STATE WATER BOARD AND THE WATER-ENERGY CLIMATE ACTION TEAM CLIMATE CHANGE SCOPING PLAN IMPLEMENTATION WORKSHOP MEASURE W-4: URBAN WATER REUSE

On June 17, 2009, the Water Board hosted a workshop on implementation of AB 32 Scoping Plan Measure W-4: Reuse Urban Water. This informational workshop examined strategies for the management of urban water including Low Impact Development, infiltration, capture, and storage. Additional workshops are planned over the next six months to assist the Board in determining what actions if any should be taken if any regarding development of policy, regulations or guidelines to assist with implementation of W-4.

Analysis Presented by Bob Wilkinson (UCSB) and by Noah Garrison (NRDC)
Results of an analysis conducted by Bob Wilkinson (UCSB) and by Noah Garrison (NRDC) indicate that low impact development (LID) could result in potential savings in urbanized southern California and the San Francisco Bay area by 2020 (and increasing thereafter):

- 120,000 to 220,000 acre-feet annually ---- water for approximately 1,000,000 people
- 325,000 to 660,000 megawatt-hours per year ---- electricity for more than 56,000 family homes per year
- 142,000 to 288,000 metric tons of CO2 equivalent/year ---- more than 52,000 cars off the road annually

The analysis included:

- Land use, existing percentage of impervious surface and projected development and rate
- Infiltration based on soil permeability (USDA A,B, or C only)
- Annual precipitation
- Groundwater use and recharge potential
- Analysis focused only on urbanized southern California and the San Francisco Bay area
- Assumes capture will harvest rainfall from rooftops only (40-60% surface in most urban sites)
- Land use did not include industrial, government, public use or transportation
- Accounts for areas of shallow groundwater and contaminated groundwater in assessing infiltration potential
- Accounts for evapotranspiration on infiltrate, but does not include loss for conveyance

Some issues considered and discussed include:

- The considerable covering of pervious soils with impervious surfaces, ex. Chino Basin since 1930's
- Impervious versus pervious surfaces and groundwater recharge
- Urban stormwater runoff pollution includes bacteria, heavy metals, pesticides, suspended solids, nutrients, and trash

Considering the overall mix of statewide of water supply sources:

- About 1/3 combined Colorado River, State Water Project, and Federal Water Project surface water
- About 1/3 local surface water projects

- About 1/3 groundwater supply

California's Water Plan lists urban water use efficiency and conjunctive use & groundwater recharge as the highest potential for increased additional annual water at 3.1/1.2 and 2.0/0.5 af-yr (high/low estimate), respectfully.

Energy use for water in California:

- 19 percent for electricity
- 33 percent natural gas (non-power plant)
- The highest energy intensity for water is for the SWP, followed by ocean desal, groundwater RO, and water reuse with RO is the least energy intensive

A number of LID elements were discussed to address stormwater capture and recharge including flood control-percolation basins (Montclair basins), infiltration islands, bioretention spaces, rain gardens, pervious surface cement and street cover, rain barrels and cisterns for rainfall harvesting.

The National Association of Home Builders supports LID as being able to simultaneously lower site infrastructure costs, protect the environment, increase a project's marketability through a variety of benefits, such as:

- Reduction in land clearing and grading costs
- Balancing the need for growth and environmental protection
- Protection of local land and water resources

Practical Considerations for Stormwater Harvesting and Use was presented by Eric Strecker, Geosyntec Consultants.

Effectiveness of stormwater best management practices are a function of:

- Runoff patterns
- Pollutant types and forms
- Storage volume/treatment rate
- Hydraulics of recovering storage
    - Deeper infiltration
    - Evapotranspiration
    - Harvest and use (irrigation/toilet flushing)
    - Draw-down/discharge rate
- Treatment process for released flows
    - Physical/biochemical (settling/adsorption, filtering, etc.)
- Operations and Maintenance

Factors affecting stormwater management in southern (and most all of) California

- Weather – timing of supply and demand of water an issue
    - Precipitation events arrive in clusters

        - High pressure ridge down, then series of storms until ridge re-established
        - High pressure ridge up – no of very little precipitation for long periods
- Most rainfall/runoff occurs in December/January/February/March
- Results
    - Makes harvest and use via irrigation difficult at best
    - Evaporation loss opportunities are limited as well
    - If infiltration rates slow, then infiltration value is limited

