RBF CONSULTING

QSD/QSP Training
Module 8
Project Planning and Risk Determination

Anna Lantin, P.E.

Overview

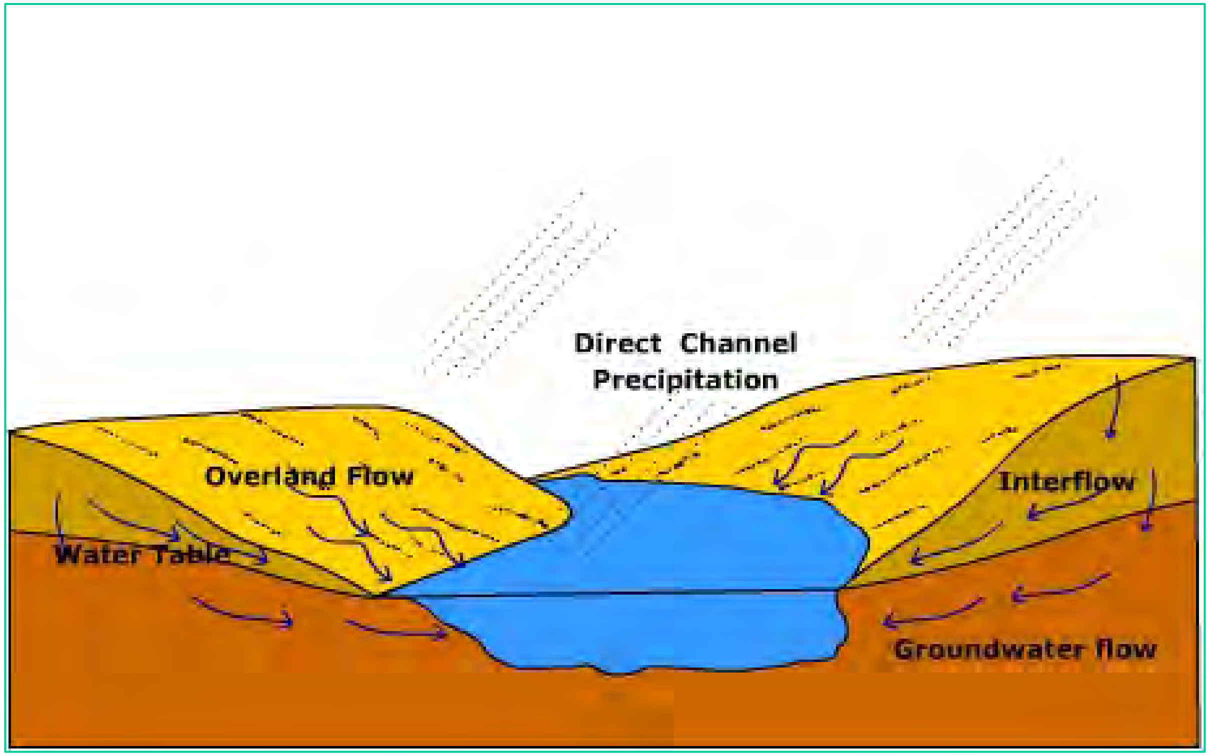
- Pre-Construction Water Balance (Hydromodification)
- Post-Construction Standards
- Soil Particle Size Analysis
- Sediment Risk
- Receiving Water Risk
- Bioassessment Monitoring

Stream Flow and Sediment Hydrology Basics

Stream Flow

There are four basic sources of stream flow.

- Groundwater
- Interflow
- Direct channel precipitation
- Surface runoff



Ritter, Michael E. The Physical Environment: an Introduction to Physical Geography. 2006. http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/title_page.html

Normal Stream Flow

All streams accomplish three basic geomorphic tasks:

- Erosion
- Sediment transport
- Sediment deposition

These determine the size and shape of the stream channel, both laterally and longitudinally.

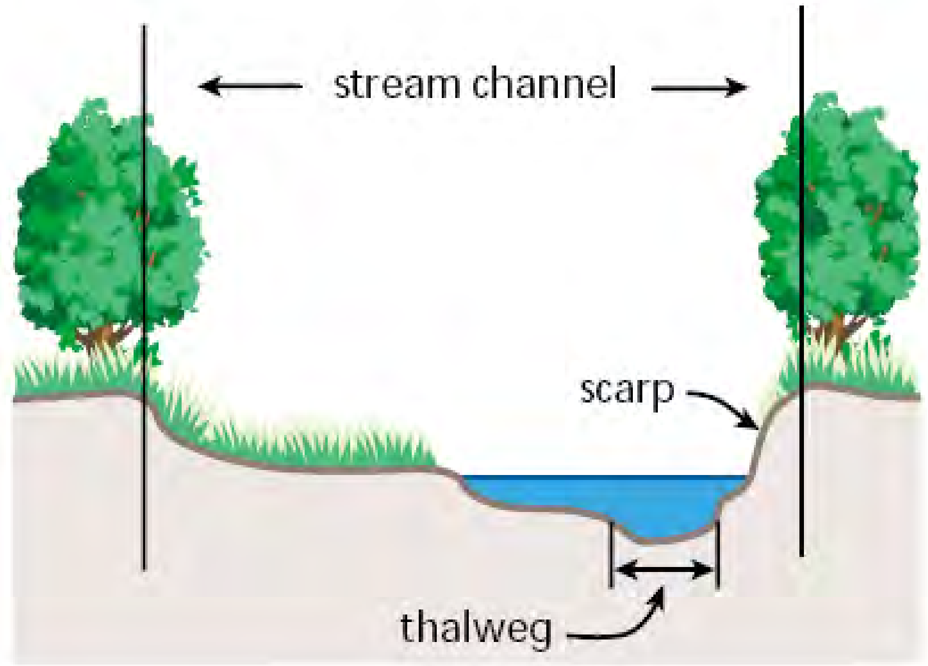


Figure 2.1 Cross-section of a Stream Channel (FISRWG, 1998)

Geomorphic Definitions

- **Erosion** – the detachment of soil particles along the stream bed and banks
- **Sediment transport** – the movement of eroded soil particles in stream flow
- **Sediment deposition** – the settling of eroded soil particles in the water or on land as water recedes.

Dynamic Equilibrium

- Sediment particles that erode are transported downstream
- Replaced by particles of the same size and shape from upstream

$$Qs * D \propto Qw * S$$

Where:

Qs = Sediment discharge	Qw = Streamflow
D = Sediment particle size	S = Stream slope

When all four variables are in balance, the channel is stable

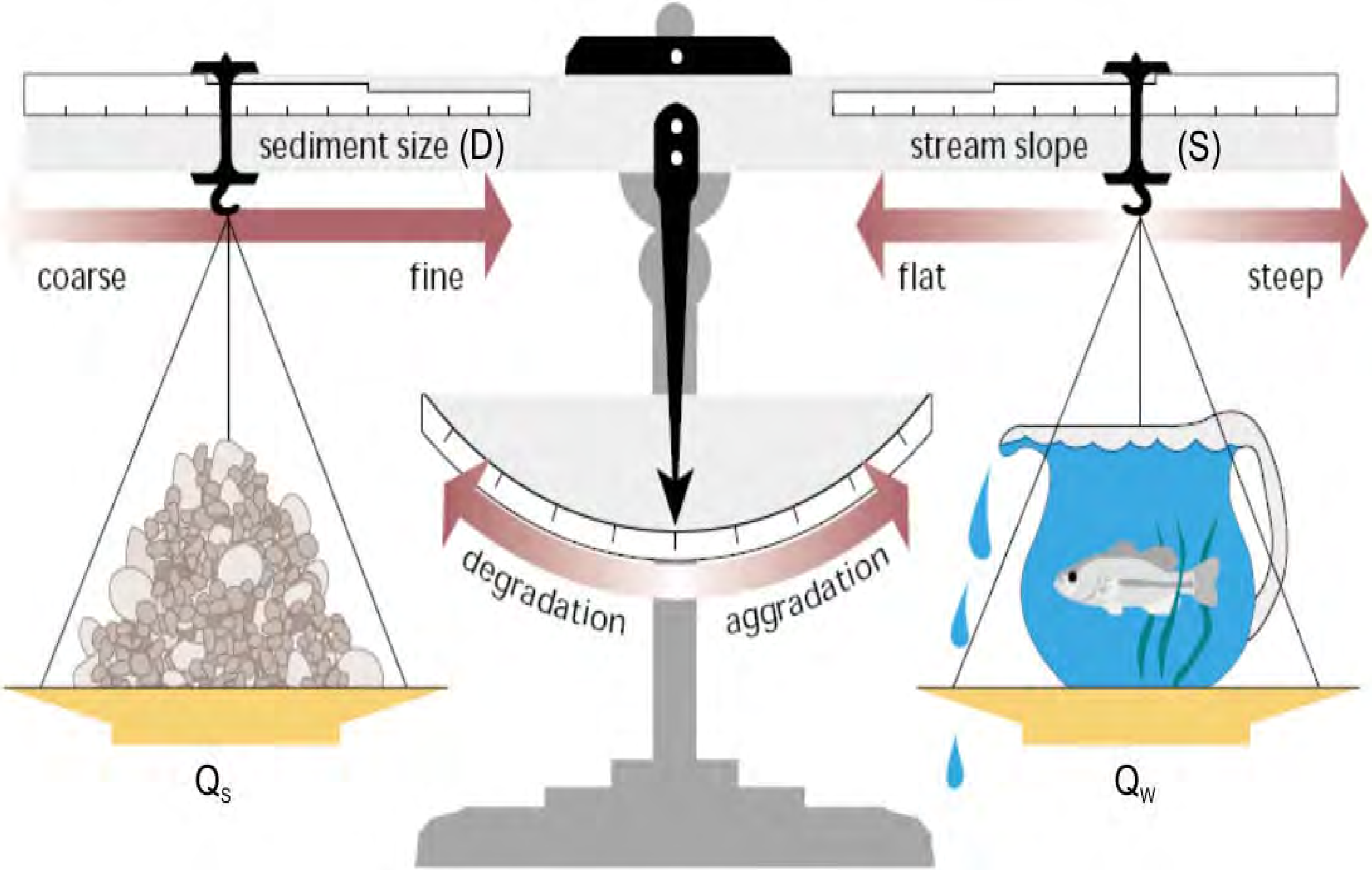


Figure 2.2 Factors Affecting Channel Degradation and Aggradation (FISRWG, 1998)

