Stormwater Capture Demonstration Study June 2023 Update

ARLA

ONEWATER ECON

waternow alliance
water leaders. resilient solutions.

RCD
RESOURCE CONSERVATION DISTRICT OF THE SANTA MONICA MOUNTAINS

G3

craftwater engineering, inc.

The Nature Conservancy

Define clear metrics and definitions

1. Develop Local Metrics
2. Refine NBS/ Nature-Mimicking
3. Expand Water Supply Benefits

Determine what is technically possible and what the needs are

4. Create Watershed Area Signatures
5. Create Community Engagement Program
6. Conduct Needs Assessments
7. Connect Community Engagement to Technical Resources Program
8. Clarify Scoring for Engagement
9. Prioritize NBS

Assess who benefits

10. Create Clear Equity Standards
11. Determine, Test, and Select Supplemental DAC Indicators
12. Quantify Benefits At Appropriate Spatial Scales
13. Calculate DAC Benefits with Population
14. Include DAC Benefits in Scoring

Set local targets

15. Set Watershed Area Targets

Determine right tools and data

16. Model Project Interactions
17. Build Potential Project Portfolio

Expand opportunities and coordination

18. Incentivize WHAM Coordination
19. **Create a Private Property Incentive Program**
20. Create and Implement A Robust Workforce Development Program

