ZOFNASS PROGRAM
FOR SUSTAINABLE INFRASTRUCTURE
Business Case for Sustainable Infrastructure

The Business Case for Sustainable Infrastructure

Envision awarded case study

Landscape and Water Infrastructure

Sun Valley Watershed Multi-Benefit Project (DPW)

Sun Valley Watershed Multi-Benefit Project has been promoted by DPW as a model infrastructure project.

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ACRONYMS

ASCE	American Society of Civil Engineers
BCA	Benefit/Cost Analysis
BMP	Best Management Practice
BOS	Bureau of Sanitation
CA	California
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWH	Council for Watershed Health
DHS	California Department of Health Services
DTSC	California Department of Toxic Substance Control
EIR	Environmental Impact Report
GIS	Geographic Information System
LA	Los Angeles
LACDPW	Los Angeles County Public Works
LADoT	Los Angeles Department of Transportation
LADWP	City of Los Angeles Department of Water and Power
LARWQCB	Los Angeles Regional Water Quality Control Board
MWDSC	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
RAP	City of Los Angeles Department of Recreation and Parks
RWQCB	California Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SFGB	San Fernando Groundwater Basin
SVWMP	Sun Valley Watershed Management Plan
SWRCB	State Water Resources Control Board
ULARA	Upper Los Angeles River Area
USEPA	US Environmental Protection Agency
WMS	Watershed Modeling System

ABSTRACT

Water is a "common-pool resource," whose utilization outcome is inherently collective. In an ideal scenario, human activity must have minimal impact on the water cycle, enabling self-balance of the system.

According to the Zofnass Program Water and Landscape Infrastructure systems are considered as strongly interrelated with multiple synergies and an important impact to urban water challenges.[1] A sustainable approach should attempt to integrate the natural cycle of water into the urban environment. Integrating urban stormwater management into the Landscape system is a key planning strategy for resilience against flooding, and at the same time offers multiple benefits due to the Landscape system's inherent multifunctional character. It can provide retention of stormwater rather than rapid conveyance, reducing peak flows and runoff from the urban environment while simultaneously offering infiltration and groundwater recharge. Instead of a drainage system expansion that simply captures, Landscape entities can reuse, store, and infiltrate stormwater.

All the above are reflected in the Sun Valley Multi-benefit Project which was chosen to be presented in this case study. The analysis focuses on why, a more expensive multipurpose project was chosen in 2004 instead of a traditional, single purpose and cheaper solution to address the problem of flooding in the Sun Valley Watershed area (sub-basin of the greater LA River Watershed).

As a first step, the report focuses on the history and context of the project followed by an overview/summary of the multiple subprojects that consist it. Their role in the overall project and their main characteristics are presented next. The sustainable multi-benefit project has been awarded with the Envision Platinum Award by the Institute of Sustainable Infrastructure (ISI). This process is already analyzed in a complementary report by the Zofnass Program. As a result, the sustainability section of this report mainly focuses on the project's multiple objectives that address sustainability principles rather than the sustainable planning features themselves. Finally, the last paragraph depicts the value of the project mainly using the results of the Benefit and Cost Analysis that was conducted in 2004.

Concluding, the BCA helped the decision makers decide to go forward with the multipurpose solution and choose the final combination of project components. The Sun Valley Multi-benefit project, demonstrates that an innovative and integrated approach, even if it is more expensive, finally it was chosen and successfully implemented making it an example sustainability and resilience infrastructure project.

[1] "Given that Landscape consists of both terrestrial and aquatic systems, it overlaps with Water infrastructure in terms of water supply, with groundwater or surface water as sources, regulation or control of flows through waterways, and filtration and storage through wetland processes and land cover permeability. In other words, both in terms of structural components and processes, Landscape is tightly related with Water infrastructure." (Source: Zofnass Program Publication: "Planning Sustainable Cities: An Infrastructure-based Approach". p.53)

1. PROJECT BACKGROUND

1.1 Regional Context

Southern CA is characterized as a semi-arid region at its wettest. The area faces numerous challenges related to water supply relying on importing water from other regions[2] and extracting groundwater at rates significantly higher than natural recharge. Many of the rivers are converted to channels that quickly drain runoff to the Pacific. As a result, a significant portion of Southern California's fresh water supply is lost. Historically, before the urbanization of the LA area, up to 95% of stormwater runoff found its way into marshes and low-lying areas where much of it recharged underlying groundwater aquifers.[3] *"The City of LA currently pays approximately $480/acre-foot of water imported from the Metropolitan Water District (MWD) of Southern CA. In an average year, over 100,000[4] acre-feet of water are lost to the Pacific Ocean in the LA River watershed, with a value in excess of $48 million. With prices like these, there is growing recognition of the importance of our local fresh water supplies. This changing view of water resources in LA is beginning to take on a tangible shape in projects like the Sun Valley Watershed Management Plan. The LA River, is an impaired water body listed on the EPA's 303(d) list.[5] Urban stormwater is one source of contamination in the Los Angeles River, and by retaining stormwater runoff and it pollutants within the Sun Valley watershed would help reduce pollutant loading to the river."*[6]

Fig.1: *LA River near Elysian Park (Source: http://www.artmortimer.com/panoramas.htm)*

[2] Current sources of water import include: Colorado River, the Owens Valley in Eastern California via the Los Angeles Aqueduct, and Northern California via the California Aqueduct. (Source: *"COMMON GROUND from the Mountains to the Sea. Watershed and Open Space Plan San Gabriel and Los Angeles Rivers".* October 2001. p. 33)

[3] "Urbanization has altered the natural flow and the runoff regime in the basin, increasing both the velocity and volume of water flowing through the rivers. Prior to 1960, the ratio of rainfall to runoff was approximately 4:1, meaning that 80% of the precipitation in the basin was either evaporated or infiltrated and 20% was converted to surface runoff. By 1990 that ratio had increased to 2:1. Now, approximately 50% of all precipitation is converted to surface runoff." (Source: *"COMMON GROUND from the Mountains to the Sea. Watershed and Open Space Plan San Gabriel and Los Angeles Rivers".* October 2001. p. 23)

[4] According to the Southern California Water Committee about 3-4 million acre-feet can be recharged into groundwater basins. (Source: "STORMWATER CAPTURE: OPPORTUNITIES TO INCREASE WATER SUPPLIES IN SOUTHERN CALIFORNIA". January 2012. p.4.)

[5] For more information on 303(d) list, see paragraph 4.3.3 Regulatory requirements of this report (Water Quality Policies section).
Source: EPA website: https://ofmpub.epa.gov/waters10/attains_index.search_wb?p_area=CA&p_cycle=2016

[6] *"SUCCESSFUL INTEGRATED WATER RESOURCE PLANNING – KNOW YOUR BENEFITS AS WELL AS COSTS. THE SUN VALLEY WATERSHED CASE STUDY."* Paper by Brown and Caldwell. (Source: https://brownandcaldwell.com/technicalPapersAll.asp?page=9)

1.2 The Sun Valley Watershed

1.2.1 Location and land uses

The Sun Valley Watershed is approximately 2800 acres (4.4 sq miles) and is a tributary of the greater LA River Watershed and located within the San Fernando Groundwater Basin (SFGB). The study area is located within the northeastern portion of the San Fernando Valley, which is bounded on the north by the San Gabriel Mountains, on the east by the Verdugo Mountains, on the west by the Simi Hills and on the south by the Santa Monica Mountains. Located approximately 14 miles northwest of Downtown Los Angeles, it is built on an alluvial fan in the Tujunga Wash,[7] on the west. The land use is a mixture of industrial, commercial, residential and few recreational spaces. The lack of natural environment (only 5% is open space) in the area's urban surroundings, which consist of residential (35%), commercial (6%), and high industrial areas (53%)[8], has a large impact on the water quality of the watershed. Active gravel mines, landfills, numerous auto-dismantling operators, and various other industrial and commercial land uses make up more than 60% of the watershed.

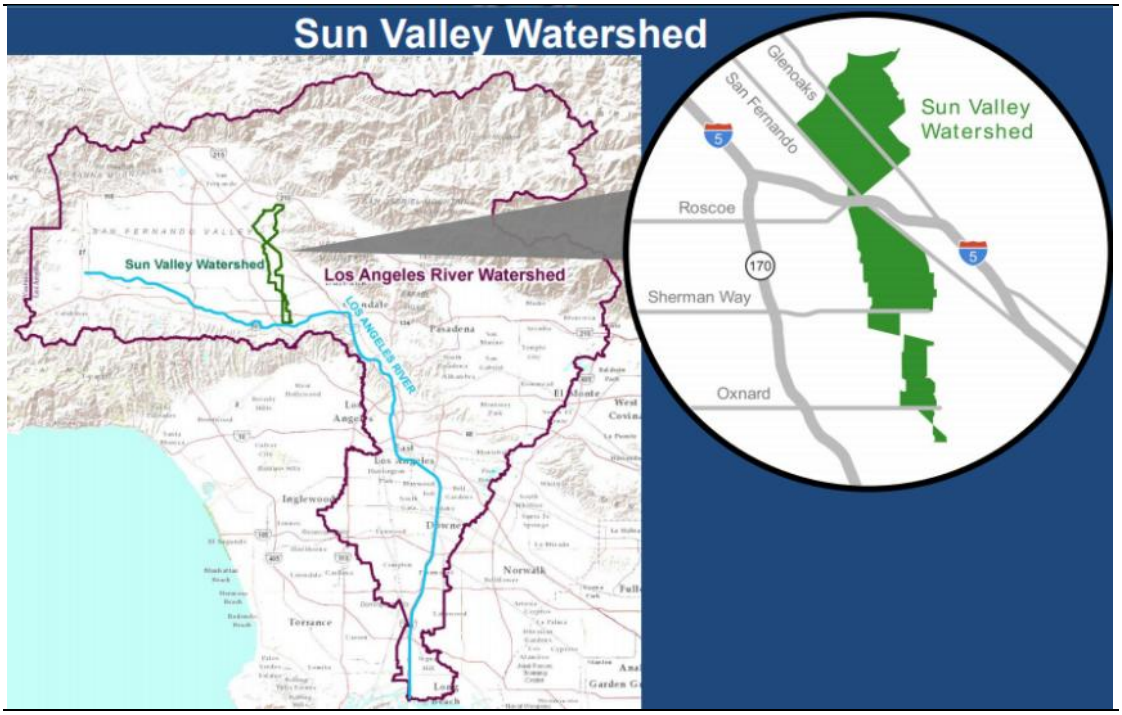


Fig.2: *Relation to the LA River Watershed and context (Source: SVWMP)*

[7] "Sun Valley Watershed: A model for Smart Urban Redevelopment", WatershedWise, Quarterly Magazine, Volume 15, Number 3.

[8] Percentages are taken from the SVWMP, 2004, p. 25.

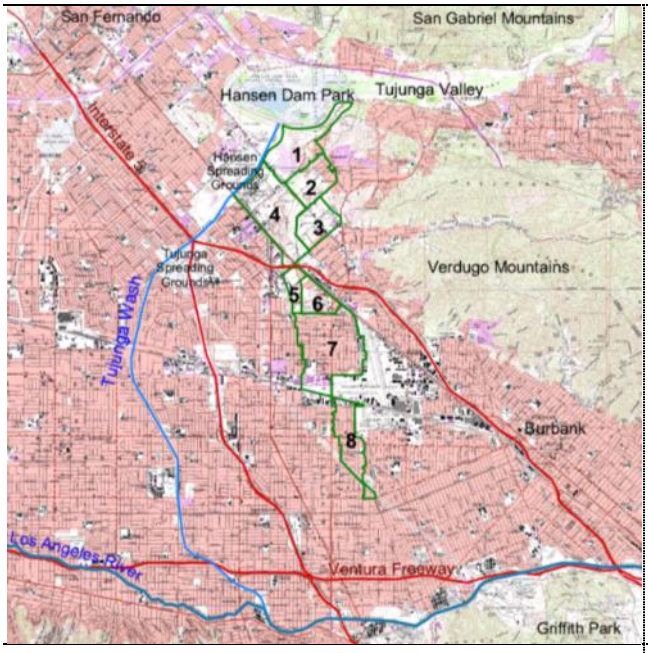


Fig.3: *Sun Valley Watershed subareas (Source: SVWMP)*

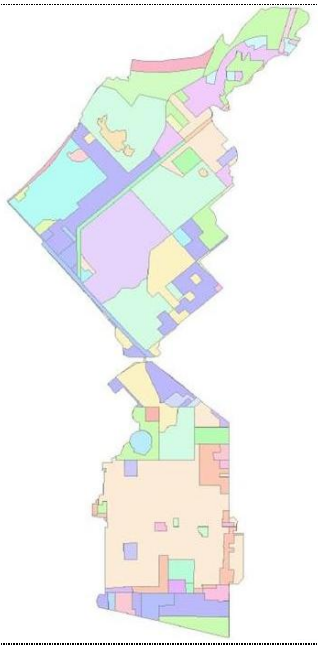
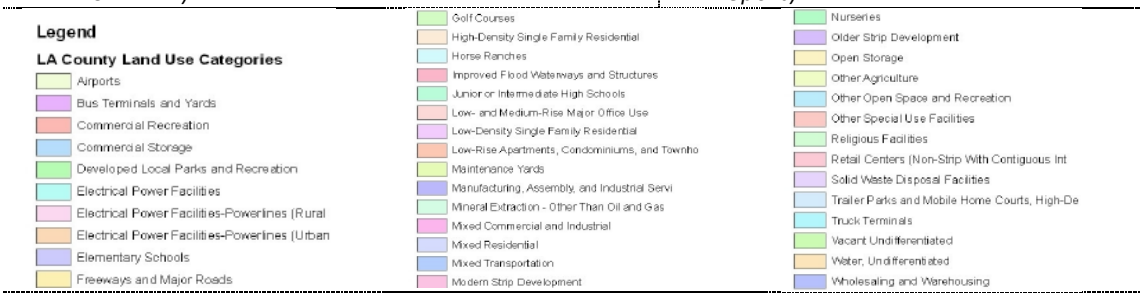


Fig.4: *Land uses (Source: Hydrology report)*



1.2.2 Watershed conditions

According to SVWMP, *"because the watershed is developed and is covered by impervious surfaces, much of the water that would have naturally percolated to replenish groundwater has been conveyed out of the watershed on street surfaces."* According to MWH estimations, nearly 66% of the rainfall in the watershed becomes runoff. Additionally, the watershed was not served by any comprehensive underground storm drain system. Instead, the stormwater was primarily conveyed by gravity on street surfaces with relatively flat slopes resulting to moderate severe flooding[9] and decrease of groundwater quality.[10] Groundwater from SFGB is an important source of drinking water for the Los Angeles region (approx. 15% from local groundwater supplies), making imperative the preservation of the water supply. Finally, the existing land uses have modified many of the habitats that historically supported native species of plants and animals. The 120 acres of recreational space in the area in relation to the 290 acres of gravel pits discourage the wildlife in the area.

[9] Even light rainfall was causing flooding of Sheldon Street, Tuxford Street, Glenoaks Boulevard, Penrose Street, Tujunga Avenue, and Cahuenga Boulevard. (Source: SVWMP 2004. p. 2-10)

[10] The SFGB is composed of alluvial fill and does not have continuous confining layers above groundwater. Urban development has decreased the amount of water that naturally infiltrates to the SFGB and at the same time, groundwater quality has been impacted. Results of a groundwater monitoring program conducted from 1981 to 1987 revealed that over 50 percent of the water supply wells in the eastern portion of SFGB were contaminated. (Source: SVWMP 2004)

1.2.3 The problem

Sun Valley was historically a river-centric society which has now transformed into an area with a heavily urbanized/industrial character. "*The decades of urban development have resulted in about 2/3 of the ground being covered by hard, or impervious, materials. Surfaces such as asphalt and cement do not allow rainwater to soak into the soil, so it flows over the pavement instead. Since Sun Valley is a relatively flat area, stormwater travels over streets slowly in comparison to other hilly regions. In many parts of Los Angeles, storm drains help carry water away, but there are currently no major drains in Sun Valley Watershed. Even a moderate rainfall quickly overwhelms the few minor drains, and rainwater backs up on streets and in low-lying areas.*" [11] As a result the community of Sun Valley area was facing flooding of city streets routinely during moderate rainfall events, due to heavy development and absence of underground storm drains. People and cars have been struggling through flooded streets, children were not able to get to schools and workers move to and from their homes/jobs.

1.2.4 An alternative approach

The construction of underground storm drains which connect to modified natural channels has been the traditional approach to solving flooding issues in the LA region. As mentioned before, this traditional solution of concrete has revealed indirect negative impacts such as the potential for increased flooding downstream, reduced groundwater recharge and loss of wildlife habitat. The LA County Public Works thought the Sun Valley Watershed as a pilot project and an opportunity to implement and test alternative solutions to flooding. Rather than going forward with a single-purpose storm drain solution, the County explored multiple solutions in order to address the problem in a non-traditional way and at the same time achieve additional local and regional benefits.