Case example – Pelican Hills Resort – Low Impact approach in southern California

Total project area almost 118 acres – part redevelopment (7 acres or impervious surface

- New tourist serving, fractionalized ownership condominiums
- New clubhouse and restaurant
- New hotel
- Client goals for water quality improvements and hydrology
    - No changes in hydrology (runoff volume or infiltration)
    - Show improvement in water quality
    - No irrigation runoff
- Initial proposal was for about 30 percent of site in 4 ft thick engineered soils biofiltration
    - Rejected by client
- Solution – install a series of 600,000 gallon subsurface cisterns and other LID features to reduce runoff
    - Water balance would be maintained for the project area with the planned 1.26 inch design depth cisterns and other reducing BMPs
    - Water quality was enhanced over existing conditions through drainage and runoff reduction improvements

Summary project outcomes

- Standard LID type controls may not be able to match pre-development surface hydrology
- Captured runoff replaced about 20 percent average annual reclaimed water use – there was no water demand reduction
- Suggested that improved guidance on LID Hydrology using appropriate hydrologic methods to look at surface and groundwater hydrology

General considerations for LID

- Retain onsite choices
    - Infiltrate
    - Evapotranspirate
    - Harvest and use
- Infiltration
    - Can You
    - Should you
    - Use care –
        - Moderate to steep slope stability

        - Depth to groundwater/liquefaction
        - Potential soil/groundwater contamination

Harvest and use (re-use)

- Key factors for successful harvest and use
    - Have a use for the water – irrigation, toilet flushing, process water
    - Be able to use the water – Code issues/human health
    - Be able to use water fast enough to recover storage (ie.e back-to-back storm events) so that subsequent stroms are captured and overall capture goals are met
    - Reclaimed water replacement – pros and cons

Stormwater capture/harvest and use

- Must drain tank relatively fast
- Irrigation uses are limited
    - Seasonal issues
    - “Zeroscaping” encouragement/requirements
    - Competition with reclaimed water
- Toilet flushing possible with high enough densities
    - Competition with reclaimed water
    - Low flush toilets
- Combine with gray water systems
        - Positives of using infrastructure better

Rainwater harvesting and reuse systems

- Impervious area
    - Roof tops
    - Driveways
    - Streets
- Stormwater conveyance and pretreatment
    - Pipes
    - Filters
- Storage
    - Cistern
    - Storage basin
    - Underground vault
- Treatment
    - UV treatment
    - Filtration
- Pumping and piping
    - Pipes back to house (purple)
- Indoor use and irrigation
    - Toilet flushing
    - Yard and garden irrigation

Summary/Recommendations

- Infiltration in general is not broadly feasible, effective and/or desirable (maximize where appropriate – i.e. Central Valley, Inland Empire)
- Harvest and use of runoff due to runoff patterns and ET potential has limited applications where it can be effective (should be considered for where it is effective – i.e. Pelican Resort)
- There needs to be more technical vetting of retain onsite and stormwater harvest/use before these approaches are made mandatory or otherwise pursued

Neal Shapiro, City of Santa Monica, provided a presentation on the Sustainable City Plan for water resources management.

Objectives

- Harvest urban runoff (dry/wet weather) for reuse (recharge or direct use) and pollution treatment
- Treat all dry weather and some wet weather urban runoff leaving the City
- Connect land use/design to the Hydrologic Cycle, reducing the disconnect and disruption of water flow
- Mimic nature; blend into the land
- Take proactive, watershed approach to reducing urban runoff problems
- Convert a perceived "waste" into a valuable resource for reuse – SMURRF, Cisterns

Hierarchy of treatment – point of "reuse" versus "use" (first time use)

- Collect, treat and **(RE)USE**
- Dry weather – **REUSE**; second time use since dry weather runoff is wasted water already used once, i.e. irrigation runoff, hosing of hardscapes, washing cars, draining pools, etc.
- Wet weather – **USE**; first time use of harvested rain water in place of potable water. Collect, treat and infiltrate (latter polishes the treated runoff)

Water Quality

- As hardscapes increase, water quality goes down

LID strategies

- Turn impermeable to permeable

Ordinance

- Urban Runoff Pollution Mitigation Code. 7.10 SMMC
- Post-construction BMPs
- LID Focus
- Harvest up to ¾" storm event
- All land uses
- Retrofits, new and re-development