Calibrate scoring

21. Test Alternative Scoring Criteria

Monitor and verify progress

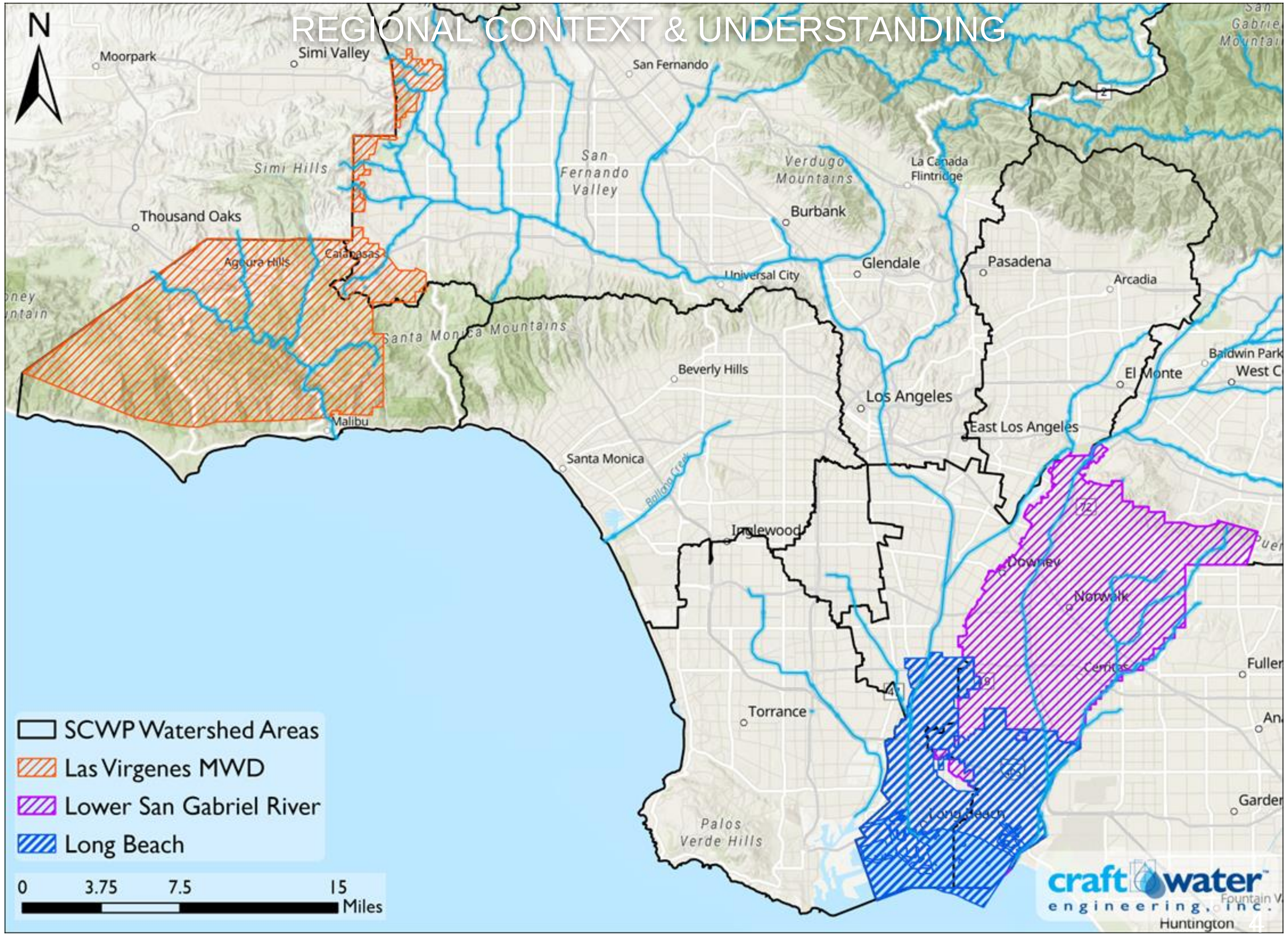
22. Develop a Monitoring Program

Creating Incentives for Local Water Resilience

How this study advances our current state of understanding:

- Estimates the maximum potential for stormwater capture on private property in three study areas
- Determines the number of parcels and BMPs that could capture flows
- Quantifies co-benefits of BMPs to drive co-investment opportunities and evaluates cost/benefits
- Outlines potential programs and related costs for achieving this potential

Study Regions & Scaled Approach



Modeled Project Types

	Single-Family Residential	Multi-Family Residential	Commercial	Institutional (Public & Private)
Landscape Transformation	X	X	X	X
Above Ground Cisterns	X	X	X	X
Below Ground Cistern	--	--	X	X
Engineered Bioretention	X	X	X	X

Landscape Transformation

Above Ground Cistern

Below Ground Cistern

Engineered Bioretention

Metrics Analyzed

Water Supply

Volume captured by fate

- Infiltrated (recharge)
- Irrigated (demand offset)

Water Quality

"Limiting Pollutant" load reduction

Community Investment Benefits

- Tree canopy
- New groundcover

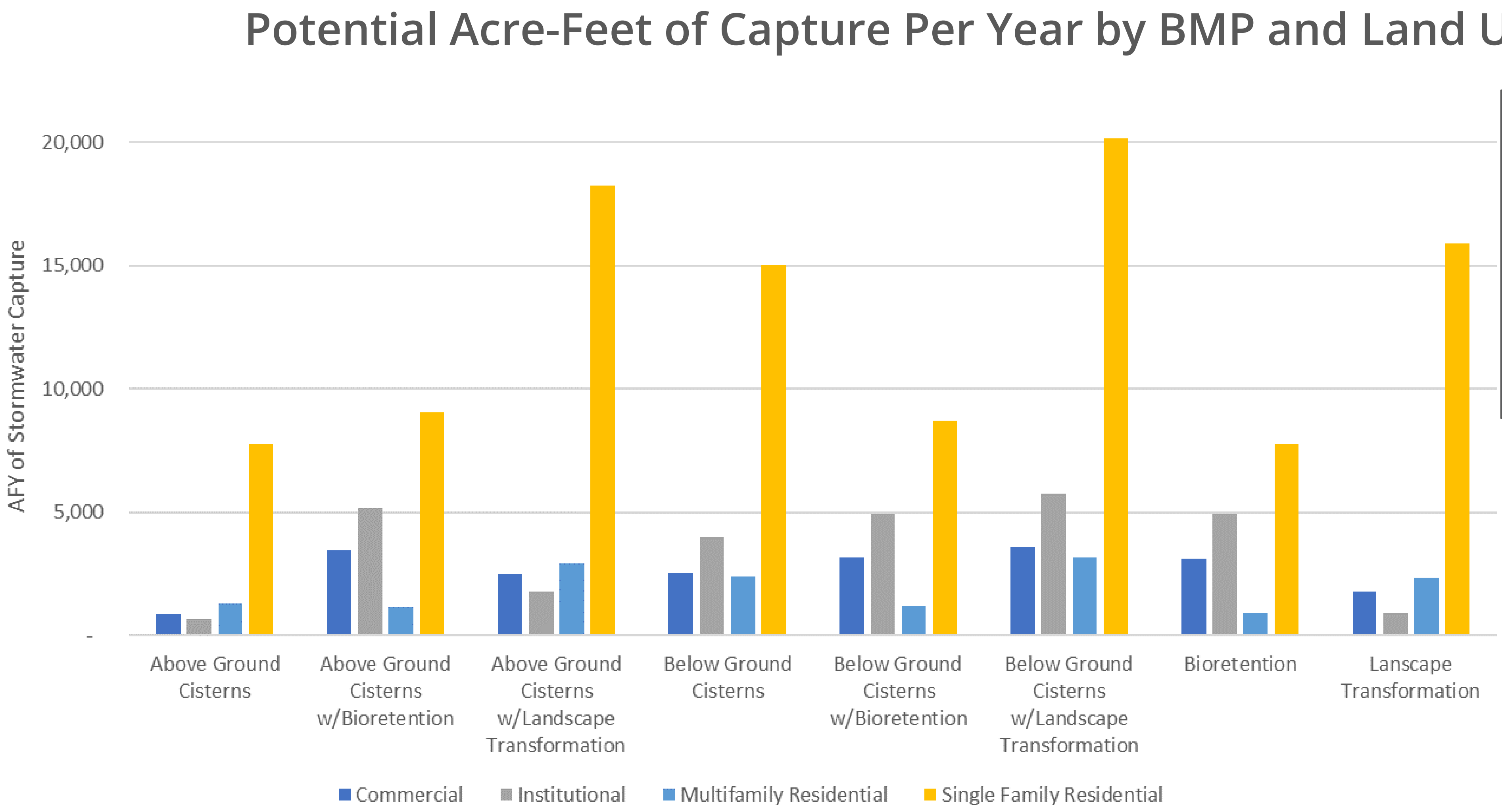
Proxies for carbon sequestration & air quality improvement

