understand how people have altered the functioning of the river and how it can be restored using green infrastructure, habitat restoration, and designed features.
- Understand that opportunities for restoration in the Los Angeles River Watershed are connected, and sometimes limited, by flow, hydrology, and the need to protect communities from flood.
- Be familiar with restoration and stormwater management strategies that rehabilitate or mimic a river system.
- Understand the concept of ecosystem services<sup>\*</sup> and be able to provide examples of the ecosystem services rivers and riparian habitat provide to communities.

Related Topics

- Flow
- Hydrology
- Habitat
- Flood

**Resource Examples** 

- Lesson Plan, <u>Habitat Restoration</u>, 5th-8th Grade, Pennsylvania State University
- Lesson Plan, Restore it? A lesson in Restoration Ecology, 9th-12th, Dauphin Island Sea Lab
- Lesson Plan, Caution: Fix it!, 9th-12th, NOAA

## 4.3.8 Watershed Management (LID) (River System Functioning)

Watershed management protects and improves the quality of water and of natural resources within the watershed. Watershed management is comprehensive and includes different strategies, like Low Impact Development (LID), restoration, and bringing communities and decision makers together to find solutions to watershed issues like pollution and unnatural flow velocities and volumes.

Low Impact Development (LID) is a watershed management strategy used to describe approaches that mimic natural processes (slowing, spreading, and infiltrating stormwater) to protect water quality and habitat health (Figure 12). LID approaches can be placed in homes, businesses, parks, and empty lots to manage stormwater and minimize the amount of impervious\* surfaces that prevent infiltration. LID makes use of natural materials and both natural and engineered systems. Examples of LID include rain gardens, green streets, permeable pavement, bioswales, rain barrels, green roofs, urban tree canopies and habitat.





Figure 12. Watershed Management and LID strategies for reducing pollutants.

Learning Objectives

- Be familiar with watershed management strategies and their role in restoring river system functioning
- Be able to identify common types of LID and green infrastructure features
- Understand the benefits of implementing strategies in homes, parks, businesses and the types of projects that are installed.

**Related Topics** 

- Flow and Flood
- Hydrology and Hydraulics
- Restoration Groundwater
- Multi-benefit Projects

Resource Examples

- Educational Resources, Designing Our Futures: Sustainable Landscapes, ASLA
- Activity, <u>Create your Own Green Infrastructure</u>, 3rd and 4th Grade, Council for Watershed Health



#### 4.4 Water Sources and Challenges

This series of concepts focuses on the water supplies of the Lower Los Angeles River and the challenges to developing sustainable water resources.

#### 4.4.1 Sources of Water (Water Sources and Challenges)

Understanding the sources of water that quench the Los Angeles region is important because it helps draw an appreciation for the value of water, an understanding for the need to develop local water sources, and helps bridge the connection between river system health and community health.

Los Angeles is a dry Mediterranean region with a large and growing population, motivating early in its history the development of alternative sources of water and large and expensive investments in moving water from the Sierras and Colorado River to the Los Angeles area. Imported water helped create a perception that water was plentiful and Angelinos treated water resources accordingly. Today, the majority of the water that is used in Los Angeles is used outside, to water grass, wash cars, and fill swimming pools. However, the movement of water from far away watersheds to Los Angeles has cost in the form of energy cost, ecological cost to the plants and animals that depend on water flows, and cost to the fisherman and farmers of distant watersheds, who also depend on water to sustain their livelihoods.

Despite the region's dependence on imported water (Figure 13), local sources can help fill water demand. Local source of water include groundwater, stormwater, surface water, and recycled water. Local water resources are valuable, underused, and present an opportunity to re-think the use of green and urban spaces to capture, clean it, infiltrate it, and re-use it.





Figure 13. The majority of drinking water in Los Angeles comes from faraway wetter watersheds. Drinking water travels long distance via aqueducts to homes and businesses (Image Source: Council for Watershed Health).

**Related Topics** 

- Hydrology and Hydraulics
- Recreation and Active Transportation
- Health
- Multi-benefit Projects
- Watershed Management
- Drought

#### Learning Objectives

- Become familiar with the sources of water to the Los Angeles region and threats and opportunities around developing and safeguarding water resources.
- Be able to identify everyday actions that reduce water use and maximize local water resource.
- Be aware of local projects and strategies that increase and supplement local water resources.

#### Resource Examples

- Curriculum, <u>Our Water Sources and Resources</u>, 5th Grade, California Education and Environmental Initiative
- Heal the Bay's Know the Flow presentation, Elementary School
- Curriculum, Liquid Gold: California Water, High School, California Education and Environmental Initiative
- Lesson Plan, <u>Movement of Water and Water Usage</u>, 4th Grade, Municipal Water District of Orange County
- Activity Book, <u>The California Water Works</u>, 3rd to 6th Grade, California Department of Water Resources



• Lesson Plan, <u>Precipitation, People, and the Natural World</u>, 5th Grade, California Education and Environmental Initiative

## 4.4.2 Drought (Water Sources and Challenges)

Drought is a natural and repeating occurrence in the Los Angeles region that impacts water supply (Figure 14) and imposes limits to water use that communities and local leaders must plan around. Drought is also an important environmental force because drought results in higher fire risk and reduces the stream flows plants and animals depend on.



Figure 14. Drought takes a toll on California's water resources. The drought that started in 2011 reduced surface water, snowpack, and groundwater, important sources of drinking water for California. (Image source: California Department of Water Resources)

The Los Angeles area has historically experienced several multi-year droughts and while droughts and dry years are a natural feature of Mediterranean climates, droughts are predicted to increase due to climate change. During times of drought the risk of water shortages, overusing groundwater, and threats of species extinction increase.

The most recent drought that occurred in California from 2011-2017 was historic. It resulted in the death of millions of trees and threatened fish species already struggling to survive in the watersheds Southern California imports its water from. In response to the drought, the state issued mandatory water restrictions and encouraged the installation of water efficient appliances, replacing thirsty grass with native species, and limiting outdoor water use. While drought will continue to threaten the water supply of the Los Angeles region, individuals can help by reducing water use in their homes.

#### Learning Objectives

- Understand the impact of drought on water supply.
- Be familiar with strategies that can be used in the home to better use the water that comes out of our faucets and falls on our homes as precipitation.
- Understand how drought impacts plants and animals.

**Related Topics** 

- Hydrology and Hydraulics
- Climate Change
- Sources of Water
- Watershed Management



**Resource Examples** 

- Teacher Packet, <u>Availability of Water~ Water Scarcity and Introduction to Aqueducts</u>, 3rd Grade, Municipal Water District of Orange County
- Curriculum, <u>Struggles with Water</u>, 8th Grade, California Education and Environmental Initiative

#### 4.4.3 Climate Change (Water Sources and Challenges)

Climate change is important because it will impact temperatures, water resources, and introduce extreme events around which communities and government entities will need to adapt\*.

In California over the last century, temperatures have increased an average of three degrees. There is less consistent rainfall, more heat waves, and the timing of snowfall melt is occurring earlier in the spring. Future predictions for California include heat wave frequency that quadruples, a larger reduction in Sierra snowpack, vital to storing California's drinking water, reduced rain, and an increase in extreme events like powerful storms. Increased heat will impact people, increasing the occurrence of heat related deaths and illnesses, particularly for elderly populations. The plants and animals, which also experience heat stress, will also be affected as communities continue to struggle with balancing water needs in their homes with the needs of the environment.

With less rain and more evaporation of surface water, California's groundwater dependence grows and water resources become even more precious. Water conservation, water recycling, and stormwater capture will be critical to continuing to provide Southern California with reliable sources of drinking water. Green spaces will also be important to capturing and cleaning water, reducing the heat, and reducing the hot gray spaces of urban cities, also known as urban heat island.



Figure 15. Climate change means the weather of Los Angeles will become more unpredictable. Changes include longer periods of drought, more fires, reduced snow pack, and hotter temperatures. Climate change will impact health and the resources communities depend on (Image source: USDA)



Learning Objectives

- Understand how climate change will impact the region's water supply.
- Understand the impacts of climate change on human health and ecosystems.
- Be familiar with the climate change predictions for the Los Angeles region.