Treatment – public projects – city is fully built-out

- New & Retrofits in built out city, worse case
- Infiltration fields
- Porous surfaces
- Filtering
- Rainwater Harvesting & Use

Types of public projects

- Onsite natural infiltration/filtration
- Onsite retention
- Permeable paving and concrete
- Modular wetlands, infiltration islands, underground cisterns and vaults

Treatment – private properties

- Infiltration fields
- Permeable surfaces
- Rainwater storage and use

Types of private projects

- Onsite natural infiltration/filtration
- Onsite retention
- Permeable paving and concrete
- Infiltration BMPs, eco-rain boxes, infiltration pits, RainStore storm cell, infiltration galleries, Cultec Rechargers, Atlantis tanks, KriStar CUDO Modular Tanks, Brentwood Industries Storm Tank
- Rain Barrel Pilot Program – disconnect or redirect
- Green roofs and pavers

Santa Monica Urban Runoff Recycling Facility – purpose/metrics

- Reuse a local water resource
- Keep a pollution source out of Santa Monica Bay
- Reduce imported water supplies & impacts on other watersheds
- Open, walk-through facility to educate the public
- Up to 500,000 gallons/day, average is 325,000
- 3% of City's daily water use
- $12 Million
- $175,000 O&M

Santa Monica Urban Runoff Recycling Facility – treatment train

- Rotating drum screen and grit chamber – removes trash, grit, suspended solids
- Dissolved air flotation – removes oil & grease
- Microfiltration – reduces turbidity
- UV radiation channel – disinfection

Water quality and nomenclature/technology

- Lack of legal/regulatory guidelines for LID and treatment recommendations
- Santa Monica working with City of LA to develop

Richard Boon, County of Orange, spoke about Urban Water Reuse in Orange County, California.

There are four interrelated but separable effects of land-use changes on the hydrology of an area

- Changes in peak flow characteristics
- Changes in total runoff
- Changes in quality of water
- Changes in the hydrologic amenities
    - Luna Leopold 1968

Beneficial uses of urban runoff

- Regional
  - Water supply – managed aquifer recharge
  - Irrigation water supply – urban runoff recovery
  - Environmental amenity – habitat creation
- Site level
  - Project aesthetics & economics – LID project

Water Supply - Orange County - Starting in 1936 OCWD began purchasing sections of the Santa Ana River for recharge. System currently comprises 1600 Acres including:

- 6 Miles of Santa Ana River
- 22 Recharge Basins
- Annual Recharge averages 250,000 AFY
- Storage Capacity = 26,000 AF
- Two inflatable rubber dams on SAR
- Deflated to allow flood flows in river
- Inflated to capture flows for groundwater recharge
- Rubber dams allow OCWD to divert flows from the river immediately after peak storm flows subside
- Dams allow up to 1,000 cfs of diversion
- OCWD recharges 100% of the baseflow of the SAR
- Benefits
  - Water Supply- Capture 50,000 AFY of stormwater
  - Wildlife Habitat
  - Recreational Amenity

Irrigation Water Supply

- South Coast Water District
  - Aliso Creek Urban Recovery, Reuse, and Conservation Project
  - Proposes capture of ~800,000 gpd from Aliso Creek
  - 1.5 miles from confluence with Pacific Ocean.
  - Benefits
    - Increase and improve recycled water supply
    - Improve Aliso Creek Beach and Recreation Area
    - (Diverts 1.23 cfs of dry season flow)
    - Help restore Aliso Creek to Natural Condition
  - Status
    - Derailed by legal challenge – water rights issue – too much dry weather flow
- Santa Margarita Water District
  - Urban Runoff Diversions
    - Oso Creek Barrier : 1120 AF
    - Horno Creek: 322 AF
    - Dove Canyon: 200 AF
  - Benefits
    - Provides 1642 acre-feet annually for irrigation
    - Protects sensitive ecological habitat (e.g. Starr Ranch)

Environmental Amenity

- City of Costa Mesa (USACOE, OCFCD & County of Orange project partners)

- Fairview Park Wetlands & Riparian Habitat Project
- Benefits
  - Enhance Habitat Diversity in the Park
  - Restore Historic Habitat Types of the Santa Ana River
  - Increase Water Quality of Wet and Dry Season Runoff
  - Diversify Recreation Within Open Green Space
  - Trails
  - Wildlife Experience