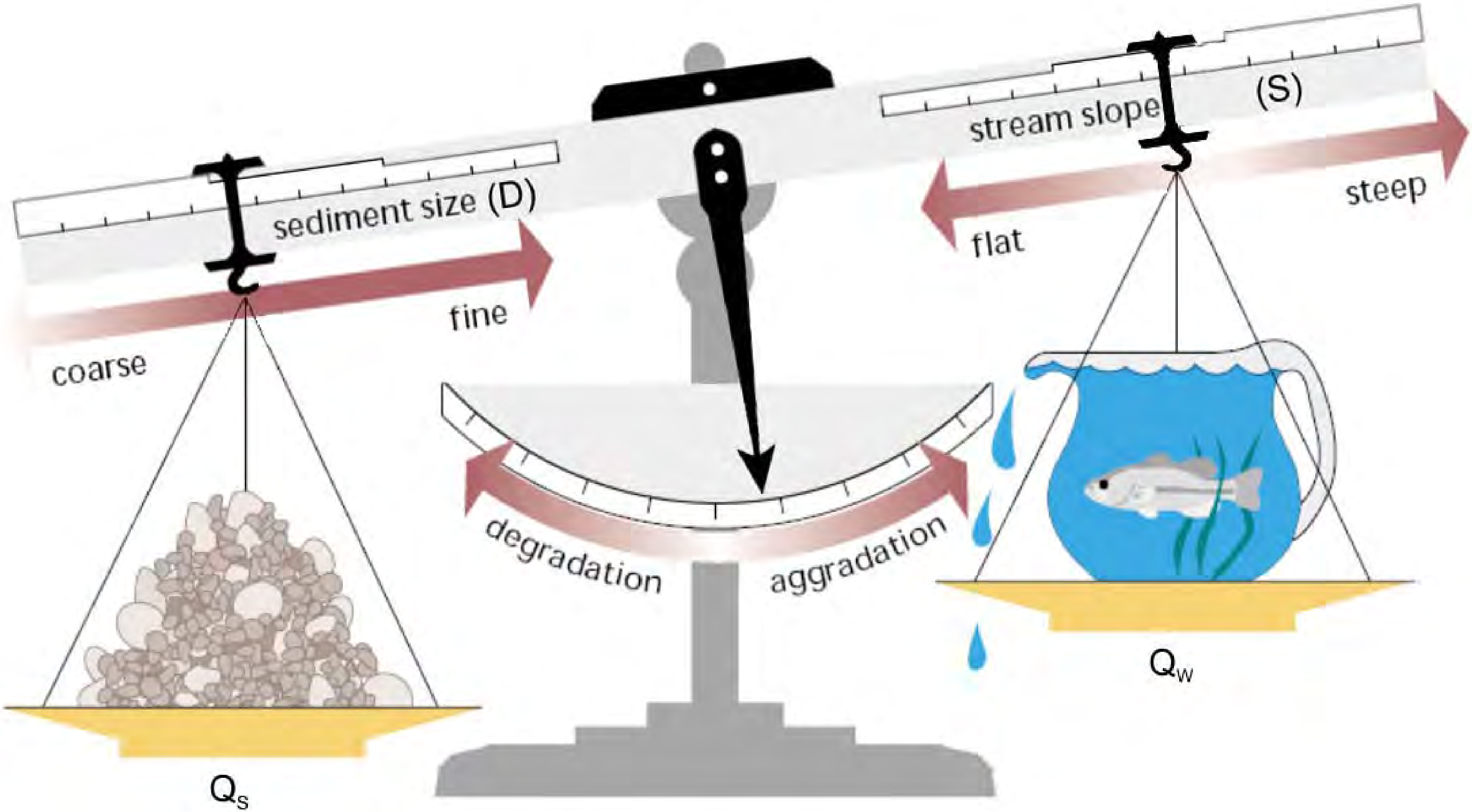
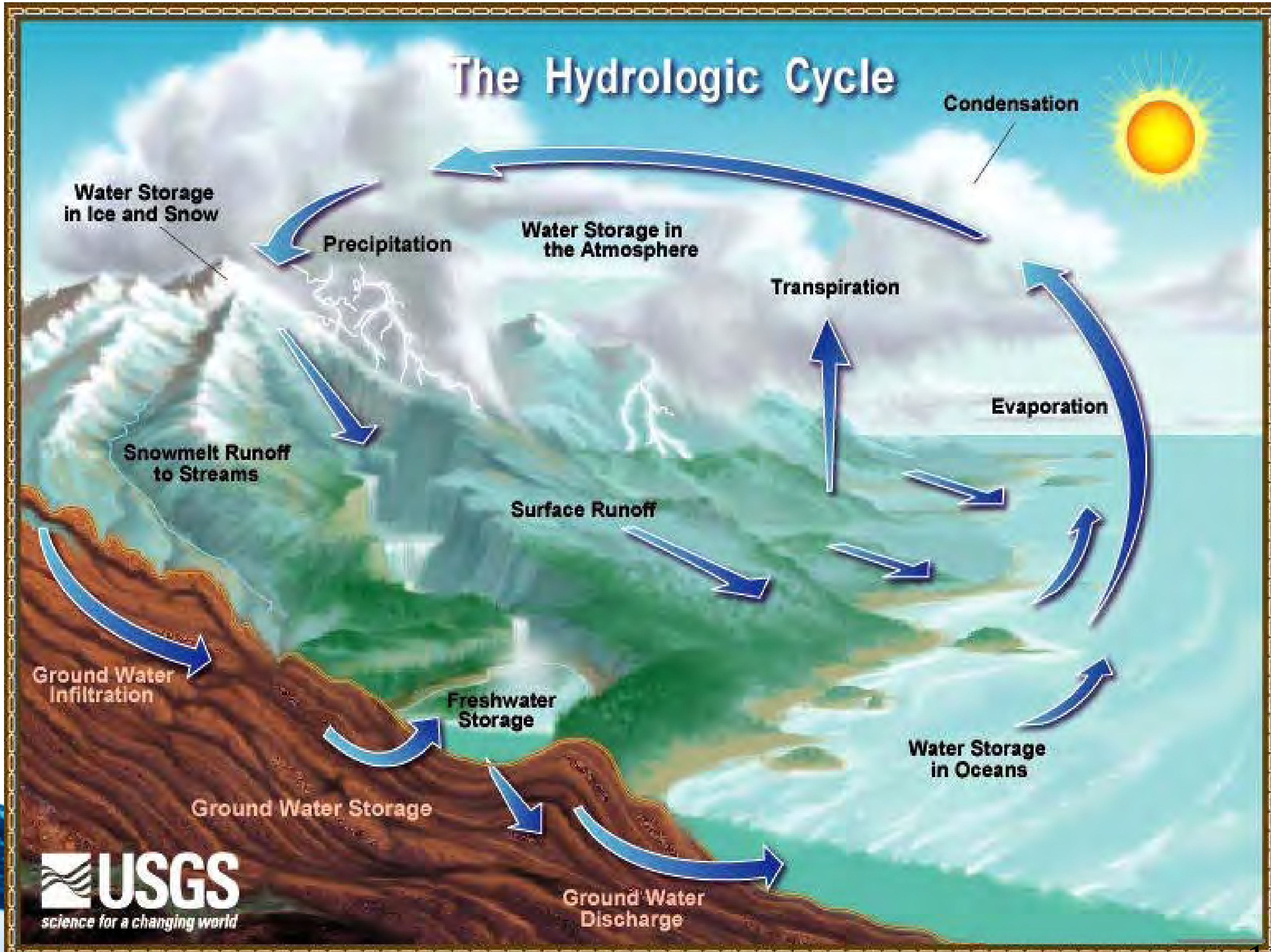
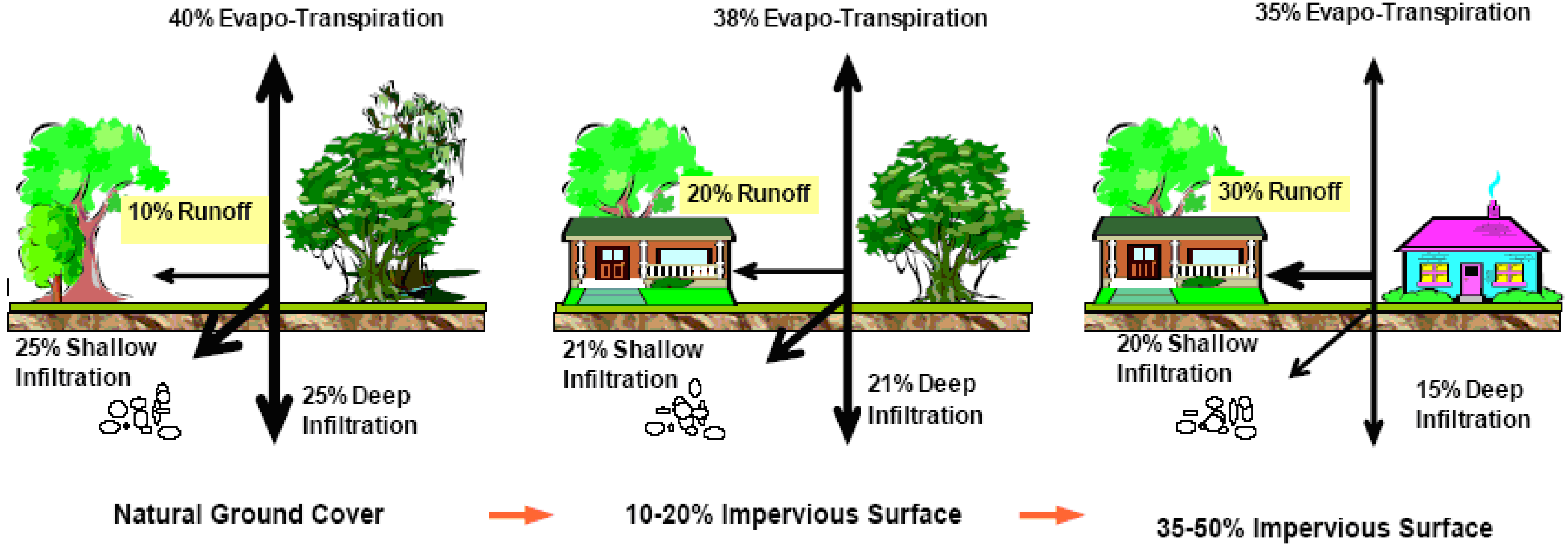


Figure 2.3 Example of Aggradation (Adapted from FISRWG, 1998)

Post-Construction Impacts


The Hydrologic Cycle
Condensation
Water Storage
in Ice and Snow
Precipitation
Water Storage in
the Atmosphere
Transpiration
Evaporation
Snowmelt Runoff
to Streams
Surface Runoff
Ground Water
Infiltration
Freshwater
Storage
Water Storage
in Oceans
Ground Water Storage
Ground Water
Discharge
USGS
science for a changing world



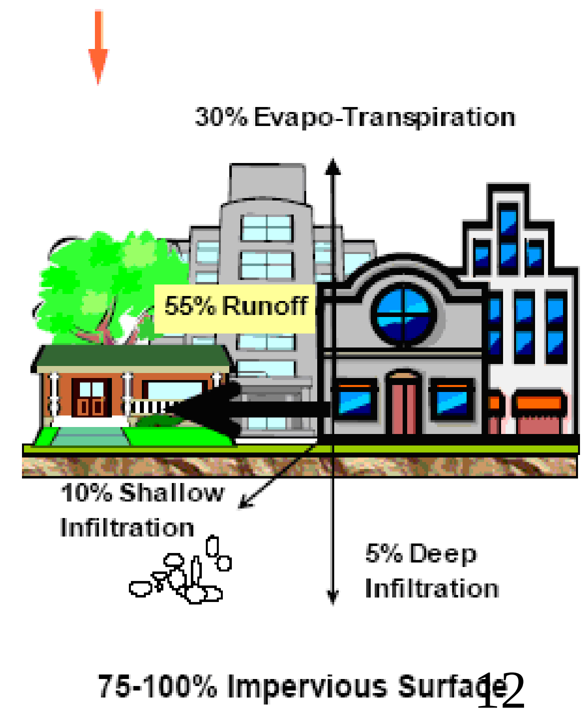


Figure 2. How impervious cover affects the water cycle.

With natural groundcover, 25% of rain infiltrates into the aquifer and only 10% ends up as runoff. As imperviousness increases, less water infiltrates and more and more runs off. In highly urbanized areas, over one-half of all rain becomes surface runoff, and deep infiltration is only a fraction of what it was naturally [6].

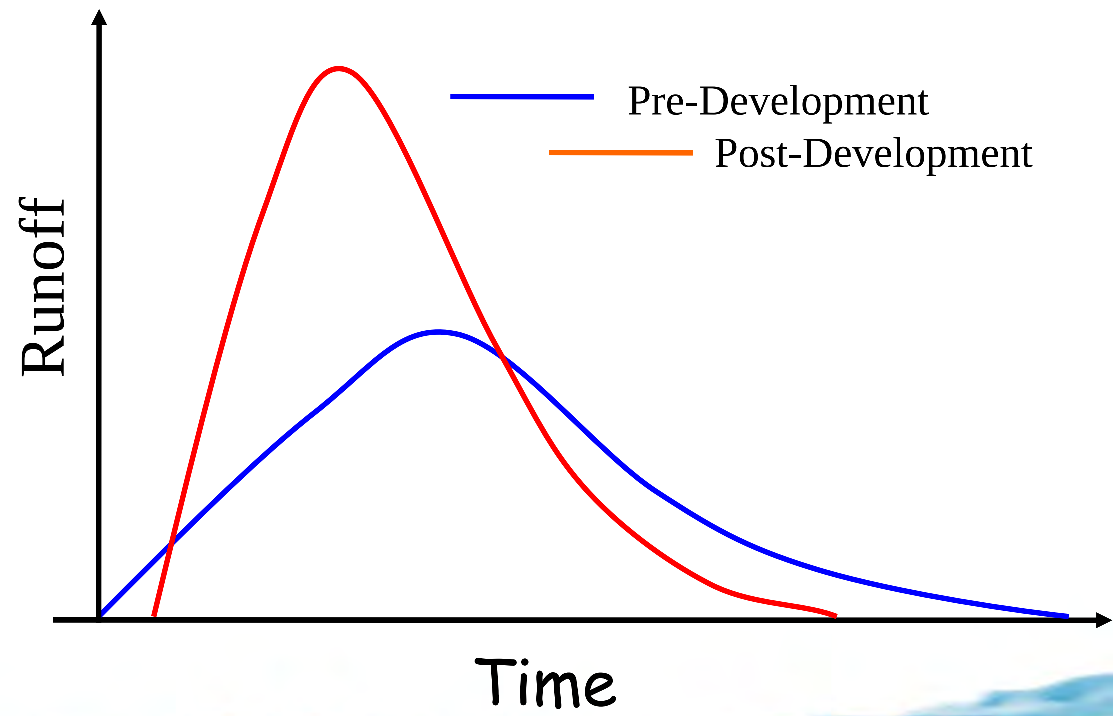
The increased surface runoff requires more infrastructure to minimize flooding. Natural waterways end up being used as drainage channels, and are frequently lined with rocks or concrete to move water more quickly and prevent erosion.

In addition, as deep infiltration decreases, the water table drops, reducing groundwater for wetlands, riparian vegetation, wells, and other uses.

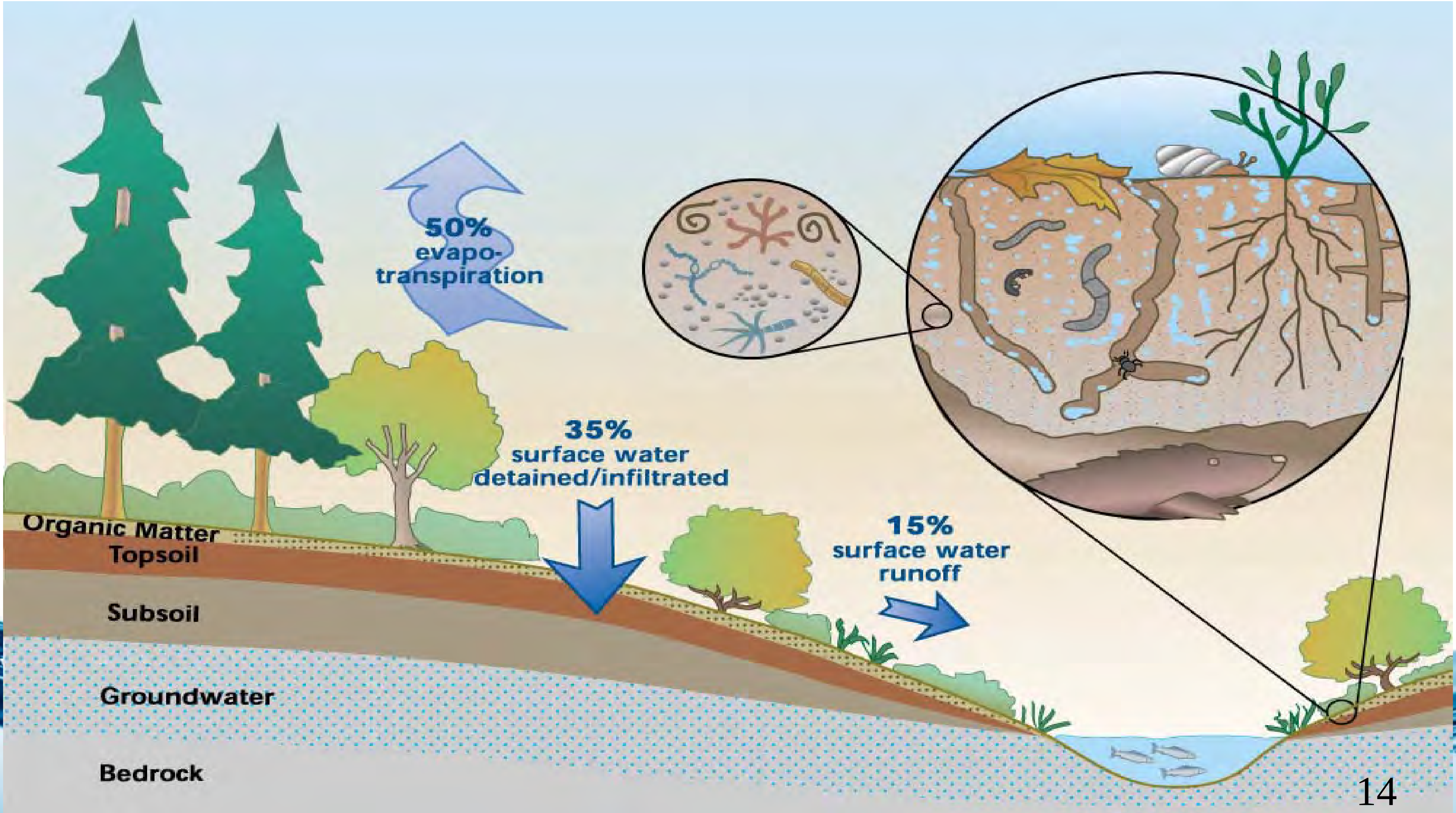
Hydrologic Changes

Urbanization tends to increase storm water runoff:

- peak flows
- volume
- frequency

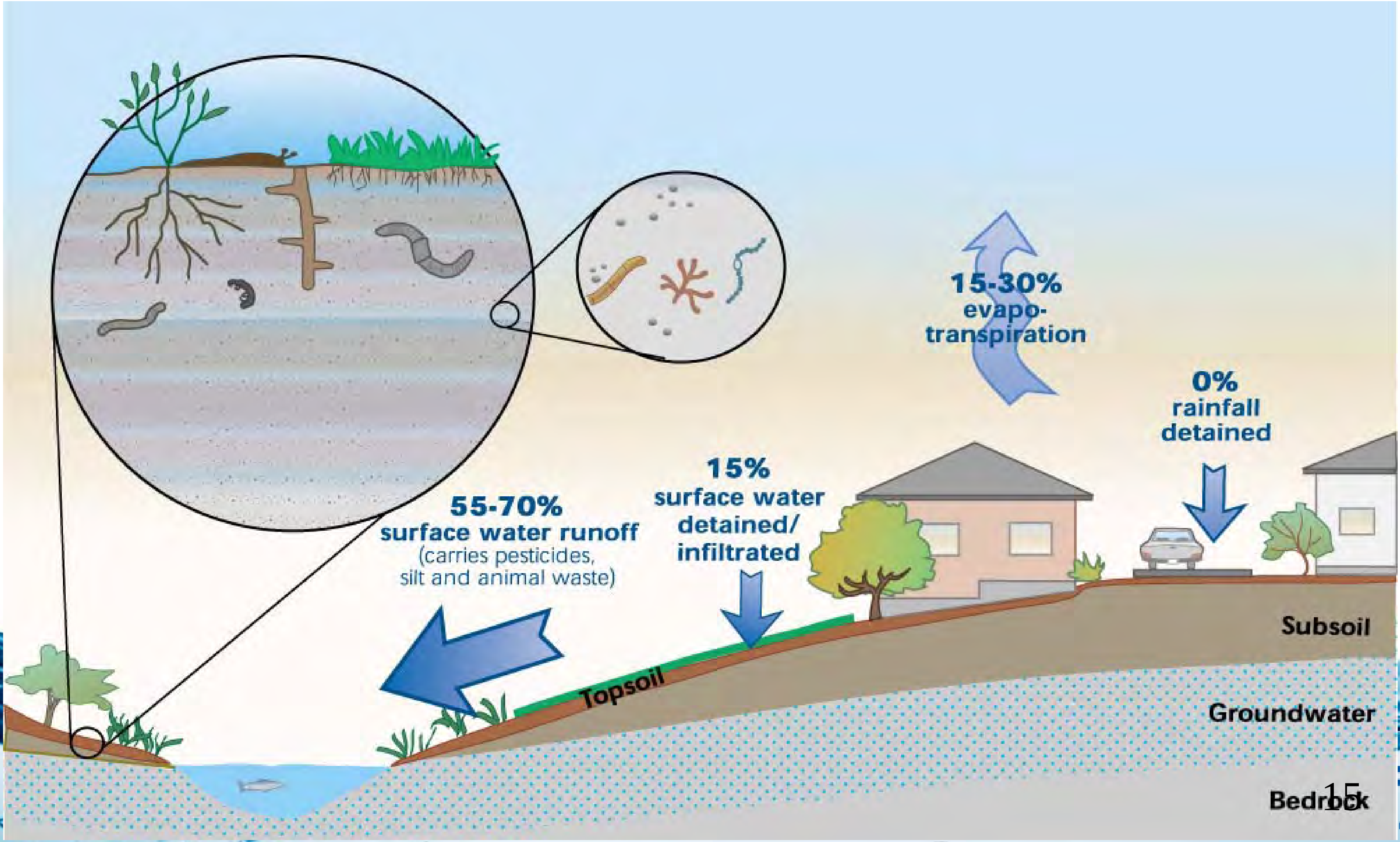


Native Soil



50%
evapo-
transpiration
35%
surface water
detained/infiltrated
15%
surface water
runoff
Organic Matter
Topsoil
Subsoil
Groundwater
Bedrock

Disturbed Soil



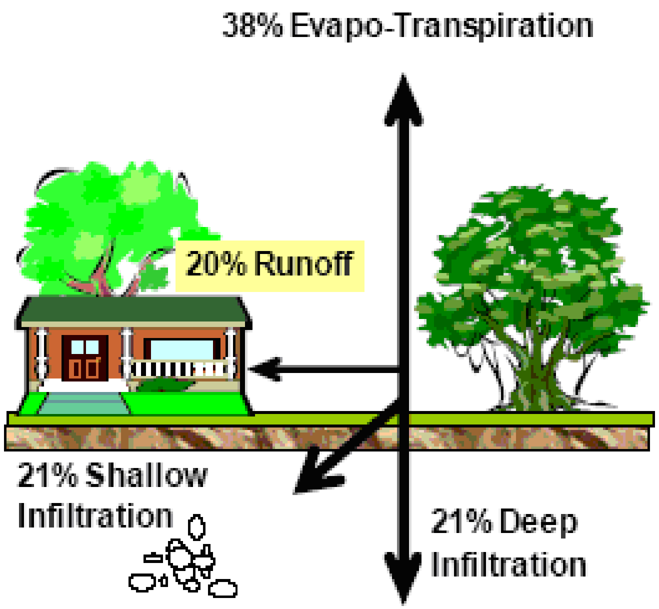
Construction Activity Threats

- Two-fold – construction projects over an acre have the potential to cause impacts to our beneficial uses of water both **during** and **after** the project.
- During – potential for accelerated erosion.
- After – potential for pollutant export and hydromodification impacts as a result of how the new landscape functions.

Construction Water Quality Threats

Source: State Board

+



Hydromodification

What is Hydromodification?

- Alteration of the hydrologic characteristics of waters, which in turn could cause degradation of water resources.
- Effectively reduces base-flow and increases overland or stormwater flow, which increases peak discharge rates and increases water temperatures in creeks and rivers through an increase in sedimentation.
- Causes excessive erosion and/or sedimentation rates, causing excessive turbidity, streambank downcutting, and/or excessive deposition within the stream channel.

Hydromodification

The USEPA cateragorizes hydromodification activities into three categories:

- Channelization and channel modification;
- Dams; and
- Streambank and shoreline erosion.

Stream Channel Modification

- In the past, new and redevelopment construction activities have resulted in modified natural watershed and stream processes.
- Caused by altering the terrain, modifying the vegetation and soil characteristics (i.e. pavement, etc.).

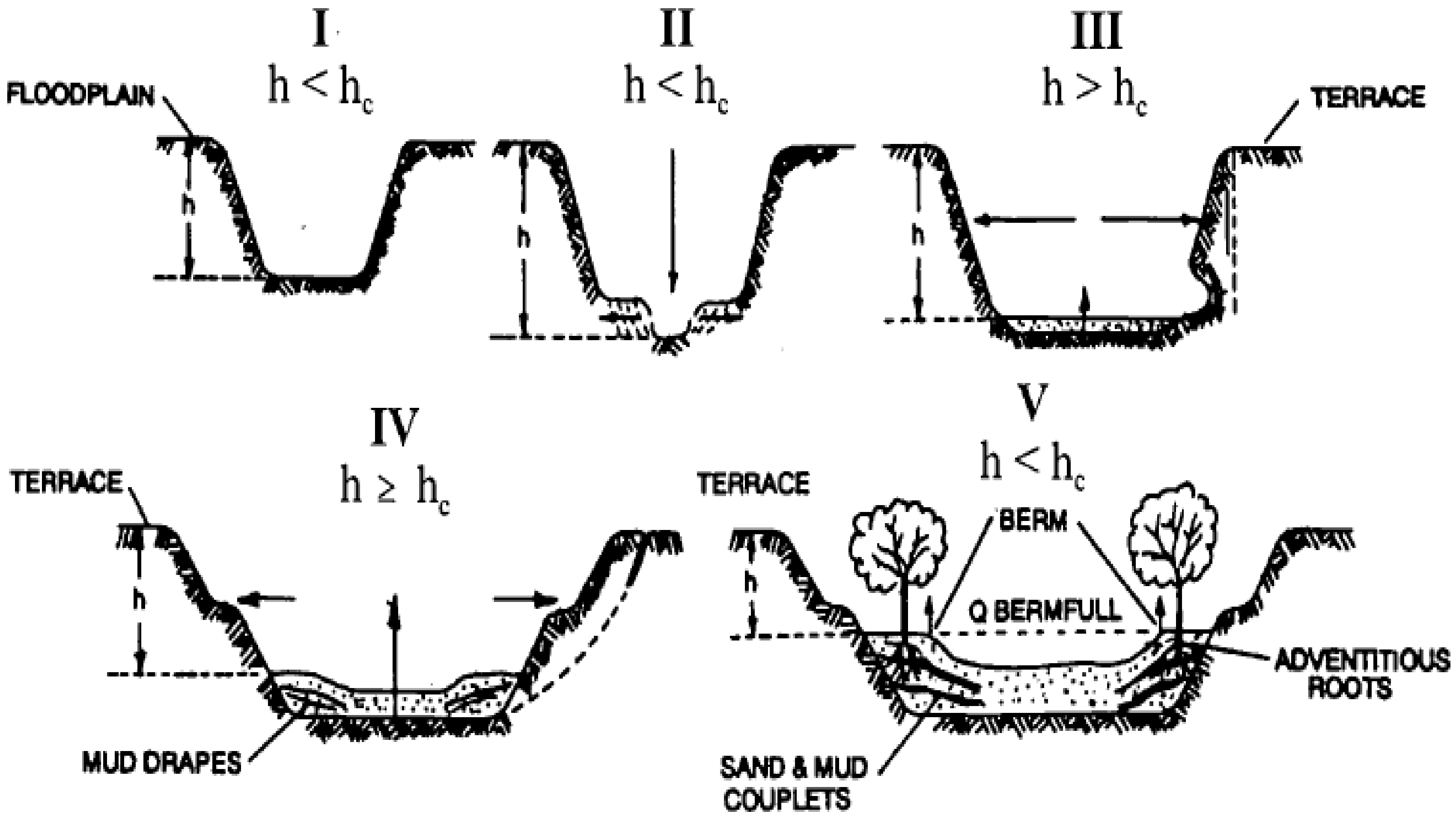
Impacts of Channel Modifications

- Plays a critical role in nonpoint source pollution by increasing downstream delivery of pollutants and sediment that enter water.
- Downstream velocities may continue to increase and lead to more frequent and severe erosion.
- A channel that is deepened or widened can result in slower or shallower flow.
- Results in an <u>increase</u> in sediment transport capacity and a <u>decrease</u> in sediment supply.

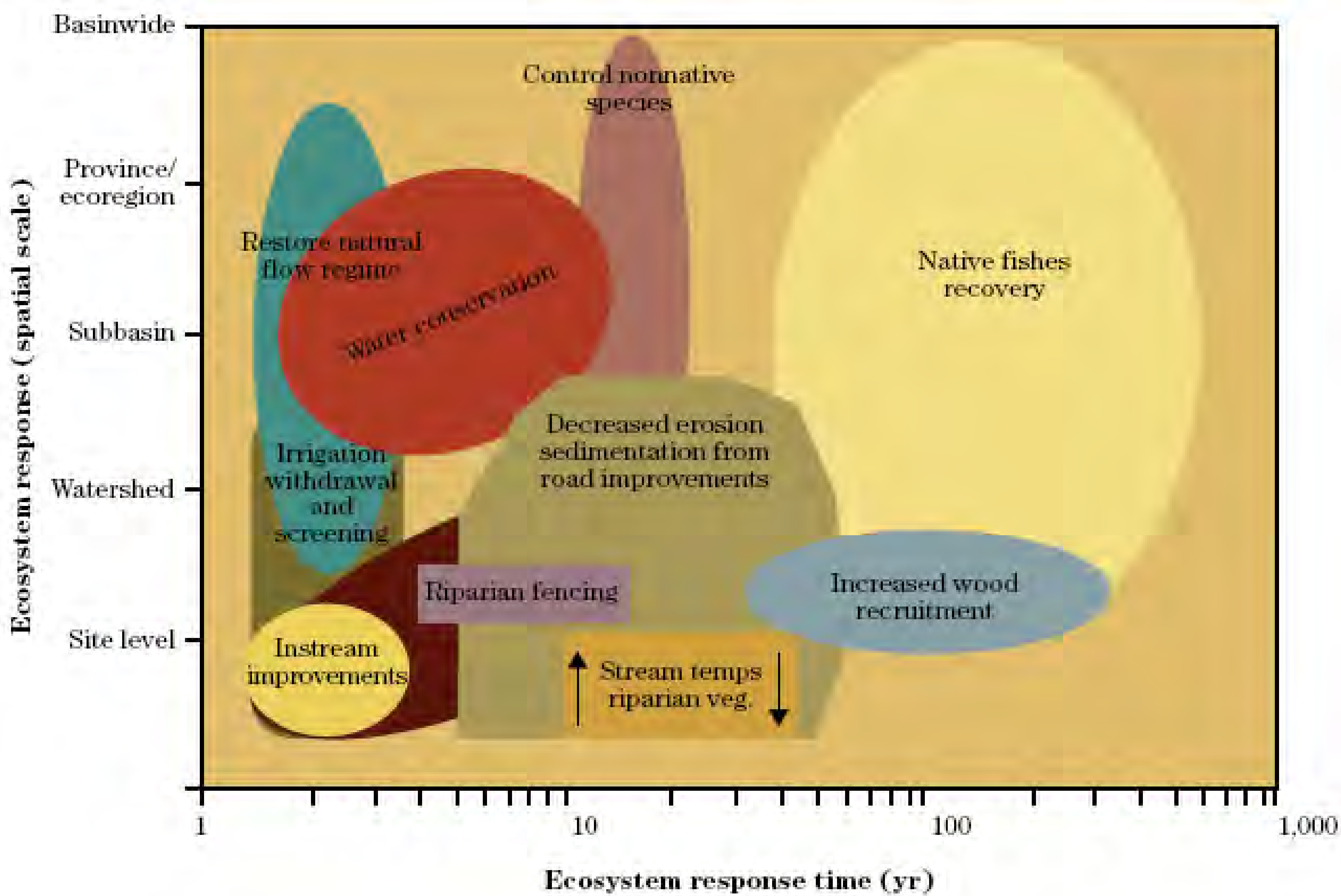
Channel Modification Impacts

- Results in an increase in sediment deposits to a stream segment which can cause:
  - Disturb stream equilibrium and cause channels to become unstable
  - Disrupt riffle and pool habitats
  - Create changes in stream velocities
  - Eliminate the function of floods to control channel-forming properties
  - Alter the base level of a stream (streambed elevation)
  - Critical habitats to be buried
  - An increase in flooding
  - Chemical impacts - Nutrients, metals, toxic organic compounds, pesticides and organic material

