Literature Review: Los Angeles River Revitalization Project
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I. Introduction

As Americans have migrated from rural to urban areas, cities have dedicated an increasing amount of space to parks in order to enhance the quality of urban life. Park visionaries gave us New York’s Central Park, San Francisco’s Golden Gate Park, and similar urban oases across the United States, but only about 30% of Los Angeles residents live within walking distance of a park. Furthermore, urban parks have declined overtime because of the emigration of people from the cities to the suburbs.

The goal of this literature review is to provide a better understanding of the potential benefits of the Los Angeles River Revitalization Project (LARRP) under specific evaluation criteria. The LARRP is leading the effort to bring together architects, communities, designers and elected officials to transform the Los Angeles River. The project has been dubbed a “linear Central Park” along the 51 miles of the Los Angeles River. This review will assess the literature pertaining to revitalization projects and other related topics in an effort to establish a concrete understanding of the potential benefits from the rejuvenation of the river. We will show that the LARRP’s pursuits are in line with a forward-looking policy suited for sustainable development in the years to come. In this review, we find that some of the points from the literature on economic benefits that are related to the potential revitalization of the Los Angeles River include (but are not limited to) the following:

Flood Control

- Green based development strategies provide economic benefits against costly alternatives without sacrificing public safety: One Kansas county spent $600,000 to develop riparian setback and a park system to manage the flooding, instead of paying an estimated $120 million for traditional flood control methods. St. Paul, Minnesota, implemented green-based infrastructure to solve problems with flooding and urban runoff. The green-based infrastructure cost 45% less than the conventional approach, saving the city $1 million. (See section II)

Water Quality

- Green-based infrastructure can help recharge groundwater aquifers and reduce urban runoff that costs millions of dollars in medical treatments: Green infrastructure designed by Seattle Public Utilities agency to reduce and treat urban runoff affecting water quality saves $100,000 per block compared to traditional treatment in addition to being a more aesthetically desirable alternative. (See section III)

- The revitalization of the Los Angeles River provides opportunities for environmental improvements: LARRP’s planting of a single tree along the Los Angeles River can generate $31,250 worth of oxygen, provide $62,000 worth of air pollution control, and recycle $375,000 worth of water over a five-year span. (See section III)

Water Recharge

- Los Angeles has relied upon recycled water since 1979 and imports water from areas that are under stress: The conservation group American Forests estimates that trees in the nation’s metropolitan areas save cities $400 billion in costs of building stormwater retention facilities. Green infrastructure can help to recharge aquifers by allowing water to penetrate below the surface, instead of creating urban runoff and polluting local streams. (See section IV)

Ecosystem Services—Habitat

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¹Sherer, Paul M. "Why America needs more city parks and open space." The Trust for Public Land (2003).
Urbanization can support the reintroduction of a more natural environment: Restoration, protection, and enhancement of green infrastructure and ecosystem services in urban areas is socially, ecologically, and economically viable. One study found that ecosystems provide benefits of $9,701 per hectare (roughly 2.5 acres) per year, with a range of between $3,212 and $17,772. These are considered conservative estimates that are likely to understate potential benefits. (See section V)

Parks, Open Space and Land Use

The revitalization of the Los Angeles River can generate revenues for local cities and add value to homeowners' equity: A single green belt generated $500,000 each year in additional potential property taxes and added a total of $5.4 million to the total property values of one neighborhood in Colorado. Numerous studies have found a positive relationship between parks, open space, and home price increases. (See section VI)

Green infrastructure can improve California's water shortage and reduce the energy costs associated with importing water: Increases in low impact development (LID) strategies, such as rain gardens and green surfaces, can save 74,600 to 152,500 acre-feet of imported water per year in Los Angeles by 2030. An acre-foot of water is roughly 325,821 gallons. Furthermore, these strategies will reduce the cost of importing water and will thus benefit the environment. (See section VI)

Stakeholders

The Los Angeles River Revitalization Project will serve diverse needs of surrounding communities and address environmental justice problems related to green spaces by making them accessible: Compared to Latinos and African Americans, Non-Hispanic whites are 12 to 15 times likely to live near more and larger parks. (See section VII)

Public Health

LARRP is actively pursuing the development of parks and green environments, which can play a significant role in improving human health, along the Los Angeles River: Investments in park restoration can reduce health care costs. Studies suggest that annual medical costs are lowered by $865 per person in such instances. Studies also confirm that access to parks and open space leads to an increase recreation and physical activity. One study estimated an increase of almost 350 million recreational trips (over a 40-year period). (See section VIII)

Transportation

Revitalizing the Los Angeles River can help the city to meet its goals of reducing greenhouse gas emissions: There is a growing concern over greenhouse gas emissions and the future of climate change. The most common and successful types of parks that create opportunities for non-motorized travel are greenways, rail trails, and bike paths: A single 1.13-mile bike lane in San Francisco was estimated to result in emissions reduction of 31.1 metric tons (MT) of carbon dioxide (CO2) annually. The 51-mile span of the Los Angeles River has the potential to encourage non-motorized travel for bikers and pedestrians as it reduces the impact of motorized transportation on the environment. (See section IX)

Arts & Culture

LARRP's plan can reduce crime by providing the setting for social cohesion, arts and culture, and community strengthening: Public places offer free, open forums for people to encounter art, to enjoy performances, and to
participate in other cultural activities. Arts in Cleveland, Ohio, contribute $1.3 billion annually to Cleveland’s regional economy. (See section X)

The unrealized potential of a river is effectively a deadweight loss to its surrounding communities until latent benefits are achieved are sought out through proper practices and successful renovations. Margaret Mead once said, “Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has.” The Los Angeles River Revitalization Project is aligned with a forward-thinking Los Angeles. The city has set goals to pursue actions aimed at strengthening the environment amidst the challenges the earth is currently facing now and will undoubtedly face in the future. The revitalization of the Los Angeles River gives the city the opportunity to engage in an initiative that will strengthen environmental sustainability for future generations and provide other benefits along the way.