Project aesthetics and economics

- LAB Holding LLC, Costa Mesa
  - The "Camp" shopping center – 4 acres – 5500 sq-ft structures
  - Zero groundwater discharge site - shallow
  - Green roof

Summary/Observations

- There is a need for both new visions of highly modified urban watersheds and opportunities for local stakeholders to invigorate Basin Planning
- Agencies are struggling to develop appropriate strategies to address non-point solution and urban runoff (esp. quantity) in particular
- Regional approaches that offer equivalent benefits should not be eschewed in favor of site-by-site approaches

Mark Hanna, LADWP and Rebecca Drayse, Tree People, discussed the LADWP-Tree People joint urban water reuse partnership project on stormwater as a supply opportunity.

Series of local and regional demonstration projects are being done under the partnership

- Residential demonstration site includes
  - Cisterns – rainwater storage for irrigation with 3600 gallon capacity
  - Mulched swales
  - Retention grading
  - Driveway drywell
  - Lawns are bermed and downspots diverted
- LADWP well site lots
  - Plans for stormwater capture and recharge at all these sites
- Broadous and Open Charter Elementary Schools
  - Runoff captured, filtered, infiltrated through new landscaping and subsurface structures
  - Increase in recharge, reduced runoff
- LADWP Power Line Easements
  - Landscaping and runoff capture design to recharge approximately 100 ac-ft/yr within selected alignments
- North Hollywood Alley Retrofits
  - Replacing with permeable asphalt – projecting 30ac-ft/yr within each of four alley segments
- Median retrofits
  - Replace heat island concrete median with landscaped runoff capture swale – 80 ac-ft/yr

- Tree People Center for Community Forestry
    - Re-landscaping for runoff capture and recharge
    - Subsurface filter, storage and infiltration structure
    - Sand box for infiltration
    - Rain barrels for rooftop rainfall harvesting
- Sun Valley Watershed Multi-Stakeholder Project
    - Porous Pavement
    - Mulching
    - Industrial and residential cisterns and drywells
    - Retention basins/parks
    - Strategic tree planting
    - Infiltration sports fields
    - Stormwater capture BMPs on 20-40 percent of individual properties
- Large-scale groundwater recharge
    - Big Tujunga Dam – increase capacity by 4,500 ac-ft/yr
    - Tujunga Spreading Grounds – increase by 8,000 ac-ft/yr
    - Hansen Spreading Grounds – increase by 1,500 ac-ft/yr
    - Pacoima Spreading Grounds – increase capacity by 2,000 ac-ft/yr
    - Shelton-Arleta Project – increase by 4,000 ac-ft/yr
    - Valley Generating Station – increase by 500 ac-ft/yr
    - Lopez Spreading Grounds – increase by 500 ac-ft/yr
- Water Augmentation Study
    - Research questions
        - Impact on groundwater quality and quantity
        - Accessibility of recharged water
        - Cost effectiveness
        - Other potential benefits: social, economic, environmental
        - Potential for region-wide implementation
    - Monitoring results – eight years of data
        - Infiltration Did Not Negatively Impact Groundwater
        - Concentrations in groundwater did not correspond to stormwater concentrations
        - Groundwater quality is stable or improved for most constituents at sites with shallow groundwater
        - Bacteria: removed by soil
        - VOCs: no impacts detected in groundwater
        - Inorganic groundwater constituents show no or decreasing trends in concentrations
    - Lessons learned
        - Determine early on who will bear maintenance and other responsibilities that remain after construction is complete
        - Extended timelines needed for partnership agreements
        - Documentation and communication protocols to avoid loss of project and institutional memory during inevitable staff turnover

        - Establish wide-ranging support at all relevant levels of staff at the partnering organizations – including maintenance staff
        - Memorialize the project with onsite interpretation if possible
        - Be sure that an accurate maintenance manual and protocols are documented and understood
        - Baseline monitoring is important so results can be shared
        - Involve appropriate regulatory agencies during design phase

Next Steps

- A "PBMP" at the CUWCC
- Draft Guidelines for Cistern Water
    - ARCSA and IAPMO
        - Who owns purple pipe?
- Programs and incentives
    - LADWP Turf Buy Back Program
    - City of LA Rainwater Harvesting pilot program
    - Green Streets Initiative
    - Retrofitting publicly owned land--LADWP undertaking
    - MWD-IRP – investigating stormwater incentives
- Examples Leading the way
    - Texas and Arizona
    - City of Santa Monica
    - San Francisco Public Utilities

Using Public spaces for Infiltration was the subject of the presentation by Esther Feldman, which focused on the Green Solution Project, Community Conservancy International.