**Related Topics** 

- Hydrology and Hydraulics
- Flow and Flood
- Drought
- Health
- Habitat

Resources

- Educational Resources, Global Climate Change: Vital Signs of the Planet, K-12, NASA
- Educational Video, <u>National Climate Assessment: Southwest Chapter</u>, General Audiences, The Story Group
- List of Climate Change Curriculum and Classroom Resources, K-College, Cool California

#### 4.4.4 Pollution (Water Sources and Challenges)

Pollution is the presence of a substance in a quantity that affects the quality of life for the plants and animals of a watershed, including humans.

Pollution is present in many forms in the Los Angeles River Watershed (Figure 16). It can be in the form of bacteria in the water we swim in, or in the groundwater from improper disposal, or an accidental spill of fuel, like gasoline, or chemicals from dry-cleaning, industry, and other business sources. When it rains stormwater washes pollutants from yards in the form of fertilizer or pet waste, from business and industry in the form of leaking fuel, from restaurants in the form of oil and grease, from roads from the wearing down of tires and brake pads on cars.



Figure 16. Trash in Compton Creek near the LA River confluence (Image Source: Council for Watershed Health)



Society will be living with many of the past pollution problems for years to come. Many of these problems arose because few people understood that pollution of a watershed impacts everyone. There were also fewer rules and regulations about what was safe to do. Without regulations or an awareness of the impacts of pollution, no one thought twice about pouring oil down the drain or onto the ground. Industry dumped out its waste and excess into drainages, creeks, and rivers. Industry liked being near rivers because it made it easier to dispose of waste (Read more about this in Land Use).

Now there are more regulations in place to ensure that the water stored underground is safe for use and that water discharged into the river is clean enough to recreate in and enjoy. Yet there are many challenges still to face because the Los Angeles region was heavily built up without a complete understanding of the importance of controlling pollution and the need to build sustainably.\* Los Angeles will need to continue to promote encourage environmental stewardship, encourage sustainable practices, and engineer their way out of its pollution problems.

Learning Objectives

- Develop an understanding of the sources of pollution on the home, neighborhood and regional scale.
- Understand the everyday activities that create pollution in our watershed.
- Build knowledge of how soil pollution affects water projects and drinking water.

#### **Related Topics**

- Land Use
- Watershed Management
- Habitat
- Sources of Water

#### Resources

- Activity Book, Clean Water Patrol, K to 4th grade, City of Los Angeles, Public Works
- Lesson Plan, <u>Water Preservation; Hazards of Water Pollution; Maximizing Water Sources</u>, 5th Grade, Municipal Water District of Orange County
- Teacher's Guide, Water Quality, Metropolitan Water District of Southern California

#### 4.5 Connectedness of People to Water

A series of learning concepts that focuses on the link between people, water, and places of the Lower Los Angeles River. Concepts will specifically explore the experiences and histories of the people that live, work, and play near the Lower Los Angeles River and their role in shaping the future of the River.

## 4.5.1 People and Cultures (Connectedness of People to Water)

Los Angeles was born out of water. Tongva and Chumash native tribes settled along the banks of the Los Angeles River and relied on the river for food, water, and raw materials. Later Spanish explorers farmed along the banks of the river and established present-day Los Angeles. The river gave life to the Los Angeles region because water was dependable, raw materials and food were available, and the mild Mediterranean climate made the region livable year-round.

In the early 1900's, an expanding economy, cheap real-estate and an exodus out of the Southern slave states to less overtly racist areas drove a migration of African Americans to Los Angeles. Black communities and communities of color populated large segments of the area stretching south of Downtown because of the discriminatory housing policies that allowed governments to control the racial make-up of an area through discriminatory loan and housing practices. Industrialization and planning practices that did not equally protect communities of color also allowed industry to establish in many of the neighborhoods of South Los Angeles. The



landscape and experiences of communities of the Lower Los Angeles River were also shaped by dense urbanization and insufficient investment.

The Lower Los Angeles River has been home to diverse communities ranging from native tribes, Spanish explorers, African Americans escaping slavery, and immigrant groups from Latin America and Asia. An understanding of the people and cultures that have lived near the river is important because they have shaped the river, have felt the social, economic, and health impacts of land use and housing decisions that have been made around the river, and will help embed their priorities and culture into plans for a future river. As the vibrant communities of South Los Angeles breathe life into the artistic, ecological, educational, and social renaissance of the river (Figure 17), recounting the experiences of the people of Lower Los Angeles River is an important opportunity to share the stories that are often left untold. The People and Cultures section of this plan presents an opportunity to unearth those stories, to connect communities across Los Angeles to each other and to the river. Since both history and planning efforts have often not written or accommodated the experiences that are held by community leaders, artists, and elders, unearthing these stories will require a different approach that is outreach and interview focused.



Figure 17. Community led tour of an urban garden in Los Angeles (Image source: Council for Watershed Health)

Learning Objectives

- Acknowledge and understand how historic and present day policies have shaped the demographic and health outcomes of the region and how the development of River has played a role in these outcomes.
- Understand the evolution of demographics and cultures in the region,
- Understand how land development, attitudes toward flooding, and the historic location of the river channel have influenced the landscape of south Los Angeles and shaped the current design of the river.



• Understand the histories of the communities of the Lower Los Angeles River and understand how those stories are connected to the river—including the link between the equestrian culture, Spanish settlement, agrarian culture, and the long standing LA River Trail.

**Related Topics** 

- Land Use
- Recreation
- Health
- Pollution
- Flood

**Resource Examples** 

- Curriculum, <u>People and Places</u>, 1st Grade, California Education and Environmental Initiative
- Curriculum, <u>California Native Peoples and the Environment</u>, 3rd Grade, California Education and Environmental Initiative

#### 4.5.2 Health (Connectedness of People and Water)

The ecological health of our watersheds is important because it is linked to community health. Apart from the ecological\* value of natural areas, or green spaces, healthy watersheds provide health benefits people value. Green spaces help maintain safe and dependable sources of water, provide opportunities to grow healthy food locally (see multi-benefit projects-Urban Orchard), and provide places for active recreation (Figure 18) and gathering spaces that build social ties in a community. Green spaces also reduce the amount of pollutants in a watershed and have been shown to improve the well-being and mental health of individuals who connect with them.

Heavily urbanized neighborhoods of the Lower Los Angeles River suffer the health impacts of dense development and industrialization—including asthma, cancer, heat related illnesses. Green spaces are also not distributed evenly across Los Angeles and many neighborhoods near the Lower Los Angeles River are park poor. Investment in park space and well-designed non-traditional projects, including transit, housing, and water projects, can bring many of the health benefits associated with natural spaces, particularly when they include the trees and vegetation that help reduce chemical and noise pollution, both of which are related to significant negative health outcomes.





Figure 18. Health is not only connected to water pollution but also the physical environment. Access to parks and open space can help people live happier, healthier, more active, and longer lives.

Learning Objectives

- Understand the ways in which the health and well-being of a community is linked to a healthy watershed.
- Understand how well designed water capture and restoration projects can benefit health.
- Understand how Lower LA River Revitalization and the subsequent "greening" of the river can improve health outcomes in the region and ultimately advance health equity for residents of the Lower LA River.

Related topics

- Water Quality
- Pollution
- Multi-benefit projects
- Land-Use

**Resource Examples** 

- Educational Video, <u>EnviroAtlas: Connecting Ecosystems, People and Well-being</u>, College, U.S. Department of the Interior
- Lesson Plan, <u>Human Impact on Water Quality</u>, 6th to 8th grade, PBS

#### 4.5.3 Recreation and Active Transportation (Connectedness of People to Water)

Recreation and active transportation can connect spaces important to a community. The active use of outdoor spaces also builds the connection of the individual and community to a particular location (Figure 19). Active transportation and recreation include walking, biking, rolling. Opportunities to engage in these activities are sprouting around the Los Angeles River. The bikeways along the Los Angeles River have enhanced commuting opportunities and have attracted more people to cycle. Bike paths and other recreational activities have also allowed visitors to experience the river differently and to enjoy the pockets of habitat that still exist.