II. Flood Control

Flooding is one of the costliest natural hazards in the United States. It is expensive, threatens public welfare, and places a severe burden on impacted communities. Early in the city’s history, the primary function of the Los Angeles River was to protect the city from floods. Today, most of Los Angeles is covered with impermeable surfaces like asphalt and buildings, so water cannot filter into the ground. The abundance of these impermeable surfaces makes managing strong storms more cumbersome because excessive water cannot be absorbed, worsening flood damages.

Municipal authorities are beginning to recognize that green infrastructure practices provide a feasible and cost-effective alternative to manage precipitation on-site and reduces loads in local storm sewers and waterways. These solutions do more than reduce localized flooding; they can also significantly reduce negative downstream impacts more effectively than traditional gray infrastructure. Beyond hydrologic benefits, green infrastructure can be incorporated into highly visible community investment and renewal projects such as greenways and parks, typically with much lower costs.

Green infrastructure is “an approach to wet weather management that uses natural systems—or engineered systems that mimic natural processes—to enhance overall environmental quality and provide utility services.” In practice, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspire, and/or recycle stormwater runoff.

The implementation of green infrastructure can mitigate flood risks by intercepting rain and providing a storage area, promoting water infiltration into the soil, and slowing and reducing runoff into streams. Green infrastructure approaches can employ infiltration, evapotranspiration, and rainfall capture to enhance water quality. With global climate change expected to increase all forms of flooding, a vast amount of literature has been devoted to explaining the positive effects of green infrastructure on slowing climate dynamics. This will be discussed later in the transportation section of this report.

³Ibid.
The adaptation of green infrastructure is a way to work “with nature’s capacity to absorb or control impact in urban and rural areas [that] can be a more efficient way of adapting than simply focusing on physical infrastructure.” The Environmental Protection Agency in 2007 released a report that summarized 17 case studies of developments that include green infrastructure; in most cases, significant savings were realized for stormwater infrastructure, site paving, and landscaping. One study also showed that property values could increase by as much as 5% if the risk of flooding were reduced.

Trees, parks, and gardens not only make a city an attractive place to live and work, they also improve air and water quality and promote resilience during extreme weather. Areas with gray infrastructure already in place can realize benefits from implementing a few selected types of green infrastructure techniques. Impermeable surfaces interrupt the natural cycle of water by preventing it from infiltrating into the ground to be used by plants. Green infrastructure counters this and helps to prevent flooding by slowing and capturing water where it falls.

Toledo, Ohio, successfully implemented green infrastructure on a neighborhood scale. After a green infrastructure investment, residents experienced no flooding, even when a major storm dumped seven inches of rain on the city.

After experiencing recurring floods, Johnson County, Kansas, spent $600,000 to develop riparian setback and a park system to manage the flooding, instead of paying an estimated $120 million for traditional flood control methods.

In addition to assisting in flood control and reducing property damage, the new system also provides trails and open spaces for biking, jogging, nature hiking, picnicking, and other recreational pursuits.

Urban runoff was also a significant contributor to flooding problems in St. Paul, Minnesota, so the city implemented green-based infrastructure as a solution. The infrastructure cost 45% less than the conventional approach, saving the city $1 million. Together, these case studies demonstrate that green-based infrastructure can serve as a viable, affordable solution to flooding in areas like Los Angeles, where urban runoff is a serious concern.

According to the Federal Interagency Task Force on Floodplain Management, “...the most sensible, least costly approach to flood hazard protection may have less to do with dams and disaster relief, and more to do with land-use patterns within floodplains.” Roughly 100% of the original wetlands and 90% to 95% of in-stream riparian habitat within the Los Angeles River watershed have been squandered as a result of urbanization. LARRP is pursuing efforts to restore the natural and historic heritage of the Los Angeles River. Although complete restoration to a naturalized condition is not entirely feasible given flood control requirements, the river channel can be “greened” and restored without sacrificing public safety. Accomplishing such proposals to enhance flood protection can be introduced in the short term by lining trails that parallel the river with plants. Long-term improvements can further develop and implement green infrastructure as a catalyst for offsetting the risk of flooding and the associated damages.

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11Odefey, Jeff, et al., op. cit., p.3
III. Water Quality

Trees and green space in urban areas provide substantial quantifiable environmental benefits. Trees not only reduce air pollution and keep cities cooler, they also reduce water pollution. Trees and the soil beneath them are natural water filters, reducing the costs associated with water purification systems. Trees can also absorb nutrients created by human activity, such as nitrogen, phosphorus, and potassium, all of which are potential pollutants to streams and lakes. The United States Forest Service calculated that over five years, a single tree can generate $31,250 worth of oxygen, provide $62,000 worth of air pollution control, and recycle $375,000 worth of water.

When rain is unable to soak into the ground, it drifts along the streets and parking lots while gathering pollutants in a process known as stormwater runoff. Stormwater picks up chemicals, sediment, and other bacteria that flow directly into rivers, lakes, and streams. These pollutants degrade water quality, contaminate recreational areas, and threaten water supplies. One strategy is to capture rainwater where it falls. For example, a medium-sized red oak tree can intercept 1,129 gallons of rainfall annually. If 100 trees were added to an area, this would translate to a 112,900-gallon reduction in runoff annually.

From rain gardens to green roofs, green infrastructure practices protect and water quality by keeping polluted stormwater out of local rivers and streams, reducing combined sewer overflows, and filtering out contaminants. Green infrastructure is also increasingly recognized for its cost effectiveness and ability to reduce energy use.

Green infrastructure practices offer multiple other benefits to communities working to improve health, safety, and equity. Such practices decrease pollutants in water, which can reduce illness from recreational contact or from drinking water. They also can improve air quality and mitigate the urban heat island effect to lower heat-related illness and fatalities. Green infrastructure can also mitigate localized flooding. These practices improve access to healthy and affordable food when combined with urban agriculture strategies and to green space for recreation.