- Water "on-hand" for fire risk reduction/value of property protected*

Monetized to $ Value

Modeling Approach

Stormwater Capture Potential Across the Pilot Areas

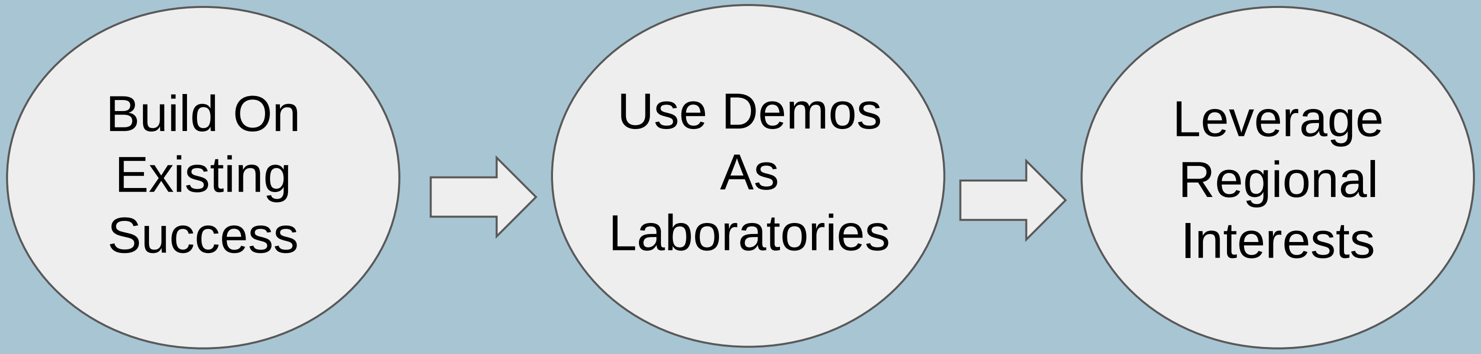


Maximum feasible capture = **Approx 33,000 AFY**

Maximum in LVMWD **= Approx 3,991 AFY**

Draft – For Discussion Purposes Only

Preliminary Recommendations



Foundational Principle: Reimagine Turf Replacement Program as Landscape Transformation

Program Recommendations:

1. Climate Resilient Landscapes (Residential Properties)

    1a. Landscape transformation w/optional cisterns

    1b. Landscape transformation w/optional larger cisterns for fire protection

1. Climate Resilient Businesses (Commercial and Institutional Properties)

Climate Resilient Landscapes (Las Virgenes): Goals & Assumptions

Key targets

- LVMWD **176 AFY** conservation savings (single family)
- Malibu Creek EWMP goal: **24.6 AF** stormwater storage capacity from private property BMPs by 2032