[11] http://www.sunvalleywatershed.org/

1.3 Multi-benefit Project Overview

1.3.1 Summary

Project type: "Multi-benefit" - Environmental Restoration, Flood Mitigation, Storm Water Recharge, Water Quality, Recreation, and Open Space/Habitat. Inland Waterways[12] - Infrastructure project for flood mitigation and storm water management for the Sun Valley Watershed. Retrofit of Sun Valley with various watershed management techniques and BMPS.	
Location:	San Fernando Valley, Los Angeles County, CA USA
Total Area:	4.4 sq miles (6 miles in length) - 2,800-acre urban watershed
General Manager:	LA County Public Works (LA Flood Control District as lead agency)
General Consultant:	MWH Global (Sun Valley Management Plan, 2004 & master plan)
Project duration:	1998 - today
Funding:	The County and the Department initiated the project with funding that came from the LA County Flood Control District, as it was a project that would resolve mainly issues of flooding. Funding was also provided by the U.S. Bureau of Reclamation | California Department of Water Resources | LA County Public Works | Metropolitan Water District of California | Water Replenishment District of Southern California | LA Department of Water and Power and | City of Santa Monica.
Overall Investment cost:	$137 Million[13] (projected)
Project Team:	In 1998 the Sun Valley Watershed Stakeholder Group was assembled to develop long term solutions. The group consists of local and federal agencies, government offices, environmental groups, local businesses, conservation agencies and residents of the community. Subsequent consultants were involved in the design stage of each of the project's components/sub-projects with different non-profit organizations as partners.
Awards:	ISI Envision Platinum award (67%), 2014

1.3.2 Stakeholders

Organizations involved in Sun Valley Stakeholder Process to Date: [14]

A - Mehr, Inc.	County of LA Supervisor Zev Yaroslavsky
American Society of Civil Engineers	David Evans and Associates, Inc.
California Coastal Coalition	Enartec, Inc.
California Department of Fish and Wildlife	Fresh Creek Technologies
California Department of Parks and Recreation	LA Byproducts, Inc.
California Department of Transportation	Land Design Consultants, Inc.
California Native Plant Society	LA Regional Water Quality Control Board
California Assemblymember Cindy Montanez	LA Unified School District
California Stete Senator Richard Alarcon	LA/San Gabriel Rivers Watershed Council
California Wildlife Conservation Board	Los Cerritos Wetland Stewardship, Inc.
City of Burbank	Lynne Dwyer & Associates
City of Burbank Department of Public Works	MWH
City of LA Canada Flintridge	North East Trees
City of LA Department of Public Works	Rick Goacher Planning, Inc.
City of LA Department of Recreation and Parks	San Gabriel & Lower LA Rivers & Mount. Conservancy
City of LA Department of Water and Power	Southern California Association of Governments

[12] http://www.asce.org/templates/sustainability-profile.aspx?id=24476
[13] http://dpw.lacounty.gov/adm/sustainability/docs/EnvISIonAwards_SunValleyWatershed.pdf
[14] SVWMP, 2004.

City of LA Department of Environmental Affairs	San Gabriel Valley Mosquito and Vector Control District
City of LA Councilmember Greuel's Office	Sun Valley Chamber of Commerce
City of LA Councilmember Padilla's Office	Sun Valley Neighborhood Improvement Organization
City of LA Councilmember Cardenas' Office	Targhee Inc.
City of LA Councilmember LaBonge's Office	TreePeople
City of San Fernando	Upper LA River Area Watermaster
Civiltec Engineering, Inc.	U.S. Army Corps of Engineers
Congressman Brad Sherman	U.S. Department of the Interior National Park Service
Congressman Howard Berman	U.S. Environmental Protection Agency
County of LA County Public Works	Vulcan Materials Company
County of LA Sanitation Districts	Vulcan Solution Strategies, Inc.

Subsequent consultants[15] were involved in the design stage of each of the project's components/ subprojects, with different nonprofit organizations as partners. Each component was led by a different organization in its project group:

ACTION/PROJECT PHASE	IMPLEMETING AGENCIES OR PARTIES
General Planning & Coordination	LA County Public Works
Fund Raising	LA County Public Works, City of LA Department of Public Works, Department of Recreation and Parks, LADWP
Construction	
Stormwater Retention Facilities	LA County Public Works
Stormdrains	LA County Public Works (Trunk drains & laterals), City of LA Department of Public Works (City laterals)
Tujunga Wash Diversion	Army Corps of Engineers, LACDPW, City of LA Department of Public Works, LADWP
Onsite BMPs	LA County Public Works, City of LA Department of Public Works, ULARA Watermaster, Participating property owners (purchase units and install), LADWP and California Department of Water resources (incentive programs for BMP installation)
Tree Planting	LADWP (provide trees free of charge through Green LA Program), TreePeople (outreach, assistance, education), Participating property owners (planting), City of LA Environmental Affairs Department, City of LA Department of Public Works
Mulching	City of LA Department of Public Works (train and certify landscapers and gardeners)
Recreational Facilities	City of LA Department of Recreation and Parks (new public parks, e.g. Cal Mat Pit, Sheldon Pit, Strathern Pit, New Park on Wentworth, Tuxford Green), LACDPW, LADWP
Wildlife Habitat Areas	City of LA Department of Recreation and Parks, LACDPW, City of LA Department of Public Works
Operation and Maintenance	
Stormwater Retention Facilities	LA County Public Works, City of LA Department of Public Works, Other property owners (schools, Vulcan Gravel Processing Plant, Parking Lot on Sherman)
Stormdrains	LA County Public Works (Trunk drains and laterals), City of LA Department of Public Works (City laterals)
Tujunga Wash Diversion	Army Corps of Engineers, LACDPW, City of LA Department of Public Works, LADWP
Onsite BMPs	LA County Public Works, LADWP, City of LA Department of Public

[15] SVWMP – Environmental Impact Report. MWH 2004.

	Works, ULARA Watermaster, Participating property owners
Tree Planting	Participating property owners, City of LA Environmental Affairs Department, City of LA Department of Public Works
Mulching	Participating property owners
Recreational Facilities	City of LA Department of Recreation and Parks (as in construction)
Wildlife Habitat Areas	City of LA Department of Recreation and Parks
Monitoring Plan	LA County Public Works, LADWP, City of LA Department of Public Works, ULARA Watermaster

1.3.3 Subprojects[16]

A process was developed to evaluate and select the most cost-effective solutions that meet the recharge objective from the range of potential projects available. The projects identified were considered based on infiltration, water conservation, stormwater reuse, and urban storm protection. The individual focus of each project would cause significant variation in overall project costs and schedule. The Sun Valley Watershed Management Plan identified 15 pilot projects that collectively could achieve the established project goals. Of more than ten originally planned projects, 8 have been identified as either constructed or substantially in progress, and therefore have been included in the list of projects for sustainability rating. Since 2004, four of these projects have been constructed and are now functioning. The other four are in planning and design phases, while the remaining six projects that were not awarded are still in concept phase. The awarded subprojects are the following:

1	**Sun Valley Park Drain and Infiltration System**	**(PILOT) COMPLETED**
2	**Tuxford Green**	**COMPLETED**
3	**Elmer Avenue Neighborhood Retrofit Project**	**COMPLETED**
4	**Elmer Avenue Paseo**	**COMPLETED**
5	Rory M. Shaw Wetlands Park	DESIGN/CONSTRUCTION
6	Whitnall Highway Powerline Easement	EARLY DESIGN
7	Valley Generating Station/steam plant	CANCELED
8	Whitnall Gardens	DESIGN

Storm Drain Alignment (Tuxford Green) | *Strathern Pit (Rory M.S. Wetlands Park)* | *Sun Valley Park Drain & Infiltration System*

[16] More information regarding each subproject and the alternatives process can be found later in the case study.

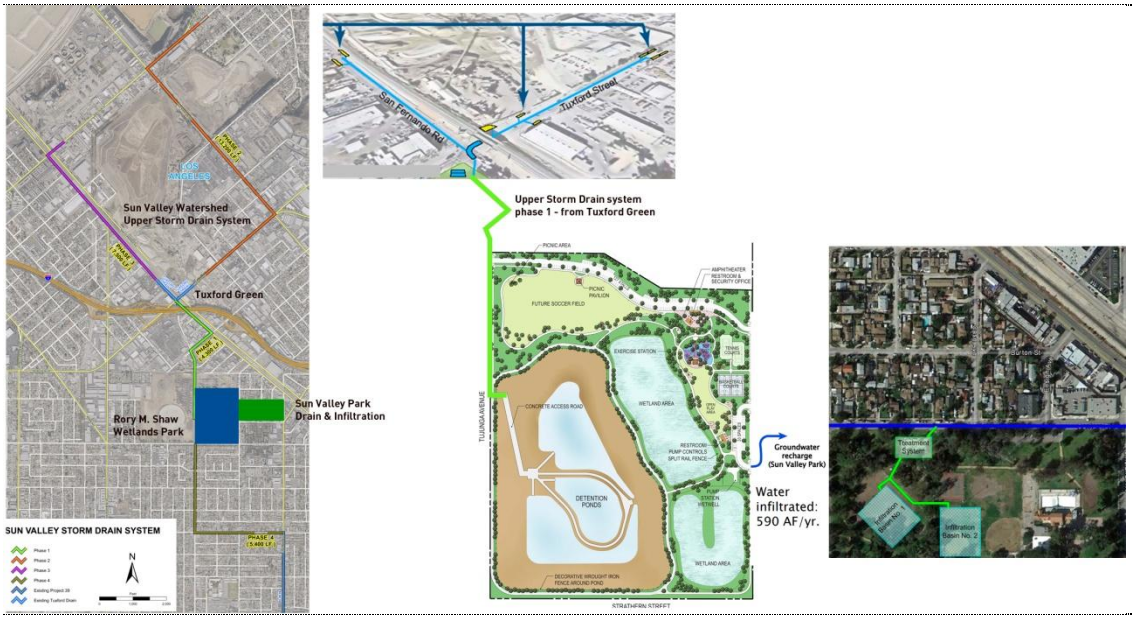


Fig.5: *Spatial & functional relation of subprojects 1- 2- 5.*

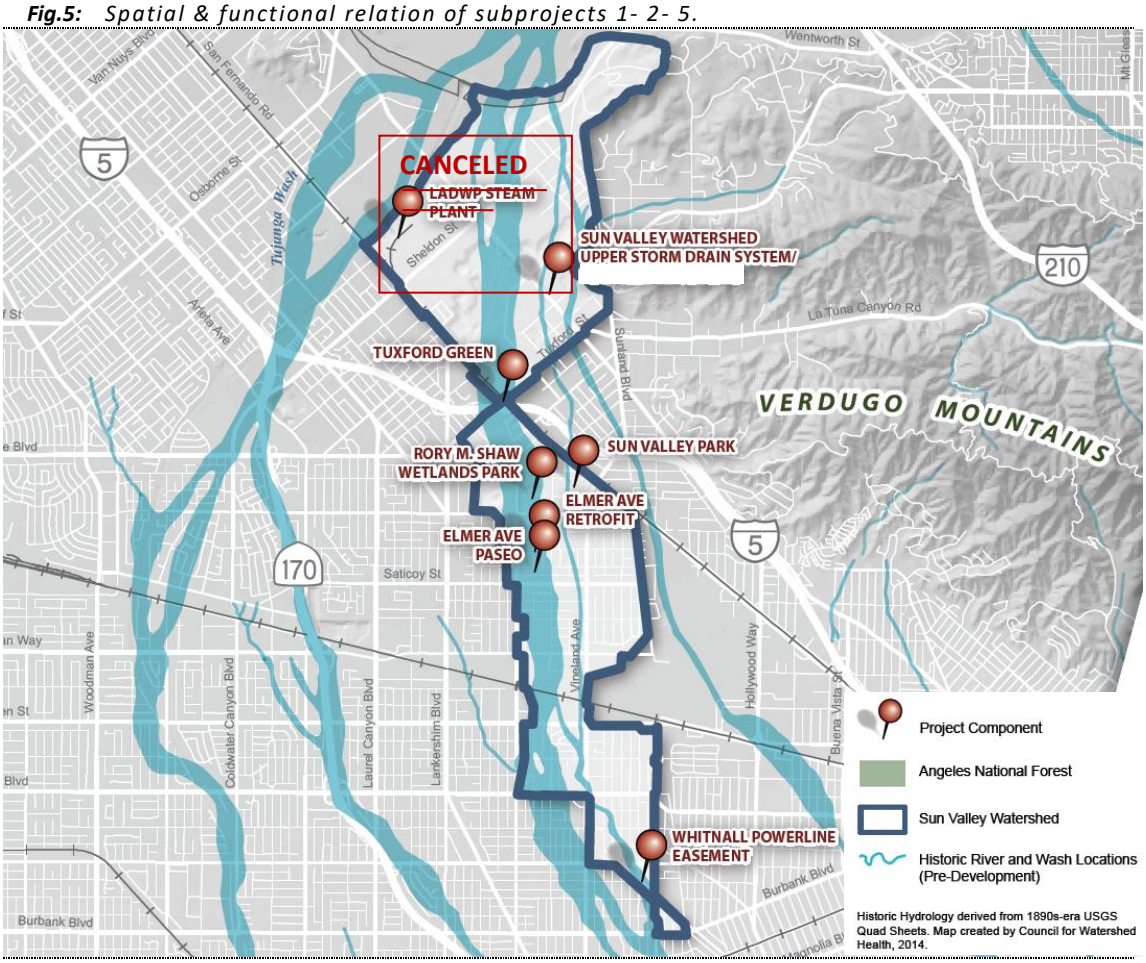


Fig.6: *Map of project components (Source: Watershed Wise Quartely Magazine, Vol15, No3, Council for Watershed Health)*

Main Project Studies completed

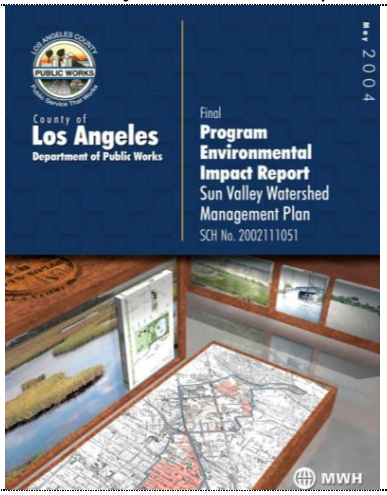


Fig.7: *Program Environmental Impact Report 2004*

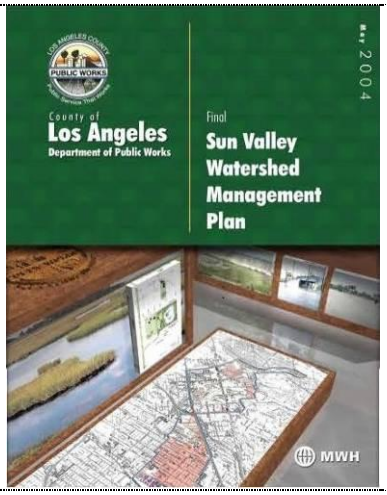


Fig.8: *Sun Valley Watershed Management Plan 2004*

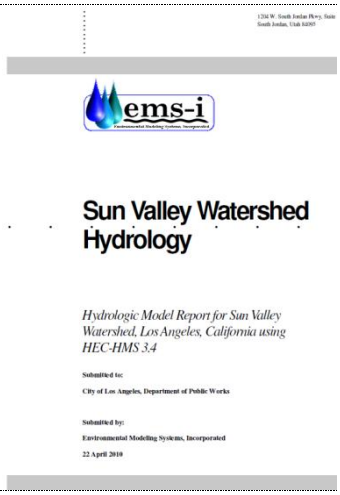


Fig.9: *Sun Valley Watershed Hydrology Report 2010*

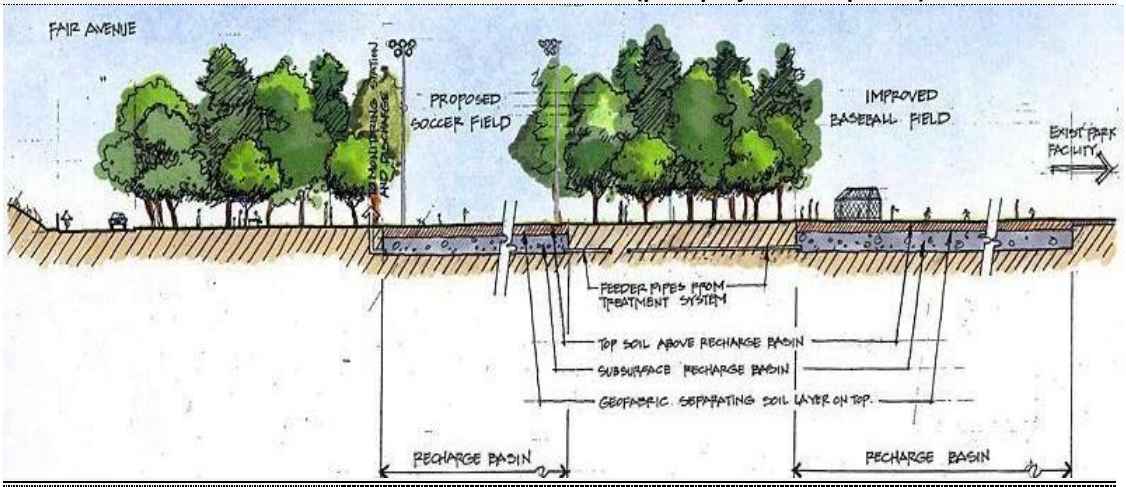
2. SUBPROJECTS SUMMARY

SUMMARY			
PROJECT	**D&C COST**	**FUNDING**	**MAIN STAKEHOLDERS**
Sun Valley Park Drain & Infiltration System	approx. $7 million	- Department of Water Resources. **Local Groundwater Assistance grant** - **Proposition 12** (Murray-Hayden) **grant** by TreePeople. - LA County Flood Control District.	- **Designed by:** *CH2MHill* - **Constructed by:** *Southwest Engineering, Inc.* - **O&M:** *LA County Flood Control District • City of LA Bureau of Sanitation • City of LA Department of Recreation and Parks*
Tuxford Green	approx. $3.6 million	- LA County Flood Control District.	- **Designed by:** *LA County Flood Control District* - **Constructed by:** *Mike Bubalo Construction Company, Inc.* - **O&M:** LA County Flood Control District • *City of LA Bureau of Sanitation • City of LA Department of Recreation and Parks*
Elmer Av. Retrofit Project	approx. $2.7 million	- **Grants and agreements** from the U.S. Department of Interior Bureau of Reclamation and California Department of Water Resources. - **Additional funding and match support:** LA City Bureau of Sanitation • LA City Bureau of Street Services • Los Angeles City Bureau of Street Lighting • LA Department of Water and Power • LA County Public Works • Metropolitan Water District of Southern California • Water Replenishment District of Southern	- **Designed by:** *Stivers & Associates, Inc. • Wilson Environmental Design • City of LA Bureau of Street Services.* - **Civil engineering, storm water and street design:** *City of LA Bureau of Sanitation • Bureau of Street Services • Amec Geomatrix.*