According to the Environmental Protection Agency (EPA), polluted runoff from stormwater is the leading source of pollution for 40% of water that fails to meet water quality standards. Furthermore, urban runoff is the primary source of impairment for 13% of rivers, 18% of lakes, 32% of estuaries, and 55% of ocean shorelines across the country, according to the EPA’s list of the nation’s impaired waters. It is important to note that urban areas cover only 3% of the entirety of landmass in the United States. Thus, urban stormwater runoff has a significant impact on water quality. The incorporation of green infrastructure helps to protect public health by reducing the amount of polluted runoff. Illnesses associated with contaminated water from urban runoff can have serious economic impacts. It is estimated that up to 3.5 million people become sick from contact with water tainted by sewage annually.

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¹⁷Ibid.
¹⁸Odefey, Jeff, et al., op. cit., p. 28
²⁰Odefey, Jeff, et al., op. cit., p. 29
A 2004 study of Huntington Beach and Newport Beach in Orange County, California, determined that the cost of gastrointestinal illness from water-borne sources was $36.58 per person in lost work days and medical costs, not including lost recreational values or willingness-to-pay of individuals to avoid getting sick.\(^1\) Illness associated with swimming in contaminated water at those beaches costs the public more than $3 million every year. Another study of 28 popular yet polluted beaches in Southern California calculated that swimmers there suffered an estimated 1.5 million gastrointestinal illnesses, resulting in an economic loss of $21 million to $51 million every year.\(^2\)

Philadelphia adapted the Green City, Clean Waters plan to use green infrastructure to reduce runoff. The plan is projected to generate more value in benefits than its costs to the city.\(^3\) The green infrastructure Los Angeles will implement with the LARRP will probably generate a net benefit to the city, as well. Because the Los Angeles River drains into the Pacific Ocean, incorporating green infrastructure can help reduce the downstream transport of pollutants, minimizing the effects the impacts on ocean waters used for recreation.

### IV. Water Recharge

With California’s water shortage expected to continue despite a rainier-than-average winter, public attention must be focused on how to combat the volatility of weather patterns. During dry periods or drought, a time when human water-use demands are often greatest, groundwater may be the only available source of water to streams.\(^4\) One approach is to improve the ability to capture, treat, and use urban stormwater. Streets paved with concrete and asphalt result in less rain being recharged because it is flowing off those surfaces and out into the ocean. Impervious surfaces like parking lots, roads, and roofs associated with urban sprawl significantly reduce the recharge of underground water supplies.

**One inch of rain in Los Angeles can generate more than 10 billion gallons of runoff.**\(^5\) It is possible to retain some of that water, however, as parks and open spaces can be reconfigured to capture rainfall by replacing pavement with trees, mulch, and rain gardens. Although there is no single solution to the water challenges California faces, one strategy is to improve water resilience through permeable landscapes that take advantage of the rain. Groundwater levels and groundwater discharge depend on a number of factors, including annual precipitation, and can vary substantially from year to year.

When rain falls onto a permeable surface, some runs off, some returns to the atmosphere, and the rest is absorbed into the ground, where it can recharge aquifers. An acre of parking lot can create 16 times more runoff than an acre of undeveloped meadow. **Furthermore, an acre of wetlands can store 1-1.5 million gallons of water.**\(^6\)

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a 120-acre rail yard on the eastern side of the Los Angeles River, can incorporate a lot of green infrastructure benefits if properly revitalized.

Seattle, Washington, for example, reduced runoff by 97% a year after converting an open ditch stormwater drain into an attractive roadside swale garden, decreasing the width of the adjacent street and planting native vegetation. Oregon’s Museum of Science and Industry in Portland redesigned its parking lots to minimize stormwater runoff and maximize local infiltration of rainwater. Its parking lot now has capacity to infiltrate almost half an inch of rainfall every time it rains, and construction costs fell $78,000.27

Conservation group American Forests estimates that trees in the nation’s metropolitan areas save cities $400 billion in costs of building stormwater retention facilities.28 However, natural tree cover has declined by almost 30% in metropolitan cities over the last several decades.29 Adding trees and incorporating them into a city’s infrastructure can result in a less expensive storm water management system.30

The crown of a large tree is a freestanding anti-flood reservoir, in some cases intercepting so much rainfall that more than 1,500 gallons a year evaporates instead of hitting the ground. Chop down the tree and you increase the volume of storm water a city must manage, an action that especially affects older cities with aging drainage systems.31

**Los Angeles imports roughly 89% of its water sources from areas that are under stress.** Moreover, almost half of the Los Angeles area’s potential drinking water is used for outdoor irrigation. Importation of water from Northern to Southern California is one of the single largest uses of energy in the state.32 By planting a substantial number of new strategically placed trees, the city can reduce energy demand,33 and water retention from trees will reduce the demand for energy-intensive imported water or desalinated ocean water.

Reliance on groundwater is particularly strong in Southern California, where approximately 40% of the region’s total water needs are met by local groundwater pumping.34 A 2008 study found that Los Angeles has the potential to collect 100,000 gallons of rainwater per year for each quarter acre of hardscape.35 A 500-foot long residential street in Los Angeles can generate 140,000 gallons of storm water.36 Estimates show that an increase in low-impact development (LID) strategies, such as rain gardens and green surfaces, can save 74,600 to 152,500 acre-feet of imported water per

