
Low Impact
Development &
Hydromodification
Changing the Standards
for Development
WGR

Why LID ?

Massive Fishkill in Stockton Port attributed to lack of dissolved oxygen

November 6, 2008 -- On Tuesday, one of CSPA's readers, Mitch Yturri, reported to CSPA that a massive fish kill had occurred in the City of Stockton's port and turning basin. Several news media people were notified because of his efforts, one of these, KCRA, Channel 3, Sacramento.

KCRA followed up with a story on the Thursday night 6:30 edition of the news where they reported that the suspected culprit in the die off was a lack of dissolved oxygen in the port area. The only fish affected were millions of Threadfin Shad. No other fish were seen in the rotting mass of carcasses when film crews arrived on Thursday.

KCRA interviewed City of Stockton personnel who reported a chronic problem with dissolved oxygen levels in that portion of the port. They suspect that the recent rains increased turbidity in the already oxygen poor water, causing the die off. DFG is investigating the die-off but has given no reason for the fish deaths as of this time.

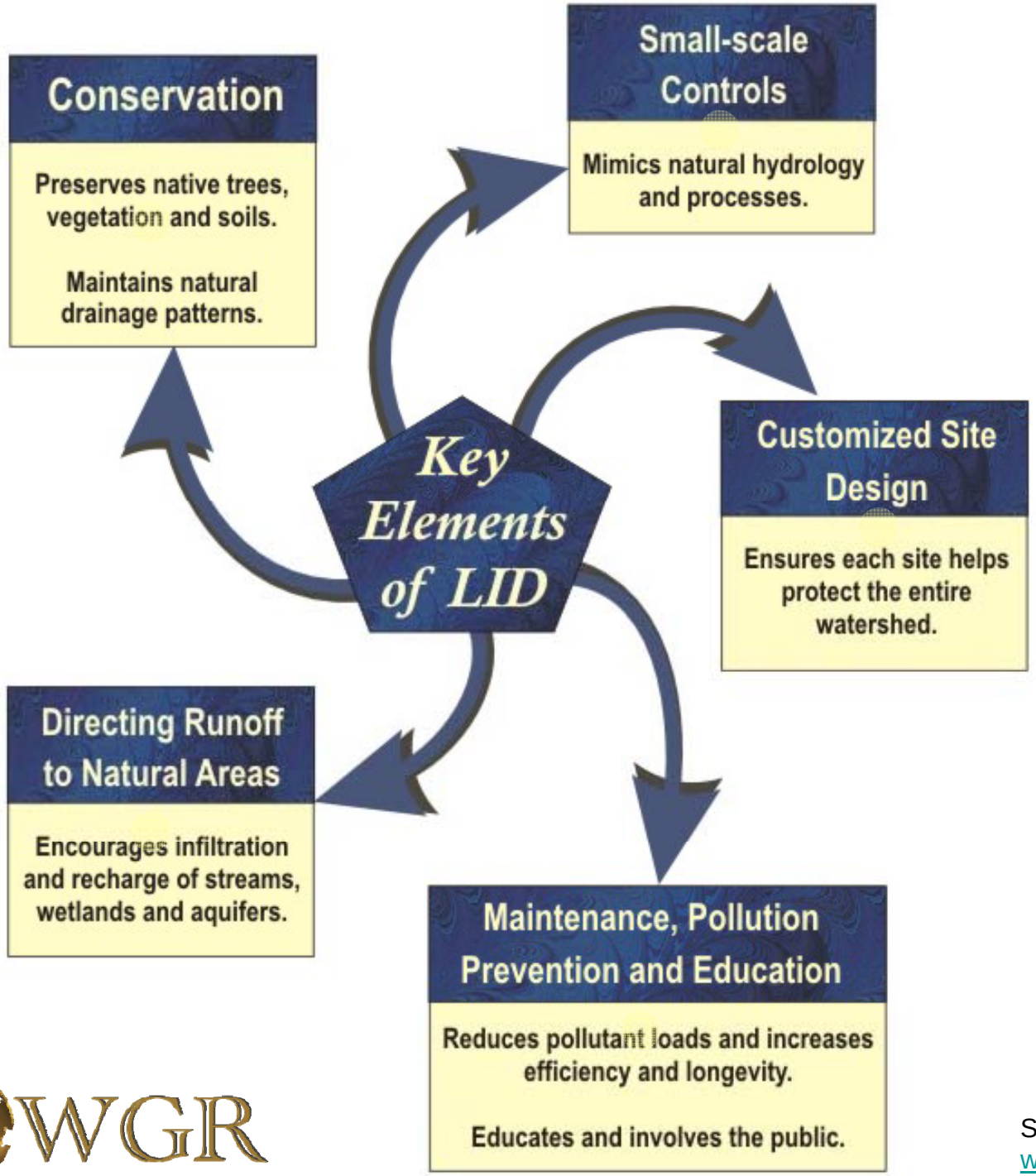
Two new standards are changing the face of development …