		California • Dr. Bowman Cutter (UCR/Pomona College) • TreePeople, University of California Riverside • City of Santa Monica Environmental Programs Division.	
Elmer Avenue Paseo	approx. $675,806	California Strategic Growth Council (SGC) for **$294,395** • Santa Monica Mountains Conservancy (SMMC) for **$127,411** • Los Angeles Waters and Power (LADWP) for **$125,000** • City of Los Angeles Proposition 0 for **$129,000** *Note: some portion of all the grants (outside of design, construction, O&M) went into training, outreach, and water quality monitoring.*	- **Designed by:** Tetratech - **Constructed by:** American Landscape - **O&M:** Residents and City of LA
Rory M.S. Wetlands Park	approx. $81 million	- LA County Flood Control District. - LA Department of Water and Power. - Proposition O grant funds	- **Designed by:** Psomas - **Construction** start: 2021 - **Expected completion**: 2027

2.1 Sun Valley Park Drain and Infiltration System

Improving recreational spaces, water quality and water supply. An existing municipal park was converted into a flood mitigation, water quality treatment, and water conservation multi-use site. The project included construction of storm water conveyance system, a state of the art water quality treatment system, and underground infiltration basin to recharge the groundwater aquifer. A storm drain system along Cantara Street captures stormwater and delivers it to the park where runoff is routed through a water quality treatment and directed into two underground infiltration chambers buried beneath the soccer and baseball fields. **(pilot project - completed)**



Area:	21 acres
Managing agency:	Operated and maintained by LA County Flood Control District • City of LA Bureau of Sanitation & Department of Recreation and Parks.
Contractor:	Designed by CH2MHill
Engineer/Designer:	Constructed by Southwest Engineering, Inc.
Project duration:	2004 - 2006
Delivery Method:	Design-Bid-Build

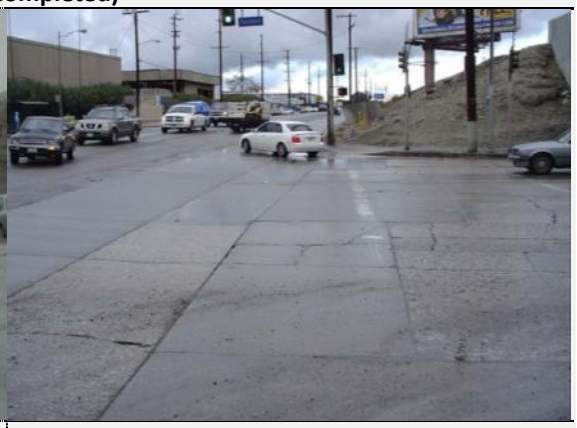
Funding:	Department of Water Resources (Local Groundwater Assistance) grant[17] • Los Angeles County Flood Control District • Proposition 12 (Murray-Hayden) grant by TreePeople.
Design & Construction cost:	Approx. $7 million
Capacity:	The water is naturally filtered and recharged into the groundwater aquifer, allowing an estimated conservation benefit of 30 acre-feet per year.

[17] FISCAL IMPACT/FINANCING: There will be no impact to the County's General Fund. The grant from the California Department of Water Resources will reimburse the Flood Control District $220,000 towards this work. The District will contribute approximately $34,000. Sufficient funding is included in the Flood Control District's Fiscal Year 2004-05 Budget. The grant provided $220,000 to the District for reimbursement of expenditures that will be incurred for the construction of three groundwater monitoring wells and the sampling and analyses of the groundwater and vadose zone until May 2006.
Source: http://file.lacounty.gov/SDSInter/bos/supdocs/15578.pdf. p. 2.

2.2 Tuxford Green

Reducing flooding. Improved storm water quality through the use of large-scale storm water separation devices and provided irrigation supply to proposed landscaping improvements at a local intersection that historically suffered from severe floods every time it rained. The project included the construction of a storm water conveyance system, a water quality treatment system, and 45,000 gallon cisterns to irrigate the native landscaping. **(completed)**

BEFORE



AFTER

Area:	2.2 square miles
Managing agency:	Operated and maintained by Los Angeles County Flood Control District • City of Los Angeles Bureau of Sanitation • City of Los Angeles Department of Recreation and Parks.
Contractor:	Designed by Cornerstone Studios, Inc.[18] (for Burns and McDonnell)[19]
Engineer/Designer:	Constructed by Mike Bubalo Construction Company, Inc.
Project duration:	2004 - 2007
Delivery Method:	Design-Bid-Build
Funding:	Los Angeles County Flood Control District
Design & Construction cost:	Approx. $3.7-4 million
O&M cost:	$97,300 (includes monthly inspections and annual servicing; annual servicing is done as-needed. basis.)
Capacity:	Collects runoff from the 2.2 sq miles of urban watershed. Stormwater stored in a 45,000 gallon underground cistern used to irrigate the drought tolerant and native plant landscaping.

[18] https://ourwaterla.org/tuxford-green-multiuse-project/
[19] http://www.csstudios.com/projects/tuxford-green.html

2.3 Elmer Avenue Neighborhood Retrofit Project

Achieving multiple benefits at the neighborhood scale. Transformed a typical residential street into a model "green street" and upgraded the open spaces of the private properties abutting the street. Included twenty-four home retrofits, twenty-three new native trees, thirteen rain barrels, and infiltration galleries beneath the street. **(completed)**

BEFORE | AFTER

Area:	Elmer Avenue 7700 Block: 4 acres (street and residential lots along one city block) - about 600ft long. A project of the Water Augmentation Study.

Managing agency:	Council for Watershed Health[20]
Contractor:	Designed by Stivers & Associates, Inc. • Wilson Environmental Design • City of Los Angeles Bureau of Street Services.
Engineer/Designer:	Civil engineering, storm water and street design: City of Los Angeles Bureau of Sanitation and Bureau of Street Services • Amec Geomatrix.
Project duration:	Started November 2008, suffered from an 8-month halt from the bond funding freeze, restarted July 2009, and was completed in April 2010.
Delivery Method:	Design-Bid-Build
Funding:	Grants and agreements from the U.S. Department of Interior Bureau of Reclamation and California Department of Water Resources • Additional funding and match support: Los Angeles City Bureau of Sanitation • Los Angeles City Bureau of Street Services • Los Angeles City Bureau of Street Lighting • Los Angeles Department of Water and Power • LA County Public Works • Metropolitan Water District of Southern California • Water Replenishment District of Southern California • Dr. Bowman Cutter (UCR/Pomona College) • TreePeople • University of California Riverside • City of Santa Monica Environmental Programs Division.
Investment cost:	Capital costs were $2,065,045[21] - Design and Construction Cost: $2.7 million[22]
Design cost:	$750,000
Construction cost:	Approx. $1.7 Million
O&M cost:	$12,000 per year[23]
Capacity:	It was designed to achieve stormwater recharge (16 acre-feet/year initial design).[24] When all its phases are completed it will capture and infiltrate storm water runoff from a 40-acre upstream area. The volume of the underground infiltration galleries is about 750,000 gallons – 2.3 acre-ft. The volume of surface infiltration in the projects about 115,000 gallons. The underground stuff contributes 87% of the project's capacity (6,575 gallons of water every 5min). Energy saved: 1,730 kW/year.
Traditional solution VS Green solution:[25] *"Construction of the Elmer Avenue retrofit cost $1.8 million, compared with an estimated $1.2 million minimum to install a traditional storm drain system that would connect the 40-acre watershed to the larger Los Angeles stormwater network. Though the two approaches are fairly comparable in price, the "green street" approach improves surface water quality and recharges groundwater, while a traditional conveyance system would not."*	

[20] Continues to collect data on how the project is performing with respect to water quality and supply benefits. The results show until today that catch basins, infiltration galleries and bioswales on Elmer Av are effective at improving water quality by capturing run-off and reducing concentrations of priority pollutants in dry-weather flows and stormwater from approx. 53 acres to the North and from 24 adjacent houses. Source: Council of Watershed Health, *"Sun Valley Watershed: A model for Smart Urban Redevelopment"*, WatershedWise, Quarterly Magazine, Volume 15, Number 3.

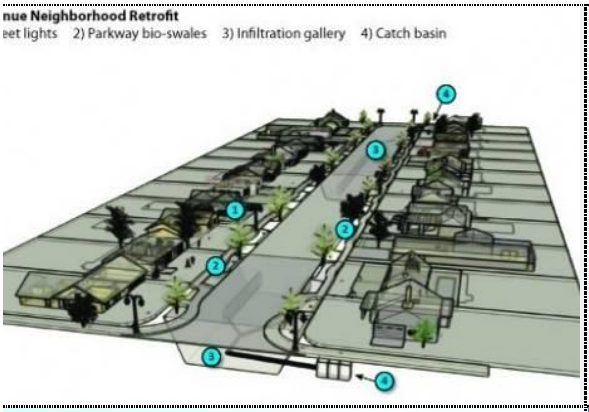
[21] CASE STUDY F, p.52, "Stormwater Capture: Opportunities To Increase Water Supplies In Southern California", Southern California Water Committee, 2012.

[22] https://landscapeperformance.org/case-study-briefs/elmer-avenue-neighborhood-retrofit

[23] CASE STUDY F, p.52, "Stormwater Capture: Opportunities To Increase Water Supplies In Southern California", Southern California Water Committee, 2012.

[24] CASE STUDY F, p.53, "Stormwater Capture: Opportunities To Increase Water Supplies In Southern California", Southern California Water Committee, 2012.

[25] https://landscapeperformance.org/case-study-briefs/elmer-avenue-neighborhood-retrofit#/cost-comparison



2.4 Elmer Avenue Paseo

Designed for learning. Provides safe passage to schools, bus stops and stores. Converted a paved 20' x 270' alley alleyway at the street's southern end into a public green path. Led by the Council for Watershed Health to reduce, capture, treat and infiltrate storm water runoff, recharge the groundwater aquifer, and provide neighborhood connections. The projects includes an infiltration gallery under the street, bioswales along the public right-of-way, permeable pedestrian surfaces, rain gardens, native landscaping green walls, solar-powered drip irrigation, monitoring equipment and interpretive signs. **(completed)**

BEFORE | AFTER

Managing agency:	City of Los Angeles and the Council for Watershed Health (CWH); City Bureau of Sanitation (BOS) as the program manager for the City and lead liaison with the Council.
Contractor:	American Landscape
Engineer/Designer:	Tetratech
Project duration:[26]	2012-2015

Deliverable	Due Date	% Complete	Funds Expended
Pre-planning	May 2012	100%	$ 76,563.78
Management	June 2013	100%	$ 12,239.67
Monitoring & Evaluation	June 2015	100%	$ 130,968.86
Construction	Jan 2013	100%	$ 0.00
Community Training	June 2015	100%	$0.00

Current Status:[27]	US EPA maintains Elmer Avenue as one of their example green infrastructure project. Moving forward, the Council is committed to maintaining monitoring and educational activities at the Paseo, and the MOU with the City of LA, the Stormwater management features of the project will be maintained by the Bureau of Sanitation. Monitoring funded by a grant, permitted improvements to be made to the earlier Elmer Avenue Neighborhood Retrofit project, adjacent to the Paseo. 1. Quantifying Infiltration (April 2010 – August 2012) & 2. Water Quality Monitoring (December storm: 12/19/2013)
Delivery Method:	Design-Bid-Build
Funding:[28]	The Council has received funding from the California Strategic Growth Council (SGC) for **$294,395,** the Santa Monica Mountains Conservancy (SMMC) for **$127,411,** Los Angeles Waters and Power (LADWP) for **$125,000** funding from the City of Los Angeles Proposition 0 for **$129,000,** and WAS Partners to design, install and monitor the project. *Note: some portion of all the grants (outside of design, construction, O&M) went into training, outreach, and water quality monitoring.*
Investment cost:	**TOTAL COST: $509,217.00**[29] (see the table below) - The estimated cost of the Project is **$675,806.**[30] *(the City will provide $129,000 of direct funding from City Proposition 0 to match the Federal, State, and regional funding of $546,806.00)*

Contribution Sources	**Date**	**Amount**
Local Contribution	7/29/2016	$ 381,806.00
Prop. 84, Upper LA River Watershed Protection Program	8/12/2013	$ 127,411.00

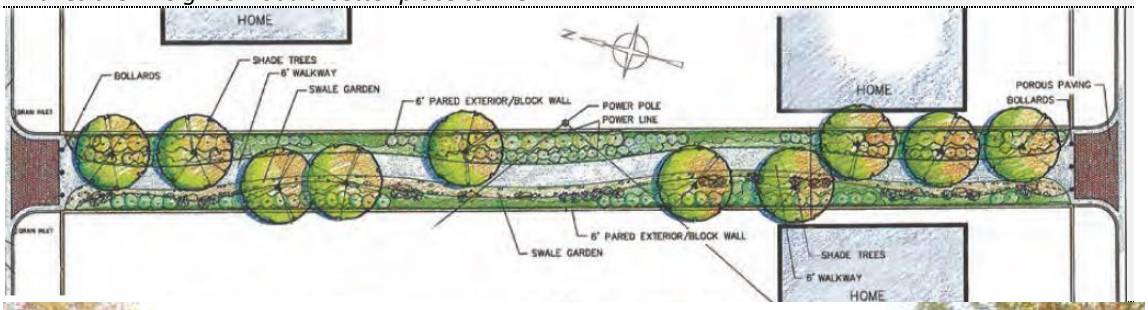
Design cost:	$101,800
Construction cost:	$381,700
O&M cost:	$8,000 annually (estimated)
Capacity:[31]	It is engineered to capture all dry-weather flow from 7 acres of

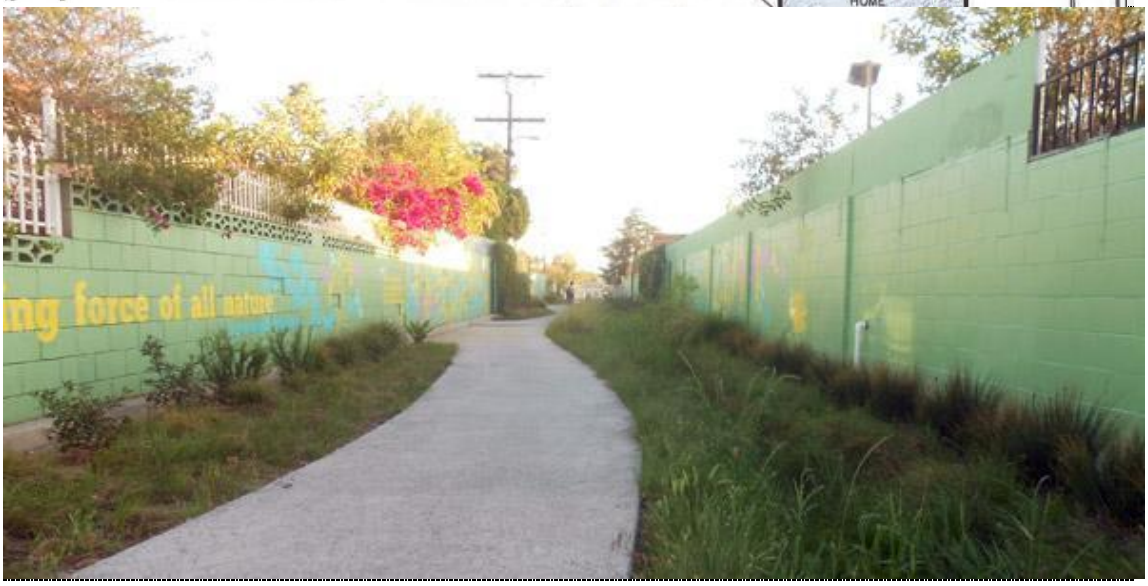
[26] "The Elmer Paseo Stormwater Improvements Project". Council for Watershed Health. Final Report 2015. (Source: https://www.usbr.gov/lc/socal/reports/ElmerPaseoStrmwaterImprovements.pdf)
[27] "The Elmer Paseo Stormwater Improvements Project". Council for Watershed Health. Final Report 2015. (Source: https://www.usbr.gov/lc/socal/reports/ElmerPaseoStrmwaterImprovements.pdf)
[28] Source: http://clkrep.lacity.org/onlinedocs/2012/12-0525_RPT_BOE_04-06-12.pdf
[29] http://bondaccountability.resources.ca.gov/Project.aspx?ProjectPK=7235&PropositionPK=4
[30] http://clkrep.lacity.org/onlinedocs/2012/12-0525_RPT_BOE_04-06-12.pdf
[31] "The Elmer Paseo Stormwater Improvements Project". Council for Watershed Health. Final Report 2015. (Source: https://www.usbr.gov/lc/socal/reports/ElmerPaseoStrmwaterImprovements.pdf)

	residential land, and up-to six acre-feet of storm water during an average rainfall year. Improvements, funded by LA City local bond proceeds, have doubled the infiltration capacity at Elmer, from about 20 to about 40 in an average rainfall year. An 80% reduction of bacteria, metals, oil & grease and pesticides.