Figure 19. Recreation and active transportation can help build connections between communities, green spaces, and the spaces a community values. Recreation and active transportation also help keep communities active and healthy (Minami Pictures, 2011, http://www.minamipictures.com/110605.la-river-ride)

Trails and river pathways benefit public health by encouraging active recreation and countering sedentary behaviors. Studies find that projects that weave together green space, active transportation elements, and outdoor recreation benefit both the physical and mental health of a community. Well-designed active transportation and recreational spaces can also transform disused or empty urban spaces into areas with the amenities communities' value. Design and investments in the infrastructure that keep people safe, like sidewalks and bike lanes, also encourage people to bike, walk, and roll for enjoyment and as a commuting option, expanding the menu of options for a safe and affordable commute. Engagement and thoughtful planning with the community, every step of the way, can go a long way toward building spaces communities use and value and can help make streets safer and reduce the time commuters would otherwise spend in traffic along the clogged roadways of Los Angeles.

Learning Objectives

- Increase understanding of the role of recreation and active transportation in connecting communities and revitalizing urban spaces.
- Understand how investments in active transportation infrastructure and smart design can benefit communities and keep users safe.
- Inform the community about the role they can play in increasing the availability of active transportation and recreational opportunities both along the river and in their neighborhoods.

Related topics

- Habitat
- Land Use
- Health



Resource Examples

- Metro Active Transportation Strategic Plan (ATSP), General Audiences, Metro
- Applications for Outdoor Activity, Get Outside 10 Free Apps, General Audiences, NEEF
- List of Guides, Guide to Safe and Healthy Streets, General Audiences, Oregon Metro
- <u>Bike Safety Tips</u>, General Audiences, Metro

## 4.5.4 Land Use (Connectedness of People and Water)

The way communities use and develop land is connected to community health and the health of the watershed in multiple ways. Land uses that are dominated by paved surfaces, for example, can raise temperatures in cities and worsen the impact and destructive force of floods.



Figure 20. Land Use along the Los Angeles River (Image Source: Council for Watershed Health).

Land use in the Lower Los Angeles River has in many ways been shaped by a history of flooding. The frequently flooded land alongside the river was cheap because of the inherent risk to development. Industry recognized the value of cheap land and a convenient dumping ground for industrial and household waste and industrial land use grew along the river. At the same time, an expanding economy, cheap land, and less discriminatory housing practices drove communities of color to these same areas. The growing network of freeways along with industrial land uses created water and air pollution issues that severely impact the environment and the communities that live next to the river.

Zoning\*and other land use and design decisions can influence dependency on cars, exposure to pollution, traffic fatalities, mental health, and physical activity. Zoning is a planning tool used to separate incompatible land uses, like industrial and residential land use. Land use decisions by cities, local businesses and government are key opportunities to voice public concerns because they will determine quality of life and the quality of experiences of a revitalized river and watershed.



Learning Objectives

- Develop an understanding of the concept and types of land use and the way community focused planning and revitalization can change it to improve the livability of communities.
- Explain how historical land use choices resulted in the current concrete flood control focused river.
- Build understanding of previous land use visions for the region (e.g. Olmstead Plan) and why they were not adopted.
- Develop a sense of ownership over future land use and land use decisions (e.g. 710 freeway expansion, LLARRP) and understand how land use decisions impact communities and health outcomes.

Related topics

- Pollution
- Active Transportation and Recreation
- Health
- Flooding
- Groundwater

Resource Examples

- Educational Brochure, <u>Where We Live Matters for Our Health: Neighborhoods and Health</u>, General Audiences, Commission to Build a Healthier America
- Lesson Plans, <u>Connecting Classrooms and Communities through Watersheds</u>, 6<sup>th</sup>-8<sup>th</sup> Grade, GeoTeach
- Educational PDF, <u>Building Vibrant Communities: Community Benefits of Land Revitalization</u>, High School and General Audiences, U.S. EPA

## 4.5.5 Multi-benefit Projects (Connectedness of People to Water)

Multi-benefit projects are important because they are an opportunity to address the multiple needs and priorities of communities and to transform poorly used spaces into spaces that are an asset to the community. Multi-benefit projects are multi-purpose and in dense urban environments, projects that meet multiple needs are the best use of a small amount of space.

Green infrastructure projects, which preserve, restore, or mimic features of a natural landscape, can be multibenefit. Green infrastructure can improve water quality, create habitat, and create spaces that are more livable and communities can enjoy. Tree and plant lined streets, bike paths, metro stops, natural areas, and parks can all be projects that manage and capture water, improve ecological health, and benefit communities (Figure 21).





Figure 21. Multi Benefit projects are multi-purpose projects. Multi-benefit projects can meet both water resource needs, by capturing, infiltrating, and recycling stormwater, but also meet the need for creating green spaces and recreational opportunities (Image Source: Council for Watershed Health).

The Urban Orchard in South Gate and Dominguez Gap Wetlands are examples of projects neighboring the river that are multiple-benefit. The Urban Orchard will create habitat through the use of native species, captures and recycles stormwater on site for use in the park, creates a food forest in a highly urbanized place that lacks access to healthy food, improves the water quality of the river by intercepting and cleaning stormwater flows. The Dominguez Gap Wetlands project is another example of a multi-benefit project. The treatment wetland improves water quality, enhances groundwater, restores native habitat, and supports outdoor recreation through the incorporation of bike, equestrian, and pedestrian trails. These projects can also serve as education resources that serve as outdoor laboratories that help community members understand the importance of healthy watersheds and the principles of river system functioning through signage and hands on educational opportunities.



Learning Objectives

- Understand common approaches to managing stormwater how stormwater projects can benefit communities and the environment.
- Understand the important role communities play in advocating for and designing projects that meet local needs and priorities.
- Understand how signage and design can help create multi-benefit spaces by creating educational opportunities and enhancing the cultural and historical connection to a place.

#### Related topics

- Habitat
- Sources of Water
- Recreation and Active Transportation
- Health
- Connectedness of People and Water

Resource Examples

- Educational Content and Tools, <u>Green Infrastructure Cost-Benefit Resources</u>, College, U.S. EPA
- Educational PDF, <u>The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA</u>, 12<sup>th</sup> grade to College, U.S. EPA
- Educational Content, <u>Water and Wellness: Green Infrastructure for Health Co-Benefits</u>, High School, U.S. EPA
- Stormwater Manual, <u>Multiple Benefits of Green Infrastructure in Sustainability and Ecosystem Services</u>, College, U.S. EPA



## 5. Resource List

Organization Name	Type of Education	Tools Used	Language	Target Audience	Tra
Green Gardens Group (G3)	Multi-nodal	Adult workshops, teacher workshops, landscape professional training, High School Design Salon, communication workshop	E	Kids, adults, educators	Landso
Heal The Bay	Multi-nodal	Field trips, aquarium camp, teacher workshops, speaker presentation, interactive online maps, educational videos, activity book	E	Ages 8-98, School children, Adults, Educators	Currer to wat
Tree People	Multi-nodal	Service learning projects, battle of the schools, Workshops, flyers, pop up educational events, 6-12 curriculum, field trips for elementary school children or adults, 'streets to the sea' challenge, eco clubs	E, S	Ages 8-98, School children, homeowners, communities	They water along t
FoLAR-schools	Multi-nodal	Lessons, activities, resources for educators, field trip, Presentations for college students, worksheets, train the trainer, workbook, fishing competition, fish studies, community center	E,S	2-12 grade,	Alread
FoLAR-Community	Event based	LA River tour, LA Rover visit, frog spot community venue in elysian park, Kayak experience, Bike tours, fishing competition	E,S	Families, community members	Alread
California Greenworks	5 Week Experience- based curriculum	Lesson plans and maps	E	5th graders	Water
City of Los Angeles Sanitation (LASAN)	Multi-nodal	Public education program utilizes school outreach, targeted point- of-purchase advertising, community events, engaging education materials and online social marketing components that include a Facebook page, blog and quarterly e-newsletter to educate Angelinos about the importance of keeping pollutants out of our local creeks, rivers, lakes and beaches. Stormwater booth in a box (similar to our toolkit)	E	None	Polluti
Water Education Foundation	School based	Curriculum, activities		K-12	Focus
The River Project	Fact sheets	Fact sheets	E	None	Focus
LA Water Keeper	Fieldwork, educating students and community members	Service learning projects	E,S	Community level	Alread
California Native plant society	Restoration events	Focus on plants within the LA Basin through tours and restoration projects		Special interest groups/tours	Would
Northeast Trees	Hands on, planning, stewardship	Plan design and build parks, plan design and building watershed improvements, educate youth to develop community based workforce, educate neighborhoods to develop resources, capacity, and network links to initiate community participation and awareness	E	Student, community, agency levels	Alread impler
Urban Semillas	Classroom	Agua University workshop series	E,S	Focus on minority and underserved high school students	Would
Puente Hills Habitat Preservation Authority	Multi-nodal	Classroom and fieldtrip	E	K-12	Would