Channel Changes Associated with Urbanization



Channel Response Time



(210–VI–NEH, August 2007)

Stream Characteristics

- Channel Shape: Function of the flow, and quantity of sediment in the flow, the materials in the bed and the vegetation in the channel.
- Channel Alignment: Natural channels meander. A straight section more than 20 times the channel width is very rare.
- Sinuosity: Channel (bankfull) length/valley length
- Low<1.2, High>1.5

Channel Morphology – Form Variables

- Average Discharge: The average daily flow. Depth from average discharge is about 1/3 of bank full flow.
- 90 percent of all channels in valley areas meander
  - Tendency toward minimum work
  - Uniform distribution of work

Channel Morphology

- Meanders indicate an approximation of a steady state
  - Wavelength: about 11 times channel width
  - Radius of curvature: About one-fifth of the wavelength or 2.3 time channel width. This ratio provides the minimum headloss.
- Riffle/pool sequence: spaced at 5 to 7 channel widths.

Channel Morphology

- Bankfull Discharge: Recurrence interval of about 1.5 to 2 years. Considered to be the 'channel forming' discharge.
- The primary effect of urbanization is to increase the frequency of bank-full flows and overbank flooding. Increase is on the order of 7 times with urbanization.

General Channel Flow Relations

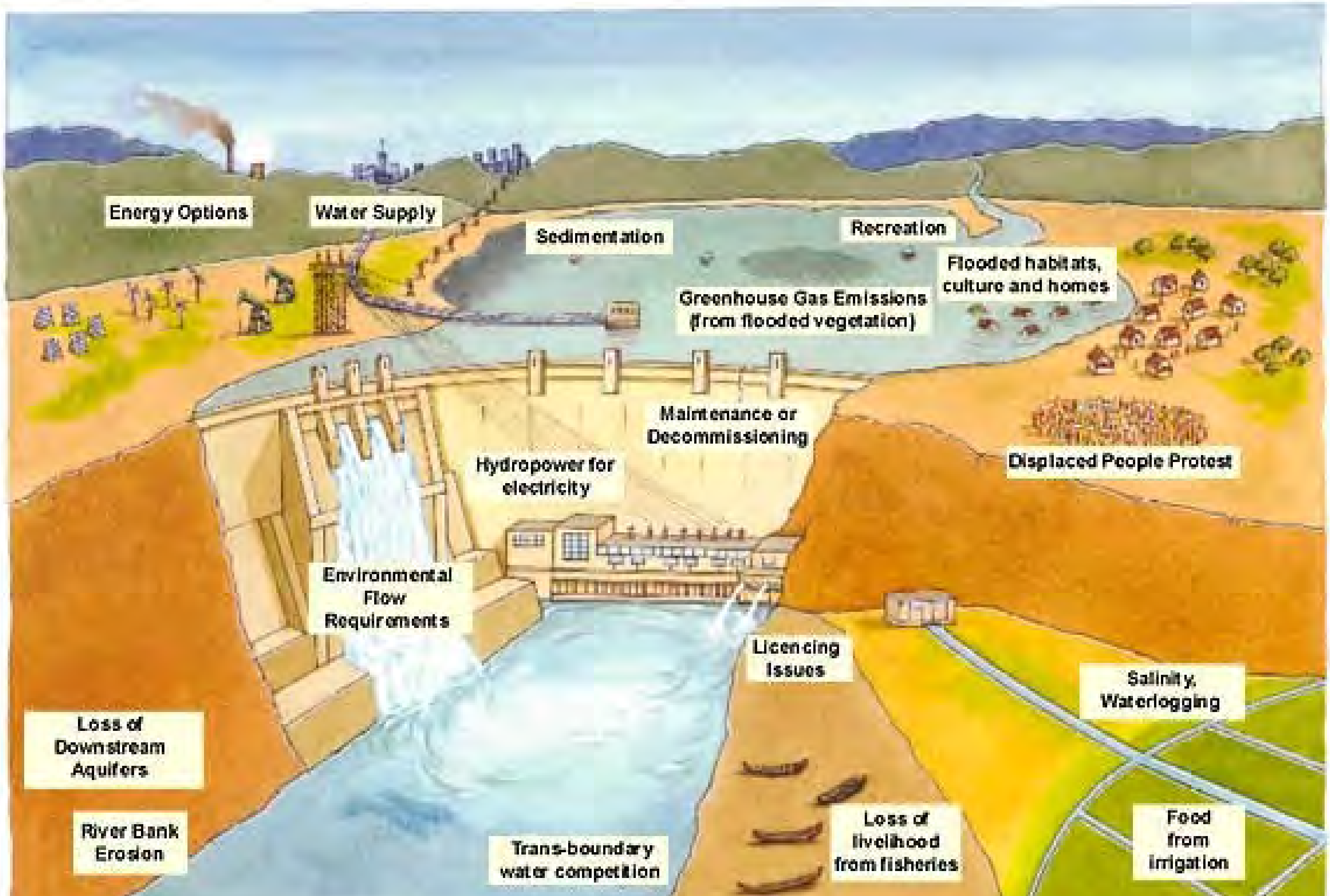
- Low Flow (Q_{avg}): 0.20 ft^3/s per square mile
- Q_{avg} = 0.034 Q bank full (Q_{bnk})
- $Q_5 = 4.5Q_{bnk}$
- $Q_2 = 1.9Q_{bnk}$

Dam Modification

- Retains water by design.
- Range in size from berms across small streams that create farm ponds to large concrete structures across major rivers for hydropower and flood control.
- Built to provide water for industrial cooling, agricultural irrigation, municipal water supplies for human consumption, and impoundment-based recreation (e.g., boating and sport fishing).

Impacts of Dams

- Associated with a number of effects including changes to hydrology, water quality, habitat, and river morphology.
- Can affect water quality and habitat both upstream and downstream of the dam. Most are observed downstream.
- Lakes and reservoirs integrate many processes that take place in their contributing watersheds including processes that contribute energy (heat), sediment, nutrients, and toxic substances.
- Presence and operation of dams can determine the fate of pollutants in a reservoir or impoundment and potentially downstream as water is released from the dam.
- Dams can lead to sediment accumulation in a reservoir.



(Image from The World Commission on Dams, www.dams.org)

Streambank and Shoreline Modifications

- Streambanks and shorelines naturally erode.
- Water flowing along (parallel to) streambanks dislodges sediment and other materials that constitute a streambank
- Waves or tides transports sediment and other materials away from the shoreline.
- Changes to the natural erosion processes often increases erosion locally and sedimentation , along adjacent shorelines, or offshore.

Impacts of Streambank and Shoreline Modifications

- **Increase in imperviousness** -results in greater flow rates and more erosive force.
- **Livestock grazing** - can significantly increase streambank erosion and destroy important riparian habitat.
- **Roads** - can erode and supply increased sediment and pollutants to adjacent streams. Stream crossings associated with rural roads can block fish passage, trap debris during storms, and lead to increased streambank erosion in nearby areas.
- **Marinas** - can alter local wave and tidal flow patterns, resulting in transference of wave and tidal energy to adjacent shorelines.

Solution

To address hydromodification concerns and/or impacts the new CGP includes:

•Post-Construction Standards

•Post-Construction Water Balance Calculator

•Increased sampling and monitoring requirements for projects according to Sediment Risk and Receiving Water Risk levels

•Added Bioassessment Monitoring

What does this mean?

- Are we trying to go back to historical conditions?
  - No! The intent is to work today forward.
  - Stream systems have changed over time and are new in a new equilibrium state. So going backwards may do more harm than good to the receiving water system.
- Owners, design engineers, consultants, etc., will need to be aware of post-construction requirements in this permit or local MS4 post-construction requirements in order to incorporate the post-construction requirements early on in the design phase of the project.
- Get the designers involved <u>early</u> in the project planning and conception phase.

Hydromodification Management and Practice Measures

Hydromodification Management

- Evaluate potential effects from construction on pre-construction water balance.
- Stormwater discharges from new development and redevelopment projects should not increase the erosion potential for the receiving stream over the pre-project (existing) condition.
- Increase in runoff flow and volumes should be managed so that post-project runoff does not exceed estimated pre-project rates and durations, where such increased flow and/or volume is likely to cause increased potential for erosion.

Hydromodification Management

New hydromodification management (HM) techniques utilize LID applications to focus on:

- Retaining,
- Detaining or infiltrating runoff, and
- Matching post-project flows and durations to pre-project patterns for a specified range of smaller, more frequent rain events, to prevent increases in channel erosion downstream.

LID tools available online on some MS4 websites.

http://www.lowimpactdevelopment.org/lidphase2/home.htm

Hydromodification Management

- Hydrologic source controls are design techniques that minimize and/or slow the rate of storm water runoff from the site. Examples include:
  - Reduction of impervious surfaces
  - Use of landscaping as a storm drain treatment feature
  - Drain rooftop downspouts to pervious areas.
- Flow Duration Controls are structures designed to detain excess runoff that remains following the use of hydrologic source controls. Examples include:
  - Detention basins
  - Wet ponds
  - Underground tanks or vaults

Hydromodification Management

Successful hydromodification management is achieved through LID by:

- Integrating stormwater management early in site planning activities
- Using natural hydrologic functions as the integrating framework
- Focusing on prevention rather than mitigation
- Emphasizing simple, low-tech, and low cost methods
- Management as close to the source as possible
- Distribution of small-scale practices throughout the landscape
- Relying on natural features and processes
- Creating a multifunctional landscape
- Maintaining HM controls

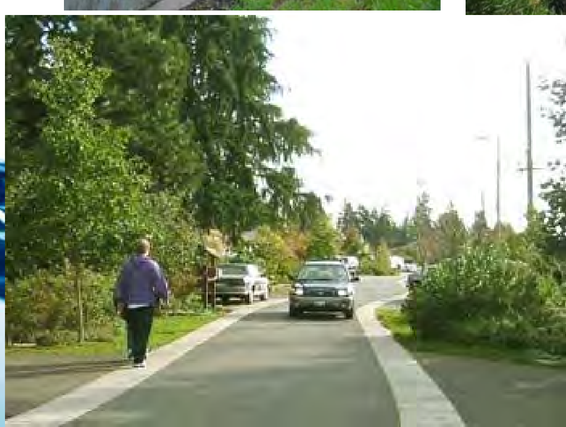
Ways to Mimic Pre-Development

- Soil quality improvement (porosity)
- Native and drought tolerant vegetation
- Trees
- Permeable pavement
- Riparian buffers
- A general reduction of connected, impervious surfaces in runoff pathways
- Bioretention
- Disconnected downspouts/rain chains/rain barrels









Channel Modification Management

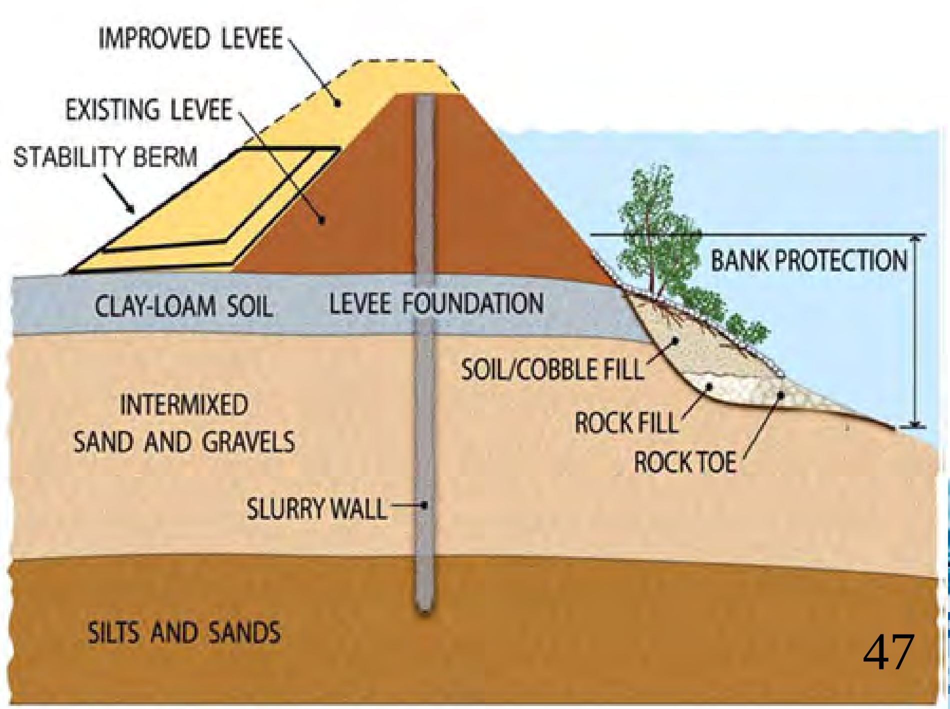
- Plan, design, and operate channel modification projects to:
  - Improve water quality, and
  - Promote aquatic live and riparian ecosystem functions.
- Reduce or limit the number of service roads adjacent to waterways
- Use models and common methodologies to evaluate effects of proposed channelization and channel modification projects on physical and chemical characteristics of the surface waters and on aquatic and riparian habitat.
- Address fish passage concerns prior to installing any grade control structure.