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27Ibid.
34Ibid.
35Estimates of potential stormwater runoff assuming an average yearly rainfall in Los Angeles of 15-inches on impervious surfaces. Potential stormwater from a ¼-acre lot = (0.25 x 43,560 sq. ft. per acre) x (15” rain per year) / (12” per ft.) x (7.481 gal. per cu. ft.) = 101,835 gallons. A typical 2-lane street is 30 feet wide. Potential stormwater from a city street, not including sidewalks = (500 ft. long) x (30 ft. wide) x (15” rain per year) / (12” per ft.) x (7.481 gal. per cu. ft.) = 140,269 gallons. Calculation by the City of Los Angeles Bureau of Sanitation, November 2008.
36This calculation is based on the average daily per capita water use of Los Angeles residents from 2006 to 2007, which was 146 gallons per person per day. (According to the City of Los Angeles Department of Environmental Affairs website, http://www.lacity.org/EAD/2007/environmental%20facts.htm). 146 gallons per day x 365 days per year = 53,290 gallons per person per year = .1635 AF/person/year. Conversion factor: 1 acre foot = 325,851 gallons. 74,600 AF per year saved / .1635 AF per person per year = the water used by 456,269 people. 152,000 AF per year saved / .1635 AF per person per year = the water used by 929,664 people.
year by 2030. Based on current per capita water usage in the city of Los Angeles, this is equivalent to the water consumption by 456,300 to 929,700 people. Moreover, because Los Angeles County would be pumping less water from distant locations, 131,700 to 428,000 MWh of energy would be saved per year by 2030. The energy required to import the water into Los Angeles in 2007 alone, resulted in emissions of 548,318 metric tons (MT) of CO2.  

LARRP's pursuits urban green space in Los Angeles can help to reduce energy demand for imported water through stormwater recharge and thus reduce stress on the environment. Los Angeles has been using recycled water since 1979 for irrigation and other industries; the growth for water demand will likely increase over time, not decrease.

V. Ecosystem Services—Habitat

Urbanization poses a challenge for conservation efforts, as some aspects of urbanization promote the loss of certain species through the large expansion of impervious surfaces in urban areas, making fewer fragments of land available for plants. However, some features of urbanization can support the reintroduction of a more natural environment.  

A key question in urban ecology is whether value of added nonnative species with urbanization exceeds the loss of native species to produce a net gain in species richness with urbanization.  

As urbanization spreads rapidly, a key challenge is to understand how it affects biodiversity. Buildings and pavement cover approximately 80% of most urban areas. Urban parks and open space can play an important role in conservation and restoration of natural habitats. Rivers and waterways historically have always attracted human settlements. Increased development has led to the degradation of natural habitats.

The conservation and restoration value of parks should be assessed on an individual basis. Generally, the most important factors to consider are size, vegetation cover, location, and age. For the case of the Los Angeles River, “restoration projects involving riparian habitat are of particular importance.”  

However, it is equally important to note that non-riparian habitats in Los Angeles are significant but lacking. A riparian buffer is a vegetated area near a stream that provides economic and social benefits including trapping and removing nutrients and contaminants, storing floodwater, improving aesthetics, and offering recreational and educational opportunities. By slowing down flow velocities, riparian buffers allow more water to percolate into the ground.  

A restoration of Reading Creek in Alabama involved planting 2,500 native plants and removing 90% of invasive species, creating a healthy riparian buffer.  

An empirical analysis based on data from 25 urban areas in the United States, Canada, and China showed that investing in the “ecological restoration and rehabilitation of ecosystems such as rivers, lakes, and woodlands occurring in urban areas, may not only be ecologically and socially desirable, but also quite often, economically advantageous, 

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37Groth, Phillip, et al., op. cit., p.18  
38McKinney, Michael L. "Urbanization, Biodiversity, and Conservation The impacts of urbanization on native species are poorly studied, but educating a highly urbanized human population about these impacts can greatly improve species conservation in all ecosystems." BioScience 52, no. 10 (2002): 883-890.  
even based on the most traditional economic approaches.” The same study found that the analyzed ecosystems in urban areas provide benefits of $9,701 on average per hectare (roughly 2.5 acres) per year, with a range of between $3,212 and $17,772.\textsuperscript{43} Those estimates also excluded other important benefits, such as improved health and positive effects on social welfare, and consequently should be treated as very conservative estimates. Investing in restoration, protection, and enhancement of green infrastructure and ecosystem services in urban areas is socially, ecologically, and economically viable. Such information is critical for guiding urban planners, architects, public policy makers, and private and institutional stakeholders.

There are other benefits produced by ecosystem services that cannot be captured by metrics. Urban green space has been shown to correlate closely with longevity,\textsuperscript{44} recovery from surgeries,\textsuperscript{45} reduction of stress,\textsuperscript{46} and improved mental health.\textsuperscript{47} Ecosystem restoration is an effective, economically beneficial outlet to reconcile the expanding human population with fragmented urban green space.

\section*{VI. Parks, Open Space, and Land Use}

Urban parks are an attractive amenity that can improve the economic value of densely populated urban dwellings. Many studies find a significant correlation between property values and proximity to parks. To justify the creation of a park more than a century ago, Fredrick Law Olmsted conducted a study of how parks help property values. Parks and open space generate revenues that can in turn be used justify the money spent on their creation and/or renovation. Studies conducted over the last couple of decades reaffirm what Olmsted found in his analysis. In fact, many studies have shown that the appraised values of homes that are in close proximity to parks and open spaces ranges from 8\% to 20\% more than comparable properties elsewhere.\textsuperscript{48}

The case for more parks in Los Angeles is among the most compelling in any American city. Only 30\% of its residents live within a quarter mile of a park, compared with between 80\% and 90\% in Boston and New York, respectively.\textsuperscript{49}

People are willing to pay a premium for property close to parks and open space.\textsuperscript{50} A survey conducted in 2001 for the National Association of Realtors by Public Opinion Strategies found that half the correspondents were willing to pay 10\% more for a house located in close proximity to a park or protected open space. That same survey also found that 57\% of those surveyed would be more likely to select one neighborhood over another if it was close to a park or open space.\textsuperscript{51} A case study done in Boulder, Colorado, showed that, all else being equal, there was a decrease in the price of a residential property of $4.20 for every one foot of distance from a green belt. Furthermore, the average

\begin{thebibliography}{99}
\bibitem{Ibid.}
\bibitem{Ulrich, Roger. "View through a window may influence recovery from surgery." \textit{Science} 224, no. 4647 (1984): 224-225.}
\bibitem{Crompton, John L. \textit{The impact of parks and open space on property values and the property tax base.} Division of Professional Services, National Recreation & Park Association, 2000.}
\bibitem{Sherer, Paul M. op. cit., p. 9}
\bibitem{Crompton, John L. op. cit., p. 1}
\bibitem{Ibid.}
\end{thebibliography}
value of homes in close proximity to the green belt was 32% higher than those 3,200 feet away.\(^{52}\) That same study also concluded that the green belt generated $500,000 each year in additional potential property taxes and added a total of $5.4 million to the total property values of one neighborhood.