Table 1. Education Resource List

#### nsferability to LLAR Communities/River Focused Education

cape and garden focused, transferable for riverside parks

nt focus is more towards the ocean- would have to be tailored tershed only education

will concurrently be providing this education for communities the LLAR through other grants

dy about LAR

dy about LAR

rshed focus only

tion prevention focus

on regional water

on ULAR

dy about LAR

have to be tailored to watershed only education

dy working on LLAR, however focus is mainly on mentation instead of education

have to only include LAR component

have to pivot to focus on watershed instead of just habitat

Organization Name	Type of Education	Tools Used	Language	Target Audience	Tran	
Bay Watershed Education and Training (B-WET)	Classroom	Funding for classroom/fieldtrip education	E	К-12	Would curricul	
LA River Index	Computer, community events, volunteer/docent program	Maps	E,S			
California Department of Fish and Wildlife	Multi-nodal	Public education programs including classroom aquarium project and archery course, public hunter education program, resources for online fishing program. Publications include magazine, games, scientific journal, atlas, and educational videos. Other outreach campaigns that include interactive pdfs.	E	K-12; fishers and hunters; hikers and recreators	Would	
California Department of Water Resources						
City of Vernon, California						
Anthony Rendon Speaker of the Assembly			E,S			
East Yard Communities for Environmental Justice	Workshops and field work	Workshops for youth and adults, research training, and project presentation, community activities. Posting on a blog for updates.	E	High school students, adults, community members	Current	
The Los Angeles Neighborhood Land Trust	Provide educational pdf, and policy education	Organize community activities and post educational pdfs on policy and greenspace	E	Community members	Current	
Prevention Institute	Research, training, educational assistance,	Public education programs and indicators, guidelines, along with collaboration efforts on the different areas of focus.	E	Community members	Current prevent	
River LA	Campaigning and event based	Organize community activities and public speaking events and advocacy group	E	Community members	Current creating commu	
The Trust for Public Land	Campaigning, funding, research programs	Publicly accessible web-based portal to demonstrate impacts of Climate Change on communities throughout LA County. TPL also publishes research on parks throughout the United States, manages campaigns related to funding for open space, and encourages advocacy and working with community members and locally based organizations	E,S	Community members	Current environ	
Trails4All	Training and organizing community events and recruitment of volunteers	Organize community activities and events to go hiking and also have consultations and volunteer programs	E	Community members	Current natural	
Watershed Conservation Authority	Training and camping programs, and promote the preservation/restoration of parks	Training for the ranger program where they promote exploring outdoors and becoming more informed and developing skills as a land steward, with hands on experience and field trips	E	Community members	Current	
Watts Reimagined					Current	
NOAA	School based activities and lesson plans	Educational activity book and lesson plans, monitoring toolkit, webinar	E	K-12	Would	
Clark Fork Watershed Education Program	School based	Training and educational content. Power point and handouts	E	6th -9th	Transfe	



sferability to LLAR Communities/River Focused Education

have to be used in tandem with an already established llum

have to pivot to focus on watershed instead of just habitat

t focus is more on policy and air quality and public health

focus is on greenspace and built environment

t focus is on public health, health equity, violence tion, food and environmental equity and safety

t focus is on the revitalization of the LA river- specifically in g more greenspace and pedestrian/bike friendly paths for unity members along the river

t focus is on the preservation of parks, land, built nment and more green space

t focus is on the creation and Preservation of trails and l sites

t focus is on improvement of water conservation and supply

focus is on sustainable development

need to be adapted from marine to river focus

erable but needs customization

Organization Name	Type of Education	Tools Used	Language	Target Audience	Tran	
EPA	Training, education	Training-focused, powerpoint, modules, and reading material including basic introduction, watershed ecology, watershed change due to climate and human activities, analysis and monitoring, planning and reaching out to communities	E	High school, college, and adults, managers	Transfe	
Metropolitan Water District	School Based curriculum	Teacher's guide, content, and activities	E		Transfe	
LA Sanitation	School based curriculum	Lesson plans and lab activities	E		Focuse	
Department of Water Resources	School based curriculum	Lesson plans, teacher guide, activity guides, educational resources, links to water information	E		Transfe issues	
California Coastal Commission	School Based curriculum	Science activity guide and teacher content	E	3rd-8th	Transfe more lo	
California Education and Environment Initiative	School Based curriculum	Workbooks, lesson plan, interactive activities	E	К-12	Transfe concep	
LA Stormwater	Activity based		E,S	3rd grade	Yes.	
Discovery Science Center	Multi-nodal	After school, teacher student workshops, summer school programs, field trips	E	K-12	Unknov	
Bureau of Land Management	Lesson plan	Experiment, learning by doing	E	K-12	Needs	
Groundwater.org	Multi-nodal	Searchable education database	E	K-12 educators	Concep	
EPA	Educational resources	Tools, background content and educational resources on green infrastructure	E	College, high-school	Yes	
Minnesota Stormwater Manual	Online resource list	Fact sheets, tools, background content	E	College, professionals	Needs	
ASLA	Multi-modal	Game, experiments, videos, classroom activities on green infrastructure	E	K-12	Yes	
Discovery Education	Lesson plan	Soil and flooding activity	E	6 <sup>TH</sup> -8 <sup>TH</sup> grade	Concep	
UCSB	Lesson plan	Activity designing flood barriers, civil engineering aspect, flood hazards and floodplains	E	3 <sup>rd</sup> grade	Concep	
Teach Engineering	Curriculum	Activity with clay, understanding why floods occur and riverbed factors and designing solutions	E	6 <sup>th</sup> grade	Concep	
NASA	Educational resources listing	Games, teaching resources, modules, lesson plans and activities about climate change	E	K-12	Concep	
The Story Group	Educational video	Supplemental video focusing on southwest region and water supply	E	General audiences	Transfe	
Cool California	Educational resources listing	Curriculum, classroom resources, programs	E	K-college	Needs	
U.S. Department of the Interior	Educational video	Supplemental video about ecosystems, people and wellbeing	E	College	Concep	
PBS	Lesson plan	Activities and multimedia sources to understand human impact on water resources and take water samples	E	6 <sup>™</sup> -8 <sup>™</sup> grade	Concep	
Metro	Strategic plan	Plan to encourage active transportation in Los Angeles	E, S	General audiences	Yes	
NEEF	List of Applications	List of applications that kids and adults can use outdoors	E	General audiences	Yes	
Oregon Metro	List of guides	Guides about how to incorporate sustainable development which can also encourage active transportation	E	General Audiences, community members	Concep	



## sferability to LLAR Communities/River Focused Education

erable

erable

ed on water treatment

erable, need customization for Los Angeles water resource

erable but marine and coast focused, would need to find ocal and relevant examples

erable, needs customization of LLAR. Good for general ots

wn. Materials not online.

customization, concepts are pertinent

ots are pertinent

customization but concepts apply

ots apply

pts apply

ots apply

pts are pertinent

errable, would need to relate to socal region

customization

pts apply

pts apply, needs customization

ots apply

Organization Name	Type of Education	Tools Used		Target Audience	Transferability to LLAR Communities/River Focused Education
Metro	List of Tips	Bike safety tips	E	General audiences	Yes
Commission to Build a Healthier America	Educational brochure	Background content about how environment affects health	E	General audiences	Is transferrable
GeoTeach	Lesson plans	Watershed and land use activities, sources of pollution and watershed conservation and management strategies	E	6th-8th	Needs customization but is transferrable
U.S. EPA	Educational PDF	Community benefits of land revitalization, case studies, background content	E	Educators and general audiences	Is transferrable with customization
California Coastal Commission	Multi-modal	Project based learning tool, slide show, teacher workshops	E	Educators	Transferrable, coastal focus
Los Angeles Conservation Corps	Workforce development	Hands on training, after school education, Sea Lab, Recreational Kayaking	E	Young adults, grades 1-8	Yes
Conservation Corps of Long Beach	Workforce development	Hands on training, after school education	E	Young adults, grades 1-8	Yes