Public Benefits: *"Through this partnership, the Council and the City can make a significant difference to the residents of the surrounding Elmer Avenue Neighborhood and complete a demonstration project that will serve as a template for future neighborhood retrofits throughout the Los Angeles region. Much-needed improvements to City infrastructure can be realized along the Paseo and surrounding area to benefit receiving water quality, provide at least 4acre-feet annually of additional groundwater supplies and increase open space and amenities for the neighborhood."*[32]

Additionally, "the Paseo has become an important tool for technical training and educational opportunities. 50 people received technical training related to green infrastructure design, construction, and maintenance. Well over 400 people have toured the Paseo, including hundreds of students from nearby Sun Valley Middle School, who have come to meet the project team and learn about watersheds and native plants. […] This represents how important small interventions can be for residential communities. It is providing a critical water management capacity for the City of LA, but for the residents it is a tranquil green space that gives respite, draws butterflies and hummingbirds, and makes their neighborhood a better place to live."[33]





[32] http://clkrep.lacity.org/onlinedocs/2012/12-0525_RPT_BOE_04-06-12.pdf

[33] "The Elmer Paseo Stormwater Improvements Project". Council for Watershed Health. Final Report 2015. (Source: https://www.usbr.gov/lc/socal/reports/ElmerPaseoStrmwaterImprovements.pdf)

2.5 Rory M. Shaw Wetlands Park

Reduction of flooding, stormwater treatment in naturalistic wetlands, increase park space.

Convert an engineered, inert landfill called Strathern Pit, into a multipurpose wetlands park in order to retain storm water runoff and reduce storm water pollution. The park will also increase water conservation, recreational opportunities for the locals, and wildlife habitat. The project consists of 3 major elements: 1) 4.2 miles of storm drain trunk line within an industrial area; 2) a 21-acre detention pond, 10 acres of wetlands, and 15 acres of recreational facilities and open space within the area of a Class 4 inert debris landfill and former concrete plant; and 3) recharge of the San Fernando Valley aquifer through underground infiltration galleries beneath ball fields in Sun Valley Park.

Area:	46 acres gravel pit salvage yards & industrial drainage into 15 acres of recreational open space, 21 acres detention pond and 10 acres of wetland area.
Managing agency:	Los Angeles County Flood Control District & City of LA
Contractor:	Project to be advertised in 2020.
Engineer/Designer:	Woodard & Curran/Psomas
Project duration:	Planned to begin in 2017. Expected completion in 2020.
Current Status:	Design Phase
Delivery Method:	Design-Bid-Build
Funding:	LA County Flood Control District • Los Angeles Department of Water and Power • Proposition O grant funds.
Investment cost:	28 million for property purchase[34]
Construction cost:	Approx. $81 million
Capacity:	The project collects stormwater runoff from the upstream 929-acre drainage area. The water conservation benefit is expected to be 590 acre-ft/year.[35] Storage capability of the detention pond is approximately 400 acre-feet.[36]

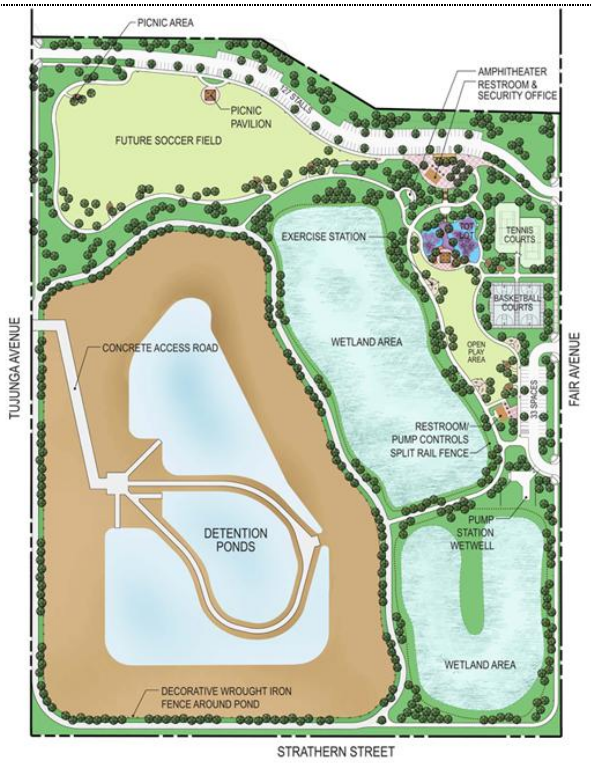
[34] http://www.nwri-usa.org/pdfs/Luthy.pdf
[35] http://dpw.lacounty.gov/wmd/svw/docs/RoryMShawWetlands_Factsheet.pdf
[36] https://psomas.com/wetlands-park-transforms-former-landfill-site-rory-shaw-wetland/

Today:
46 acre pit

Salvage yards & industrial drainage

Future:
Stormwater collection, treatment & recharge

21-acre detention pond | 10-acre wetland | 15-acre recreational space



Benefits from neighborhood-scale stormwater capture: "This project illustrates how co-benefits and public support may be achieved with neighborhood-scale stormwater capture. By working with local groups the project generated greater effectiveness in community engagement and links between decision makers and the people they serve."[37]

2.6 Future awarded projects

Whitnall Highway Powerline Easement[38]

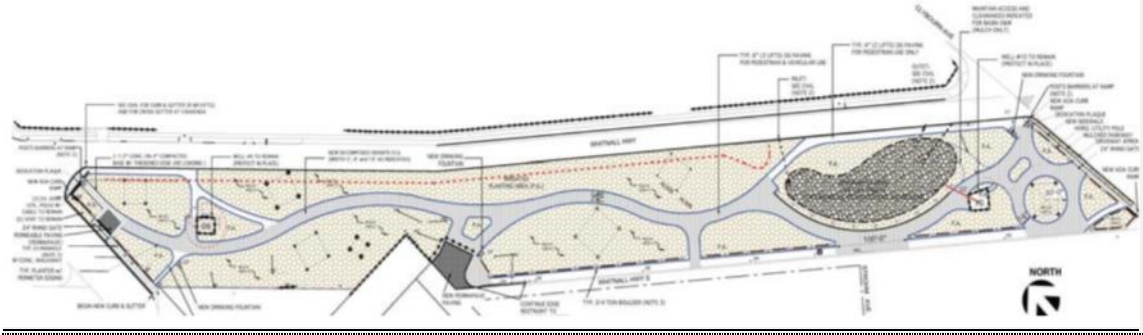
Stormwater runoff capture and infiltration through the soil to reduce local flooding and improve downstream surface water and groundwater quality. Surface runoff will be captured at several locations along the easement and then directed into a network of swales, culverts, hydrodynamic separators, and infiltration basins for pre-treatment and infiltration.

Location:	Along Whitnall Highway from Vineland Avenue to Cahuenga Boulevard.
Managing agency:	City of Los Angeles Department of Water and Power
Current Status:	Planning stage. Construction Start: Late 2022

[37] https://www.nap.edu/read/21866/chapter/4#38
[38] LADWP Factsheet 2018: Whitnall Highway Power Transmission Line Right-of-Way Stormwater Capture Project.

Construction cost:	Total construction cost is estimated at $13.6 million
Investment cost:	Estimated cost of $11 million
Partners & supporters:	City of LA Department of Water and Power, LA County Flood Control District, City of LA Department of Public Works, City of Glendale, City of Burbank, Upper LA River Area Watermaster, TreePeople Inc., Sun Valley Watershed Stakeholders Group. [39]
Capacity:	Improvement of health and long-term sustainability of the local groundwater supply, reduction of the region's reliance on water imports, additional community enhancements by including walking trails, educational signage, and native habitat. Estimated stormwater capture of 270 acre-feet per year.

Whitnall Gardens Demonstration Project[40]



Reduction of local flooding, groundwater recharge, and enhanced open space opportunities. A power system project developed as a conservation garden including drought tolerant planting, a walking path, and a stormwater capture element. Designed to capture stormwater runoff at the northwest corner of the lot, where large flows typically accumulate. An underground culvert box will direct some of these flows through the gutters along Whitnall Highway and into an infiltration basin for groundwater recharge. Any excess stormwater will be routed to a nearby storm drain.

Location:	A small-scale pilot project to serve as a demonstration to other potential projects in the San Fernando Valley which share similar soil characteristics. South of the Whitnall Powerline Easement Project.
Managing agency:	City of Los Angeles Department of Water and Power
Current Status:	Planning stage
Construction cost:	Total Construction Cost is currently estimated at $1.3 million.
Designer:	Bureau of Sanitation
Funding:	Los Angeles Department of Water and Power
Capacity:	The proposed stormwater basin is 16,000 sq.ft. and 2 ft. deep. An infiltration test was conducted at this site in March 2009, which proved the soils in this area to be excellent for infiltration at a rate of 8.2 ft/day. Possibly recharge about 87 AFY.

[39] Council of Watershed Health, "Sun Valley Watershed: A model for Smart Urban Redevelopment", WatershedWise, Quarterly Magazine, Volume 15, Number 3.

[40] LADWP Factsheet 2011: Whitnall Gardens Demonstration Project

3. SUSTAINABILITY

In the current report Sun Valley Multi-benefit project is considered as a sustainable[41] innovative-thinking example. The project team's provision for additional TBL project benefits lead to innovative features and processes as well as to a high level of integration. Innovations include the alternative and multipurpose character, when addressing traditional watershed problems, the extensive stakeholder collaboration and community engagement and finally the 3-year plan development process that identified as necessary 18 subprojects.

3.1 Multiple Objectives

The project mainly focused on managing stormwater for the Sun Valley Watershed area in order to mitigate flooding (meet flood protection criteria of the LA County Public Works and provide protection in an area that historically had issues with severe floods. *"Much of the runoff from the Sun Valley Watershed is currently lost to the Los Angeles River as a result of the large amount of urbanization in the watershed. Capturing this runoff can increase local water supplies by groundwater recharge. Specific objectives include maximizing opportunities for infiltration BMPs where feasible (e.g. recharge basins, dry wells) and replacing existing uses of potable water with captured stormwater."* [42]

3.1.1 Primary Objectives

The group of stakeholders that was formed in 1998 expanded their mission by developing a list of additional detailed objectives for the Sun Valley area. Primary objectives included water conservation by capturing and retaining stormwater runoff in order to fulfill local water needs, significant restoration through the improvement of the watershed's health and quality, the reduction of storm water pollution, the increase of wildlife habitat and the creation of open spaces and recreational opportunities for the local community.

The reduction of chronic local flooding included both short-term and long-term targets. Within the first 1-2 years the project would focus on reducing flooding occurrences at the key intersections and neighborhoods of San Fernando and Tuxford, Tujunga and Strathern, and the neighborhood downstreams of Tujunga and Strathern. For the following 6-8 years the project would focus on reducing flooding occurrences throughout the Sun Valley Watershed in order to meet the LACDPW level of protection policy, retaining all stormwater within the watershed generated from the 50-year frequency storm and reducing flooding at the intersection of San Fernando and Tuxford during 50-year frequency storm to meet LACDPW standards for sump areas.

Water Conservation strategies included adding infiltration BMPs, with capacity to recharge up to 1,000 acre-ft/year (e.g. recharge basins, dry wells, etc.) and replacing existing uses of potable water with stormwater runoff (e.g. gravel processing wash water, landscape

[41] The sustainable strategies and sustainable features of the project are extensively presented in the related ENV Case study.

[42] CASE STUDY A, p.16, "Stormwater Capture: Opportunities To Increase Water Supplies In Southern California", Southern California Water Committee, 2012.

irrigation, etc.). The selection of individual Best Management Practice (BMP) types and sizes and their ultimate combination was based on consideration of target stormwater quantity control, site opportunities and constraints, and benefit and cost.[43] The BMPs listed below consist of projects that capture from the offsite as well as onsite runoff, often referred to as regional and onsite projects, respectively.[44]

Description	Storage Volume (acre-feet)	Capital Cost	Annual O&M Cost	Total Cost (Capital + O&M[1])	Total Cost Per Unit Storage Volume ($/acre-feet)
Regional Projects					
Vulcan Gravel Processing Plant	65	$952,000	$10,000	$1,452,000	$22,338
LADWP Steam Plant	234	$4,539,000	$71,000	$8,089,000	$34,568
Sun Valley Middle School	35	$3,033,000	$6,000	$3,333,000	$95,229
Sun Valley Park	49	$5,200,000	$16,000	$6,000,000	$122,449
Strathern Pit	736	$17,450,000	$239,000	$29,400,000	$39,946
Powerline Easement	455	$18,100,000	$54,000	$20,800,000	$45,714
Onsite Projects					
Parking Lot Infiltration	129	$33,100,000	$35,000	$34,850,000	$270,155
Onsite Infiltration, Reuse, Street Storage	137	$61,988,000	$112,000	$67,588,000	$493,343

[1] Over 50 year life

Fig.10: *List of optimally selected stormwater management projects including storage capacity and costs (Source: Southern California Water Committee, 2012)*

More recreational opportunities for the people of Sun Valley was another objective that was accomplished by increasing the area of parks and open spaces and the public access to these areas as well as by upgrading the green areas within public and private properties. With the above initiatives the quality of the local wildlife habitat was also strengthened.

Improving the water quality of the watershed was a key goal of the project. The watershed's receiving water body was benefited from both the change of the community's behavior and the project itself. The project team educated the public on responsible watershed management practices and proactively enforced regulation on illegal discharge by controlling pollution at its source. The project itself helped maintain and improve the existing groundwater quality ensuring local potable water supply. Important strategies included the elimination of the pollutant load entering Los Angeles River from Sun Valley stormwater runoff and the improvement of the quality of the area's urban runoff through the installation of BMPs.

3.1.2 Secondary Objectives

Multiple secondary objectives included the provision for additional environmental benefits (reduction of solid waste stream and energy costs, improvement of air quality), the

[43] "Regional and on-site BMPs represent two approaches for managing stormwater at new developments and re-developments and involve different design and cost/benefit assessments. It is important to note that the selection of BMPs, either regional or on-site, should be based on finding the optimal combination considering performance, site availability, and site constraints, while evaluating the benefits and costs to maximize overall benefits to the watershed." Source: "STORMWATER CAPTURE: OPPORTUNITIES TO INCREASE WATER SUPPLIES IN SOUTHERN CALIFORNIA". January 2012. p.7.)

[44] "Stormwater Capture: Opportunities To Increase Water Supplies In Southern California", Southern California Water Committee, 2012. APPENDIX. CASE STUDY A.

promotion of multiple agency participation, education of the public regarding its impact on water supply and water quality, the interaction between the community and government, the effective use of resources, and the creation of an opportunity to improve the economic climate for Sun Valley residents.[45]

3.2 Main Challenges

"Planning at watershed and subwatershed scales necessarily involves consideration of the entire water cycle, both above and below the ground. This includes the intertwined concerns of flood protection, water resources, water quality, protection and enhancement of habitat, open space for passive and active recreation, and strategies to encourage sustainable future development."[46] In this context, the Sun valley Watershed project team faced important challenges from the beginning of the project.