- **Low Impact Development**
- **Hydromodification**

Low Impact Development

Low Impact Development (LID) is an approach to land development that uses various land planning and design practices and technologies to simultaneously conserve and protect natural resource systems and reduce infrastructure costs. LID still allows land to be developed, but in a cost-effective manner that helps mitigate potential environmental impacts.

Source: The Practice of Low Impact Development; Prepared for: U.S. Department of Housing and Urban Development, Office of Policy Development and Research, Washington, D.C.



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Source:
www.lowimpactdevelopment.org

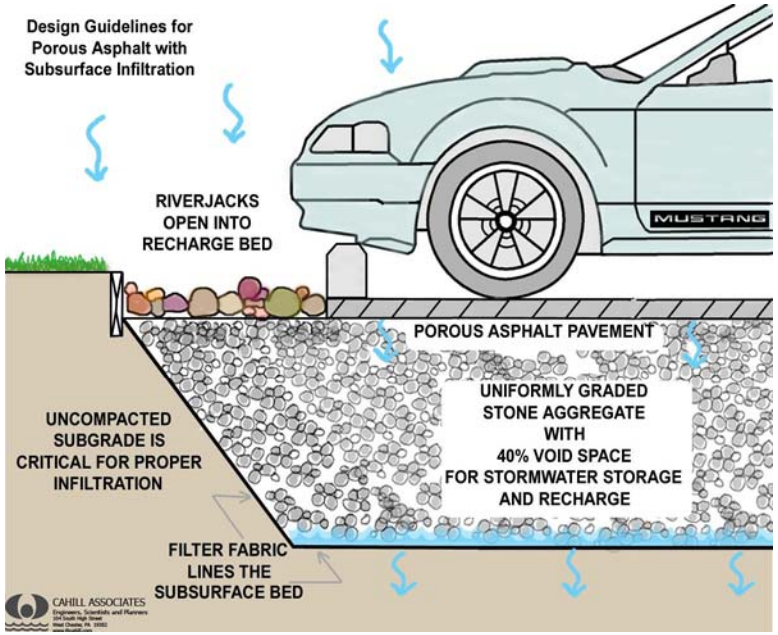
Three LID tools …

- **Infiltration**
- **Bioretention**
- **Phytoremediation**

Infiltration

Design features that allow storm water to infiltrate into the subsurface …

An example of an infiltration system is porous pavement.