#### Table 2. School Location List

CDS Code	Status	Charter	Ed. Type	Level	Grades	Туре	School	District	Street	City	State	Zip
19647336089700	Active	No	Traditional	Elementary	K-5	Public	Fishburn Avenue Elementary	Los Angeles Unified	5701 Fishburn Avenue	Maywood	CA	90270-2819
19647336058309	Active	No	Traditional	Intermediate/Middle/ Junior High	6-8	Public	South Gate Middle	Los Angeles Unified	4100 Firestone Boulevard	South Gate	CA	90280-3218
19647336019574	Active	No	Traditional	Elementary	K-5	Public	Tweedy Elementary	Los Angeles Unified	9724 Pinehurst Avenue	South Gate	CA	90280-5222
19647336107411	Active	No	Traditional	Elementary	K-6	Public	Teresa Hughes Elementary	Los Angeles Unified	4242 Clara Street	Cudahy	CA	90201-5010
19647336110274	Active	No	Traditional	Elementary	K-6	Public	Nueva Vista Elementary	Los Angeles Unified	4412 Randolph Street	Bell	CA	90201-1224
19647336016794	Active	No	Traditional	Elementary	K-5	Public	Dominguez Elementary	Los Angeles Unified	21250 Santa Fe Avenue	Carson	CA	90810-1446
19647336016158	Active	No	Traditional	Elementary	K-5	Public	Bryson Avenue Elementary	Los Angeles Unified	4470 Missouri Avenue	South Gate	CA	90280-5057
19647331930866	Active	No	Traditional	High School	9-12	Public	Bell Senior High	Los Angeles Unified	4328 Bell Avenue	Bell	CA	90201-2528
19647336016620	Active	No	Traditional	Elementary	K-5	Public	Corona Avenue Elementary	Los Angeles Unified	3825 Bell Avenue	Bell	CA	90201-2308
19647336019020	Active	No	Traditional	Elementary	K-5	Public	San Gabriel Avenue Elementary	Los Angeles Unified	8628 San Gabriel Avenue	South Gate	CA	90280-3112
19647336017545	Active	No	Traditional	Elementary	K-5	Public	Heliotrope Avenue Elementary	Los Angeles Unified	5911 Woodlawn Avenue	Maywood	CA	90270-3525
19647336020051	Active	No	Traditional	Elementary	K-5	Public	Woodlawn Avenue Elementary	Los Angeles Unified	6314 Woodlawn Avenue	Bell	CA	90201-1417
19647336017131	Active	No	Traditional	Elementary	К-6	Public	Ford Boulevard Elementary	Los Angeles Unified	1112 South Ford Boulevard	Los Angeles	CA	90022-2912
19647330109363	Active	No	Traditional	Elementary	K-5	Public	Maywood Elementary	Los Angeles Unified	5200 Cudahy Avenue	Maywood	CA	90270
19647330109207	Active	No	Traditional	Elementary	К	Public	Martha Escutia Primary Center	Los Angeles Unified	6401 Bear Avenue	Bell	CA	90201
19647330111997	Active	No	Traditional	Elementary	K-5	Public	Huntington Park Elementary	Los Angeles Unified	6055 Corona Avenue	Huntington Park	CA	90255
19647330107011	Active	No	Traditional	Elementary-High Combination	6-12	Public	International Studies Learning Center at Legacy High School Complex	Los Angeles Unified	5225 Tweedy Boulevard	South Gate	CA	90280
19647336016885	Active	No	Traditional	Elementary-High Combination	K-12	Public	Elizabeth Learning Center	Los Angeles Unified	4811 Elizabeth Street	Cudahy	CA	90201-5205
19644516057640	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Stauffer Middle	Downey Unified	11985 Old River School Road	Downey	CA	90242
19647741935436	Active	No	Traditional	High School	9-12	Public	Lynwood High	Lynwood Unified	4050 East Imperial Highway	Lynwood	CA	90262
19644516012868	Active	No	Traditional	Elementary	K-5	Public	Rio Hondo Elementary	Downey Unified	7731 East Muller Street	Downey	CA	90241
19644516012819	Active	No	Traditional	Elementary	K-3	Public	Imperial Elementary	Downey Unified	8133 Imperial Highway	Downey	CA	90242
19647256057848	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Stephens Middle	Long Beach Unified	1830 West Columbia Street	Long Beach	CA	90810-2913
19644516012900	Active	No	Traditional	Elementary	К-3	Public	Williams Elementary	Downey Unified	7530 East Arnett Street	Downey	CA	90241
19647746020283	Active	No	Traditional	Elementary	К-6	Public	Roosevelt Elementary	Lynwood Unified	10835 Mallison Avenue	Lynwood	CA	90262-2113
19647746020275	Active	No	Traditional	Elementary	К-6	Public	Mark Twain Elementary	Lynwood Unified	12315 Thorson Avenue	Lynwood	CA	90262-5243
19648736021398	Active	No	Traditional	Elementary	K-3	Public	Wesley Gaines	Paramount Unified	7340 East Jackson Street	Paramount	CA	90723-4809
19648086113799	Active	No	Traditional	Elementary	1-8	Public	Laguna Nueva	Montebello Unified	6360 South Garfield Avenue	City Of Commerce	CA	90040-3615
19644511939164	Active	No	Traditional	High School	9-12	Public	Warren High	Downey Unified	8141 De Palma Street	Downey	CA	90241
19647256015275	Active	No	Traditional	Elementary	K-5	Public	Edison Elementary	Long Beach Unified	625 Maine Avenue	Long Beach	CA	90802-1143
19647256015689	Active	No	Traditional	Elementary	K-5	Public	Whittier Elementary	Long Beach Unified	1761 Walnut Avenue	Long Beach	CA	90813-2430