3.2.1 Quantify the value of a multipurpose watershed management project

The chosen alternative was more expensive than the traditional solution of a simple drainage system, making its approval a challenge. The construction cost estimates of the traditional solution were higher, but it would have had lower maintenance costs than the alternative plan. According to Rossana G. D'Antonio, the Assistant Deputy Director of LA County Public Works, *"Sometimes people believe that green infrastructure is more expensive during its maintenance, but it is just a different type of maintenance. The client always stuck with the dollar figure of the proposal, without taking into account all other added benefits to the community. This [other] approach is mostly common in transportation infrastructure projects. In this field, people compare the cost of a new highway to the benefit of the commerce [and] economic improvement which will be the result of the transportation. This custom economic analysis is common, but when it comes to flood control, storm water, watershed projects, those non-tangible social and quality-of-life improvements cannot be monetized. If custom cost evaluations are applied for this kind of infrastructure projects, then there are still plenty of those who will want to quantify this type of perspective. To them, not being able to provide such numbers is sometimes the challenge."*[47]

3.2.2 Multiple Agencies Participation and Funding sources

For the realization of this huge project multiple stakeholders had to cooperate, agencies to get involved and funding partners to contribute. Challenges included the development of multi-purpose solutions that would attract multiple funding sources, the cooperation with schools within the watershed to improve the aesthetics of their campuses and provide secondary benefits, the maximization of community involvement and literacy on watershed issues and the development of the project as a model that can be replicated in other watersheds.

[45] SVWMP, 2004.
[46] "COMMON GROUND from the Mountains to the Sea". Watershed and Open Space Plan San Gabriel and Los Angeles Rivers. October 2001. P. 13.
[47] "The Sun Valley Watershed Multi-benefit project. An Envision case study". Zofnass Program material.

Funding for natural resource protection and conservation activities as well as acquisition of open space, traditionally come from government[48] and include federal, state, and local funds. In order to restore Sun Valley Watershed, multiple financial resources were used including federal and state grants and local agency budgets. The project team worked to identify and secure funding opportunities for all subproject phases (concept design, planning, management, O&M).[49] In order to promote the planning of multi-purpose projects and strengthen the award of funds *"the San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy (RMC) and Santa Monica Mountains Conservancy (SMMC) have each developed criteria to rank projects that are eligible for funding administered by those agencies. These criteria have been reviewed and discussed with state and county agencies to ensure that they are in concurrence with agency missions and funding criteria.*[50]

3.2.3 Integration through community outreach and involvement

From the beginning, the project required a huge effort to better convince the community to address their needs and support the solution that the Agency was proposing. *"The project framework included an organized approach to stakeholder involvement and public outreach in order to assure that the final alternatives were acceptable to the community. The ultimate aim was to assure that a solid base of community support was developed for the final set of components that are likely to be constructed."*[51] The involvement of the locals was needed at many project levels including making decisions in the design phase, on household level and finally on individual level (e.g. tree planting, mulching and BMPs utilization). The strategies followed by the project team to achieve the above were to educate, develop interest and facilitate the implementation of all project components by giving presentations, releasing a website and providing monthly stakeholder meetings.

[48] "Government agencies have a variety of grant programs, for water quality enhancement, wildlife protection, habitat restoration and enhancement, groundwater recharge, stormwater pollution planning, fisheries restoration, and watershed protection. Funds may also be available from state, county, and local city voter-approved bonds, such as Proposition 12 (The Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act) and Proposition 13 (the Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Bond Act) or assessment districts. The Los Angeles County Safe Neighborhood Parks Acts (Proposition A) of 1992 and 1996 have been responsible for most of the Los Angeles River greening and riverfront parks." (Source: "COMMON GROUND from the Mountains to the Sea". Watershed and Open Space Plan San Gabriel and Los Angeles Rivers. October 2001. P. 54)

[49] Short-term and long-term funding opportunities will be analyzed later in the report.

[50] "Basin ranking categories include: Urban Resource Value | Watershed Resource Value |Partner Resource Value | Economic Value | Access Value | Scenic Resource Value | Wildlife Resource Value | Floristic Resource Value | Archaeological or Historic Resource Value | Trails Resource Value | Recreational Resource Value." Source: "COMMON GROUND from the Mountains to the Sea". Watershed and Open Space Plan San Gabriel and Los Angeles Rivers. October 2001. P. 55.

[51] SVWMP, 2004. Introduction.

Fig.11: *Community outreach*

3.2.4 Continuing Efforts

As a multi-benefit project, the Sun Valley Watershed management process included strong efforts in order to integrate into key infrastructure operations, update policies and programs, develop analytic tools (database), outreach and assist small business and construction communities, communicate with cities and other public agencies, make cross-jurisdictional efforts on sustainable infrastructure development and promote mutual understanding on the need for a sustainable infrastructure platform.

3.3 Sustainable performance evaluation

3.3.1 Evaluation through tools

The Envision® system measures the sustainability of infrastructure projects through 60 criteria organized into the five categories of Quality of Life (QL), Leadership (LD), Natural World (NW), Resource Allocation (RA), and Climate and Risk (CR). The overall credits measure the positive social, economic, and environmental impacts of an infrastructure project in the community. The tool can be applied in the planning, design, construction, and maintenance stages. The Sun Valley Watershed project received a total of 67% of the applicable Envision® credits, the most any project has received to date.[52] Below is the analytical project score.

[52]http://research.gsd.harvard.edu/zofnass/los-angeles-countys-sun-valley-watershed-multi-benefit-project-receives-isis-highest-sustainable-infrastructure-award-envision-platinum/

	Subcategory	Credit	Points	Points Awarded	Level of achievement
SUN VALLEY WATERSHED MULTI-BENEFIT PROJECT					
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	25	25	Restorative
		QL1.2 Stimulate sustainable growth and development	16	13	Conserving
		QL1.3 Develop local skills and capabilities	15	5	Superior
	WELLBEING	QL2.1 Enhance public health and safety	16	16	Conserving
		QL2.2 Minimize noise and vibration	11	8	Conserving
		QL2.3 Minimize light pollution	11	8	Conserving
		QL2.4 Improve community mobility and access	14	14	Conserving
		QL2.5 Encourage alternative modes of transportation	15	6	Superior
		QL2.6 Improve site accessibility, safety and way finding	15	15	Restorative
	COMMUNITY	QL3.1 Preserve historic and cultural resources	16	13	Conserving
		QL3.2 Preserve views and local character	14	14	Restorative
		QL3.3 Enhance public space	13	13	Restorative
	Innovation	QL0.0 Innovatice credit	8	6	PARTIAL
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	17	17	Conserving
		LD1.2 Establish a sustainability management system	14	7	Superior
		LD1.3 Foster collaboration and teamwork	15	15	Conserving
		LD1.4 Provide for stakeholder involvement	14	14	Conserving
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	12	15	Conserving
		LD2.2 Improve infrastructure integration	13	16	Conserving
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	10	10	Conserving
		LD3.2 Address conflicting regulations and policies	8	2	Enhanced
		LD3.3 Extend useful life	12	6	Superior
	Innovation	LD0.0 Innovatice credit	6	4	MAXIMUM
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	18	0	No Added Value
		RA1.2 Support sustainable procurement practices	9	2	Improved
		RA1.3 Use recycled materials	14	5	Enhanced
		RA1.4 Use regional materials	10	10	Conserving
		RA1.5 Divert waste from landfills	11	6	No Added Value
		RA1.6 Reduce excavated materials taken off site	6	6	Conserving
		RA1.7 Provide for deconstruction and recycling	12	4	Enhanced
	ENERGY	RA2.1 Reduce energy consumption	18	7	Enhanced
		RA2.2 Use renewable energy	20	0	No Added Value
		RA2.3 Commission and monitor energy systems	11	0	No Added Value
	WATER	RA3.1 Protect fresh water availability	21	21	Restorative
		RA3.2 Reduce potable water consumption	21	17	Conserving
		RA3.3 Monitor water systems	11	11	Conserving
	Innovation	RA0.0 Innovative credit	9	2	PARTIAL

	Subcategory	Credit	Points	Points Awarded	Level of achievement
SUN VALLEY WATERSHED MULTI-BENEFIT PROJECT					
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	18	14	Conserving
		NW1.2 Protect wetlands and surface water	18	18	Restorative
		NW1.3 Preserve prime farmland		N/A	EXCLUDED
		NW1.4 Avoid adverse geology	5	2	Enhanced
		NW1.5 Preserve floodplain functions	14	14	Conserving
		NW1.6 Avoid unsuitable development on steep slopes	6	4	Superior
		NW1.7 Preserve greenfields	23	23	Restorative
	LAND & WATER	NW2.1 Manage stormwater	21	21	Restorative
		NW2.2 Reduce pesticide and fertilizer impacts	9	5	Superior
		NW2.3 Prevent surface and groundwater contamination	18	18	Restorative
	BIODIVERSITY	NW3.1 Preserve species biodiversity	16	13	Conserving
		NW3.2 Control invasive species	11	5	Superior
		NW3.3 Restore disturbed soils	10	10	Restorative
		NW3.4 Maintain wetland and surface water functions	19	19	Restorative
	Innovation	NW0.0 Innovative credit	8	3	PARTIAL
CLIMATE AND RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	25	4	Improved
		CR1.2 Reduce air pollutant emissions	15	12	Conserving
	RESILIENCE	CR2.1 Assess climate threat	15	15	Conserving
		CR2.2 Avoid traps and vulnerabilities	20	16	Conserving
		CR2.3 Prepare for long-term adaptability	20	16	Conserving
		CR2.4 Prepare for short-term hazards	21	17	Conserving
		CR2.5 Manage heat islands effects	6	2	Enhanced
	Innovation	CR0.0 Innovative credit	5	0	NONE

3.3.2 Evaluation through data analysis and monitoring

Data analysis performed: Rainfall (2001), Hydrologic (2001), Water Quality (2001), Water supply (2001) for both Surface & Groundwater. Wildlife habitat, Air quality, Recreation, Water conservation.

Monitoring plan: Based on the 2004 EIR report, an initial monitoring plan has been developed for the following Phase1 projects: Cal Mat Pit, Sun Valley Middle School, Tuxford Green, Vulcan Gravel Processing Plant, and Valley Steam Plant. The monitoring plan consisted of three elements: 1) flood control and water conservation monitoring, 2) stormwater quality monitoring, and 3) groundwater quality monitoring. In order to quantify the flood control and water conservation benefits of the projects, flow measuring devices were planned to be installed in proposed storm drains and other conveyance systems. The objectives of stormwater quality sampling are to characterize the types of pollutants in stormwater entering each site, to evaluate the pollutant removal rate of each facility, and to monitor the quality of stormwater being infiltrated or reused. Monitoring of groundwater levels and water quality was also proposed. The objective of groundwater monitoring was to evaluate the effects of stormwater infiltration on groundwater flow, level and quality. In addition, soil and water quality in the vadose zone would be measured in order to evaluate the effectiveness of the soil matrix in infiltrating the stormwater before it reaches the water table.

3.3.3 Awards:[53]

2006 Environment Now. Top Achievements of the Environmental Community in Southern California. Category: Freshwater Protection and Restoration. Project: Sun Valley Watershed Plan takes hold with Completion of Multipurpose Park (Sun Valley Park). Environmental Organizations honored: California Coastal Commission, California Native Plant Society, Council for Watershed Health, Los Cerritos Wetland Stewardship, Inc., North East Trees, Theodore Payne Foundation, TreePeople, Verde Vistas.

California Storm water Quality Association (CASQA). Outstanding Stormwater Research Project Award for the LA Basin Water Augmentation Study. Presented to Council for Watershed Health.

2009 Community Conservancy International. Sun Valley Park Drain and Infiltration System, Green Solutions Project of the Year Award. Presented to LA County Public Works.

American Society of Civil Engineers. Outstanding Public/Private Sector Engineering Project. Sun valley Park Drain and Infiltration System. Presented to LA County Public Works.

2010 County of LA Board of Supervisors. Green Leadership Award for Elmer Avenue Neighborhood Retrofit Demonstration. Presented to Council for Watershed Health.

CASQA. Outstanding Stormwater BMP Implementation Project. Elmer Avenue Neighborhood Retrofit Demonstration. Presented to Council for Watershed Health.

2014 Institute for Sustainable Infrastructure (ISI) Envision Platinum Award. Sun Valley Multi-Benefit Project. Presented to LA County Public Works.

[53] Council of Watershed Health, "Sun Valley Watershed: A model for Smart Urban Redevelopment", WatershedWise, Quarterly Magazine, Volume 15, Number 3. Image.

4. THE VALUE OF A MULTIPURPOSE PROJECT

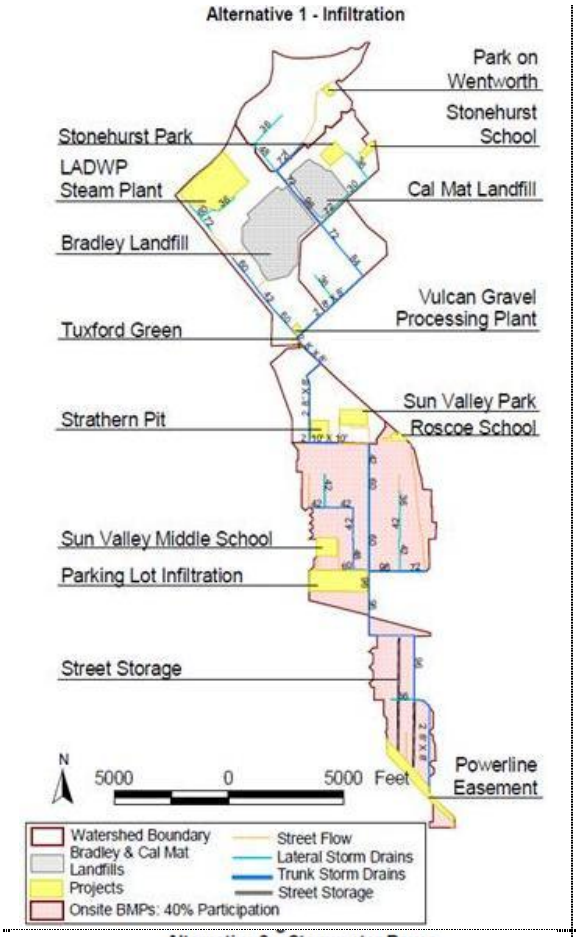
This section aims to describe the value of developing multi benefit projects (when addressing watershed problems) and of quantifying their economic benefits. The Sun Valley Watershed management project included a comprehensive analysis of alternatives in order to indentify the best multipurpose solution that would address the chronic local problem of flooding. Additionally, the project conducted an economic benefit-cost analysis of the alternatives and a proposal for resources of funding that helped the decision makers to conclude and proceed with the best group of projects.

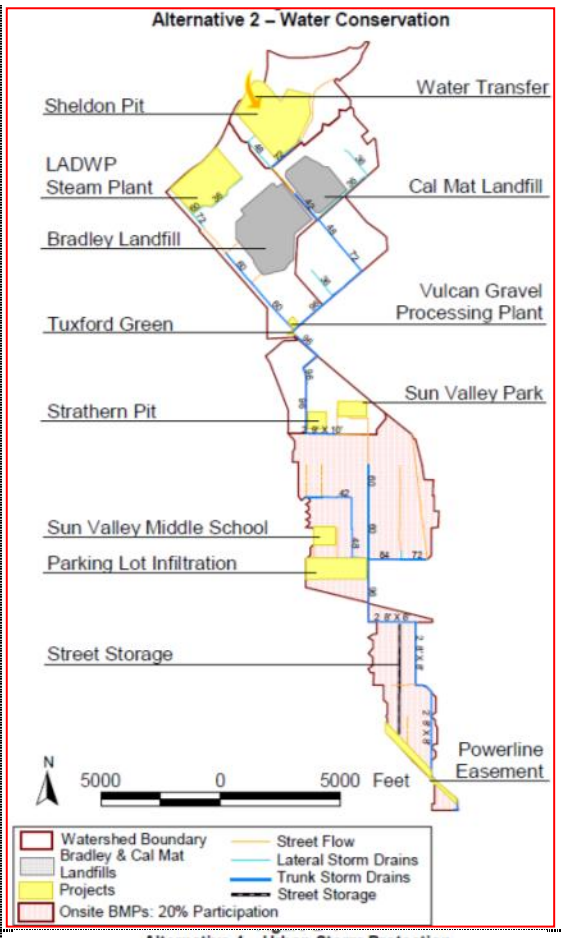
4.1 The Alternatives Evaluation Process

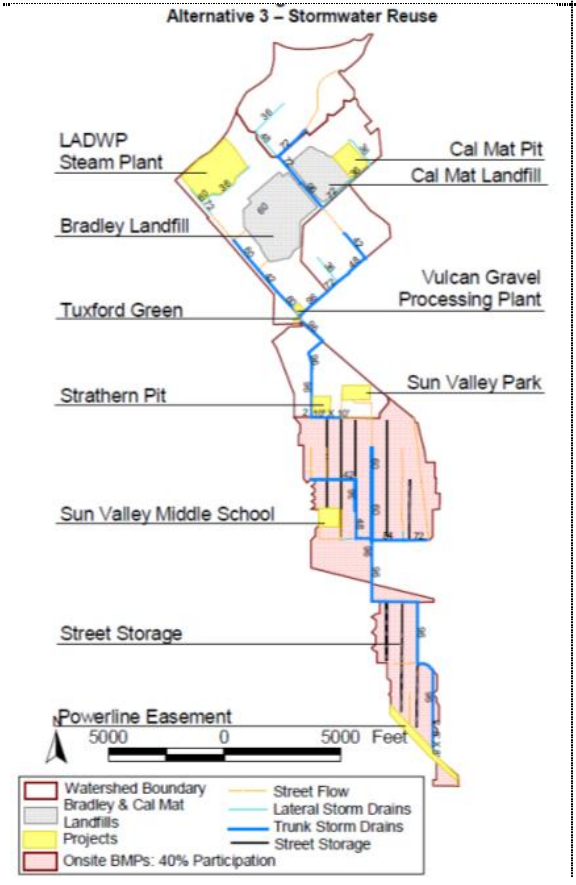
The project team proposed as "alternatives" different combinations of subprojects/project components. Those were evaluated according to opportunities and constraints. The multiple components were designed to meet primarily the flooding issues of the area and secondarily the additional objectives and the mission statement of the Sun Valley Stakeholders group. As some of the components had great beneficial impact, they were proposed in multiple alternatives. Together, the subprojects function as a system and form a "sample alternative". Each sample alternative was formulated through a process of identifying and analyzing water retention opportunities throughout the watershed. After evaluating and refining the sample alternatives, the range of possible solutions was narrowed down to four, each one with different configuration of regional retention projects and onsite Best Management Practices (BMPs) throughout the watershed. Each one was named by its main strategy into: 1) Infiltration, 2) Water Conservation, 3) Stormwater Reuse, 4) Urban Storm Protection.