A study conducted by the University of Southern California found that “an 11% increase in the amount of green space within a radius of 200 to 500 feet from a house leads to an approximate increase of 1.5% in the expected sales price of the house, or an additional $3,440 in the median price.”\(^{53}\) Furthermore, a “$200,000 purchase of a one-third-acre lot for creation of a small park would yield additional property tax revenues of $13,000 per year. These tax revenue increases would pay for the park’s cost in about 15 years with no additional taxes.”

A study conducted by The Trust for Public Land in Long Island found that “the state’s parks and open space provide a $2.74 billion annual economic benefit to local governments and taxpayers, and that conservation of Long Island’s parks and open space is eight times less costly than new residential development.”\(^{54}\) The same study also concluded that “Long Islanders are willing to pay $1.48 billion annually to recreate in public parks. Non-residents who visit Long Island because of parks and open space spend $615 million in the local economy, which generates $27.3 million in sales tax. More than 600,000 Long Islanders engage in physical activities in parks, generating measurable health benefits of $164 million per year. Proximity to parks and open space enhances the value of residential properties by an aggregate, one-time increase of $5.8 billion. Increased tax revenues from these properties generate $58.2 million annually.”\(^{55}\) By implication, given that the Los Angeles River spans 51 miles, there is a lot of potential value to be reaped by its revitalization.

Land use policies and planning decisions can have a serious impact on the well-being of residents. A key element in land use policy is to recognition of environmental capacities and resource bases. Land use policy should enhance the long-term benefits of goods and services derived from these resources. Overall, parks are a positive financial investment for a community, and the understanding of the economic impacts of public parks and open space offer can help decision-makers evaluate and maintain urban parks and/or green space.

Urban development puts stresses on natural landscape and can compromise environmental quality. Decisions about land use development frequently fail to consider the values of environmental amenities.\(^{56}\) Recognizing the economic benefits of open space access could help enable urban planners to accurately assess the trade-off between the protection of open space and allowing land to be developed.\(^{57}\)

Because open space is very often scarce in developed areas, recognition of its value is an important factor for landscape and planning committees to consider. In one study, open space was found to be of greater value in neighborhoods


\(^{55}\)Ibid.


that were dense, high-income, high-crime, highly urban, or that had many children. Views of landscape can also be reflected in property values. A review of 35 studies found that the majority reported positive impacts on home values. The impact varied from a mere 1% up to as much as 147%. Conversely, property values are negatively affected by views of industrial lands and roads.

Recognition of the effects of land use decisions can help provide the justification for efforts to restore the Los Angeles River. The potential benefits of the revitalization of the Los Angeles River will never come to fruition if the current state of the river remains unchanged. LARRP’s revitalization of the river, combined with sound land use practices, can provide significant economic and non-economic benefits.

VII. Stakeholders

Stakeholders of green infrastructure initiatives come from a wide variety of backgrounds. Successful initiatives—among them the Chicago Wilderness, Keeping America Growing, and the Cooper River Wildlife Corridor, among others—rely on alliances among various organizations, both public and private. Successful initiatives must excite people, engage them from the beginning, and keep them involved throughout the entire duration of the initiative. A shared vision can help drive the underlying process.

Developing and revitalizing parks and open spaces has become a catalyst for linking neighborhoods and communities throughout the United States. Residents once commonly referred to Marvin Gaye Park in Washington, DC, as “Needle Park” because of problems with extensive drug use and sales. It has been restored to a place of recreation and neighborhood gatherings. In New York, High Line Park and Lou Walker Park were also renovated, becoming amenities for their neighborhoods.

Successful citizen involvement in such programs must expand beyond traditional methods of attracting their attention. In the city of West Eugene, Oregon, many techniques were used to elicit citizen involvement, including direct mailings to landowners, marketing posters, news releases, newspaper stories, public surveys, and public hearings.

Chicago Wilderness was once seen as a contradictory pairing of words. In 1996, a coalition of organizations launched the Chicago Wilderness with a vision of a thriving mosaic of natural areas. The partnership is made up of more than 100 agencies that include community groups, landowners, government, and centers of research and education. The traditional approach to public input includes both meetings and surveys. Public meetings disseminate information and capture feedback from attendees. Stakeholder meetings are appropriate for efficiently surveying input from community interests.

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63Ibid.
A 2003 study looked at the cleanup and redevelopment of brownfield sites as green space in the City of Toronto. Community groups and organizations recognized the potential benefits of the redevelopment through the implementation of parks, playgrounds, trails, greenways, and other open spaces.\textsuperscript{64} The Toronto experience demonstrates that redevelopment on a large scale requires effort from residents across all walks of life in the community. It entailed the involvement of communities throughout the process: the establishment of green space inventories to identify opportunities, the identification of potential funding sources, the encouragement of greening projects with an eye toward enhancing their social and economic appeal, a risk assessment of the feasibility of the projects, and funding for all stages of the process as well as long-term maintenance.\textsuperscript{65}

Restoration and revitalization can be ambiguous conceptually. In the case of Chicago’s Montrose Point, a 2001 study concluded that the success of restoration “depends not so much on choosing the ‘right’ nature as it does on integrating diverse values of culture and nature.”\textsuperscript{66} Success can be achieved by integrating the different visions of nature expressed by the parks’ shareholders. Support is especially crucial in urban settings where political, financial, and other forces can impede progress.