CDS Code	Status	Charter	Ed. Type	Level	Grades	Туре	School	District	Street	City	State	Zip
19644516012777	Active	No	Traditional	Elementary	K-3	Public	Ward Elementary	Downey Unified	8851 East Adoree Street	Downey	CA	90242
19648086020689	Active	No	Traditional	Elementary	K-5	Public	Winter Gardens Elementary	Montebello Unified	1277 South Clela Avenue	Los Angeles	CA	90022-4903
19647256015184	Active	No	Traditional	Elementary	K-5	Public	Burbank Elementary	Long Beach Unified	501 Junipero Avenue	Long Beach	CA	90814-1031
19734376012355	Active	No	Traditional	Elementary	K-6	Public	Mayo Elementary	Compton Unified	915 North Mayo Avenue	Compton	CA	90221-2112
19647336018667	Active	No	Traditional	Elementary	K-6	Public	Park Avenue Elementary	Los Angeles Unified	8020 Park Avenue	Cudahy	CA	90201-6018
19644516114235	Active	No	Traditional	Elementary	4-5	Public	Old River Elementary	Downey Unified	11995 Old River School Road	Downey	CA	90242
19647336108641	Active	No	Traditional	Elementary	K-5	Public	San Miguel Elementary	Los Angeles Unified	9801 San Miguel Avenue	South Gate	CA	90280-4823
19647336057939	Active	No	Traditional	Intermediate/Middle/Junior High	6-9	Public	Chester W. Nimitz Middle	Los Angeles Unified	6021 Carmelita Avenue	Huntington Park	CA	90255-3320
19647336118186	Active	No	Traditional	Elementary	K-8	Public	Ellen Ochoa Learning Center	Los Angeles Unified	5027 Live Oak Street	Cudahy	CA	90201
19647330109462	Active	No	Traditional	High School	9-12	Public	Maywood Academy High	Los Angeles Unified	6125 Pine Avenue	Maywood	CA	90270-3110
19647330122168	Active	No	Traditional	Elementary	K-6	Public	Jaime Escalante Elementary	Los Angeles Unified	4443 Live Oak Street	Cudahy	CA	90201-4207
19647330122390	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Orchard Academies 2B	Los Angeles Unified	6411 Orchard Avenue	Bell	CA	90201
19647330122747	Active	Yes	Traditional	Intermediate/Middle/Junior High	6-8	Public	Magnolia Science Academy Bell	Los Angeles Unified	6411 Orchard Avenue	Bell	CA	90201-1023
19647330122408	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Orchard Academies 2C	Los Angeles Unified	6411 Orchard Avenue	Bell	CA	90201
19647330122614	Active	Yes	Traditional	Elementary	K-5	Public	Aspire Gateway Academy	Los Angeles Unified	8929 Kauffman Avenue	South Gate	CA	90280
19647330122622	Active	Yes	Traditional	Elementary	K-5	Public	Aspire Firestone Academy	Los Angeles Unified	8929 Kauffman Avenue	South Gate	CA	90280-3422
19647330124529	Active	No	Traditional	Elementary-High Combination	6-12	Public	Rancho Dominguez Preparatory	Los Angeles Unified	4110 Santa Fe Avenue	Long Beach	CA	90810-1439
19647330126391	Active	No	Traditional	Elementary	K-6	Public	Lucille Roybal-Allard Elementary	Los Angeles Unified	3232 Saturn Avenue	Huntington Park	CA	90255
19647330126540	Active	No	Traditional	High School	9-11	Public	Science, Technology, Engineering, Arts and Mathematics at Legacy High School Complex	Los Angeles Unified	5225 Tweedy Boulevard	South Gate	CA	90280
19647330126557	Active	No	Traditional	High School	9-11	Public	Visual and Performing Arts at Legacy High School Complex	Los Angeles Unified	5225 Tweedy Boulevard	South Gate	CA	90280
19734376012272	Active	No	Traditional	Elementary	K-6	Public	Emerson Elementary	Compton Unified	1011 East Caldwell Street	Compton	CA	90221-4340
19734376061261	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Roosevelt Middle	Compton Unified	1200 East Alondra Boulevard	Compton	CA	90221-4306
19734376057582	Active	No	Traditional	Elementary-High Combination	5-9	Public	Whaley Middle	Compton Unified	14401 South Gibson Avenue	Compton	CA	90221-2514
19734371932326	Active	No	Traditional	High School	9-12	Public	Dominguez High	Compton Unified	15301 South San Jose Avenue	Compton	CA	90221
19734376012280	Active	No	Traditional	Elementary	K-6	Public	Foster Elementary	Compton Unified	1620 North Pannes Street	Compton	CA	90221-1734
19734376012306	Active	No	Traditional	Elementary	K-6	Public	Kelly Elementary	Compton Unified	2320 East Alondra Boulevard	Compton	CA	90221-4202
19734376120877	Active	No	Traditional	Elementary	K-6	Public	Clinton, William Jefferson	Compton Unified	6500 Compton Boulevard	Compton	CA	90221-3181
19734376012389	Active	No	Traditional	Elementary	K-6	Public	Roosevelt Elementary	Compton Unified	700 North Bradfield Avenue	Compton	CA	90221-2307
19764970115725	Active	Yes	Traditional	Elementary-High Combination	6-12	Public	Lifeline Education Charter	SBE - Lifeline Education Charter	225 South Santa Fe Avenue	Compton	CA	90221-3240



CDS Code	Status	Charter	Ed. Type	Level	Grades	Туре	School	District	Street	City	State	Zip
19647256057814	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Lindbergh STEM Academy	Long Beach Unified	1022 East Market Street	Long Beach	CA	90805-6034
19647256057780	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Hamilton Middle	Long Beach Unified	1060 East 70th Street	Long Beach	CA	90805-1008
19647256015135	Active	No	Traditional	Elementary	K-5	Public	Barton Elementary	Long Beach Unified	1100 East Del Amo Boulevard	Long Beach	CA	90807-1010
19647256015440	Active	No	Traditional	Elementary	K-5	Public	Lincoln Elementary	Long Beach Unified	1175 East 11th Street	Long Beach	CA	90813-3659
19647256015341	Active	No	Traditional	Elementary	K-5	Public	Grant Elementary	Long Beach Unified	1225 East 64th Street	Long Beach	CA	90805-2534
19647256015606	Active	No	Traditional	Elementary	K-5	Public	Roosevelt Elementary	Long Beach Unified	1400 E. 20th Street	Long Beach	CA	90806
19647256015416	Active	No	Traditional	Elementary	K-5	Public	King Elementary	Long Beach Unified	145 East Artesia Boulevard	Long Beach	CA	90805-2003
19647256061386	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Washington Middle	Long Beach Unified	1450 Cedar Avenue	Long Beach	CA	90813-1705
19647256116933	Active	No	Traditional	Elementary	K-8	Public	Powell Academy for Success	Long Beach Unified	150 Victoria Street	Long Beach	CA	90805
19647251936947	Active	No	Traditional	High School	9-12	Public	Polytechnic High	Long Beach Unified	1600 Atlantic Avenue	Long Beach	CA	90813-2017
19647256015358	Active	No	Traditional	Elementary	K-5	Public	Harte Elementary	Long Beach Unified	1671 East Phillips Street	Long Beach	CA	90805-4811
19647256015671	Active	No	Traditional	Elementary	K-5	Public	Webster Elementary	Long Beach Unified	1755 West 32nd Way	Long Beach	CA	90810-2459
19647251995570	Active	No	Alternative School of Choice	High School	9-12	Public	Educational Partnership High	Long Beach Unified	1794 Cedar Avenue	Long Beach	CA	90813-1770
19647256109292	Active	No	Traditional	Elementary	K-5	Public	Alvarado Elementary	Long Beach Unified	1900 East 21st Street	Signal Hill	CA	90755
19647256015572	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Jessie Nelson Academy	Long Beach Unified	1951 Cherry Avenue	Signal Hill	CA	90755
19647251937176	Active	No	Continuation School	High School	11-12	Public	Reid High	Long Beach Unified	2153 West Hill Street	Long Beach	CA	90810-3400
19647256015325	Active	No	Traditional	Elementary	K-5	Public	Garfield Elementary	Long Beach Unified	2240 Baltic Avenue	Long Beach	CA	90810-3597
19647256015614	Active	No	Traditional	Elementary	K-5	Public	Signal Hill Elementary	Long Beach Unified	2285 Walnut Avenue	Signal Hill	CA	90755
19647256015382	Active	No	Traditional	Elementary	K-8	Public	Hudson K-8	Long Beach Unified	2335 Webster Avenue	Long Beach	CA	90810-3254
19647251996503	Active	No	Alternative School of Choice	High School	9-12	Public	Renaissance High School for the Arts	Long Beach Unified	235 East Eighth Street	Long Beach	CA	90813
19647256015424	Active	No	Traditional	Elementary	K-5	Public	Lafayette Elementary	Long Beach Unified	2445 Chestnut Avenue	Long Beach	CA	90806-2997
19647256112056	Active	No	Traditional	Elementary	K-8	Public	Robinson Academy	Long Beach Unified	2750 Pine Avenue	Long Beach	CA	90806-2617
19647256015531	Active	No	Traditional	Elementary	K-8	Public	Muir K-8	Long Beach Unified	3038 Delta Avenue	Long Beach	CA	90810-2843
19647250127506	Active	Yes	Traditional	Intermediate/Middle/Junior High	6-8	Public	Intellectual Virtues Academy of Long Beach	Long Beach Unified	3601 Linden Avenue	Long Beach	CA	90807
19647256015457	Active	No	Traditional	Elementary	K-5	Public	Longfellow Elementary	Long Beach Unified	3800 Olive Avenue	Long Beach	CA	90807-3577
19647256061360	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Hughes Middle	Long Beach Unified	3846 California Avenue	Long Beach	CA	90807-3510
19647250101741	Active	No	Community Day School	High School	10-12	Public	Select Community Day (Secondary)	Long Beach Unified	2221 Argonne Avenue	Long Beach	CA	90815
19647250115535	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Lindsey Academy	Long Beach Unified	5075 Daisy Avenue	Long Beach	CA	90805-6307