- The Problem
    - Polluted runoff endangers beaches, rivers, lakes, bays, and ocean waters
- CCI'S Solution
    - Create a network of green open space - parks, habitat and recreation lands -that will allow soil and plants to naturally capture, filter and clean polluted runoff while creating badly-needed new park, habitat and open space lands
- About the Problem
    - Water pollution from contaminated runoff plagues Bays, ocean waters, beaches, lakes, rivers and streams throughout California – and many are in violation of state and federal water quality standards
    - Pollutants flow daily directly to our most precious waters – without treatment of any kind
    - This polluted runoff endangers human health and marine and aquatic life and threatens ocean waters worldwide
    - In Los Angeles County, nearly 100 pollutants threaten over 500 miles of rivers and streams, both San Pedro and Santa Monica Bays, and the county's world-renowned beaches
- Why has polluted runoff become such a serious problem?

    - More than a century of growth and development has drastically changed the natural function of rivers and watersheds, and paved thousands of square miles with concrete and asphalt
    - These non-porous surfaces can't absorb or filter water the way soil and natural lands do
    - And to make matters worse, our yards, landscaping, businesses, industry and parking lots create "runoff" – pollutant-laden water that flows daily, even in dry weather, directly into drainage systems and into our rivers, beaches, bays and ocean. When it rains, the problem only gets worse
- About CCI's Solution
    - Community Conservancy International's Green Solution changes long-held assumptions about the lack of available land for green approaches to increasingly urgent water quality problems caused by polluted runoff
    - The Green Solution Project pioneers a creative and practical approach by focusing on unpaving concrete and impervious areas and retrofitting porous areas on existing public lands, so that these lands can act as natural filters while also providing important park, habitat and other green open space
    - The Green Solution approach can be implemented in any area suffering from polluted runoff problems
    - As ocean pollution continues to grow, improving water quality by proactively filtering and cleaning up pollutants before they can reach our rivers, bays and ocean becomes ever more important
- CCI's Green Solution Findings in L.A. County
    - In Los Angeles County, the CCI team found that up to 20,000 acres on 10,000 parcels of existing public lands are suitable for conversion and retrofit from paved, non-porous surfaces to innovative, multiple-benefit Green Solution Projects in all watersheds of the county
    - Transforming these lands to a network of new, green open space lands that can naturally capture, filter and clean polluted runoff would address nearly 40% of the county's polluted runoff problem that can be dealt with by Green Solutions – while also creating badly-needed park, habitat and other green open space amenities
- Available in the report at www.ccint.org/greensolution.html

Eric Berntsen, SWRCB staff and licensed landscape designer, provided a presentation on Water Friendly Landscaping.

- Overview of the hydrologic cycle
- California is a dry state, where generally speaking, ET exceeds annual precipitation, and a water distribution system that relies heavily on snowmelt runoff
- 50-70 percent per capita water use is devoted to landscape irrigation – we can shift the balance by
    - Keeping more rainwater onsite (rainfall harvesting)
    - Create landscapes that require less water
    - Improve irrigation system efficiency

- Benefits of rainfall harvesting
  - Minimize pollution and provide source control
  - Keep clean rainwater from coming in contact with polluted surfaces (driveways, roads, etc.).
  - Supplement dwindling water supplies
  - Create/use supply of free irrigation water that is better for plants (no salt, contains sulfur, lacks calcium carbonate and magnesium – "soft")
- Doing rainfall harvesting elsewhere
  - Australia
  - Malaysia
  - Germany
  - City of Tucson
  - City of Santa Fe
  - Case studies presented at this workshop
- Eight principles of successful rainfall harvesting
  - Begin with long and thoughtful observation
  - Start at the top of your watershed (usually the roof) and work your way down
  - Start small and simple
  - Spread and infiltrate the flow of water
  - Always plan an overflow route, and manage that overflow as a resource
  - Maximize living and organic groundcover
  - Maximize beneficial relationships and efficiency by "stacking functions"
  - Continuously reassess your system: the "feedback loop"
- Rain Gardens http://learningstore.uwex.edu/pdf/GWQ037.pdf
  - Three Questions