Channel Modification Management

Operation and Maintenance

In cases where existing channelization or channel modification projects can be changed to enhance instream or streamside characteristics, several practices can be included as part of regular operation and maintenance programs. These practices include:

- Grade control structures
- Levees, setback levees, and floodwalls
- Non-eroding roadways
- Streambank protection and instream load controls
- Vegetative cover



Streambank and Shoreline Modification Management

- Plan, design, and operate streambank and shoreline modification projects to improve water quality, and promote aquatic live and riparian ecosystem functions.
- Use models and common methodologies to evaluate effects of proposed streambank and shoreline modification projects on physical and chemical characteristics of the surface waters and on aquatic and riparian habitat. Perform an analysis of physical factors that includes determining:
  - Limits of the shoreline reach
  - Rates and patterns of erosion
  - Estimation of factors such as ground-water seepage or surface water runoff that contribute to erosion

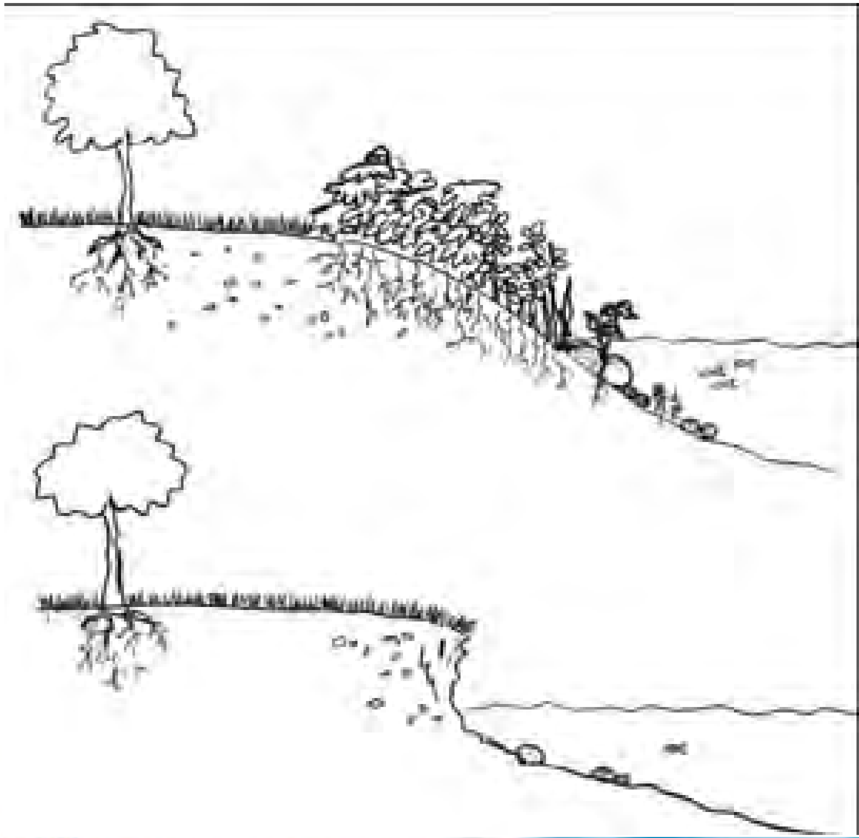
Streambank and Shoreline Modification Management

- Stabilize eroding streambanks and shorelines using indirect or vegetative methods over structural methods.
- Protect and conserve streambank and shoreline features with the potential to attenuate polluted runoff.
- Plan and manage activities to reduce erosion and retain sediment onsite during and after construction
- Silt basin location siting and design considerations.

Streambank and Shoreline Modification Management

Vegetative Practices

- The use of vegetative streambank and shoreline stabilization practices refers to the installation of plant materials as a main structural component.
- Implementation has shown to be physically and ecologically successful.
- Less costly as an alternative to engineering structures for controlling erosion of streambanks and shorelines.



Streambank and Shoreline Modification Management

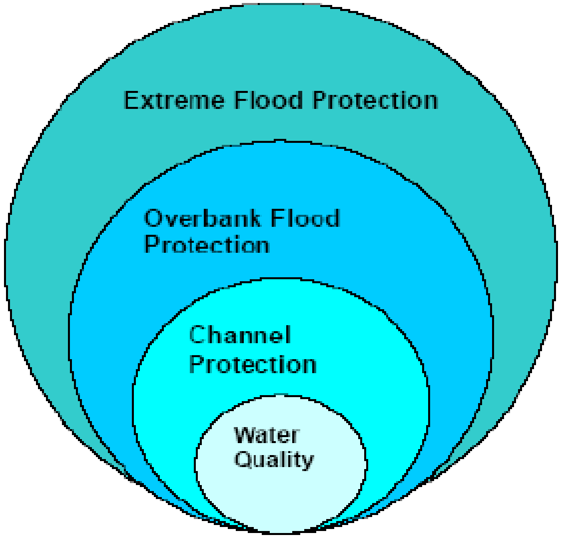
Vegetative Practices

- Designed to be low maintenance or maintenance-free in the long run
- Enhance habitat not only by providing food and cover sources, but by serving as a temperature control for aquatic and terrestrial animals
- If successful, can stabilize slopes effectively in a short period of time (e.g., one growing season)
- Self-repairing after establishment
- Filter overland runoff, increase infiltration, and attenuate flood peaks

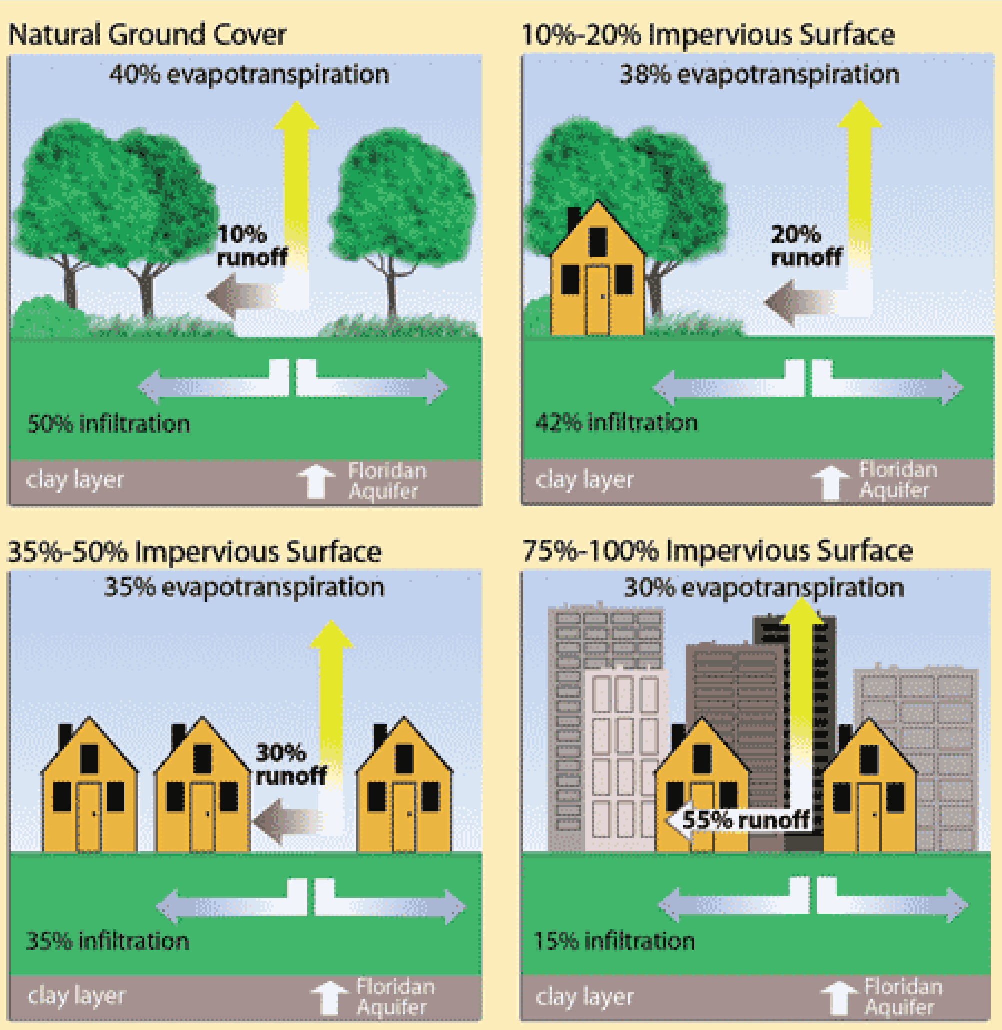
Post-Construction Standards

Post Construction Standards

- Post-Construction Standards developed to avoid, minimize and/or mitigate post-construction storm water runoff impacts
- Specifically addresses water quality and channel protection events
- Required for all new traditional projects in areas not covered by an active Phase I or Phase II Municipal Separate Storm Sewer System (MS4) NPDES permit that has an approved Storm Water Management Plan *(Out: if the project is required to develop a WQMP or similar, it is not required to comply with the post construction standards in the CGP)*