Access to parks and open space access is not distributed uniformly across demographics. Los Angeles County in particular is one of the most disadvantaged counties for children and people of color in terms of access to parks and open space.\textsuperscript{67} Compared to Latinos and African Americans, non-Hispanic whites are 12 to 15 times more likely to have more park acreage per capita.\textsuperscript{68} President Barack Obama acknowledged the disparities inherent in Los Angeles County, saying, “And too many children in L.A. County, especially children of color, don’t have access to parks where they can run free and breathe fresh air, experience nature, and learn about their own environment.”\textsuperscript{69} The revitalization of the Los Angeles River will improve access for minorities, giving them an opportunity for recreation and improved health. According to the National Park Service, “the communities with the least amount of access to parks and open space tend to have higher rates of childhood diseases related to obesity, such as diabetes.”

\textbf{VIII. Public Health}

Nature advocates believe that parks and green environments play a significant role in positively impacting human health. People who engage in regular physical activity benefit from reduced risk of premature death; reduced risk of coronary heart disease, hypertension, colon cancer, and non-insulin-dependent diabetes; improved maintenance of muscle strength, joint structure, and joint function; weight loss and favorable redistribution of body fat; improved physical functioning in those experiencing poor health; and healthier cardiovascular, respiratory, and endocrine systems.\textsuperscript{70} Quality of life can be improved by incorporating moderate amounts of physical activity.

\textsuperscript{64} De Sousa, Christopher A. “Turning brownfields into green space in the City of Toronto.” \textit{Landscape and Urban Planning} 62, no. 4 (2003): 181-198.
\textsuperscript{65} Ibid.
\textsuperscript{67} http://www.cityprojectca.org/san-gabriel-mountains#101014.
\textsuperscript{68} Ibid.
Although the well-documented benefits of physical activity are no mystery, according to the Centers for Disease Control and Prevention (CDC), only 25% of American adults engage in the recommended levels of physical activity. This problem further extends to American youth, as only 27% of students in grades 9 to 12 engage in moderate to intensive physical activity.\(^{71}\) American's diet and sedentary lifestyles have exacerbated the growing obesity epidemic.

The trends are worsening. The percentage of children and adolescents who are overweight has more than doubled in the last half century, and roughly 17% of children and adolescents are seriously overweight.\(^{72}\) Obesity is associated with increased risk of “of high blood pressure, hypertension, high blood cholesterol, non-insulin-dependent diabetes, coronary heart disease, congestive heart failure, stroke, gallstones, osteoarthritis, some types of cancer (such as endometrial, breast, prostate, and colon), complications of pregnancy, poor female reproductive health (such as menstrual irregularities, infertility, and irregular ovulation), and bladder control problems. They also are at risk for such psychological problems as depression, eating disorders, distorted body image, and low self-esteem.\(^{73}\) How can public parks mitigate the trends? Investments in parks have a dramatic effect on health and fitness and can thereby reduce the financial strain on the health care system.

Access to nature, whether it is in the form of bona fide natural areas or in mere views of nature, eases psychological as well as social functioning. Greater access to green views and green environments yields better cognitive functioning; more proactive, more effective patterns of life functioning; more self-discipline and more impulse control; greater mental health overall; and greater resilience in response to stressful life events. Less access to nature is linked to exacerbated attention deficit/hyperactivity disorder symptoms, more sadness, and higher rates of clinical depression. People with less access to nature are more prone to stress and anxiety, as reflected not only in individuals’ self-reporting but also in measures of pulse rate, blood pressure, and stress-related patterns of nervous system and endocrine system anxiety, as well as physician-diagnosed anxiety disorders.\(^{74}\)

Evidence shows that when people have access to parks, they exercise more. When they have nowhere to walk, they gain weight. Obesity is more likely to occur in unwalkable neighborhoods.\(^{75}\) A group of studies reviewed by the American Journal of Preventative Medicine showed that enhanced access to places for physical activity produced a 48.8% increase in the frequency of physical activity.\(^{76}\) In urban areas, even fewer people have access to such opportunities. One study found that the lack of park access in Los Angeles may be contributing to the lack of fitness among Los Angeles school children.\(^{77}\) Approximately one-third of the schools in the Los Angeles Unified School District reported fewer than 10% of students meeting basic fitness levels.\(^{78}\) Trends for adults are equally alarming; studies suggest that


\(^{75}\)Dr. Lawrence Frank (findings from SMARTRAQ study in Atlanta presented at the Congress for the New Urbanism, Washington, D.C., June 19, 2003).


\(^{78}\)Ibid.
when inactive adults increase their participation in moderate physical activity, annual medical costs are lowered by $865 per person (in 2000 dollars).\textsuperscript{79}

The benefits of parks and open space extend not only to physical health, but to psychological health as well. One study reviewed 10 years of recoveries of surgical patients, in which some rooms overlooked trees while others faced a brown brick wall. The study found that patients with the view of trees had “shorter hospitalizations, less need for painkillers, and fewer negative comments in the nurses’ notes, compared with patients with brick-wall views.”\textsuperscript{80} One study conducted on 10,000 residents in the Netherlands found that a 10% increase in nearby greenspace decreased a person’s health complaints in an amount equivalent to a five-year reduction in that person’s age.\textsuperscript{81}

**IX. Transportation**

The most common and successful types of parks for creating opportunities for non-motorized travel are greenways, rail trails, and bike paths. Often designed as a route for workday commuters, these urban parks are usually long and narrow with one or more paved walkways.\textsuperscript{82} Urban parks can provide a safe locations for travel safer than cars in many cases, and consequently can play a significant role in reducing auto trips.\textsuperscript{83} The safer alternative may provide enough incentive for some people to shift away from motorized transportation.\textsuperscript{84}

The scientific community regards greenhouse gas (GHG) emissions as an axiomatic contributor to global climate change.\textsuperscript{85} Growing political consensus and international agreements, including the Kyoto Protocol, push towards the goal of bringing down GHG emissions between to 60% to 80% below 1990 levels by 2050.\textsuperscript{86} Open space and parkland provide an important opportunity for potential ways to reduce GHG emissions. Special attention is key for urban policy and planning considerations, as the growing concern over climate change becomes a challenge facing the planet. Governments are working to provide answers in response to climate change. At the local level, community leaders can pay increasing attention to the role that parks play in the reduction of GHG emissions because land use provides vital opportunities for reducing those emissions.