Program goal

- Achieve 50% of conservation target savings **(89 AFY)**
- Meet portion of relevant EWMP goals
- Add storage for fire protection (Zone 1)

Key assumptions

- Landscape transformation: $19.61/sq. ft., average size ~1,250 sq. ft.
- Cistern: $1.86 per gallon, average size ~4,100 gallons (max 5,000)

Climate Resilient Landscapes (Las Virgenes)

Incentive bundle:

- Landscape Transformation
- Optional Larger Capacity Above-Ground Cistern
- Tiered rebate covers percentage of unit cost

Property type: Single-Family Residential

How many: 445 pilot installations

Details: Larger cisterns provide additional storage capacity to support defensible space irrigation during 'red flag' warning periods

Climate Resilient Landscapes (Las Virgenes)

Benefits (Annual) and Costs (Capital)

	Practice Type	Single Family Homes	Stormwater Capture (AFY)	Potable Water Supply Offset (AFY)	Water Quality Benefit (Lbs. of Zinc)	Fire protection benefits ($/year)	Full Cost (cost for all potential co-payors)
Demonstration Scale	Landscape transformation + ~30% cistern uptake	445	37	89	11	$38.1K	$12.1 M

- Potable offsets = 50% of LVMWD SF home conservation target of 176 AFY
- Contributes to Malibu Creek EWMP stormwater capture goals, at fraction of cost per AF estimated in EWMP

Climate Resilient Businesses: Program Goals

Key Targets

- CII water savings:
  18 AFY (LV) (UWMP)
- Stormwater storage capacity (EWMP):
  24.6 AF (LV private property)

Program goals:

- LV: 18 AFY conserved (100% of target)
- Meet portion of EWMP goals

Climate Resilient Businesses (Las Virgenes)

Incentive bundle:

- Landscape transformation
- Bioretention component (~60% uptake of BR)
- Tiered rebate covers percentage of unit cost

Property type: Commercial & Institutional

How many: 50 installations

Details: Modifies current commercial turf program to landscape transformation w/optional bioretention (leverages ban on irrigating non-functional turf)

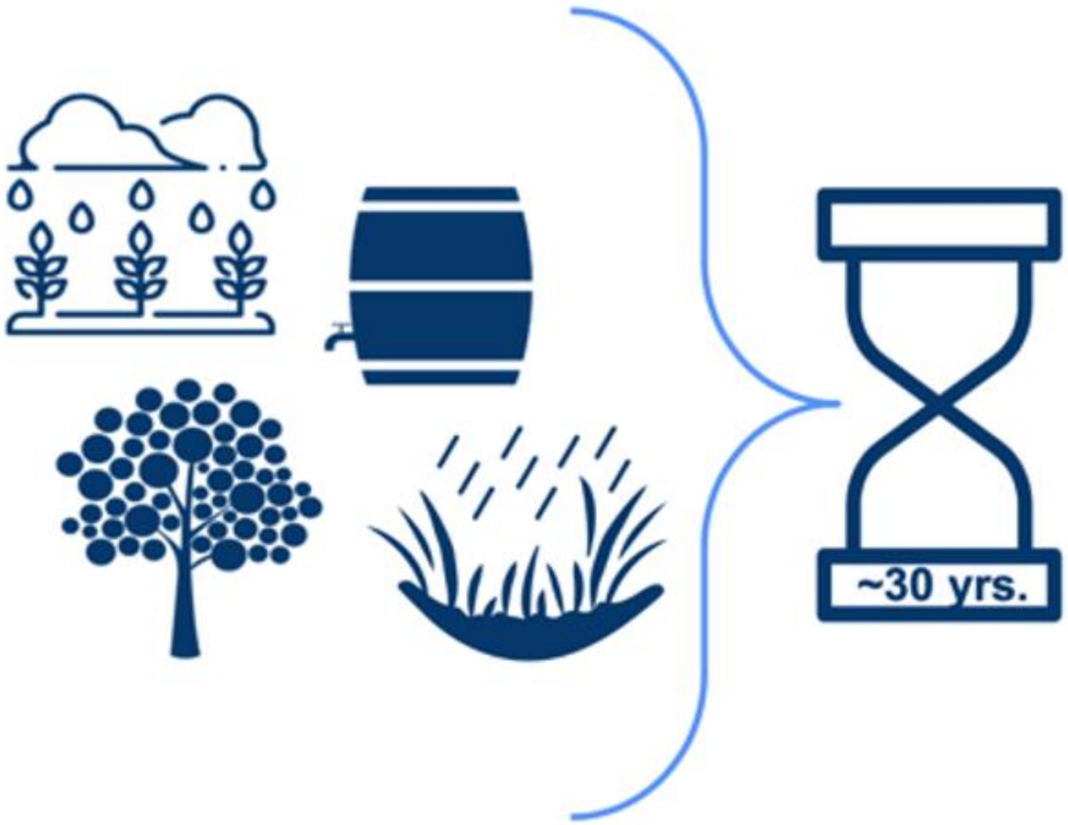
Climate Resilient Businesses: Benefits and Costs