Development Impacts – Quick Review



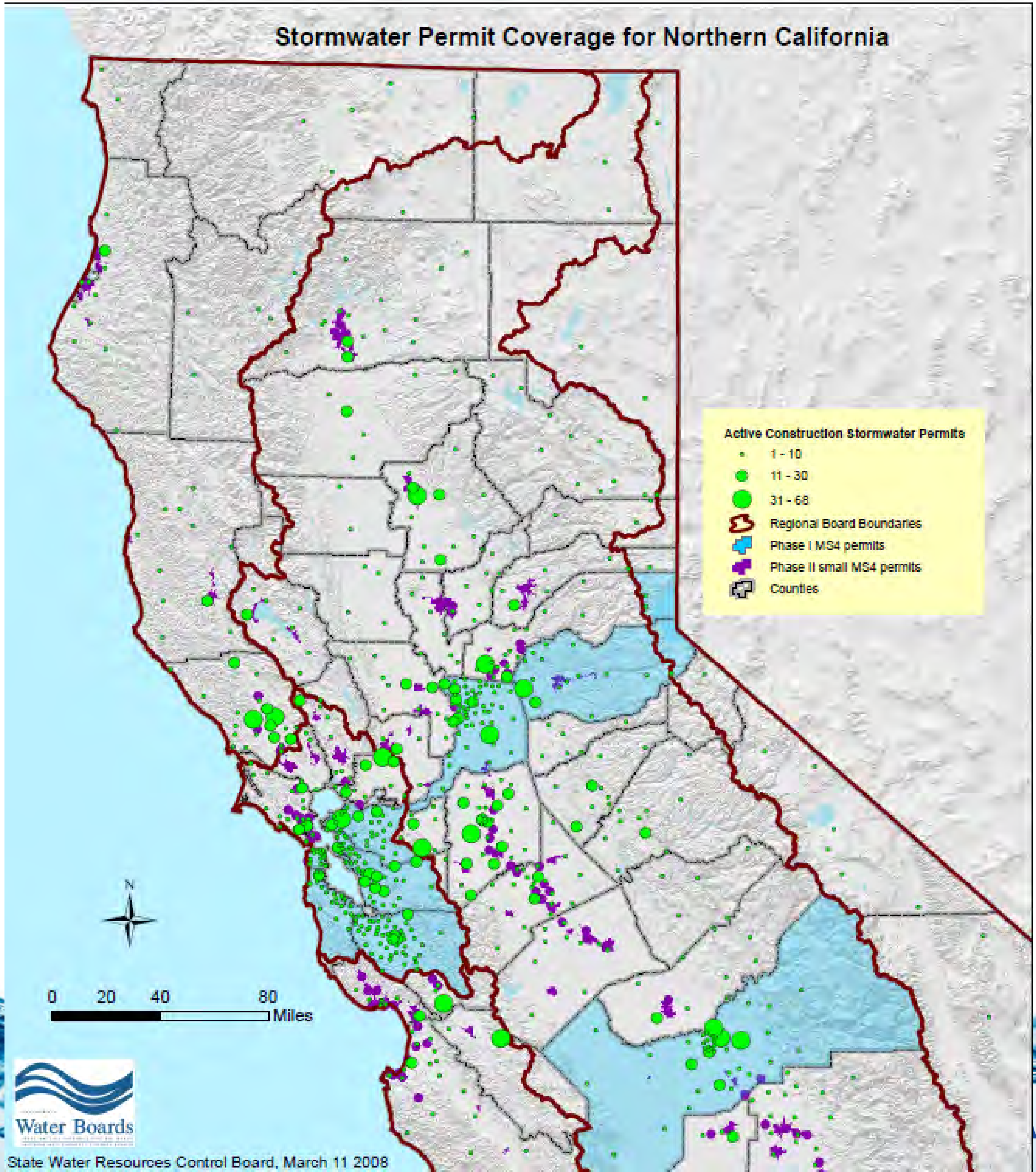
Post-Construction Standards

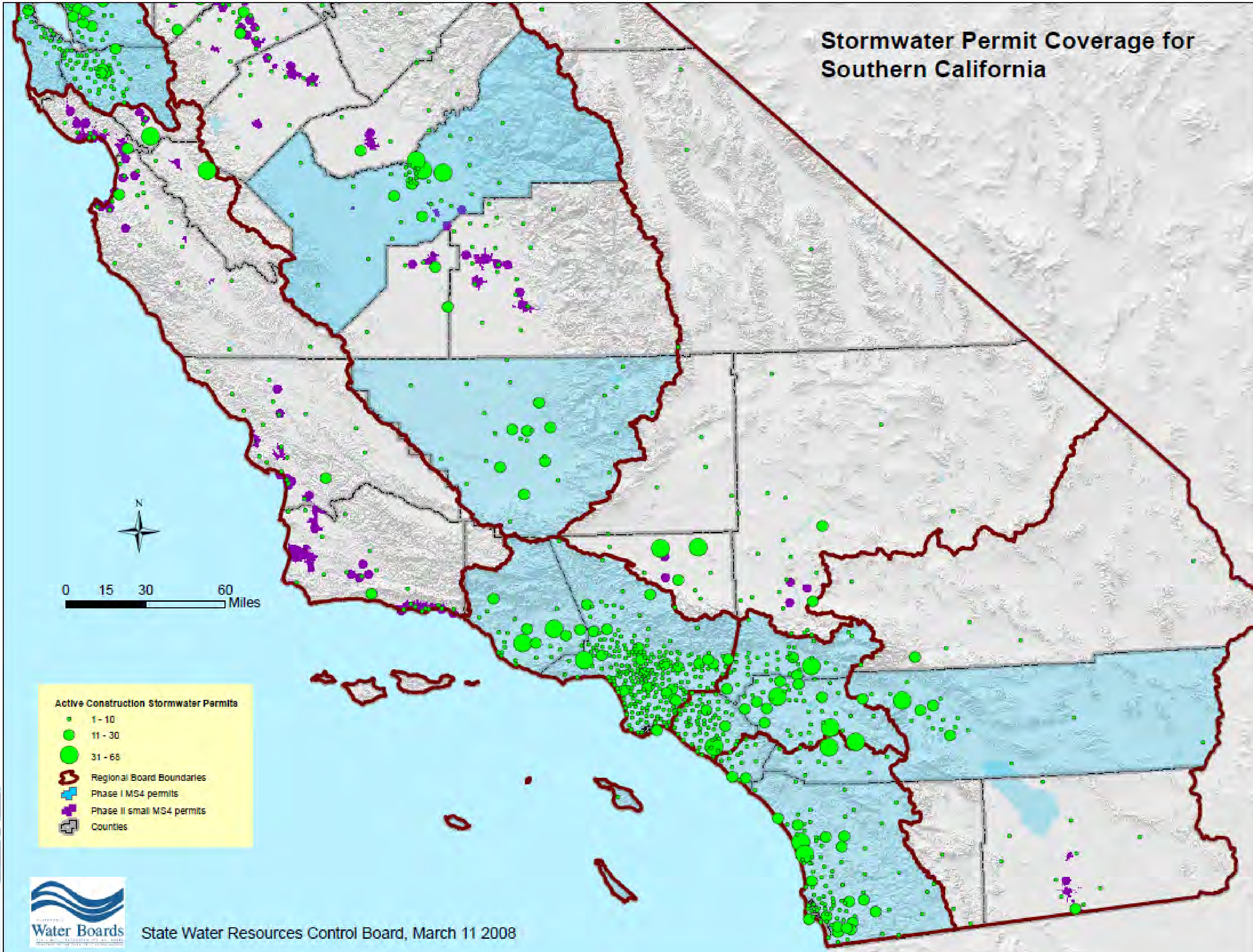
- For projects not covered under MS4 requirements:
  - Effective 3 years after permit adoption (September 2, 2012)
  - Should be addressed now for projects currently in planning/design
  - *Small loophole: Applies to all project areas with active permit coverage* ***on the effective date***
- For projects covered under MS4 requirements:
  - Need to comply with MS4 standards now or as soon as they come into effect
  - For example, several MS4s are in the process of getting their plans approved and will be in effect shortly thereafter
- How to address for small, non-traditional MS4s
  - e.g. universities, military bases

Post-Construction Standards Exceptions

- LUP projects are not subject to post-construction requirements due to the nature of their construction to return project sites to preconstruction conditions.
- Not applicable to projects that are under an active MS4 jurisdiction with an approved Storm Water Management Plan

Municipal Permit Coverage


Stormwater Permit Coverage for Northern California
Active Construction Stormwater Permits
1 - 10
11 - 30
31 - 68
Regional Board Boundaries
Phase I MS4 permits
Phase II small MS4 permits
Counties
0 20 40 80
Miles
N
Water Boards
State Water Resources Control Board, March 11 2008


Stormwater Permit Coverage for Southern California
N
0 15 30 60
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State Water Resources Control Board, March 11 2008

CONSULTING

For those not in Municipal Permit Coverage areas....

CGP Post-Construction Standards

- Requires replication of pre-project water balance
  - up to the 85th percentile rainfall event
  - using non-structural management practices where feasible (match pre-development runoff volume)
  - Emphasis on Low Impact Development (LID)
  - (Bay Area, LA and San Diego have good tools for understanding LID)
- For sites over two acres of disturbed area
  - preserve the pre-construction drainage density (miles of stream length per mile of drainage area) for all drainage areas with the area serving a first order stream or larger
  - replicate pre-project time of concentration.

What is a first order stream?

- A first order stream is defined as a stream with no tributaries

Post-Construction Runoff Reduction

- Through on-site stormwater reuse, interception, evapotransportation, and infiltration through non-structural controls and conservation design measures
- Non-structural measures implemented close to the source of runoff is the easiest most cost-effective way to comply with the pre-construction water balance standard
- Obtain runoff reduction credits

Runoff Reduction Through LID

- LID’s goal is to mimic a site’s pre-development hydrology by using design techniques that infiltrate, store, evaporate, and detain runoff close to its source.
- Serves to protect related watersheds and waterbodies from both hydrologic-based and pollution impacts associated with post-construction landscape

Does it all have to look like this?


But, sometimes, even 100%
vegetation isn't enough

Non-Structural Controls Available for Crediting

- Porous Pavement
- Tree Planting
- Downspout Disconnection
- Impervious Area Disconnection
- Green Roof
- Stream Buffer
- Vegetated Swales
- Rain Barrels/Cistern
- Landscaping Soil Quality

Cluster Development

Post-Construction Structural Controls

- Structural controls are to be used when:
  - Non-structural controls are infeasible
  - Structural controls will produce greater reduction in water quality impacts

Note: The use of structural controls must be approved by the local Regional Water Quality Control Board prior to installation and use

- discuss with Regional Board staff early in the design phase

- There is no pre-determined method or timeline of submitting to the RB, no review checklist for RB staff to follow

Post-Construction Structural Controls

- Vegetated Swales
- Bioretention Cells
- Water Quality Ponds
- Media Filtration Systems

Structural Post-Construction Practices need to be approved by RWQCB.


We’ve come a long way from the large structural BMPs that were popular…

Water Quality Pond

Bioretention Area (with underdrain)

CGP Post-Construction Water Balance Method

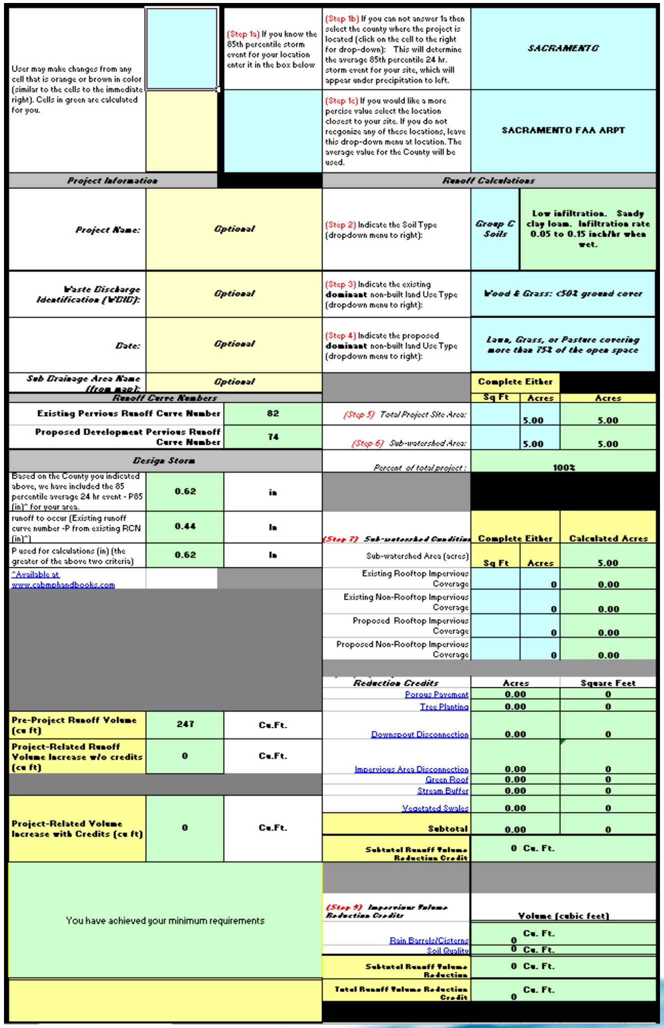
- Based on NRCS Hydrologic Soil Groups
- Hydrologic Soil Groups based on soil texture, runoff potential, and water transmission rate.
- Mimic pre-development water balance
- Preserve existing (pre-construction) time of concentration
- Protect channels

NCRS Hydrological Soil Groups

HSG	Example Soil Texture	Runoff Potential	Water Transmission Rate
A	Sand	Low	High
B	Sandy loam	Moderately Low	Moderate
C	Clay loam	Moderately High	Low
D	Clay	High	Very Low

Submittal Requirements

- Determine the project-related increase in runoff volume by either:
  - Completing Attachment 2 spreadsheet; or
  - A sophisticated watershed process-based model (e.g. Hydrologic Simulation Program Fortran).
- Submit with the NOI to demonstrate compliance with the New and Re-Development Water Balance Performance Standard.



Post-Construction Water Balance Calculator

Information that you will need:

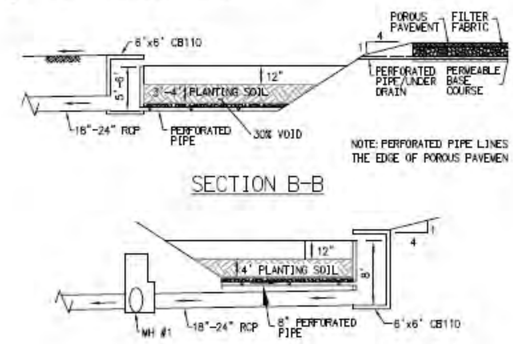
- Project location county
- Soil type *(e.g., Group C soils)*
- Existing dominant non-built land use type *(e.g., Wood & Grass: <50% ground cover)*
- Proposed dominant non-built land use type *(e.g., Lawn, Grass, or Pasture covering more than 75% of the open space)*
- Total project site area
- Sub-watershed area
- Runoff Reduction Credits

Post-Construction Water Balance

- Must be performed for each land use/soil type combination for each project sub-watershed.

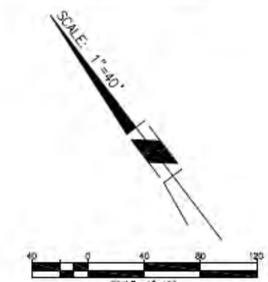
LEGEND

- SURFACE FLOW DIRECTION
- DRAINAGE BASIN BOUNDARY
- VEGETATED AREAS W/ EFFICIENT IRRIGATION CONTROL
- BIORETENTION AREAS
- WEEKLY STREET SWEEPING
- TE COVERED TRASH ENCLOSURE AND PET WASTE BAG SUPPLY
- TRACT BOUNDARY
- PROPOSED STORM DRAIN
- POROUS PAVEMENT
- STAGE 2 BIORETENTION AREA
- BMP-VORTECHS 1000



SECTION B-B

SECTION A-A



	A	B
Total Area	3.18	3.92
Roof Area	1.11	0.98
Impervious Area, not counting roof area	0.99	1.3
Pervious Area	1.08	1.64

Water Balance Calculator Demonstration

To Calculator

Soil Particle Size Analysis

Soil Particle Size Analysis

- Performing a soil particle size analysis by American Society for Testing and Materials (ASTM) Test Method D422 will assist in:
  - Determining soil compatibility for planting of native plant species or the broadcasting of native seed mixes. It is crucial to have a good understanding of the soil type(s) at the project site.
  - Determining effective non-structural and structural BMPs to be implemented during and post-construction activities.

Soil Particle Size Analysis

ASTM D422

- ASTM D422 is a quantitative determination of the distribution of particle sizes in soils.
- The distribution of particle sizes larger than 75 micrometers (retained on the No. 200 sieve) is determined by sieving.
- The distribution of particle sizes smaller than 75 micrometers is determined by a sedimentation process using a hydrometer.
- Sieve analysis, hydrometer analysis and hygroscopic moisture analysis shall be performed on the sample soil.