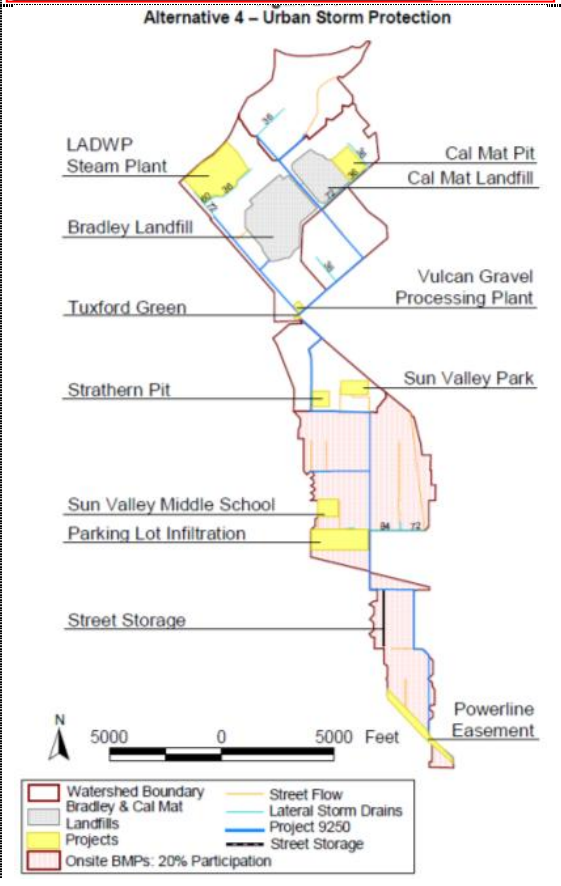
The process led to the final choice through the evaluation of different combinations of subprojects in potential sites within the watershed. Regional project sites that were examined included abandoned gravel pits, school sites, playgrounds, parking lots, parkas, a power plant, a powerline easement and an open airport property. For the smaller onsite BMPs, private residential, commercial and industrial properties were considered. Alternative 1 included onsite BMPs in local schools and parks, Strathern Gravel Pit Retention and onsite street water storage solutions. Alternative 2 included water storage and recreation facilities in the Sheldon Pit together with the Tujunga Wash Diversion structure, Strathern Gravel Pit Retention (used in Alternative 1), and a Powerline Easement Retention project. Alternative 3 included the Strathern Gravel Pit Retention (used in Alternatives 1&2), the Powerline Easement Retention (used in alternative 2), and onsite BMPs in residential, commercial and industrial sites. Finally, alternative 4 included the Cal Mat Gravel Pit Infiltration & Recreation project, Strathern Gravel Pit Retention (used all alternatives), and the Powerline Easement Retention (used in alternatives 2&3). See below the four final alternatives plans.[54]

[54] SVWMP, 2004.


Alternative 1 - Infiltration
Park on Wentworth
Stonehurst School
Stonehurst Park
LADWP Steam Plant
Cal Mat Landfill
Bradley Landfill
Vulcan Gravel Processing Plant
Tuxford Green
Sun Valley Park
Roscoe School
Strathern Pit
Sun Valley Middle School
Parking Lot Infiltration
Street Storage
Powerline Easement
N
5000 0 5000 Feet
Watershed Boundary
Bradley & Cal Mat Landfills
Projects
Onsite BMPs: 40% Participation
Street Flow
Lateral Storm Drains
Trunk Storm Drains
Street Storage


Alternative 2 – Water Conservation
Water Transfer
Sheldon Pit
LADWP Steam Plant
Cal Mat Landfill
Bradley Landfill
Vulcan Gravel Processing Plant
Tuxford Green
Sun Valley Park
Strathern Pit
Sun Valley Middle School
Parking Lot Infiltration
Street Storage
Powerline Easement
N
5000 0 5000 Feet
Watershed Boundary
Bradley & Cal Mat Landfills
Projects
Onsite BMPs: 20% Participation
Street Flow
Lateral Storm Drains
Trunk Storm Drains
Street Storage


Alternative 3 – Stormwater Reuse
LADWP Steam Plant
Cal Mat Pit
Cal Mat Landfill
Bradley Landfill
Vulcan Gravel Processing Plant
Tuxford Green
Sun Valley Park
Strathern Pit
Sun Valley Middle School
Street Storage
Powerline Easement
N
5000 0 5000 Feet
Watershed Boundary
Bradley & Cal Mat Landfills
Projects
Onsite BMPs: 40% Participation
Street Flow
Lateral Storm Drains
Trunk Storm Drains
Street Storage


Alternative 4 – Urban Storm Protection
LADWP Steam Plant
Cal Mat Pit
Cal Mat Landfill
Bradley Landfill
Vulcan Gravel Processing Plant
Tuxford Green
Sun Valley Park
Strathern Pit
Sun Valley Middle School
Parking Lot Infiltration
Street Storage
Powerline Easement
N
5000 0 5000 Feet
Watershed Boundary
Bradley & Cal Mat Landfills
Projects
Onsite BMPs: 20% Participation
Street Flow
Lateral Storm Drains
Project 9250
Street Storage

The final multi-benefit project ultimately included fifteen subprojects[55] that the team chose based on three primary criteria: 1) the results of the benefit-cost analysis, 2) the subprojects' ability to meet the overall project objectives, and 3) the subprojects' consistency with guiding principles applicable to any watershed planning. The four alternatives were further evaluated and analyzed in detail using water balances, conceptual designs, hydraulic models and benefit/cost analysis (BCA). Each solution was preliminary designed to meet LA County's standards for urban flood protection. Then a hydrologic evaluation provided the project volume requirements and ensured that adequate storage was present in the watershed to retain the quantity of runoff for each alternative. Finally, the benefit and cost analysis developed the value for each category of benefit and compared the costs and benefits of the alternatives and determined the final choice.

4.2 Benefit and Cost Analysis

This section provides a summary of the benefits and costs of the final four sample alternatives, and describes the methodology for developing the value for each category of benefit. In addition, the costs and benefits of the final alternatives are compared with the costs and benefits of the proposed the single-purpose flood control Project 9250.[56] Proposed in 1970, it consisted of storm drains throughout the Sun Valley Watershed. A draft EIP was prepared in 1995 for the project, however it was never implemented primarily due to lack of funding and community support.

4.2.1 Value Methodology

General assumptions and various methods were used in developing the Sun Valley Watershed BCA including cost avoidance, willingness to pay and valuation pricing. The benefits and costs of each alternative were quantified over a 50-year time horizon. The costs included all capital facilities costs, land acquisition costs, and expected O&M costs.[57] The annual benefits and O&M costs were assumed constant from year to year and a 4% discount factor net of inflation determined the present value of benefits and costs over the next 50-years. All capital costs were incurred in year one and O&M costs calculated from year two. Capital cost assumptions were developed based on costs obtained from industry and data provided by LACDPW.[58] A ratio of benefits to cost was ultimately calculated. A ratio greater than 1 indicated an alternative with greater benefits than cost, whereas an alternative with ratio less than 1 had greater costs than benefits.

[55] For detailed subprojects description please refer to the SVWMP 2004.

[56] "Numerous projects have been proposed to relieve the flooding in the watershed. LACDPW's Project 9250 proposed approximately 10 miles of storm drains, including 7 miles of trunk drain and 3 miles of laterals. The alignment and lengths of the drains are similar to those proposed under the SVWMP, however the dimensions of the pipes required by Project 9250 would generally be larger than those of the multi-benefit solution. " (Source: SVWMP, 2004)

[57] All valuations in the model are presented in 2002 dollars.

[58] "All estimates have been adjusted to an Engineering News Record (ENR) Construction Cost Index (CCI) of 7572 (Los Angeles, March, 2003) and are consistent with the American Association of Cost Engineers guidelines for developing reconnaissance-level estimates which should range between 50 percent above and 30 percent below actual capital expenditures. A 50 percent contingency is included in the cost estimates. The engineering, administration, and legal costs are estimated to be 25 percent of construction costs. The engineering, administration, and legal costs also include typical services such as inspection, materials testing, and construction management." Source: SVWMP, 2004.

To calculate the value of the project benefits for each of the four final sample alternatives, nine BCA benefit categories[59] were disaggregated:

Flood Control – assess the avoided cost of facilities needed to provide comparable local and downstream flood protection.

Water Quality Improvement – assess the avoided cost of the removal of bacteria and other listed pollutants from waters that contribute to the LA River.

Water Conservation – assess the benefit of using stormwater for groundwater recharge and associated water supply augmentation instead of purchasing imported water.

Energy – assess the reduction of energy consumption by planting shade trees and decreasing the amount of energy used to pump imported water into the LA Basin.

Air Quality Improvement – assess the benefits of absorption of pollutants by the tree canopy, pollution reduction by reducing the amount of emissions related to greenwaste hauling, and reduced emissions from power plants from decreased energy consumption.

Greenwaste Reduction – assess the cost avoidance of hauling and tipping for landfill disposal of greenwaste.

Ecosystem Restoration – assess the benefits of increased habitat and open space.

Recreation – assess the value of parkland and recreation for the area.

Property Values – assess the value of project components to nearby property values.

4.2.2 BCA Results[60]

Alternative 2, Water Conservation, presented the highest benefit-to-cost ratio of 1.72 due to the combination of higher overall benefits and lower total project costs ($171.58 million). The higher benefits are associated with the water transfer component from Tujunga Wash to Sheldon Pit, which provides almost four times the groundwater recharge provided by any other alternative. The lower cost results from implementing fewer retention projects, and releasing water from the watershed outlet during large storm events. Before the implementation of the project the chosen alternative 2 would be optimized by incorporating further improvements to boost its benefits and further lower its cost.

The Benefit/Cost ratio for each alternative as well as the capital costs and O&M costs per component for each alternative are shown below. The ratios use the present value of the total project cost including O&M over the 50-year evaluation period and the summed benefits over the same evaluation period. As presented below Sample Alternative 2 has a total construction cost of $151 million and provides approximately 8,123 acre-ft of water amount to be conserved and 1,450 acre-ft of flood protection.

Benefit	Alternative				
	9250	1	2	3	4
Present Value of All Benefits	$73.44	$270.47	$295.39	$274.93	$239.95
Present Value of Capital and O&M Costs	$74.46	$230.40	$171.58	$297.90	$206.61
Benefit/Cost Ratio	**0.99**	**1.17**	**1.72**	**0.92**	**1.16**

Fig.12: *Benefit/Cost Ratio for each Alternative (Source: SVWMP, 2004.)*

[59] SVWMP, 2004.
[60] For the analytical BCA results see Appendix 1 (Source of the tables: SVWMP, 2004)

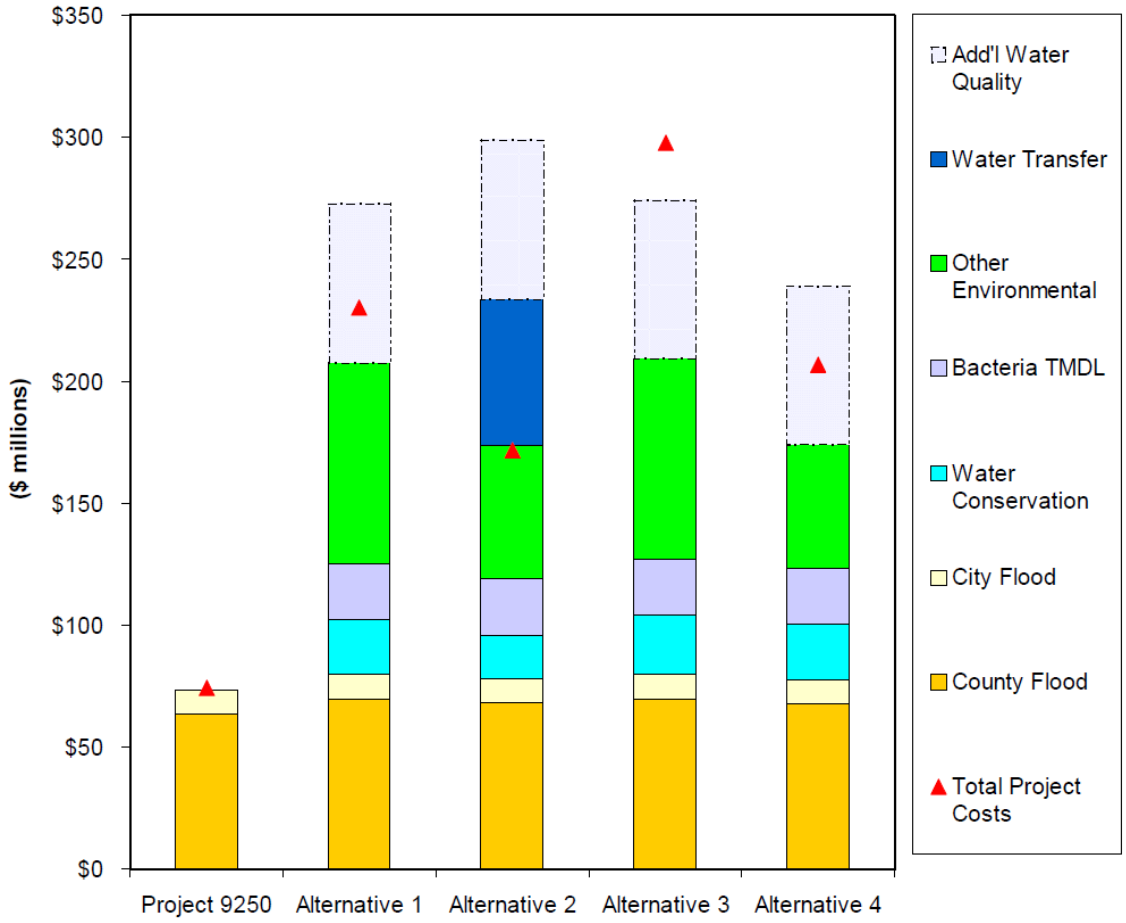


Fig.13: *Graphical summary of the benefits and costs for each alternative including the simple-purpose solution – Project 9250 (Source: SVWMP, 2004)*

Project Component	Average Annual Water Conservation (acre-ft)	Capital Cost
LADWP Steam Plant	184	$4,539,000
Vulcan Gravel Processing Plant	45	952,000
Tuxford Green	Mostly Conveyance – Negligible Conservation	4,350,000
Sun Valley Park	38	2,800,000
Sun Valley Middle School	25	3,033,000
Tree Planting and Mulching	N/A[1]	2,200,000
Tujunga Wash Diversion	6,000	650,000
Sheldon Pit	303	16,850,000
Strathern Pit	649	15,500,000
Parking Lot Infiltration	57	15,300,000
Street Storage	113	17,643,000
Onsite BMPs	113	16,407,000
Powerline Easement	596	7,500,000
Trunk Storm Drains	Conveyance Only	36,816,000
Lateral Storm Drains	Conveyance Only	6,362,000
Total	8,123	**$150,902,000**

[1] Water conservation from tree planting and mulching may be significant but has not been calculated.

Fig.14: *Alternative 2 components, Water conservation amount in an average year, Estimated capital/construction cost for each component. (Source: SVWMP, 2004)*

The cost of constructing a traditional storm drain to eliminate the problem has been estimated to be $75 million (see Fig.14, Project 9250). *"The results of the BCA indicate that each of the alternatives yields the same level of flood protection as the traditional single purpose solution, but also provides multiple benefits including: approximately $78 million in flood control benefits, $88 million in stormwater quality benefits, and $78 million in water supply benefits, with a cost of approximately $172 million. The benefits of the traditional single purpose solution have been estimated to be $73 million with a cost of $74 million. These quantified benefits have been used as a basis for approaching water supply and water quality agencies, as well as park departments, and potential funding partners."*[61]

4.3 Implementation Plan

4.3.1 Prioritization of projects

The prioritization of Alternative 2 components and their implementation period is shown below. The projects that initiate first are the pilot project (Sun Valley Park Drain and Infiltration System), the Phase 1 projects and the projects with long construction/community involvement timelines (Tree planting and onsite BMPs).