Benefits (Annual) and Costs (Capital)

Demonstration scale	Practice Type	Installations	Stormwater Capture (AFY)	Potable Water Supply Offset (AFY)	Water Quality Benefit (Lbs. of Zinc)	Full Cost (cost for all potential co-payors)
Las Virgenes	Landscape Transformation and Bioretention	50	24	18	29	$3.9 M

Cost/benefit estimates assume that 50% of bioretention area will replace turf that could have otherwise been converted to landscape transformation

Getting to Scale



Identify Co-Payers and Partners

- SCWP
- Water retail agencies/utilities
- Municipalities
- Grants
- Customers

Consider Debt Financing

- Get to scale
- Lessen rate impacts
- Promote intergenerational equity

Evaluate Delivery Models

- Direct install
- Technical assistance
- P3

SCWP Pathways

SCWP Pathway Options

- Regional Program
  - Potential to meet 19 Feasibility Study Criteria
  - Scoring threshold within reach
  - Technical Assistance can provide support
  - Scientific Study viable for small scale demonstration
- Municipal Program
  - Key element for leveraging Regional Program funds
  - Funds in high demand but highly flexible
- District Funds
  - Potential for some flexible funding
  - Forthcoming grants program could be one source of funds
- Other
  - Biennial Review is an opportunity to recommend other pathways

Thank You

Please visit **acceleratela.org/scwp** for ARLA's SCWP Working Group Report and Recommendations

Landscape Transformation • *Removal of irrigated turf* • *Replacement with native vegetation* • *Soil-enriching runoff depressions*		Land Uses & Spatial Considerations:	*All Land Uses Considered* *All Regions Considered*
Opportunity Identification:	• *Land cover data from LARIAC were used to identify all Grass and Tall Shrub areas as candidates for Landscape Transformation. Any existing Native Vegetation areas from the USDA Existing Vegetation data layer that coincided with these identified areas were removed so as not to propose Landscape Transformation of areas already in native planting. No parcel line or building setbacks were delineated because Landscape Transformation is designed to retain all runoff without the need to provide any buffer.*	**Contributing Runoff:**	• *Assumed 1 sf rain garden for every 15 sf of impervious parcel area per sizing recommendations from Pamela Berstler.*
Sizing & Cost Calculation:	• *Full conversion of suitable area defined above* • *6" deep storage, 1.5' soil layer storage with 40% void space on up to 80% of converted area per design guidance from Pamela Berstler* • *0.57 in/hr infiltration rate per design guidance from Pamela Berstler*	**Costs Applied:**	• *We applied a cost of $19.61 per sq. ft. to align with known costs of completing landscape transformation projects in Southern California. We relied on expert opinion from Pamela Berstler from the Green Gardens Group to arrive at this cost. Note that it is significantly higher than the existing rebate offered by MWD ($2.00/square foot). Costs include labor and materials but <u>not</u> O&M.*
Water Supply Benefits Derived:	• *To be conservative, we did **<u>not</u>** attribute any groundwater recharge benefits to Landscape Transformation projects. Instead, the water supply benefits are only counted as an **<u>irrigation demand offset</u>** - where the infiltrated water being stored in the root zone of the plants reduces their need for watering. We did, however, factor in the ability for plants to store water in their root zone when calculating the total volume of **<u>potential stormwater capture</u>** derived from landscape transformation projects. This contributes to water quality benefits through runoff capture (see below).* • *Water supply benefits from Irrigation Demand Offset were valued at $966/ac-ft based on Earth Economics' monetization prepared for <u>the ARLA SCWP Working Group</u>.*	**Water Supply Quantification:**	• *<u>SLIDE Rule irrigation demand</u>: The SLIDE rule is a methodology for estimating the irrigation demand of different types of vegetation. The vegetation type was identified using the LARIAC land cover data.* • *<u>0.55 Irrigation Efficiency applied</u> (from ACWA): The irrigation efficiency value represents the ratio of water actually used by the plants being watered compared to the amount of water being output from an irrigation device. Some irrigation nozzles/sprayers are more efficient than others and we took a conservative approach.* • *Irrigation demands calculated using the SLIDE rule are divided by the Irrigation Efficiency coefficient for more realistic irrigation demand estimates that account for actual water used to irrigate.*
Water Quality Benefits Derived:	• *Landscape Transportation removes pollutants from captured stormwater directed to the shallow depressions, generating water quality benefits. Pollutant removal was valued at $3,173 per pound of zinc removed based on Earth Economics' monetization prepared for <u>the ARLA SCWP Working Group</u>. Zinc was chosen for quantification because it is the limiting pollutant of analysis in most regional Watershed Management Programs.*	**Water Quality Quantification:**	• *Continuous modeling was carried out using the L.A. County Department of Public Works' LSPC model. Runoff was directed to the shallow depressions associated with the landscape transformation to estimate runoff captured from parcel impervious areas. Zinc loads carried by runoff captured in the modeling were summed to quantify this benefit for the Landscape Transformation.*
Community Benefits Derived:	• *Landscape Transformation results in new groundcover and healthier soil, which leads to Community Benefits like improved Air Quality and Carbon Sequestration. The value of Air Quality was set at $46/sq.ft, and the value of carbon sequestration was set at $96/sq.ft. based on Earth Economics' monetization prepared for <u>the ARLA SCWP Working Group</u>.*	**Community Benefits Quantification:**	*The full area of Landscape Transformation was assumed to result in beneficial new groundcover to provide the following benefits:* • *Air Quality = $46/sq.ft.* • *Carbon Sequestration = $96/sq.ft.* *These benefit values are consistent with those used for <u>the ARLA SCWP Working Group</u>.*