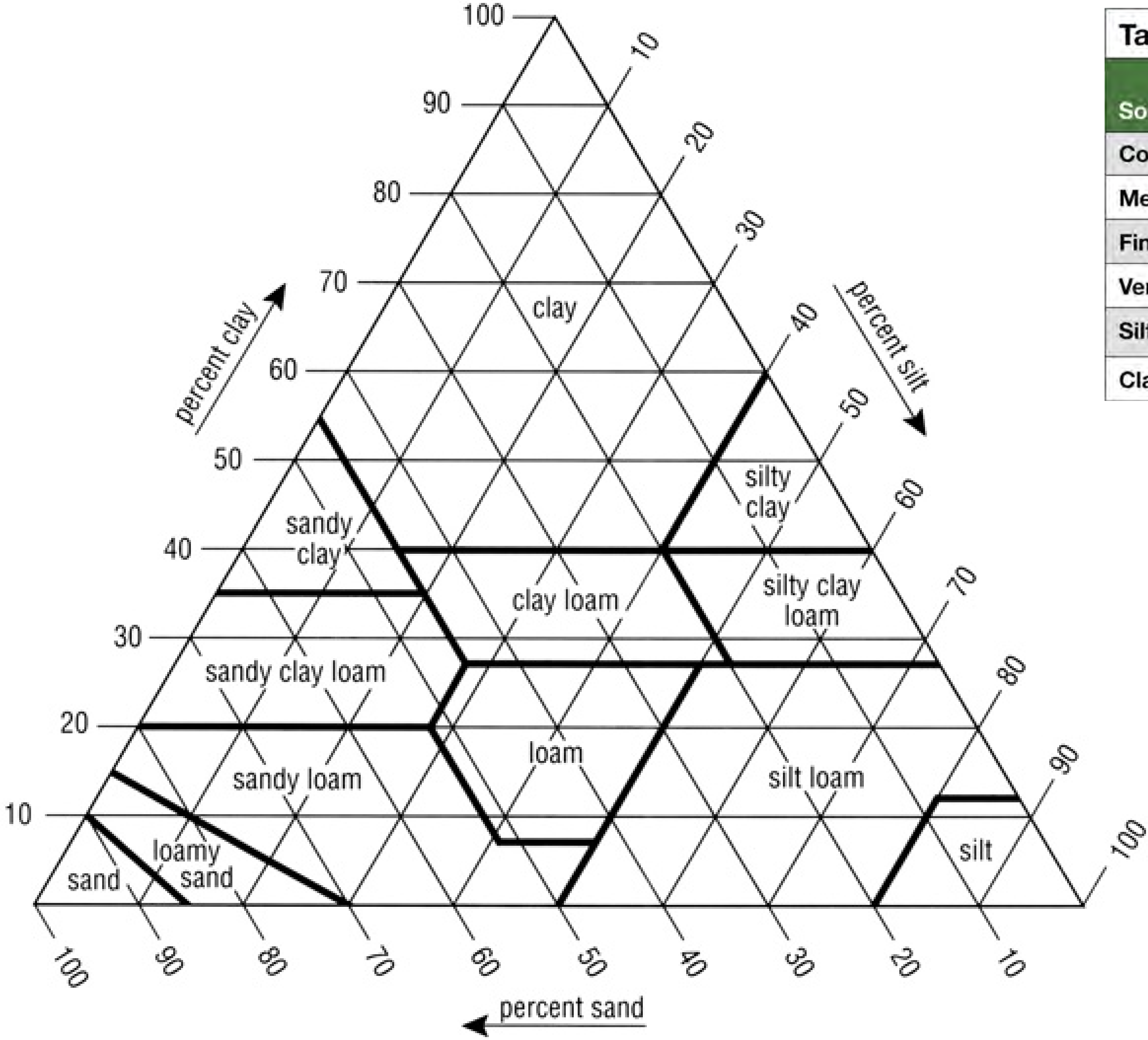


Table 1. Soil Particle Sizes	
Soil Type	**Particle Diameter, mm**
Coarse sand	0.5 – 1
Medium sand	0.25 – 0.5
Fine sand	0.1 – 0.25
Very fine sand	0.005 – 0.1
Silt	0.002 – 0.05
Clay	<0.002

Standard USDA soil texture triangle http://www.soils.usda.gov/

K Determination

$$K_{fact} = (1.292)\left[2.1\text{x}10^{-6} f_p^{1.14}(12 - P_{om}) + 0.0325(S_{struc} - 2) + 0.025(f_{perm} - 3)\right] \quad (5.51)$$

$$f_p = P_{silt}(100 - P_{clay}) \quad (5.52)$$

f_p is the particle size parameter (unitless)
P_{om} is the percent organic matter (unitless)
S_{struc} is the soil structure index (unitless)
f_{perm} is the profile-permeability class factor (unitless)
P_{clay} is the percent clay (unitless).

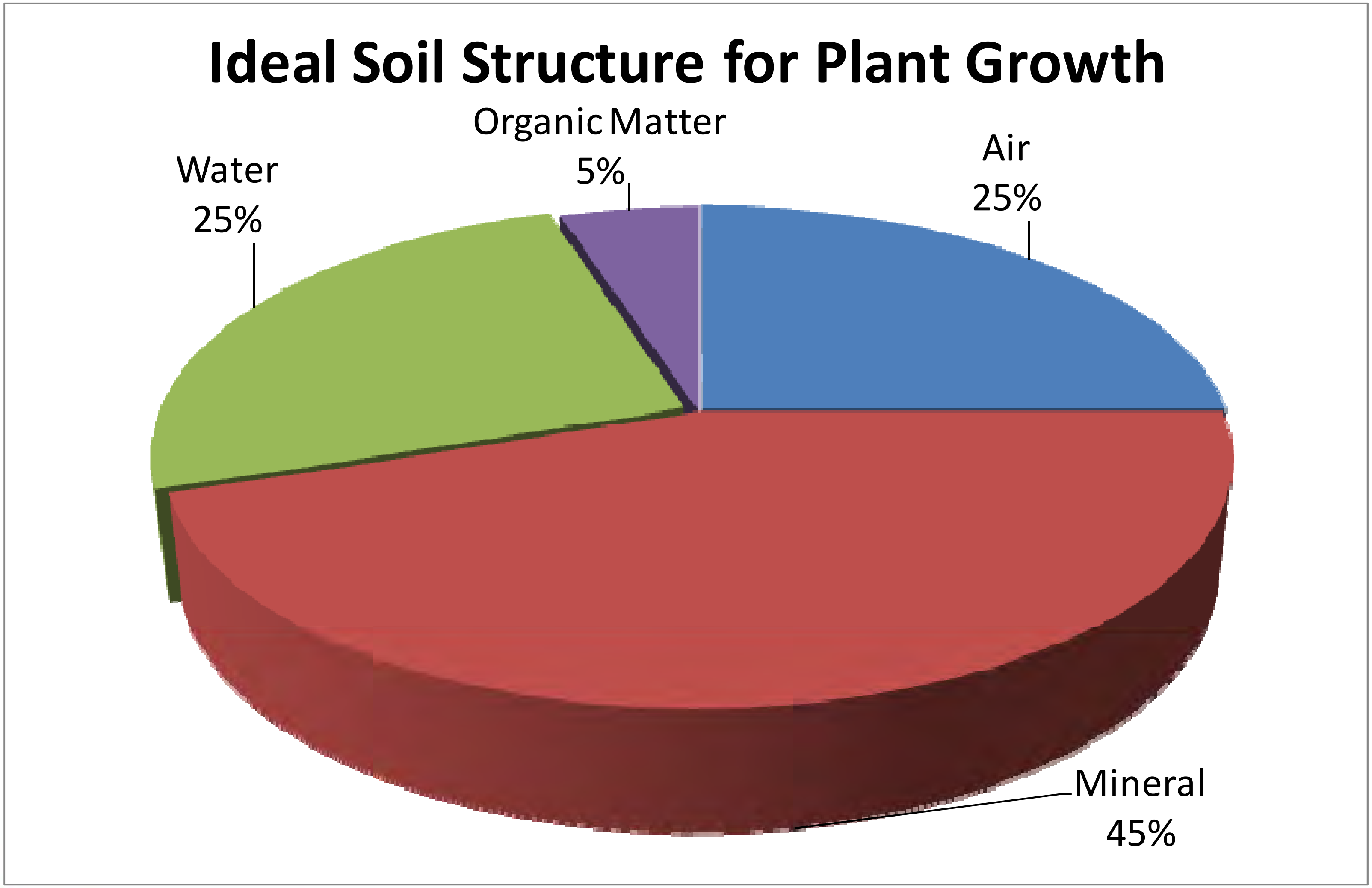
K Determination Con't

- The profile-permeability class factor, f_{perm}, is equal to: 1 for very slow infiltration; 2 for slow infiltration; 3 for slow to moderate infiltration; 4 for moderate infiltration; 5 for moderate to rapid infiltration; 6 for rapid infiltration

S_{struc}, is equal to: 1 for very fine granular soil; 2 for fine granular soil; 3 for medium or coarse granular soil; 4 for blocky, platy, or massive soil

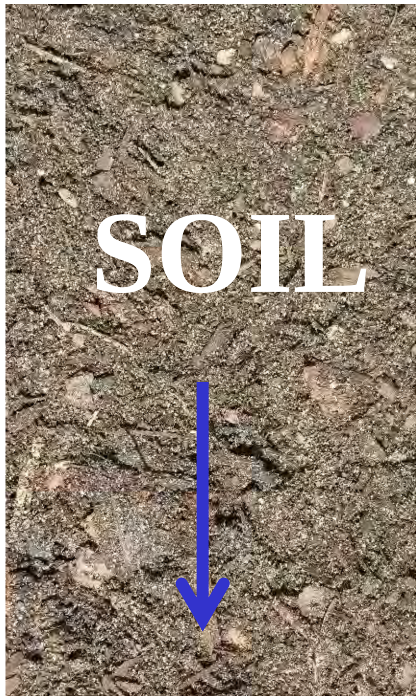
	P_{om}(%)		
Textural Class	<0.5	2	4
Sand	0.05	0.03	0.02
Fine sand	0.16	0.14	0.10
Very finesand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.08
Loamy finesand	0.24	0.20	0.16
Loamy veryfine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Fine sandyloam	0.35	0.30	0.24
Very fine sandy loam	0.47	0.41	0.33
Loam	0.38	0.34	0.29
Silt loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy clayloam	0.27	0.25	0.21
Clay loam	0.28	0.25	0.21
Silty clayloam	0.37	0.32	0.26
Sandy clay	0.14	0.13	0.12
Silty clay	0.25	0.23	0.19
Clay		0.13-0.2	

(a) The values shown are estimated averages of broad ranges of specific soil values. When a texture is near the border line of two texture classes, use the average of the two K_{fact} values. In addition, the values shown are commensurate with the English units used in the cited reference (and as used in the source-term module input files). To obtain analagous values in the metric units used in this report, the above values should be multiplied by 1.292.


Ideal Soil Structure for Plant Growth
Organic Matter
5%
Air
25%
Water
25%
Mineral
45%

Rainfall

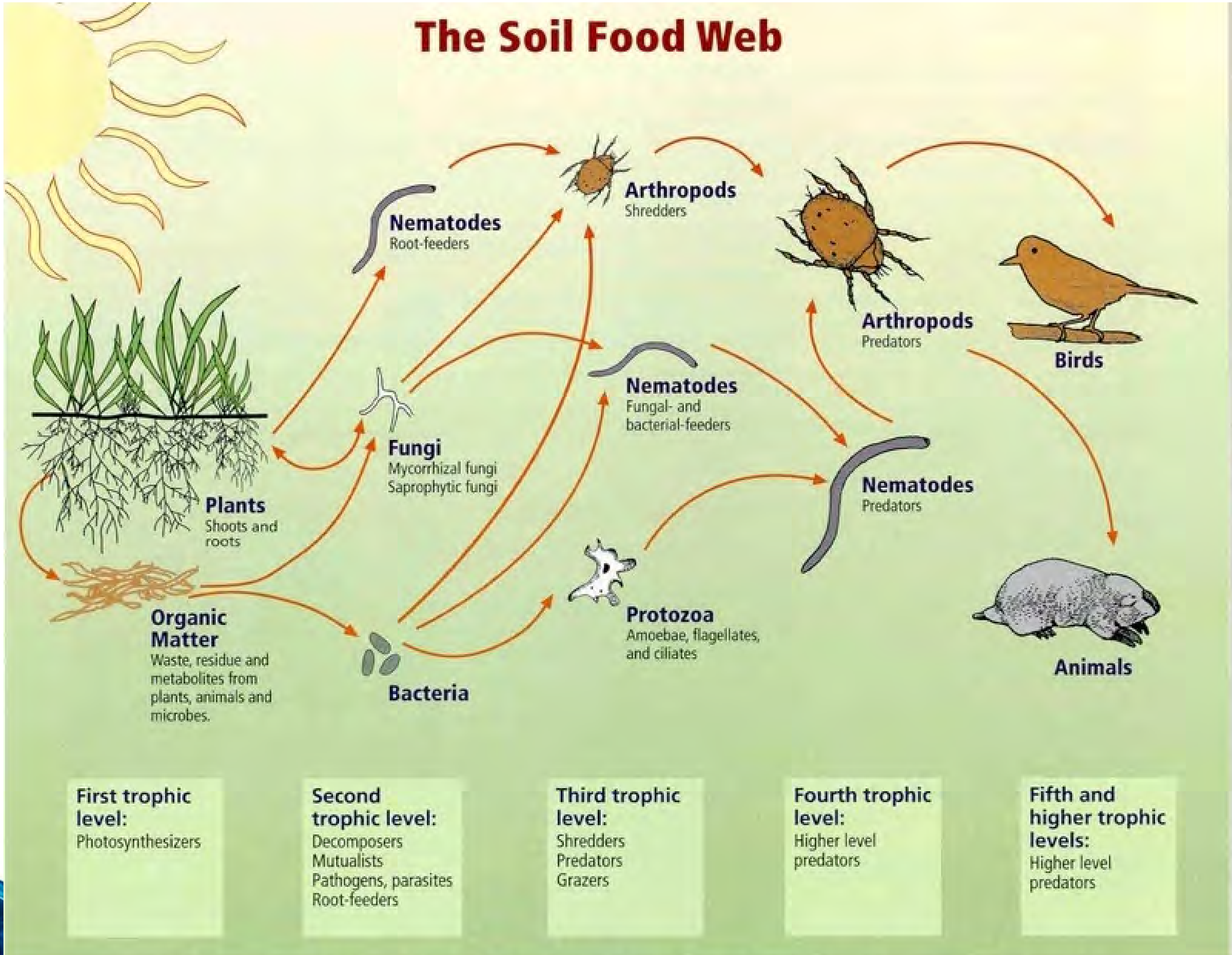
- Organisms build structure
- Nutrients held
- Water is retained and moves slowly thru the soil



Clean Water

Water moves clay, silt and inorganic chemicals so no "cleaning" process

- No organism, no structure
- Nutrients move with the water
- Water not held in soil pores, moves rapidly thru soil
- Leaching, erosion and run-off are problems



Relationships between soil food web, plants, organic matter, and birds and mammals
Image courtesy of USDA Natural Resources Conservation Service
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_food_web.html.