Infiltration

Hemisfair Park
San Antonio, TX

Infiltration

Hemisfair Park
San Antonio, TX

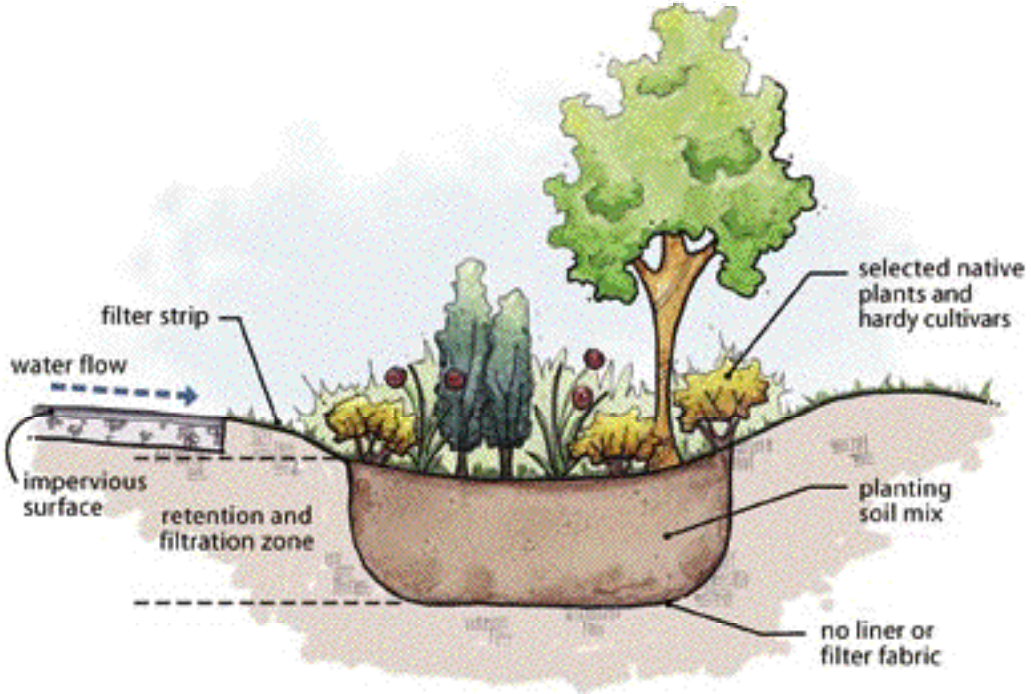
Infiltration

Hemisfair Park
San Antonio, TX

Bioretention

Design features that capture and hold storm water in “natural” areas …

Many times bioretention is incorporated into landscaping.