ABOVE-GROUND CISTERNS • *Collection/Storage of roof runoff* • *Irrigation demand offset*		Land Uses & Spatial Considerations:	*All Land Uses Considered* *All Regions Considered*
Opportunity Identification:	• *Previous analysis has shown that using LIDAR can be problematic for cistern opportunity identification because it screens out things like trees which you can actually locate a cistern below. Because cisterns in the analysis were sized to capture the 85th percentile storm from rooftops, recommended sizes tend to have a relatively small footprint compared to the rooftop and total parcel area. Additionally, Above-Ground Cisterns are available in a variety of shapes and heights. Since there are so many unknowns associated with site-specific configuration, we assumed space would always be available at a ratio of approximately 45-60 gallons/100 sq.ft. of roof area. We applied this "liberal" assumption so that we could understand the maximum potential benefits of cisterns.*	**Contributing Runoff:**	• *Runoff contributing to Above-Ground Cisterns was assumed to be all rooftop areas on the parcel to maximize potential capture and reuse on-site. Multiple Cisterns or rain gutters may be necessary if not existing on a site-specific basis to accommodate this.*
Sizing & Cost Calculation:	• *The volume of the Above-Ground Cisterns were set to fully capture runoff from the 85th percentile storm falling on rooftop areas as a cost-effective sizing estimate that will capture runoff from most storm events and a portion of the largest events that occur.* • *Rainfall depths (0.75 in. Long Beach; 0.90 in. LSGR; 0.95 in. Las Virgenes) were identified from Los Angeles County isohyetal maps for the 85th percentile rainfall event depths.*	**Costs Applied:**	• *$1.86/gallon storage (low end; corrected to 2022 from 2013 @ $1.50) Additional costs are incurred for filtration, pumps, distribution systems, excavation (if cisterns are placed underground), distribution plumbing and drainage connections, installation, and other components which can add an additional $2-5/gallon not included in this analysis. (USEPA Rainwater Harvesting Manual, 2013).* • *$78/year O&M (CLASIC, 2022) includes 3x annual inlet screen cleaning, 1x annual tank interior cleanout, and small pump maintenance every 5 years* • *Does not include costs for treating to Title 22 standards (only necessary if using spray irrigation).*
Water Supply Benefits Derived:	• *Water Supply Benefits for Above-Ground Cisterns were assumed to derive from the use of captured water to offset on-site irrigation demands. To account for the differential between seasonal irrigation demand and rainfall/runoff patterns, runoff capture estimates were downscaled based on monthly differentials between irrigation demand and rainfall on record. Benefit value was applied based on the resultant volume used to offset irrigation demand at a rate of $755/ac-ft as defined for the ARLA SCWP Working Group.*	**Water Supply Quantification:**	• *Water Supply estimates were developed with continuous modeling of runoff directed to the Above-Ground Cistern. Captured runoff was assumed to be utilized over a 7-day period following rainfall of greater than 0.1 in. (typical regional designation for wet-weather events). Average annual capture numbers were then downscaled based on the monthly differential between irrigation demand and rainfall records for final water supply volume estimates (in other words, water supply benefit is tied to the irrigation demand of the landscape).*
Water Quality Benefits Derived:	• *Water Quality Benefits for Above-Ground Cisterns are derived from capturing stormwater runoff and sequestering it on-site, thus removing it from contributing to downstream aggregation of pollutants in storm drains and receiving waters. This Benefit was valued at $3,173 per pound Zinc removed as previously defined for the ARLA SCWP Working Group. Zinc was chosen to quantify this benefit as it is the limiting pollutant of analysis in many local Watershed Management Plans.*	**Water Quality Quantification:**	• *Continuous modeling results from the L.A. County Department of Public Works' LSPC model were used for runoff capture estimates and are paired with pollutant timeseries'. Zinc loads carried by runoff captured in the modeling were summed to quantify this benefit for the Above-Ground Cisterns.*
Community Benefits Derived:	• *None*	**Community Benefits Quantification:**	• *None*