    Where do I put the rain garden?
    - At least 10 feet away from foundation, not over septic, etc

    How big to I make it?
    - Depends on soils, area draining to it, depth, and slope
    - Need to provide berm

    What do I plant it with?
    - Larger gardens can support more diversity
    - Must use plants that are moisture tolerant (e.g., *Carex barbarae*)
    - Larger gardens can accommodate more diversity
- Lawn is the largest irrigated "crop" in the US
- Lawn/turf is usually the most water intensive feature of landscape
  - DWR Model Landscape Ordinance
  - Some jurisdictions offering "cash for grass" to conserve water (incentives are good)
    - Marin County
    - Placer County
    - City of Roseville
- We tend to overwater our landscapes
  - Stresses plants – makes them more prone to disease
  - Usually then break our non-selective pesticides
- Irrigation efficiency
  - Group plants together with similar water needs (hydrozones)

        - Species factor (WUCOLS)
    - Match precipitation rates
        - Fixed spray sprinklers – 1.8 inch/hr
        - Point source drip – 0.35 inch/hr
    - Irrigate according to water budget
        - Run time depends on
        - Reference Et (CIMIS)
        - Species factor (WUCOLS)
        - Precipitation rate (Manufacturer)
        - Distribution efficiency (catch can for overhead sprinklers, drip = 0.9)
    - Make seasonal adjustments
        - Cheap option – use % water function on timer, June/July peak Et
        - More expensive option – Et and soil moisture based timers (Rebates!!)

Declining Rainwater Recharge in the Chino Basin was the subject of the presentation by Mark Wildermuth, Wildermuth Environmental.

- Overview of discussion included
    - Impact of Urbanization on storm water recharge to the Chino Basin
    - Implication to other Basins that are managed to a "safe" yield
    - Chino Basin parties response to projected decline in yield
    - GHG emissions associated with the loss in storm water recharge
- From 1920-2000 impervious surface cover increased dramatically in the Chino Basin
    - Result was loss of 80,000 ac-ft/yr recharge
    - Went from 140,000 ac-ft/yr recharge down to 60,000 ac-ft/yr
- Channel lining of all creeks and major irrigation drainages occurred in the last half of the 1900's
    - Loss of 30,000 ac-ft/yr recharge from channel lining alone in upper watershed
- Implications for the watershed and beyond - water supply reliability
    - Land use and drainage decisions have resulted in reduced groundwater recharge
    - Stormwater recharge in Chino Basin declined by 14,000 acre-ft/yr
    - Stormwater recharge in the Upper Watershed has probably declined by ~ 30,000 acre-ft/yr
    - Groundwater yields are declining – more imported water is required to meet existing and future demands
- Implications for the watershed and beyond - additional GHG emissions
    - For Chino Basin, flood control decisions that have lead to reduced storm water recharge will cause a discharge of about 37,000 metric tons of CO_2 per year
    - For the Upper Watershed, flood control decisions that have lead to reduced storm water recharge will cause a discharge of about 79,000 metric tons of CO_2 per year
- Implications for the watershed and beyond – potential for GHG emissions reduction
    - Chino Basin Recharge Master Plan (July 2010)
    - Tentative goal is to increase storm water recharge by an average of 20,000 acre-ft/yr through combination of local and regional improvements
    - Achieving this goal will more than offset the loss due to channelization

Darla Iglis, Low Impact Development Organization, provided a presentation on optimizing environmental benefits with LID.