One effective way that cities and regions can reduce the overall contribution of transportation-related GHGs is with public parks, which can provide an attractive alternative to for motorized transportation, increasing the amount of travel by walking or bicycling. Just as the establishment and or renovation of a highway will increase the demand for motorized transportation, the expansion and/or creation of more extensive pedestrian-based infrastructure will lead

\textsuperscript{80}R. S. Ulrich. op. cit., p. 224
\textsuperscript{81}Wilson, Edward O. "Biophilia: The human bond with other species." (1984).
to an increase in walking and biking. This is known as the induced travel demand.\textsuperscript{87} One study estimated an increase of almost 350 million recreational trips (over a 40-year period).\textsuperscript{88} The linear structure of the Los Angeles River means that if offers an effective way to encourage non-motorized travel. Little research has been done to “quantify the increases in the number of people choosing non-motorized transportation after the implementation of an urban park.”\textsuperscript{89} Demand for non-motorized travel is more probable, however, in urban areas where a quarter of all trips are less than one mile in length, a reasonable distance walking or biking.\textsuperscript{90}

Riverfronts are a popular choice for the location of urban green space planning. Revitalization of riverfronts can provide a myriad of benefits, including giving residents the opportunity to engage in outdoor activities such as walking or bicycling. “Greenhouse gas emissions from mobile sources such as cars, trucks, and buses constitute a major source of the air pollutants that are linked to climate change.”\textsuperscript{91} The EPA estimated that GHG emissions from the transportation sector account for nearly 28% of emissions in 2006.\textsuperscript{92} In California, 41% of all GHG emissions are from the transportation sector, which makes it the largest contributor of GHGs in the state.\textsuperscript{93}

The reduction in GHG emissions for a bike path can be estimated using the simple equation:\textsuperscript{94}

\[
ER= A \times L \times EF
\]

Where:
- \(ER\) = GHG emissions reduced
- \(A\) = Motor vehicle trips reduced
- \(L\) = Average length of bike/pedestrian trips
- \(EF\) = Motor vehicle CO2 emissions factor

\textsuperscript{87} Noland, Robert B. and Lewinson, L. Lem. “Induced Travel: A Review of Recent Literature and the Implications for Transportation and Environmental Policy” (2000).
\textsuperscript{89} Groth, Philip, et al., op. cit., p.6
\textsuperscript{90} National Governor’s Association. 2000. “In the Fast Lane: Delivering more Transportation Choices to Break Gridlock.” National Governor’s Association. Washington, D.C.
\textsuperscript{91} Groth, Philip, et al., op. cit., p. 4
\textsuperscript{94} Groth, Philip, et al., op cit., p. 7
Estimates for a case study in San Francisco found that the development of a single 1.13-mile bike lane would result in a reduction in annual emissions of 31.1 metric tons (MT) of CO2 annually. Similarly, a case study of an urban park in Oakland made use of the following equation.\footnote{Ibid.}

\[
ER = H \times P \times V \times L \times EF
\]

Where:
- \(ER\) = GHG emissions reduced
- \(H\) = Households in the park service area
- \(P\) = Percentage of households that visit a park
- \(V\) = Average annual park visits per household
- \(L\) = Average distance to next closest park
- \(EF\) = Motor vehicle CO2 emissions factor

It was estimated that an urban park in Oakland, California would reduce annual CO2 emissions by 2.4 MT. If pedestrians have access to these recreational facilities, larger amounts of GHG emissions will be avoided. Anderson,\footnote{Anderson, J. 2003. The Environmental Benefits of Water Recycling and Reuse. Water Science and Technology: Water Supply, Vol. 3, No. 4, pg. 1-10.} and Kramer and Dorfman\footnote{Kramer, L. and J. Dorfman. 2000. A toolkit for the evaluation of land parcels for green space planning. University of Georgia River Basin Center.} provide evidence that the effective way to reduce CO2 emissions and energy use related to water delivery is by providing a medium for wastewater recycling and storm water retention. The planting of trees in urban green space areas can be used not only to sequester substantial amounts of carbon obtained from air and soil, but also to reduce the demand for local energy consumption by providing cooler surfaces and shade for surrounding buildings.

Carbon sequestration is the long-term storage of carbon dioxide or other forms, which helps to counter and avoid climate change. The rate of net sequestration per area of tree cover can be as high as 0.29 kg C/sq. m tree cover.\footnote{U.S. Environmental Protection Agency. Emissions & Generation Resource Integrated Database (eGRID). www.epa.gov/solar/energy-resources/egrid/} As trees continue to grow, they remove carbon dioxide from the air and store it in the form as biomass carbon in the leaves, roots, branches, and trunk. One study found that a young sapling can sequester anywhere from 1.0 to 1.3 pounds of carbon each year, and a 50-year-old tree can sequester more than 100 pounds annually.\footnote{DOE, US. “Method for Calculating Carbon Sequestration by Trees in Urban and Urban Settings.” Voluntary Reporting of Greenhouse Gasses (1998): 1-16.} The knowledge of the potential benefits from carefully selected trees provides yet another powerful argument for increasing investment in the proposed revitalization of the Los Angeles River. According to a 2015 study conducted by the UCLA Institute of the Environment and Sustainability, Los Angeles County contributed 21.7% of California’s GHG in 2009.\footnote{http://www.environment.ucla.edu/perch/resources/report-card-2015-energy.pdf} LARRP’s
revitalization can act to mitigate the threat posed by the automobile sector through induced travel demand as the Los Angeles River is transformed, offering an attractive alternative to motorized transportation.