RED FLAG HYDRATION STORAGE • *Additional "static" storage for cisterns* • *Stored water for site vegetation hydration* • *Fire risk reduction prior to Red Flag conditions*		Land Uses & Spatial Considerations:	*All Land Uses Considered* *Only Las Virgenes Considered*
Opportunity Identification:	• *Previous analysis has shown that using LIDAR can be problematic for cistern opportunity identification because it screens out things like trees which you can actually locate a cistern below. Because cisterns in the analysis were sized to capture the 85th percentile storm from rooftops, recommended sizes tend to have a relatively small footprint compared to the rooftop and total parcel area. Additionally, Above-Ground Cisterns are available in a variety of shapes and heights. Since there are so many unknowns associated with site-specific configuration, we assumed space would always be available at a ratio of approximately 45-60 gallons/100 sq.ft. of roof area. The additional Cistern space here would be in addition to the Cistern volume intended for irrigation uses and would be accommodated either by additional cistern height or slightly larger footprint, depending on the overall volume and site configuration.*	**Contributing Runoff:**	• *Runoff for the Red-Flag Hydration Storage Cistern would be the same source as Above-Ground Cisterns detailed above. It was assumed that runoff for these purposes is captured initially upon installation and held for use during Red Flag conditions, with replenishment occurring in the event of use as needed.*
Sizing & Cost Calculation:	• *To size these Cisterns, vegetation was measured between 5' and 30' from the building footprint according to currently defined Red Flag hydration requirements to diminish the risk of ember ignition surrounding buildings. Storage volumes were set equivalent to 1-week of irrigation demand (as defined by the SLIDE rule) to adequately hydrate this vegetation.*	**Costs Applied:**	• *Costs applied for these Cistern volumes are the same as Above-Ground Cistern costs commensurate to the additional storage volume required.*
Water Supply Benefits Derived:	• *Water Supply Benefits for this additional Cistern storage were not added as the Benefits from the Storage of this runoff are accounted for as Community Benefits detailed below.*	**Water Supply Quantification:**	• *Not applicable.*
Water Quality Benefits Derived:	• *Water Quality Benefits for this additional Cistern storage were not added as the Benefits from the Storage of this runoff are accounted for as Community Benefits detailed below.*	**Water Quality Quantification:**	• *Not applicable.*
Community Benefits Derived:	• *Water stored in cisterns can be used to increase soil moisture during Red Flag warnings to reduce the risk of homes igniting during a wildfire. We assumed that the additional "static" storage for Above-Ground Cisterns would generate community benefits through the value of property protected.*	**Community Benefits Quantification:**	*Fire risk reduction valuation equation:* *Median home value (per square foot) * square footage of home * % Fire Risk * % damage reduction from cistern * % building value damage avoided* *Where:* ● *Median home value = 2020 ACS 5-year estimates by Census Tract* ● *% Fire Risk = FEMA National Risk Index Fire Frequency by Census Tract* ● *% damage reduction attributed to cisterns/tanks = 10%, per FEMA standards* ● *% of building value damage avoided = 90%, estimate*