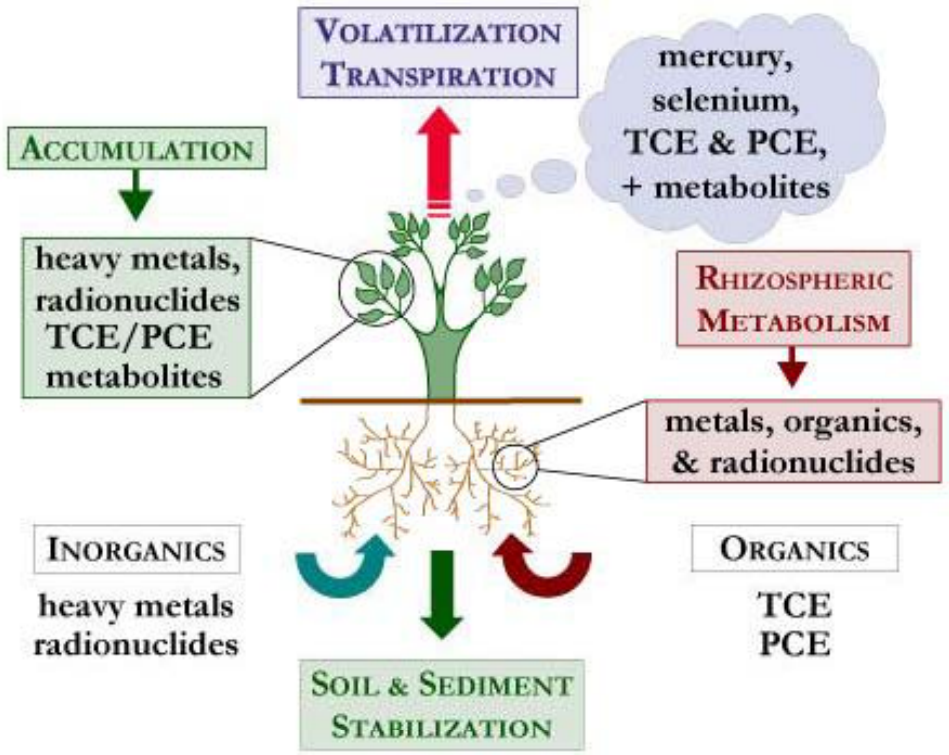


Bioretention

Retention Basin
Houston, TX

Phytoremediation

"Soils frequently receive a wide range of contaminants from industrial activities, sewage sludge disposal, metal processing, and energy production, and in many cases remediation is both expensive and intrusive to the ecosystem. Phytoremediation is the use of plants and plant processes to remove, degrade, or render harmless hazardous materials present in the soil or groundwater. This emerging technology may offer a cost-effective, non-intrusive, and safe alternative to conventional soil cleanup techniques by using the ability of certain tree, shrub, and grass species to remove, degrade, or immobilize harmful chemicals from the soil."



Source: University of Georgia Savannah River Ecology Laboratory http://www.uga.edu/srel/Snapshots/phytoremediation.htm

Phytoremediation

Phytoremediation can include aspects of three different processes:

Phytovolatilization – uptake of contaminants through roots and released through leaves as a detoxified vapor

Phytoaccumulation / extraction – uptake of contaminants through roots and deposits them in leaves

Phytodegradation – breakdown or metabolism of contaminants into non-toxic components

Phytostabilization – reducing contaminant movement or availability; hydraulic pumping.

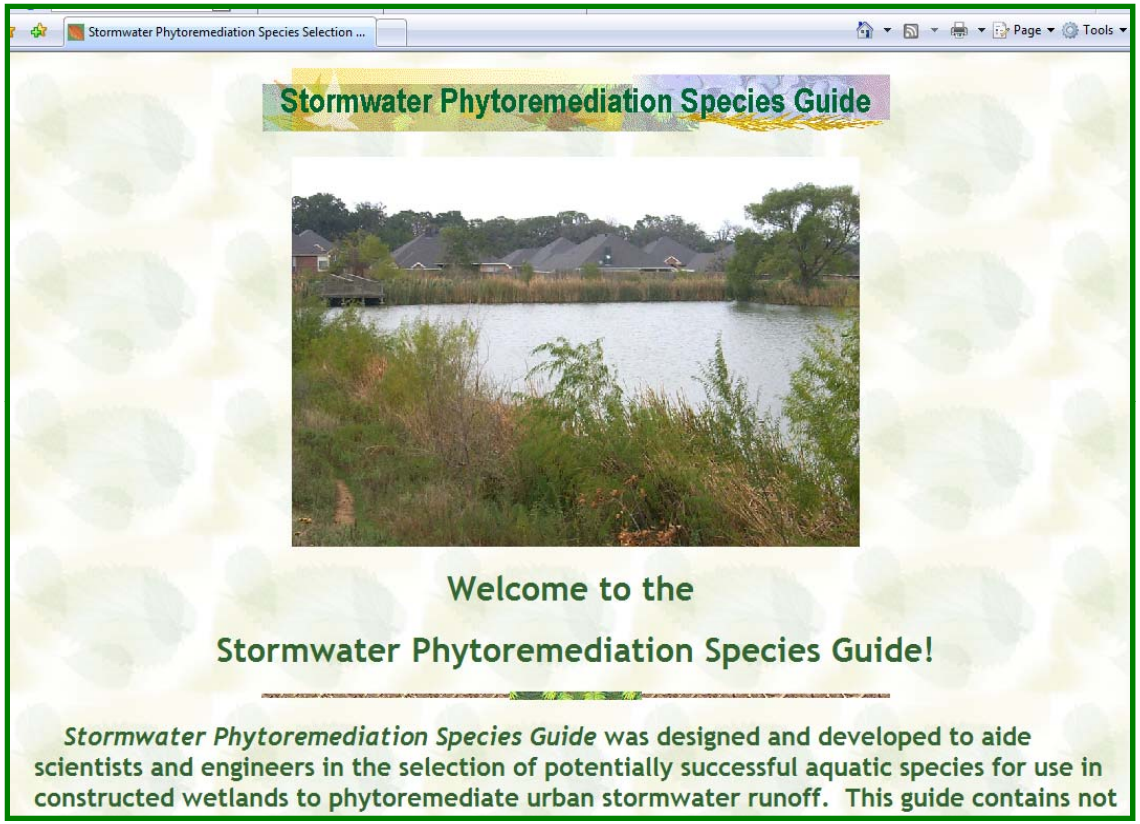
Source: University of Georgia Savannah River Ecology Laboratory http://www.uga.edu/srel/Snapshots/phytoremediation.htm