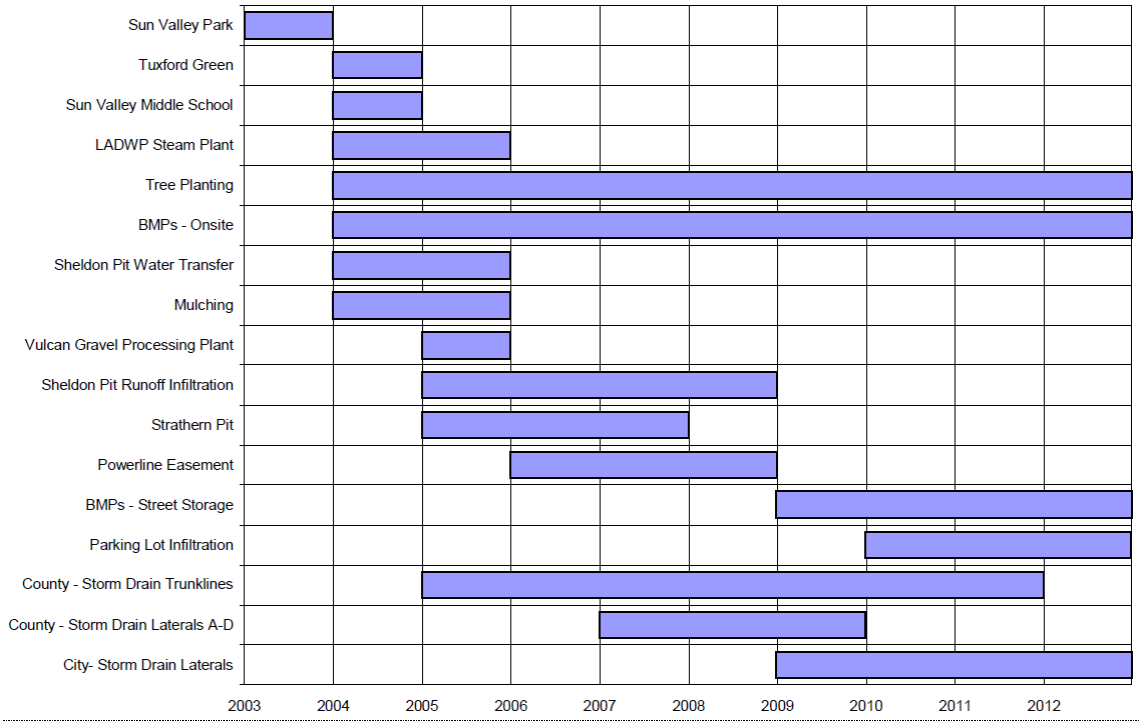


Fig.15: *Potential prioritization of projects in Alternative 2*

Based on the project prioritization, the estimated construction duration, the construction cost estimates, the annual capital costs and the average flood control achieved per year are presented below.

[61] Paper: *"SUCCESSFUL INTEGRATED WATER RESOURCE PLANNING – KNOW YOUR BENEFITS AS WELL AS COSTS. THE SUN VALLEY WATERSHED CASE STUDY."*
(Source: https://brownandcaldwell.com/technicalPapersAll.asp?page=9)

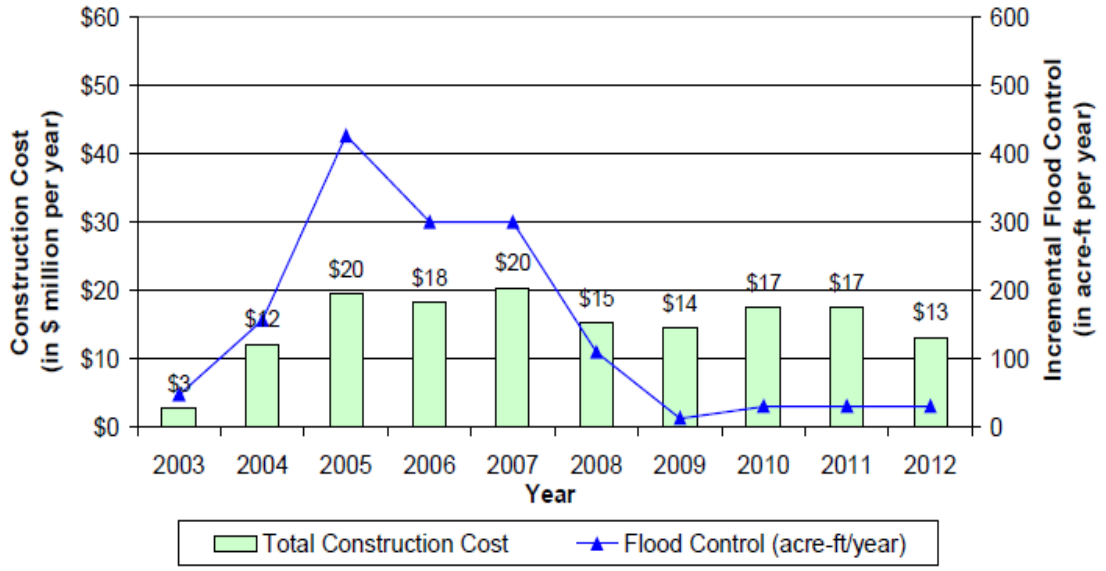


Fig.16: *Annual Capital Costs &* Average Annual Flood Control *of Alternative 2, based on the project prioritization, estimated construction duration and the construction cost estimates.*

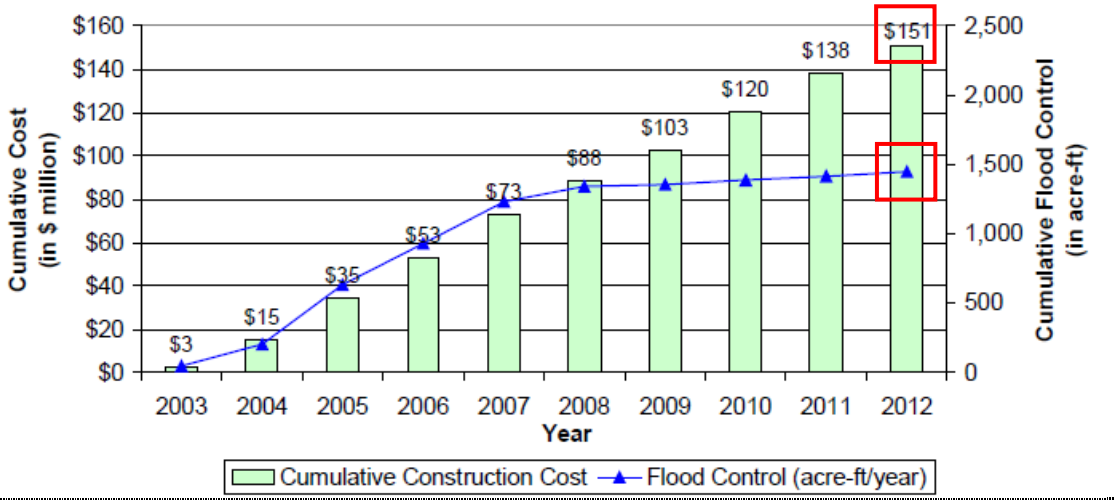


Fig.17: *Cumulative construction cost in Year 2002 dollars and cumulative flood control benefit. Alternative 2 has a total construction cost of $151 million and provides approx. 1,450 acre-ft of flood protection.*

4.3.2 Funding Opportunities[62]

The following tables provide a summary of near-term priority grant opportunities and on-going grant opportunities. The near-term grant opportunities target grants available in the next two to three years to fund projects identified to start in 2004 and 2005. The grants available in the longer-term are recently approved bonds, such as Proposition 50, or grant programs such as the City of LA Proposition K, which is scheduled to provide grants over 25 years.

[62] SVWMP, 2004, p. 5-2.

Near Term Sources of Funding

Funding Source	Purpose of Fund and Applicability to Project	Geographic Area	Who is eligible to apply	Maximum amount	Matching funds required	Amount available	Deadline / Grant Cycle	Additional Information Source
Prop 13 Watershed Protection	Develop local watershed management plans and/or implement projects consistent with watershed plans	CA	Nonprofits, local government agencies incl. special districts, Indian Tribes, and educational institutions	$200,000	Yes	$32.8 million to SoCal Counties	Cycle begins in March. FY 2003/2004 funding cycle expected	http://www.swrcb.ca.gov/prop13/index.html
Prop 13 Nonpoint Source	Reduce, eliminate, or prevent water pollution resulting from polluted runoff and to enhance water quality in impaired waters	CA	Nonprofits, local government agencies incl. special districts, Indian Tribes, and educational institutions	$5 million	Yes	$5-6 million annually	Cycle begins in March. FY 2003/2004 funding cycle expected	http://www.swrcb.ca.gov/prop13/index.html
Prop 13/CALFED Watershed Program	Development of watershed management or restoration programs and implementation of projects consistent with watershed plans.	CA	Nonprofits, local government agencies incl. special districts, Indian Tribes, and educational institutions	$5 million	Yes	$32.8 million	RFCP published	http://www.swrcb.ca.gov/funding/docs/2003rfcp.doc
Prop 13 Urban Water Conservation Capital Outlay	Finance feasible, cost effective water conservation capital outlay projects, or programs to improve water use efficiency	CA	Public agencies and mutual water companies	Unknown	Yes	$18 million	Applications due in December	http://www.owue.water.ca.gov/finance/grants_2003/grants.cfm
MWD Local Resources Program	Provide financial assistance for new sources of water that reduce MWD's demand for imported water	CA	Public or private water agencies	Up to $250/acre-foot of water developed. Min of 100 acre-feet/yr.	No	Varies by RFP cycle	December 1, 2003	http://www.mwdh2o.com/mwdh2o/pdf/business/RFPforLRPApril302003Final.pdf
AB303 Local Groundwater Management Assistance Act of 2000	Help agencies better understand how to manage groundwater resources effectively to ensure the safe production, quality, and proper storage of groundwater	CA	Local public agencies	Maximum of $250,000	No	$5 million	Applications due in October	http://www.dpla2.water.ca.gov/grants-loans/ab303/
319 Program – Nonpoint Source Implementation	Implement nonpoint source projects and programs in accordance with section 319 of the Clean Water Act	CA	States and tribes	Unknown	No	$5-6 million	Applications due in May 2004. FY 2003/2004 funding cycle expected	Applicant must contact RWQCB or SWRCB prior to applying. http://www.swrcb.ca.gov/nps/docs/fldpl319.doc
Prop 40 – Murray-Hayden	Funding for capital projects including parks, park facilities, environmental enhancement projects, youth centers, and environmental youth service centers	CA	Counties, parks districts, and nonprofit organizations	$2.5 million	No	$46 million	Applications due November 17, 2003	http://www.parks.ca.gov/pages/1008/files/MH_Draft.PDF
Prop 40 – Roberti-Z'berg-Harris	Funds are for urgent park and recreation needs, funding supplements for local expenditures, and block grants	CA	Counties, parks districts, and nonprofit organizations	$3 million	Yes –3/7 of funds must be non-state funds	$130 million for FY 2003 funding cycle	December 15, 2003. Similar cycle expected for future cycles	http://www.parks.ca.gov/default.asp?page_id=22329
Prop 40 – Urban Park Act	Finance acquisition and development of parks, recreation areas, and facilities in neighborhoods least served by parks and recreation providers	CA	Counties, parks districts, and nonprofit organizations	$3 million	No – but more competitive with additional funding	$131 million for FY 2003 funding cycle	December 15, 2003. Similar cycle expected for future cycles	http://www.parks.ca.gov/pages/1008/files/UPA_Draft.PDF or http://www.parks.ca.gov/default.asp?page_id=22294
Los Angeles City Prop K	Funds are for acquisition, development, and protection of recreational, cultural, and natural areas. Funds are for capital improvement only.	City of Los Angeles	Nonprofit organizations, government entities, and City departments	Depends on the grant category applied to	No – but applicant must demonstrate financial ability to complete project	$25 million annually until 2022	Expected to be April annually	http://www.ci.la.ca.us/cyf/cyfpt1.htm or contact (213) 978 – 1840 for more information

Summary of Long-Term Funding Sources

Funding Source	Purpose of Fund and Applicability to Project	Geographic Area	Who is eligible to apply	Maximum amount	Matching funds required	Amount available	Deadline / Grant Cycle	Additional Information Source
Prop 50	Water Quality, Supply and Safe Drinking Water Projects, Coastal Wetlands Purchase and Protection Bonds	CA	Unknown	Unknown	Unknown	$3.44 billion for total bill	Unknown	http://wwwdwr.water.ca.gov/grants-loans/
USACE Challenge 21	Focuses on identifying sustainable solutions to flooding problems by examining nonstructural solutions in flood-prone areas	National	Flood control entities, state and local government entities	$75 million Corps per project cap	.Projects cost-shared 65%/35% Federal/non-Federal	$20 –50 million annually	Unknown	Currently unfunded. Stay in contact with local US Army Corps of Engineers planning office
Caltrans Environmental Enhancement Mitigation Program	Projects must have direct or indirect connection to environmental impacts of a transportation program	CA	Local, state or federal agency or nonprofit entity	$250,000	No	$10 million annually	September	http://www.caltrails.org/trailfunding.html#eemp or EEMP coordinator 916-653-5656
Clean Water Revolving Fund	Address water quality problems associated with discharges from wastewater and water reclamation facilities, as well as from nonpoint source discharges and for estuary enhancement	CA	Public and private entities	Approximately $25 million. Will vary annually	Yes – 20% state match	Varies	Priority list from Regional Board approved in June	http://www.swrcb.ca.gov/cwphome/mss/srf1.htm and contact the Regional Water Quality Control Board to apply for priority list
USDA Cooperative Forestry	Achieve ecosystem health and sustainability through forestry stewardship	National	Forestry agencies, local and tribal governments, and the private sector	Varies as funding changes from Prop. 12 to Prop. 40	Yes – 25%	$3.3 million annually	Applications due in March	http://www.fs.fed.us/cooperativeforestry/ucf_general.htm or http://www.ufei.org/. Local contact is John Melvin 909-320-6124
DWR Flood Control Project Subventions Program	Ensure construction of flood control and watershed management projects through assistance to local agencies	CA	Local agencies	Varies	Yes – 50% with additional 20% for meeting stated objectives	Unknown	May	http://www.fcpsubventions.water.ca.gov
MWD Local Resources Program	Provide financial assistance for new sources of water that reduce MWD's demand for imported water	CA	Public or private water agencies	Up to $250/acre-foot of water developed. Min of 100 acre-feet/yr.	No	Varies by RFP cycle	Varies by RFP cycle	http://www.mwdh2o.com/mwdh2o/pages/business/business01.html
USBR Water Reclamation and Reuse Program	Sets aside federal funds to support up to 25% of a water recycling project's capital costs	National	Local, state or federal agency or nonprofit entity	Up to 25% of the capital costs or $20 million.	Yes	USBR must request funding for projects annually	Funding cycle begins in October	http://www.usbr.gov/tcg/guidelines/ or http://www.lc.usbr.gov/scao/titlexvi.htm
WateReuse Variable Rate Loan Program	Provides loans to advance capital projects, reduce financing costs, and avoid delays due to processing requirements	CA	State or local agencies	$50 million	Yes	Varies annually	Projects must contact California WateReuse Finance Authority	http://www.watereuse.org/Pages/financenew.html

Summary of Long-Term Funding Sources

Funding Source	Purpose of Fund and Applicability to Project	Geographic Area	Who is eligible to apply	Maximum amount	Matching funds required	Amount available	Deadline / Grant Cycle	Additional Information Source
California State Parks – Land and Water Conservation Fund	Provides funds for statewide planning, and acquiring and developing outdoor recreation areas and facilities with 60/40 split for Southern/Northern CA	CA	Cities, counties, and districts	Unknown	Yes – dollar for dollar	Varies annually. $12 million anticipated in FY 2003/2004 cycle	Applications due in May until 2015	http://www.nps.gov/ncrc/programs/lwcf/ or http://www.parks.ca.gov/default.asp?page_id=21360
California State Parks – Recreational Trails Program	Funds for recreational trails and trails-related projects	CA	Cities, counties, districts, state agencies, and nonprofit organizations	Unknown	Yes	$3.2 million	October 1, 2003 Similar cycle expected for future cycles	http://www.parks.ca.gov/default.asp?page_id=21362
Department of Water Resources – Flood Protection Corridor	Provides funds to acquire easements and other interests in real property from willing sellers	CA	Local agencies or nonprofit organization	$5 million	Yes	Funding expected through Prop 50	Applications due in February	http://www.dfm.water.ca.gov/fpcp/index.cfm
California State Parks – Habitat Conservation Fund	Looks to bring urban residents into park and wildlife areas and increase awareness and appreciation for parks and wildlife	CA	Cities, counties, or districts as defined by Subdivision (b) of Section 5902 of the Public Resources Code	Unknown – average is $100,000	Yes – dollar for dollar	$2 million	Applications due October 1 annually	http://www.parks.ca.gov/default.asp?page_id=21361 or http://www.parks.ca.gov/pages/1008/files/hcfguide.pdf

The implementation of the proposed project in Sun Valley will likely result in many benefits for multiple agencies, plenty of which have been actively participating in the stakeholder process and have provided input. Agencies that could be involved in the project funding and the applicable benefit include: [63]

Flood Control	County of Los Angeles Department of Public Works, City of Los Angeles Department of Public Works, U.S. Army Corps of Engineers.
Water Quality Improvement	LARWQCB, California Coastal Conservancy, California Resources Agency – Department of Water Resources, DHS, USEPA, ULARA Watermaster.
Water Conservation/Supply	LADWP, California Department of Water Resources, USEPA, U.S. Bureau of Reclamation, Metropolitan Water District of Southern California.
Energy Conservation	LADWP.
Air Quality Improvements	SCAQMD.
Greenwaste Reduction	City of Los Angeles Bureau of Sanitation, Los Angeles County Sanitation Districts.
Ecosystem Restoration	Santa Monica Mountains Conservancy, CDFG, U.S. Fish and Wildlife Service, California Coastal Conservancy– Southern California Wetlands, Recovery Project, California Resources Agency – Department of Conservation, California Wildlife Conservation Board, Caltrans, California Department of Forestry and Fire Protection – Urban Forestry, USEPA, U.S. Army Corps of Engineers.
Tree Planting	LADWP, TreePeople, City of Los Angeles, Environmental Affairs Department, City of Los Angeles, Public Works Department, Bureau of Street Services.
Recreation	City of Los Angeles Department of Recreation and Parks, Los Angeles County Department of Parks and Recreation, California Department of Parks, National Park Service.