### X. Arts & Culture

Shared beliefs, values, and practices of a community can all define culture. Arts can be subdivided into 13 categories: acting, announcing, architecture, fine art, directing, animation, dancing and choreography, design, entertainment and performance, music and singing, photography, production, and writing. The development of a health arts community can be fostered by the revitalization of community parks and open space. Urban parks provide an important setting for arts and cultural programs.

Parks are the democratic spaces of a city, where communities can jointly express their identities. One of the most important benefits of parks and open space is their role in influencing community development through arts and culture. Although the effect of city parks on inner-city neighborhoods is difficult to quantify, access to them has been strongly linked to reductions in crime and juvenile delinquency.

Parks are an extension of their communities. Public places often provide free open forums where people can encounter art, enjoy performances, and participate in other cultural activities. From “Shakespeare in the Park” festivals to string quartets at a downtown plaza, good places foster and enhance a city’s cultural life. Providence, Rhode Island’s WaterFire, an award-winning fire and music installation, has had an impressive cultural and economic impact, attracting hundreds of thousands of visitors to the downtown riverfront on summer and fall evenings. A symbol of the city’s renaissance, WaterFire brings people and events to a central urban area that had typically been deserted after dark. These events bring together diverse people and set the stage for positive social interaction.

Public places can provide a forum for artists and community members alike. In the absence of revitalization, however, parks can attract crime and drug use. New York’s Marvin Gaye Park, once known for drug abuses, now holds events sponsored by National Geographic including classes, parades, bike rodeos, health fairs, fun runs, field days, nature walks, talent shows, concerts, and more.

Parks support diverse communities by bringing them together. “Park improvements are often quick and tangible actions for mayors and citizens, which can work in concert with other issues such as reducing crime, eliminating graffiti, or traffic management.” A downtown park in Eugene, Oregon, hosts one of the community’s signature events, the Saturday Market, which brings community members together for shopping, food and entertainment and features farmer’s market produce. People are able to connect and build strong ties within their respective communities while hanging out, shopping, and listening to music. Working together, Eugene residents “took back” Washington-Jefferson

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Park, which had been overrun with illegal activity, including prostitution and drug dealing. The park is now used for a variety of recreational activities and community celebrations, including Eugene’s Cinco de Mayo.¹⁰⁵

The Los Angeles River is famous for the graffiti that spans miles of its concrete walls. The river’s 51-mile stretch offers artists a colorful canvas. Los Angeles-based artist Alex Poli, co-founder of an influential graffiti and street art gallery, believes that artists would be the best people to reflect the diversity of the city. Los Angeles spends money to remove graffiti. In 2009, for example, the Army Corp of Engineers used $837,000 of federal stimulus money to paint over 45 miles of river bank that fell within its jurisdiction.¹⁰⁶ This is likely the wrong approach.

The idea of cities cooperating with graffiti artists in order to bring art to the city’s bare walls is becoming more common. The city of Saint Louis, Missouri, eventually decided to take the “if you can't beat 'em, join 'em” approach after an un-permitted annual graffiti event cost the city millions of dollars in cleanup costs. In 2013, the city finally embraced the event, "Paint Louis," which brought more than 300 artists and 1,000 attendees.¹⁰⁷

UCLA researcher John Arroyo has arrived at the conclusion that “a space like the Los Angeles River, despite the many negative connotations associated with it, has the potential to be the civic space Los Angeles has long dreamed of, but never achieved.” Civic spaces are an extension of the community when they work well. Great civic spaces create great public places. They improve the quality of life for residents by establishing a stronger sense of community. When such spaces are scarce or in disrepair, residents may feel disconnected from their surroundings. Arts and culture contribute to regional and local economies, attracting tourists, generating jobs and spending. Both arts and culture aid in the development of social capital and can aid in the attainment of important community goals.¹⁰⁸ In Ohio, the Cleveland City Planning Commission estimated that the arts contribute $1.3 billion annually to the regional economy.¹⁰⁹ The literature on the impacts of arts and culture is extensive. A multitude of studies have shown that arts alone have a positive impact at the individual level by building interpersonal ties, improving an individuals sense of belonging, and building individual social networks. The arts also have a positive impact on the community with cultural, economic and social benefits.¹¹⁰ The Los Angeles River provides a potential destination for arts to emerge.

In October 2014, New York billionaire Michael Bloomberg invited U.S. mayors to band together with artists and arts organizations in an effort to develop innovative public arts projects. From 237 applications, four projects were selected to receive up to $1 million each as part of the Public Art Challenge. Of the four, the Los Angeles River was selected in an initiative to draw focus to issues including water conservation and the drought. The Los Angeles River provides an outlet for artistic renovation, and the demand for such artistic developments in the region is growing and will continue to grow. Interventions proposed by the LARRP that allow for the redevelopment and renewal of the Los Angeles River will nurture the artistic spirit that has been unable to thrive in the urban stage in which the river is settled.

¹⁰⁷ Ibid.
XI. Conclusion

Adopting green infrastructure practices merged with the restoration of the Los Angeles River can yield a multitude of benefits along the 51-mile span of water, and such a vast stretch of land provides a substantial amount of opportunities for benefits to accrue. Even though economic figures provide valuable arguments for the Los Angeles River Revitalization Project, there are numerous benefits that cannot be easily quantified, such as social cohesion through strengthened communities. Indeed, the consideration of both economic and non-economic benefits provides a strong stance for the restoration and revitalization of the Los Angeles River that LARRP is actively pursuing.
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