Source: http://www.envirotools.org/factsheets/phytoremediation.shtml

Phytoremediation

Application	Contaminants	Typical Plants
1.Phytovolatization	Herbicides (atrazine, alachlor); Aromatics (BTEX); Chlorinated aliphatics (TCE); Nutrients; Ammunition wastes (TNT, RDX)	Phreatophyte trees (poplar, willow, cottonwood, aspen); Grasses (rye, Bermuda, sorghum, fescue); Legumes (clover, alfalfa, cowpeas)
2.Microorganism stimulation	Organic contaminants (pesticides aromatic, and polynuclear aromatic hydrocarbons	Phenolics releasers (mulberry, apple, osage orange); Grasses with fibrous roots (rye, fescue, bermuda); Aquatic plants for sediments
3.Phytostabilization	Metals (Pb, Cd, Zn, As, Cu, Cr, Se, U), Hydrophobic Organics (PAH, PCB, DDT, dieldrin)	Phreatophyte trees to transpire large amounts of water (hydraulic control); Grasses to stabalize soil erosion; Dense root systems are needed to sorb/bind contaminants
4.Phytoaccumulation/ extraction	Metals (Pb, Cd, Zn, As, Cu, Cr, Se, U) with EDTA addition for Pb and Selenium	Sunflowers; Indian Mustard; Rape seed plants; Barley, Hops; Crucifers; Serpentine plants; Nettles, dandelions
5.Degradation	Herbicides (atrazine, alachlor); Aromatics (BTEX); Chlorinated aliphatics (TCE); Nutrients; Ammunition wastes (TNT, RDX)	Phreatophyte trees (poplar, willow, cottonwood, aspen); Grasses (rye, Bermuda, sorghum, fescue); Legumes (clover, alfalfa, cowpeas)

Phytoremediation



http://rydberg.biology.colostate.edu/Phytoremediation/2003/Knuth/home.htm

Hydromodification

Is the change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive stream bank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Source: California State Regional Water Quality Control Board, Central Valley Region

Hydromodification Goal

Peak flow rate before development

Hydromodification Goal

Equals peak flow rate after development

Hydromodification Goal

Phase II MS4 Permit

e. **Post-Construction Storm Water Management in New Development and Redevelopment**
The Permittee must:

1) Develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the Small MS4 by ensuring that controls are in place that would prevent or minimize water quality impacts;

2) Develop and implement strategies, which include a combination of structural and/or non-structural BMPs appropriate for your community;

3) Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State or local law For those Small MS4s described in Supplemental Provision E below, the requirements must at least include the design standards contained in Attachment 4 of this General Permit or a functionally equivalent program that is acceptable to the appropriate RWQCB; and

4) Ensure adequate long-term operation and maintenance of BMPs.

Hydromodification Goal

Phase II MS4 Permit

E. SUPPLEMENTAL PROVISIONS

Those regulated traditional and non-traditional Small MS4s serving a population over 50,000 or that are subject to high growth (at least 25 percent over ten years) must comply with the requirements in Attachment 4 of this General Permit. Compliance is required upon full implementation of the Small MS4s' storm water management plan.