4.3.3 Regulatory Requirements[64]

The following table shows the regulatory requirements that were identified as applicable to project components or the project as a whole during the SVWMP.

[63] SVWMP, 2004, p. 5-7.
[64] SVWMP, 2004, p. 5-9.

Permit/Document	Agency	Level	Conditions when required
National Environmental Policy Act (NEPA)		Federal	Federal involvement in project.
National Historic Preservation Act		Federal	Historic archaeological sites identified.
ESA Section 10(a) Incidental Take Permit	U.S. Fish and Wildlife Service	Federal	Potential for endangered and threatened species in the vicinity of the project.
Wetland and Riparian Restoration and Creation Activities (#27)	U.S. Army Corps of Engineers	Federal	Existing wetlands are affected, or new wetlands are created.
Safe Harbor	U.S. Fish and Wildlife Service	Federal	Endangered species are present.
Intake Structures	U.S. Army Corps of Engineers and/or California Regional Water Quality Control Board	Federal /State	Maintenance of regulated intake structures.
National Pollutant Discharge Elimination System (NPDES) Permit	SWRCB	State	Creation of or modification to a water of the State.
Clean Water Act Section 401 Water Quality Certification	SWRCB	State	Diversion of Tujunga Wash
California Environmental Quality Act (CEQA)		State	Components of the project require further analysis than provided in the PEIR.
Section 2081 Incidental Take Permit	California Department of Fish and Game (CDFG)	State	Potential for endangered and threatened species in the vicinity of the project.
Approval of bermed retention basins	California Dept. of Water Resources	State	Construction of bermed retention facilities
Encroachment Permit or Easement	California Department of Transportation	State	Construction of facilities for Tuxford Green component.
	South Coast Air Quality Management District (SCAQMD)	Local	Construction BMPs consistent with air quality standards for ozone, carbon monoxide and PM_{10}
Construction Permits	Los Angeles Department of Transportation (LADoT)	Local	Coordination required for work in County or City streets.
Municipal Code, Chapter XI, Noise Reduction	City of Los Angeles	City	Compliance with regulated noise levels during construction.

The project also was aligned with the frameworks of EPA: “Moving Toward Sustainability. Sustainable and Effective Practices for Creating Your Water Utility Roadmap” and Water EUM: “Effective Utility Management: A Primer for Water and Wastewater Utilities”. Additionally, the following agencies and organizations were contacted for project input:

- City of Los Angeles, Bureau of Engineering, Valley District
- Union Pacific Railroad
- Southern Pacific Railroad
- Southern California Regional Rail Authority (Metrolink)
- LADWP
- Caltrans, District 7
- Metropolitan Transit Authority
- City of Los Angeles, Department of Recreation and Parks
- Greater Los Angeles County Vector Control District
- County of Los Angeles Sanitation Districts

Water Quality Policies[65] were also related to the Sun Valley Watershed Project. *"The Federal Water Pollution Control Act, known as Clean Water Act (CWA), is the driving force behind LA water quality policy. Its primary objective is to restore and maintain the chemical, physical, and biological integrity of the surface waters. Additionally, the Water Quality Control Plan for the LA Region (Basin Plan) establishes water quality standards (WQS) which define beneficial uses for surface and groundwater and numerical objectives necessary to support beneficial uses. Section 303(d) of the CWA requires each state to conduct an assessment of its waters,*[66] *and identify those waters that are not achieving WQS. The resulting list is referred to as the 303(d) list. The National Pollutant Discharge Elimination System (NPDES) Program (CWA §502) controls direct discharges into waters of the United States. NPDES permits contain industry-specific, technology-based limits and may also include additional water quality-based limits, and establish pollutant-monitoring requirements.*

On June 13, 1994, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted the Basin Plan which incorporates by reference the California State Water Resources Control Board (SWRCB) water quality control plans, significant SWRCB policies that are applicable to the Los Angeles Region, and the State anti-degradation policy. The SWRCB also adopted a general NPDES permit to regulate stormwater discharges associated with industrial activity in California. The existing NPDES framework was expanded in 1987 to regulate stormwater runoff (discharges) originating from municipal and industrial sources. The LARWQCB is authorized to implement a municipal stormwater permitting program as part of its general NPDES authority, as an agent of the SWRCB."[67]

CONCLUSION

The Sun Valley Watershed Project integrated multiple objectives into a single project making it possible to combine several funding sources and thereby optimize its resources. According to Brown and Caldwell: "*The BCA benefited the project as it was used as a tool to allocate cost sharing among potential funding partners. For example, Alternative 2 includes* ***a benefit of $78.1 million of water supply*** *which may be of interest to agencies such as the City of Los Angeles Department of Water and Power, and/or the Metropolitan Water District of Southern California. Alternative 2 also includes* ***a benefit of $88.1 million of water quality*** *benefits which may be of interest to the City of Los Angeles Bureau of Sanitation and/or the Los Angeles Regional Water Quality Control Board. In a simplified case, assuming these are the only benefits used to allocate costs* ***(along with the $78 million of flood control benefit)****, the total benefit would equal $244 million (78 + 88 + 78 = 244). In order to determine the estimated cost allocation to potential funding partners, a simple method is to take the ratio of the partner benefit to the total benefit and multiply the project cost. The estimated costs of Alternative 2 are $172 million. For example, the estimated cost to the water supply agency*

[65] SVWMP, 2004.
[66] The CWA requires States to develop and implement Total Maximum Daily Loads (TMDLs) for the waters on the list. A TMDL specifies the maximum amount of a pollutant that a water body can receive and still meet the water quality standard. TMDLs allocate the acceptable pollutant load to point and non-point sources (LARWQCB, 2002).
[67] SVWMP, 2004.

would be ($78/$244) x $172 = $55 million. This appears to be an attractive investment to the water supply agency with an estimated return on investment equal to 1.41. Similarly, the estimated cost to the flood control agency would be $55 million with a similar return on investment. This is particularly persuasive when recognizing that the flood control agency was originally prepared to spend $74 million on a single purpose solution prior to the benefit cost analysis. It is important to stress that all of these calculations for both benefits and costs are preliminary estimates and subject to change based on the review and analysis of each of the potential funding partners.

Meeting project objectives by formulating a multi-purpose solution was found to be technically feasible. With a thorough investigation of stormwater storage opportunities within the Sun Valley watershed, ample retention basin sites were identified and treatment and storage criteria could be met. The BCA demonstrated that multipurpose solutions were economically feasible, even though capital costs of these solutions were potentially twice as costly as the traditional single purpose solution. These multipurpose solutions provided significant quantifiable benefits that may be used to attract other funding partners to participate in the funding of capital improvements as well as routine operation and maintenance.

For example, Alternative 2 yields a present worth value of water supply benefits of $78 million, for an estimated investment of $55 million. Alternative 2 also yields a present worth value of water quality benefits of $88 million, for an estimated investment of $62 million. Based on the results of BCA, and a conservative assumption that only three funding partners (water quality, water supply and flood control agencies) are attracted to participate, it appears that although the County flood control agency was originally prepared to invest $74 million in a single purpose solution, it may end up needing to invest its fair share of only $55 million in a multipurpose solution to achieve similar flood control benefits."[68]

Concluding, the Sun Valley Watershed Multi-benefit project is an innovative project of multipurpose and integrated watershed planning. It is an emerging concept that can extend, as a demonstration project, beyond the border of individual communities as it reflects a consistent approach in which science-based planning and TBL objectives are considered together. Watershed management was enhanced by emphasizing in stormwater capture/reuse, runoff infiltration and groundwater recharge, the multiple objectives brought diverse stakeholders which functioned as a leverage of funding and sustainability principles were followed.

[68] Paper: *"SUCCESSFUL INTEGRATED WATER RESOURCE PLANNING – KNOW YOUR BENEFITS AS WELL AS COSTS. THE SUN VALLEY WATERSHED CASE STUDY."*
(Source: https://brownandcaldwell.com/technicalPapersAll.asp?page=9)

APPENDIX 1 – BCA RESULTS SUMMARY

Summary of Capital Costs for Each Alternative

Project Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lateral Storm Drains	$7,469,000	$6,362,000	$6,450,000	$10,006,000
Trunk Storm Drain	44,145,000	36,816,000	34,996,000	57,824,000
LADWP Steam Plant	4,539,000	4,539,000	4,539,000	2,852,000
Vulcan Gravel Processing Plant	952,000	952,000	952,000	346,000
Tuxford Green	4,350,000	4,350,000	4,350,000	4,350,000
Sun Valley Park	2,800,000	2,800,000	2,800,000	2,800,000
Sun Valley Middle School	3,033,000	3,033,000	3,033,000	2,535,000
Tree Planting and Mulching	4,400,000	2,200,000	4,400,000	2,200,000
Stonehurst School	1,077,000	n/a	n/a	n/a
Stonehurst Park	833,000	n/a	n/a	n/a
Roscoe School	975,000	n/a	n/a	n/a
Park on Wentworth	816,000	n/a	n/a	n/a
Water Transfer in Sheldon Pit	n/a	650,000	n/a	n/a
Sheldon Pit	n/a	16,850,000	n/a	n/a
Cal Mat Pit	n/a	n/a	27,480,000	26,400,000
Strathern Pit	17,450,000	15,500,000	12,800,000	11,000,000
Parking Lot Infiltration	33,100,000	15,300,000	n/a	21,300,000
Street Storage	29,177,000	17,643,000	129,758,000	17,643,000
Onsite BMPs	32,811,000	16,407,000	32,811,000	16,407,000
Powerline Easement	18,100,000	7,500,000	14,900,000	13,300,000
Total	**$206,027,000**	**$150,902,000**	**$279,269,000**	**$188,963,000**

Summary of O&M Costs for Each Alternative

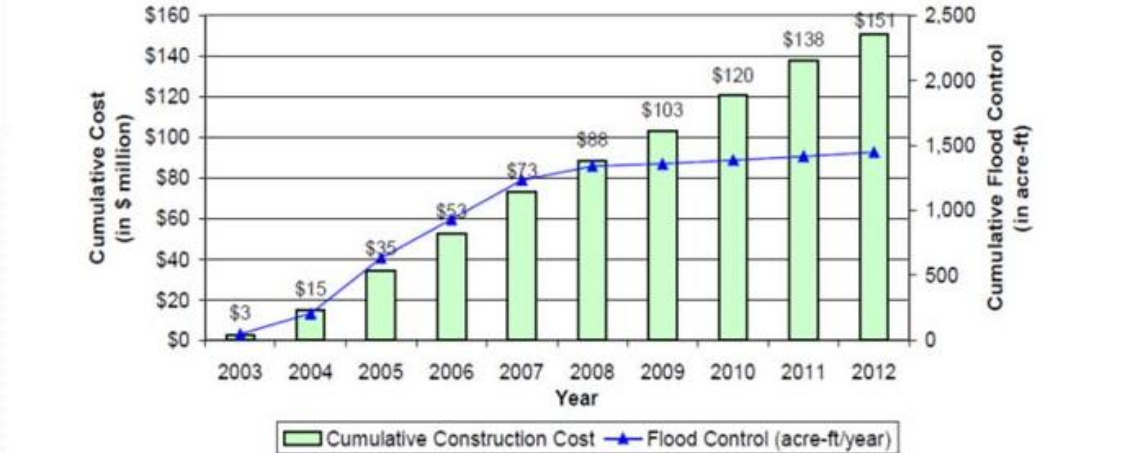
Project Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bradley Landfill	n/a	n/a	n/a	n/a
Sun Valley Park	16,000	16,000	16,000	16,000
LADWP Steam Plant	71,000	71,000	71,000	71,000
Vulcan Gravel Processing Plant	10,000	10,000	10,000	10,000
Tuxford Green	18,000	18,000	18,000	18,000
Sun Valley Middle School	6,000	6,000	6,000	6,000
Tree Planting	98,000	33,000	98,000	33,000
Mulching	0	0	0	0
Water Transfer	n/a	206,000	n/a	n/a
Stonehurst School	70,000	n/a	n/a	n/a
Stonehurst Park	78,000	n/a	n/a	n/a
Roscoe School	66,000	n/a	n/a	n/a
New Park in Subarea 2	30,000	n/a	n/a	n/a
Sheldon Pit	n/a	100,000	n/a	n/a
Cal Mat Pit	n/a	n/a	71,000	71,000
Strathern Pit with Transport to TSG/Vulcan	239,000	208,000	194,000	151,000
Parking Lot Infiltration (Subarea 33)	35,000	17,000	n/a	20,000
Street Storage	21,000	13,000	57,000	28,000
Onsite BMPs	91,000	46,000	91,000	46,000
Powerline Easement	54,000	25,000	49,000	44,000
Storm drain - Trunklines	171,000	139,000	131,000	236,000
Storm drain - Laterals (City + County)	64,000	57,000	58,000	73,000
Total	**1,135,000**	**963,000**	**867,000**	**821,000**

Annual Benefits in $ Million

Benefit	Alternative				
	9250	1	2	3	4
County Flood Control					
Regional damage avoidance	$3.00	$3.00	$3.00	$3.00	$3.00
Change in downstream flooding	($0.05)	$0.25	$0.17	$0.25	$0.15
City Flood Control	$0.47	$0.47	$0.47	$0.47	$0.47
Water Quality					
Bacteria TMDL	$0.00	$1.07	$1.07	$1.07	$1.07
Additional water quality	$0.00	$3.03	$3.03	$3.03	$3.03
Water Conservation					
Water transfer	$0.00	$0.00	$2.80	$0.00	$0.00
Avoided cost of imported water	$0.00	$1.04	$0.83	$1.12	$1.05
Energy Reduction	$0.00	$0.20	$0.08	$0.20	$0.08
Air Quality	$0.00	$0.95	$0.38	$0.95	$0.38
Greenwaste	$0.00	$0.93	$0.47	$0.93	$0.47
Ecosystem Restoration	$0.00	$0.09	$0.19	$0.21	$0.21
Recreation	$0.00	$1.09	$1.09	$1.09	$1.09
Property Values	$0.00	$0.47	$0.18	$0.47	$0.18
Total Annual Benefits	**$3.42**	**$12.59**	**$13.75**	**$12.80**	**$11.17**

Present Value of the Total Annual Benefits in $ Million

Benefit	Alternative				
	9250	1	2	3	4
County Flood Control					
Regional damage avoidance	$64.46	$64.46	$64.46	$64.46	$64.46
Change in downstream flooding	($1.03)	$5.37	$3.65	$5.37	$3.22
City Flood Control	$10.01	$10.01	$10.01	$10.01	$10.01
Water Quality					
Bacteria TMDL	$0.00	$22.95	$22.95	$22.95	$22.95
Additional water quality	$0.00	$65.15	$65.15	$65.15	$65.15
Water Conservation					
Water transfer	$0.00	$0.00	$60.21	$0.00	$0.00
Avoided cost of imported water	$0.00	$22.35	$17.89	$24.07	$22.65
Energy Reduction	$0.00	$4.30	$1.70	$4.30	$1.70
Air Quality	$0.00	$20.50	$8.10	$20.50	$8.10
Greenwaste	$0.00	$20.00	$10.00	$20.00	$10.00
Ecosystem Restoration	$0.00	$1.86	$4.04	$4.58	$4.48
Recreation	$0.00	$23.34	$23.34	$23.34	$23.34
Property Values	$0.00	$10.20	$3.90	$10.20	$3.90
Total Benefits	**$73.44**	**$270.47**	**$295.39**	**$274.93**	**$239.95**



Cumulative construction cost and flood control of Alternative 2. The curve shows that projects with a large flood protection benefit will be constructed in the first 5 years. After completion of all flood control structures, the SVW will be in compliance with the County Flood Control requirements.

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