CDS Code	Status	Charter	Ed. Type	Level	Grades	Туре	School	District	Street	City	State	Zip
19647250114603	Active	No	Traditional	Elementary	K-5	Public	Dooley Elementary	Long Beach Unified	5075 Long Beach Boulevard	Long Beach	CA	90805
19647256015622	Active	No	Traditional	Elementary	K-5	Public	Stevenson Elementary	Long Beach Unified	515 Lime Avenue	Long Beach	CA	90802-2642
19647256015465	Active	No	Traditional	Elementary	K-5	Public	Los Cerritos Elementary	Long Beach Unified	515 West San Antonio Drive	Long Beach	CA	90807-3117
19647256015119	Active	No	Traditional	Elementary	K-5	Public	Addams Elementary	Long Beach Unified	5320 Pine Avenue	Long Beach	CA	90805-5930
19647256061345	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Franklin Classical Middle	Long Beach Unified	540 Cerritos Avenue	Long Beach	CA	90802-1623
19647256015200	Active	No	Traditional	Elementary	K-5	Public	Burnett Elementary	Long Beach Unified	565 East Hill Street	Long Beach	CA	90806-4457
19647251934470	Active	No	Traditional	High School	8-12	Public	Jordan High	Long Beach Unified	6500 Atlantic Avenue	Long Beach	CA	90805-2304
19647256015515	Active	No	Traditional	Elementary	K-5	Public	McKinley Elementary	Long Beach Unified	6822 Paramount Boulevard	Long Beach	CA	90805-1937
19647256108013	Active	No	Traditional	Elementary	K-5	Public	International Elementary	Long Beach Unified	700 Locust Avenue	Long Beach	CA	90813
19647256015143	Active	No	Traditional	Elementary	K-5	Public	Birney Elementary	Long Beach Unified	710 West Spring Street	Long Beach	CA	90806-1413
19647250107458	Active	No	Traditional	Elementary	K-5	Public	Chavez Elementary	Long Beach Unified	730 West Third Street	Long Beach	CA	90802
19101990121905	Active	No	Juvenile Court School	High School	9-12	Public	Kirby, Dorothy Camp	Los Angeles County Office of Education	1500 South McDonnell Avenue	City Of Commerce	CA	90040
19647746020309	Active	No	Traditional	Elementary	K-7	Public	Will Rogers Elementary	Lynwood Unified	11220 Duncan Avenue	Lynwood	CA	90262-3041
19647740114777	Active	No	Alternative School of Choice	High School	9-12	Public	Pathway Independent Study	Lynwood Unified	11300 Wright Road	Lynwood	CA	90262
19647741935428	Active	No	Continuation School	High School	10-12	Public	Vista High (Continuation)	Lynwood Unified	11300 Wright Road	Lynwood	CA	90262-3126
19647740127845	Pending	No	Community Day School	High School	7-12	Public	Lynwood Community Day	Lynwood Unified	11387 Bullis Road	Lynwood	CA	90262
19647746115539	Active	No	Traditional	Intermediate/Middle/Junior High	7-8	Public	Hosler Middle	Lynwood Unified	11300 Spruce Street	Lynwood	CA	90262
19647746020317	Active	No	Traditional	Elementary	K-6	Public	Wilson Elementary	Lynwood Unified	11700 School Street	Lynwood	CA	90262-4348
19647746116685	Active	No	Traditional	Elementary	K-6	Public	Rosa Parks Elementary	Lynwood Unified	3900 Agnes Street	Lynwood	CA	90262-4415
19647746115547	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Lynwood Middle	Lynwood Unified	12124 Bullis Road	Lynwood	CA	90262-5106
19647740107912	Active	No	Traditional	Elementary	K-6	Public	Helen Keller Elementary	Lynwood Unified	3521 Palm Avenue	Lynwood	CA	90262
19647740108399	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Cesar Chavez Middle	Lynwood Unified	3898 Abbott Road	Lynwood	CA	90262
19647740108381	Active	No	Traditional	Elementary	K-5	Public	Thurgood Marshall Elementary	Lynwood Unified	3593 Martin Luther King Boulevard	Lynwood	CA	90262
19647746020291	Active	No	Traditional	Elementary	K-6	Public	Washington Elementary	Lynwood Unified	4225 Sanborn Avenue	Lynwood	CA	90262-2998
19647746020267	Active	No	Traditional	Elementary	K-6	Public	Lugo Elementary	Lynwood Unified	4345 Pendleton Avenue	Lynwood	CA	90262
19647740109538	Active	No	Traditional	High School	9-12	Public	Marco Antonio Firebaugh High	Lynwood Unified	5246 Martin Luther King Boulevard	Lynwood	CA	90262
19647746020234	Active	No	Traditional	Elementary	K-6	Public	Janie P. Abbott Elementary	Lynwood Unified	5260 East Clark Street	Lynwood	CA	90262-5443
19648086020507	Active	No	Traditional	Elementary	K-5	Public	Bandini Elementary	Montebello Unified	2318 Couts Avenue	City Of Commerce	CA	90040-1102
19648086020648	Active	No	Traditional	Elementary	K-8	Public	Rosewood Park	Montebello Unified	2353 Commerce Way	City of Commerce	CA	90040-1407



CDS Code	Status	Charter	Ed. Type	Level	Grades	Туре	School	District	Street	City	State	Zip
19648081930825	Active	No	Traditional	High School	8-12	Public	Bell Gardens High	Montebello Unified	6119 Agra Street	Bell Gardens	CA	90201-1705
19648086020515	Active	No	Traditional	Elementary	K-5	Public	Bell Gardens Elementary	Montebello Unified	5620 Quinn Street	Bell Gardens	CA	90201-5421
19648086058408	Active	No	Traditional	Intermediate/Middle/Junior High	5-8	Public	Bell Gardens Intermediate	Montebello Unified	5841 Live Oak Street	Bell Gardens	CA	90201
19648086020531	Active	No	Traditional	Elementary	K-5	Public	Cesar E. Chavez Elementary	Montebello Unified	6139 Loveland Street	Bell Gardens	CA	90201-1738
19648086020655	Active	No	Traditional	Elementary	K-5	Public	Suva Elementary	Montebello Unified	6740 East Suva Street	Bell Gardens	CA	90201-1936
19648086085682	Active	No	Traditional	Intermediate/Middle/Junior High	5-8	Public	Suva Intermediate	Montebello Unified	6660 East Suva Street	Bell Gardens	CA	90201-1943
19648086020564	Active	No	Traditional	Elementary	K-5	Public	Garfield Elementary	Montebello Unified	7425 South Garfield Avenue	Bell Gardens	CA	90201-4815
19648736021471	Active	No	Traditional	Elementary	K-5	Public	Theodore Roosevelt	Paramount Unified	13451 Merkel Avenue	Paramount	CA	90723-4378
19648731936749	Active	No	Traditional	High School	8-12	Public	Paramount High	Paramount Unified	14429 South Downey Avenue	Paramount	CA	90723-4378
19648731996107	Active	No	Community Day School	High School	8-12	Public	Paramount Unified Community Day	Paramount Unified	14507 Paramount Boulevard	Paramount	CA	90723
19648730119438	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Paramount Park Middle	Paramount Unified	14608 Paramount Boulevard	Paramount	CA	90723
19648736021448	Active	No	Traditional	Elementary	K-5	Public	Los Cerritos	Paramount Unified	14626 Gundry Avenue	Paramount	CA	90723-4378
19648736021430	Active	No	Traditional	Elementary	K-5	Public	Abraham Lincoln	Paramount Unified	15324 California Avenue	Paramount	CA	90723-4378
19648736114615	Active	No	Traditional	Intermediate/Middle/Junior High	6-8	Public	Frank J. Zamboni	Paramount Unified	15733 South Orange Avenue	Paramount	CA	90723-4378
19648736021414	Active	No	Traditional	Elementary	K-8	Public	Hollydale	Paramount Unified	5511 Century Boulevard	South Gate	CA	90280-8114
19648736021455	Active	No	Traditional	Elementary	K-5	Public	Mark Keppel	Paramount Unified	6630 East Mark Keppel Street	Paramount	CA	90723-4378
19648730108779	Active	No	Traditional	Elementary	K-5	Public	Howard Tanner	Paramount Unified	7210 Rosecrans Avenue	Paramount	CA	90723
19648730102681	Active	No	Traditional	Intermediate/Middle/Junior High	4-8	Public	Leona Jackson	Paramount Unified	7220 Jackson Street	Paramount	CA	90723-4378
19648736021489	Active	No	Traditional	Elementary	K-5	Public	Harry Wirtz Elementary	Paramount Unified	8535 Contreras Street	Paramount	CA	90723-4378
19648736117444	Active	No	Traditional	Elementary	K-5	Public	Jefferson Elementary	Paramount Unified	8600 Jefferson Street	Paramount	CA	90723-4378
19648081995364	Active	No	Adult Education Center	Adult	Adult	Public	Ford Park Community Adult	Montebello Unified	7800 Scout Avenue	Bell Gardens	CA	90201-5630
19647251995935	Active	No	Traditional	High School	9-12	Public	Cabrillo High	Long Beach Unified	2001 Santa Fe Avenue	Long Beach	CA	90810
11101160130807	Active	Yes	Traditional	High School	9-12	Public	Conservation Corps of Long Beach Gateway Cities Charter	Glenn County Office of Education	3635 Atlantic Avenue	Long Beach	CA	90807
19101990132605	Active	Yes	Traditional	Intermediate/Middle/Junior High	4-8	Public	Valiente College Preparatory Charter	Los Angeles County Office of Education	8691 California Ave	South Gate	CA	90280
19647250131938	Active	Yes	Traditional	High School	9-12	Public	Clear Passage Educational Center	Long Beach Unified	1471 Martin Luther King Junior Avenue	Long Beach	CA	90813
19647330129825	Active	Yes	Traditional	Elementary	K-6	Public	Clemente Charter	Los Angeles Unified	5701 Fishburn Avenue	Maywood	CA	90270-2819
19734370132845	Active	Yes	Traditional	Elementary	K-8	Public	Today's Fresh Start Compton	Compton Unified	2301 East Rosecrans Ave	Compton	CA	90221
19642871996479	Active	Yes	Traditional	Elementary-High Combination	K-12	Public	Opportunities For Learning - Long Beach	Baldwin Park Unified	6608 Cherry Avenue	Long Beach	CA	90805