Attachment 5 provides a list of communities that SWRCB anticipates being subject to the provisions in Attachment 4.

Hydromodification Goal

Phase II MS4 Permit

2. Design Standards Applicable to All Categories

   a. Peak Storm Water Runoff Discharge Rates
   Post-development peak storm water runoff discharge rates shall not exceed the estimated pre-development rate for developments where the increased peak storm water discharge rate will result in increased potential for downstream erosion.

   b. Conserve Natural Areas
   If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

      1) Concentrate or cluster Development on portions of a site while leaving the remaining land in a natural undisturbed condition.
      2) Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
      3) Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

      4) Promote natural vegetation by using parking lot islands and other landscaped areas.
      5) Preserve riparian areas and wetlands.

Hydromodification

May apply to …

- **Regional Watersheds**
- **Micro Watersheds (your project)**

Let's talk about your project …

What are some ways you can hydromod your project ?

- Disconnect roof drains

Roof Drain Options

Hemisfair Park
San Antonio, TX

Roof Drain Options

Hemisfair Park
San Antonio, TX

Roof Drain Options

Henry B. Gonzalez Convention Center
San Antonio, TX

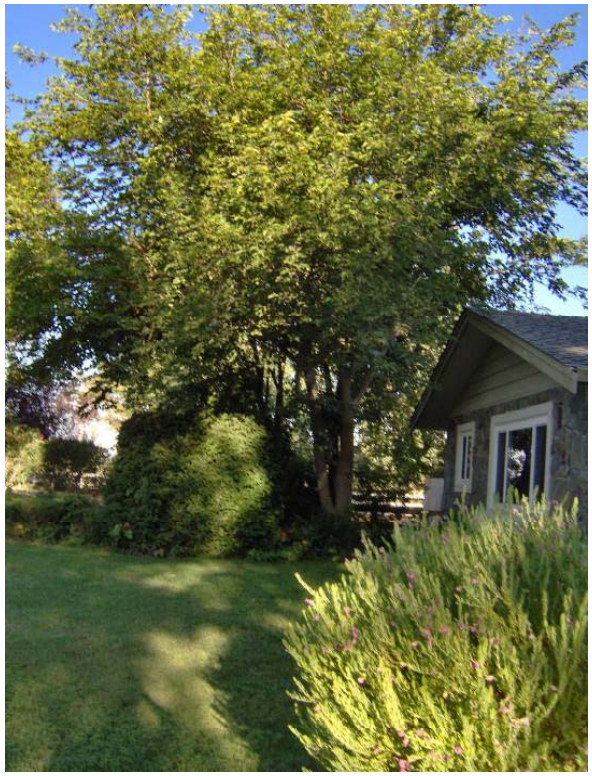
Roof Drain Options

Las Cruces, NM

Let's talk about your project …

What are some ways you can hydromod your project ?

- Disconnect roof drains
- Plant trees



Let's talk about your project …

What are some ways you can hydromod your project ?

- Disconnect roof drains
- Plant trees
- Conserve natural areas

Let's talk about your project …

What are some ways you can hydromod your project ?

- Disconnect roof drains
- Plant trees
- Conserve natural areas
- Use good LID Practices

Local LID Resources …

California State Water Resources Board LID Webpage
http://www.waterboards.ca.gov/water_issues/programs/low_impact_development/

UC Davis Extension – Center for Water and Land Use
http://extension.ucdavis.edu/unit/center_for_water_and_land_use/index.asp

Technical Paper on Phytoremediation of Heavy Metals in Wastewater in the Central Valley
http://isebindia.com/icpep-3/icpep3-s-8.html

UC Berkley, Dr. Norman Terry's Website on Phytoremediation Research
http://plantbio.berkeley.edu/~terry/index.html

UC Cooperative Extension – San Joaquin County Master Gardeners Program
http://sjmastergardeners.ucdavis.edu/index.cfm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Hydromodification
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For more information or help with your storm water project, contact …

WGR

… not your typical consultant

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Storm Water Video Contest

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