- Presentation Focus
  - Current drivers for municipal project selection
  - How broader environmental benefits can be incorporated into municipal alternative analysis
    - Comprehensive accounting of environmental benefit
    - Use of whole-life cycle, triple bottom line project assessment
  - What is a sustainable stormwater design?
- History of stormwater management
  - Protection of public health and property
  - Water quality and peak flow management
  - Decentralized stormwater management – LID is a tool
- What is LID
  - Performance and technology based = environmental effectiveness and economic efficiency
- LID is able to address multiple environmental objectives
  - Stormwater &LID
  - Water supply
  - Groundwater
  - Wastewater
  - Climate change
  - Energy
- Municipal perspective – what are the current drivers that initiate municipal projects
  - Local government – customer service
    - Flood protection, water quality, road improvements
  - Private sector – economics
- How can municipalities start integrating broader environmental benefits when evaluating project options?
- Swale on Yale water quality project evaluation – Seattle Washington
  - Incorporated economic, environmental, and social factors in a whole life cycle cost-benefit analysis
  - Documented benefits and risks for a variety of considerations an d factors
    - Human health and aquatic life - solids, metals, nutrients, oil and grease removal, organics and temperature
    - Contact recreation with fecal coliform and trash
    - Ancillary benefits to environment, community, parks, utilities
  - Learned from the project that as project options are developed there is a need to think about the spectrum of environmental benefits and how to quantify those benefits
- Energy efficient parking lot
  - Groundwater recharge
  - Nitrogen loading reduction
  - Heat island effect reduction
  - Lighting and electrical needs reduction – GHG reduced
  - Greener community created

Eileen Takata, California Resource Connections, Inc. gave a brief presentation on the Inland Empire Sustainable Watershed.

- Inland Empire Sustainable Watershed received a capacity building CALFED grant for
  - Watershed management atlas
  - Green places map
  - Model land use ordinance
  - Green development initiative
  - Watershed forums
- Planning team included
  - Cal State San Bernardino Water Resources Institute
  - GreenInfo Network
  - Connective Issue
  - Cal Poly Pomona
  - NPS Rivers, Trails, and Conservation Assistance program
- Vision – an integrated general plan
  - Watershed
    - Stormwater harvesting for urban water reuse
    - Water quality improvement
    - Peak flow attenuation
    - Open space/floodplain protection
  - Urban Planning/transportation
    - Thriving mixed-use districts
    - Infill development
    - Transit oriented development
    - Walkable/bikeable communities
    - Alternative transportation
  - Sustainability
    - Zero carbon/zero waste developments
    - Green buildings
    - Water-efficient landscapes
    - Local food production
- Designing with Nature
- Suitability mapping process – groundwater recharge suitability
  - First order maps/base maps
    - Groundwater basins
    - Geology
    - Soils
    - Topography
    - Land use
  - Second order maps/analysis
    - Depth to basin floor
    - Porosity
    - Absorption
    - Slope (and aspect)
    - Impervious surfaces

        - Third order maps/suitability maps
            - Groundwater recharge suitability
                - Low
                - Medium
                - High
- Land classification units – map hazards and beneficial uses on a landform alluvial fan example
    - Alluvial fan flooding hazards
        - Active
        - Active infrequent
        - Not active
    - Other hazards on alluvial fan
        - Fire risk
        - Seismic activity
        - Liquefaction
        - Landslides
    - Beneficial values on alluvial fan
        - Recharge zones
        - Ecologically valuable
        - Mineral resources
        - Recreation
- Watershed integration at all levels
    - General Plan
    - Master plans, specific plans & strategies
    - City codes, ordinances, and operations
- How we develop matters – can impact or enhance environment
    - Water supply
    - Habitat
    - Climate
    - Open space and recreation
    - Transportation
    - Human quality of life
- Santa River Watershed
    - Faults & alluvial soils – faulting creates steep mountains, while intense episodic storms deposit sediment creating a vast alluvial plain
    - Aquifers & faults – 22 aquifers partitioned by faulting and geologic structure store groundwater used for public water supply
    - Aquifers/water supply – 63 percent more water is extracted than recharged, leading to a future of external water dependence
    - Water resource management – only clean water should enter the river to preserve regional dirking water quality
    - Impacted water resources – includes pathogens, nutrients, metals, coliform, salinity
    - Critical resource conservation – preserving the areas identified will help ensure long-term water quality and security

Workshop wrap up and discussion was led by Francis-Spivey Weber, SWRCB Vice Chair.

- Doug Kirk with the Green Plummers made a few announcements
- Solar panels/heat island reduction – solar versus green roof – how to do metrics on quantifying benefits and metrics for GHG redcutions
- Need to come up with ways to quantify GHG reductions from LID
- Looking for projects/pilots
- Decision-making tools lacking to qualify/quantify GHG reductions
- Gray water
- Ordinance to define should include vegetation, not just subsurface
- Building/state code is on private property and outside is public infrastructure
- State/IAPMO working on revisions to gray water code
- Stormwater recharge – nothing really in code – San Francisco came up with an MOU to deal with
- Performance measures are needed for stormwater management