INFILTRATIVE BIORETENTION • *Engineered, vegetated runoff capture* • *Infiltration to native soils/aquifers*		Land Uses & Spatial Considerations:	*All Land Uses Considered* *All Regions Considered*
Opportunity Identification:	• *Bioretention opportunities on Residential parcels were identified using LARIAC land cover data to identify Bare Soil, Grass, or Tall Shrub Areas that could be converted without removing any functional impervious areas. Setbacks of 10 feet from property lines and 15 feet from building footprints were used to limit the potential areas in accordance with local guidance to avoid local drainage conflicts.* • *Similar considerations were applied for Commercial and Institutional parcels but an additional allowance was provided for these parcel types to account for the potential conversion of some existing impervious areas to Biofiltration areas due to the high prevalence of parking areas that could be partially repurposed to accommodate these installations. This additional accommodation was restricted to no more than 10% of the parcel's non-rooftop impervious area.*	**Contributing Runoff:**	• *All parcel impervious areas were considered to contribute runoff to Bioretention installations to maximize on-site capture.*
Sizing & Cost Calculation:	• *A standard design for bioretention installations was used based on L.A. County Design Guidance. This configuration features an engineered "cell" with 1' of ponding depth and 4' of engineered soil media/gravel with 0.4 porosity for an effective storage depth of 2.6'. This storage depth was used in conjunction with Bioretention footprint area to provide adequate storage volume to capture runoff up to the 85th percentile of runoff given available space. An infiltration rate of 0.57 in/hr was used as an average soil condition for these types of installations.*	**Costs Applied:**	***Capital Costs (residential from EPA, others from City of San Diego)*** • *Residential: average of typical ($1.91*footprint + $4,496.43) and complex ($5.64*sq.ft + $12,228.93) costs; typical installations are more simple vegetated depressional storage while complex represent more highly engineered installations* • *Institutional and private commercial: ($33.5 *sq.ft)* • *Public commercial: ($33.50*1.4*sq.ft)* ***O&M (ASCE EWRI Survey of BMP O&M Costs)*** • *Residential: capital costs * 0.01 * years* • *Institutional and private commercial: capital costs * 0.015 * years* • *Public commercial: footprint (sqft) * 0.98 * years*
Water Supply Benefits Derived:	• *Water Supply Benefits for Bioretention derive from captured runoff infiltrating and contributing to recoverable water supplies in underlying groundwater aquifers. Given the limited access to usable aquifers in the study area, these benefits were only counted for Bioretention projects located in the forebay area of Los Angeles. These benefits were valued at $966/ac-ft for Groundwater Recharge as used in the ARLA SCWP Working Group. We did not assume any irrigation demand offset benefits from bioretention.*	**Water Supply Quantification:**	● *Water Supply estimates were developed with continuous modeling of runoff directed to the Bioretention installations. Captured runoff was assumed to be infiltrated to the aquifer below for projects over the forebay region.*
Water Quality Benefits Derived:	• *Infiltrative bioretention removes pollutants from captured stormwater, generating water quality benefits. Pollutant removal was valued at $3,173 per pound of Zinc removed based on Earth Economics' monetization prepared for the ARLA SCWP Working Group.*	**Water Quality Quantification:**	• *Continuous modeling results from the L.A. County Department of Public Works' LSPC model were used for runoff capture estimates and are paired with pollutant timeseries'. Zinc loads carried by runoff captured in the modeling were summed to quantify this benefit for the Bioretention projects.*
Community Benefits Derived:	• *Bioretention projects were assumed to accommodate plantings of additional trees depending on the overall footprint which add canopy and associated benefits where these projects are installed. Different tree types and typical canopy spread were evaluated and analyzed to accommodate as many tree plantings as possible over the*	**Community Benefits Quantification:**	*The number of trees and area of canopy added for each Bioretention installation were quantified based on the following:* ● *Aesthetic Value: $120/tree* ● *Removal of Air Pollutants: $9/tree* ● *Carbon Sequestration: $18/tree*