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## 7. Glossary of Terms

Acre-foot – A volume of water that covers one acre to a depth of one foot, or 43,560 cubic feet (1233.5 cubic meters). One acre foot is enough water to supply two families with a years worth of water. One acre-foot is 325,000 gallons or approximately one-living of a million gallons. One million gallons is 3.07 acre-feet. An average family of four living in a single-family home uses about 0.6 acre-feet per year.

Adapt - When populations change to conform or better fit a situation.

Aquifer – A natural underground layer of porous, water bearing materials (sand, gravel) usually capable of yielding a large amount or supply of water.

Artesian (aquifer or well) – Water held under pressure in porous rock or soil confined by impermeable geologic formations. An artesian well is free flowing.

Best management practices (BMPs) – Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants yet are compatible with the productive use of the resource to which they are applied. BMPs are used in both urban and agricultural areas.

Biodiversity – the amount of different living things in an ecosystem or habitat. Health ecosystems have higher biodiversity than unhealthy ecosystems.

CBO - A community-based nonprofit organization representing sector interests

Confined Aquifer – an aquifer in which an impermeable layer of soil or rock lays on top and prevents water from seeping into the ground

Ecology - the study of the interactions between organisms and their environment.

Ecosystem Services – are services that people benefit from the ecosystem. These benefits include 1) provisioning services, which include food, raw materials, fresh water, and medicinal resources. 2) Regulating services, which include local climate, air quality, storage, and waste-water treatment regulating. 3) Habitat services, which include habitat for species and maintenance of genetic diversity and 4) cultural services, which include recreation and mental and physical health, tourism, aesthetic appreciation, inspiration for culture, and sense of place.

Engagement - For our purposes, engagement is a two-way "relational interaction".

Erosion – is a process that uses wind, water and other natural elements to breakdown surface material and move substances such as rock and soil to another area than its original location.

Green Infrastructure – a watershed management that protects, restores, or mimics the natural water cycle through the use of natural materials (soils and plants) and engineered systems

Groundwater Basin – groundwater stored in an area with permeable materials below the water, it is capable of storing a significant supply of water.

Groundwater Recharge – the process in which water moves downward from the surface water to the groundwater.

Heavy metals – metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead. They can damage living things at low concentrations and ten to accumulate in the food chain.

Herbicide - A compound, usually a man-made organic chemical, used to kill or control plant growth.

Hydraulics - science that focuses on the movement of water

Hydrology – the study of water, specifically its properties, movement and interaction with land, and how it affects the earth and atmosphere.



Infiltration – the gradual flow or movement of water into and through (to percolate or pass through) the pores of the soil.

Multiple Benefits - Benefits of water projects that are not directly related to water quality or

Multiple use – Use of land for more than one purpose; i.e., grazing of livestock, wildlife production, recreation, watershed, and timber production. Could also apply to use of bodies of water for recreational purposes, fishing, and water supply.

NGO – A nongovernmental entity, representing a sector of interest, specific nongovernmental organizations, and academia.

Nutrient – Any substance that is assimilated (taken in) by organism and promotes growth. Nitrogen and phosphorous are nutrients which promote the growth of algae. There are other essential and trace elements that are also considered nutrients.

Organic – Substances that come from animal or plant sources. Organic substances always contain carbon. (Inorganic materials are chemical substances of mineral origin.)

Pathogens – Microorganism that can cause disease in other organisms or in humans, animals and plants. They may be bacteria, viruses, or parasites and are found in sewage in runoff from animal farms or rural areas populates with domestic and / or wild animals, and in water used from swimming. Fish and shellfish contaminated by pathogens, or the contaminated water itself, can cause serious illnesses.

Percolation – 1) the slow seepage of water into and through the ground. 2) The slow passage of water through a filter medium.

Permeate – to penetrate and pass through, as water penetrates and passes through soil and other porous materials.

Pesticide - Any substance or chemical designed or formulated to kill or control weeds or animal pests.

Plumes – the way polluted water extends downstream from the pollution source (analogous to smoke from a smoke-stake as it drifts downwind in the atmosphere).

Pollutant – Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

Pollution – Generally, the presence of matter or energy whose nature, location or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or maninduced alteration of the physical, biological, and radiological integrity of water.

Receiving waters – All distinct bodies of water that receive runoff or wastewater discharges, such as streams, rivers, ponds, lakes, and estuaries.

Recharge area – Generally, an area that is connected with the underground aquifer(s) by a highly porous soil or rock layer. Water entering a recharge area may travel for miles underground.

Recharge - Process by which rain water (precipitation) seeps into the groundwater system.

Run-off – That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into the receiving waters.

Seepage – The percolation of water through the soil from unlined channels, ditches, watercourses and water storage facilities.



Sewage treatment plant – A facility that receives wastewaters (and sometimes runoff) from domestic and/ or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts. Also, known as POTW (publicly owned treatment works) and wastewater reclamation plant.

Spreading basin – Basin used to impound water to allow for slow percolation of water into the ground in order to recharge the underlying groundwater aquifer.

Spring - Ground water seeping out of the earth where the water table intersects the ground surface.

Stakeholders - Organizations and individuals who have an interest in water issues and supply.

Surface runoff – Precipitation, snowmelt, or irrigation in excess of what can infiltrate into the soil or be stored in small surface depressions. Runoff is a major transporter of pollutants.

Surface water – All water that naturally opens to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.).

Unconfined aquifer - where water seeps directly into the ground surface above an aquifer

Urban runoff – Storm water from city streets and adjacent domestic or commercial properties that may carry pollutants of various kinds into the storm water systems and / or receiving waters.

Wastewater – The used water and solids from a community (including used water from industrial processes) that flow to a treatment plant through its sewer system. Storm water, surface water, and groundwater infiltration also may be included in the wastewater that enters a wastewater treatment plant. Wastewater can also be managed by other means such as evaporation in a holding pond or in a wetland.

Wastewater treatment plant (WWTP) – A facility that receives wastewaters (and sometimes runoff) from domestic and / r industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful by products. Also, known as POTW (publicly owned treatment works) and sewage treatment plant.

Water table the level of ground water. The upper surface of the zone of saturation of ground water above an impermeable layer of soil or rock (through which water cannot move) as in an unconfined aquifer. This level can be very near the surface of the ground or far below it.

Watershed – The land area that drains into a river or stream. An area of land that contributes runoff to one specific delivery point. Large watersheds may be composed of several smaller "sub watersheds", each of which contributes runoff to different locations that ultimately combine at a common delivery point. Watersheds are usually bordered and separated from other watersheds by mountain ridges or other naturally elevated areas. Watersheds are usually bordered and separated from other watersheds by mountain ridges or other naturally elevated areas.

Wetlands – Any number of tidal and non-tidal areas characterized by saturated or nearly saturated (wet) soils most of the year that form an interface between terrestrial (land-based) and aquatic environments. These include freshwater marshes around ponds and channels (rivers and streams), brackish and salt marshes. Other common names include swamps and bogs.