What happens when we maintain soil quality?

- More nutrient and water retention
- Less need for fertilizer, pesticides, etc.
- Filtering and decomposition of toxins

- Keep your soil onsite!

Risk Assessment

Risk Based Permitting Approach

A project's overall risk assessment is broken up into three steps:

1) **Project Sediment Risk** – the relative amount of sediment that can be discharged, driven largely by <u>scheduling</u> and <u>site characteristics.</u>

2) **Receiving Water Risk** – the risk sediment discharges pose to the receiving waters.

3) **Overall Risk**

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Sediment Risk</td></tr>
<tr><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td rowspan="2">Receiving Water Risk</td><td>Low</td><td>Level 1</td><td colspan="2">Level 2</td></tr>
<tr><td>High</td><td colspan="2">Level 2</td><td>Level 3</td></tr>
</table>

Traditional Risk Matrix

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Project Sediment Risk</td></tr>
<tr><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td rowspan="3">Receiving Water Risk</td><td>Low</td><td>Type 1</td><td>Type 1</td><td>Type 2</td></tr>
<tr><td>Medium</td><td>Type 1</td><td>Type 2</td><td>Type 3</td></tr>
<tr><td>High</td><td>Type 2</td><td>Type 3</td><td>Type 3</td></tr>
</table>

Linear Risk Matrix

Risk Assessments (Traditional)

First: Does the project qualify for a waiver?

If no, perform risk assessment

Step 1: Determine Sediment Risk

Step 2: Determine Receiving Water Risk

Step 3: Determine Combined Risk Level

If yes,

Complete waiver forms on SMARTS, submit $200 fee to State Board, WDID will be issued

Risk determination worksheets available at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml

Or, use the calculator in SMARTS!

LUP Type Assessments (Linear)

First: Does the project qualify for a waiver?

If no, perform risk assessment. Start with flow chart in Attachment A.1

Step 1:	Does the project qualify for automatic LUP Type 1 designation?
Step 2 (if no):	Determine Sediment Risk
Step 3:	Determine Receiving Water Risk
Step 4:	Determine Combined LUP Type

If yes,

Complete waiver forms on SMARTS, submit $200 fee to State Board, WDID will be issued

*Linear project risk (LUP Type) is performed segment by segment; each segment may have a separate LUP Type

Risk Assessment (The Old, Slow Way)

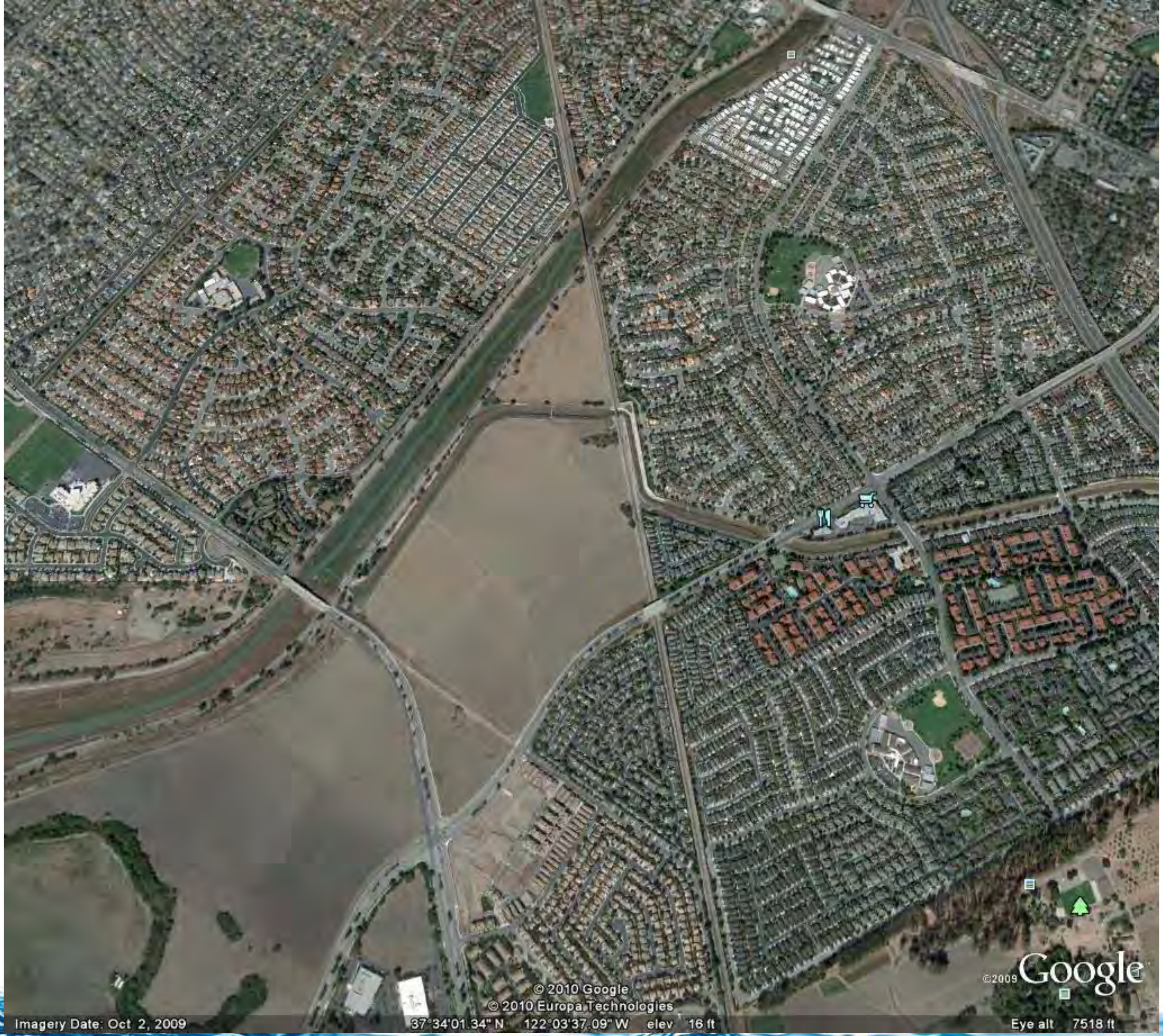
With practice, 1/2 hour

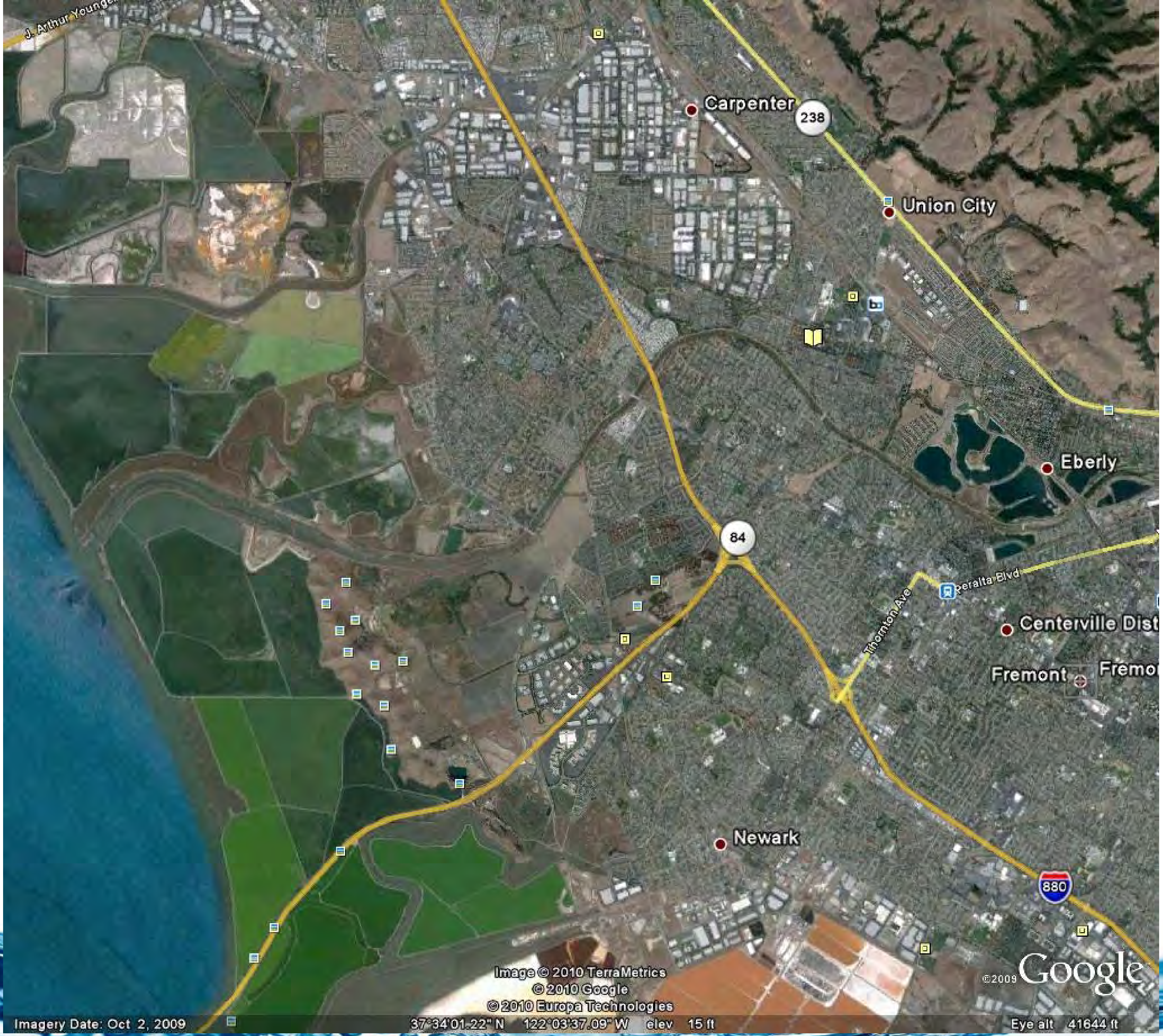
Finding the receiving water and impairments was longest task (GIS or hard copy maps were required)

Sediment Risk Factor Worksheet	Entry
A) R Factor	
Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site. http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm	
R Factor Value	0
B) K Factor (weighted average, by area, for all site soils)	
The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted. Site-specific K factor guidance	
K Factor Value	0
C) LS Factor (weighted average, by area, for all slopes)	
The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction. LS Table	
LS Factor Value	0
Watershed Erosion Estimate (=RxKxLS) in tons/acre	0
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >=15 and <75 tons/acre High Sediment Risk: >= 75 tons/acre	Low

Example Site – Risk Determination

- Project in Fremont:
  - Fictitious site
- Determine Risk Level:
  - Project sediment risk
  - Receiving water risk
- Risk determinations drive the requirements for the site – They must be done as the first step


© 2010 Google
© 2010 Europa Technologies
Imagery Date: Oct 2, 2009
37°34'01.34" N 122°03'37.09" W elev 16 ft
Eye alt 7518 ft
©2009 Google


J. Arthur Younger
Carpenter
238
Union City
Eberly
84
Peralta Blvd
Thornton Ave
Centerville Dist
Fremont
Fremon
Newark
880
Image © 2010 TerraMetrics
© 2010 Google
© 2010 Europa Technologies
©2009 Google
Imagery Date: Oct 2, 2009
37°34'01.22" N 122°03'37.09" W elev 15 ft
Eye alt 41644 ft

Sediment Risk Factor Worksheet

Sediment Risk Factor Worksheet	Entry
A) R Factor	
Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm to determine the R factor for the project site.	
http://cfpub.epa.gov/npdes/stormwater/waiver.cfm	
R Factor Value	40.11
B) K Factor (weighted average, by area, for all site soils)	
The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Refer to GIS Map provided or site-specific data (requires submittal of supporting data).	
K Factor Value	0.45
C) LS Factor (weighted average, by area, for all slopes)	
The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use GIS Map provided or LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.	
LS Factor Value	0.01
Watershed Erosion Estimate (=RxKxLS) in tons/acre	0.180495
Site Sediment Risk Factor	
Low Sediment Risk: < 15 tons/acre	
Medium Sediment Risk: >/=15 and <75 tons/acre	**Low**
High Sediment Risk: >/= 75	

Determine Site R Factor

- The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1,000 locations in the Western U.S. Refer to http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Facility Name: Fremont Test Site
Start Date: 05/17/2010
End Date: 05/17/2012
Latitude: 37.5658
Longitutde: -122.0619

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF **84.02** HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **05/17/2010 - 05/17/2012**.

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction.
You do not qualify for a waiver from NPDES permitting requirements.

Start Over

Stormwater Information
Recent Additions
FAQs
Publications
Regulations
Training & Meetings
Links
Contacts

Enter R Value

A) R Factor	
Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm to determine the R factor for the project site.	
R Factor Value	84.02

USDA Soil Survey

Stormwater

RBF CONSULTING

Web Soil Survey - Home | Web Soil Survey

http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

K Factor, Whole Soil

View Description | View Rating

View Options

Map ☑

Table ☑

Description of Rating ☑

Rating Options ☑

☐ Detailed Description

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cutoff

Tie-break Rule: Lower / Higher

Layer Options: ◉ Surface Layer ○ Depth Range

Top Depth

Bottom Depth

○ Inches ◉ Centimeters

○ All Layers

View Description | View Rating

T Factor

Wind Erodibility Group

Wind Erodibility Index

Soil Physical Properties

Soil Qualities and Features

Water Features

Warning: Soil Ratings Map may not be valid at this scale.

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Tables — K Factor, Whole Soil — Summary By Map Unit

Summary by Map Unit — Alameda County, California, Western Part

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131	Omni silty clay loam, drained	.28	15.4	15.0%
143	Sycamore silt loam, drained	.49	42.9	42.0%
144	Sycamore silt loam, clay substratum	.49	43.8	42.9%
162	Water		0.0	0.0%
Totals for Area of Interest			**102.1**	**100.0%**

Description — K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt,

WssNavigate_salemnp....png | Show all downloads...

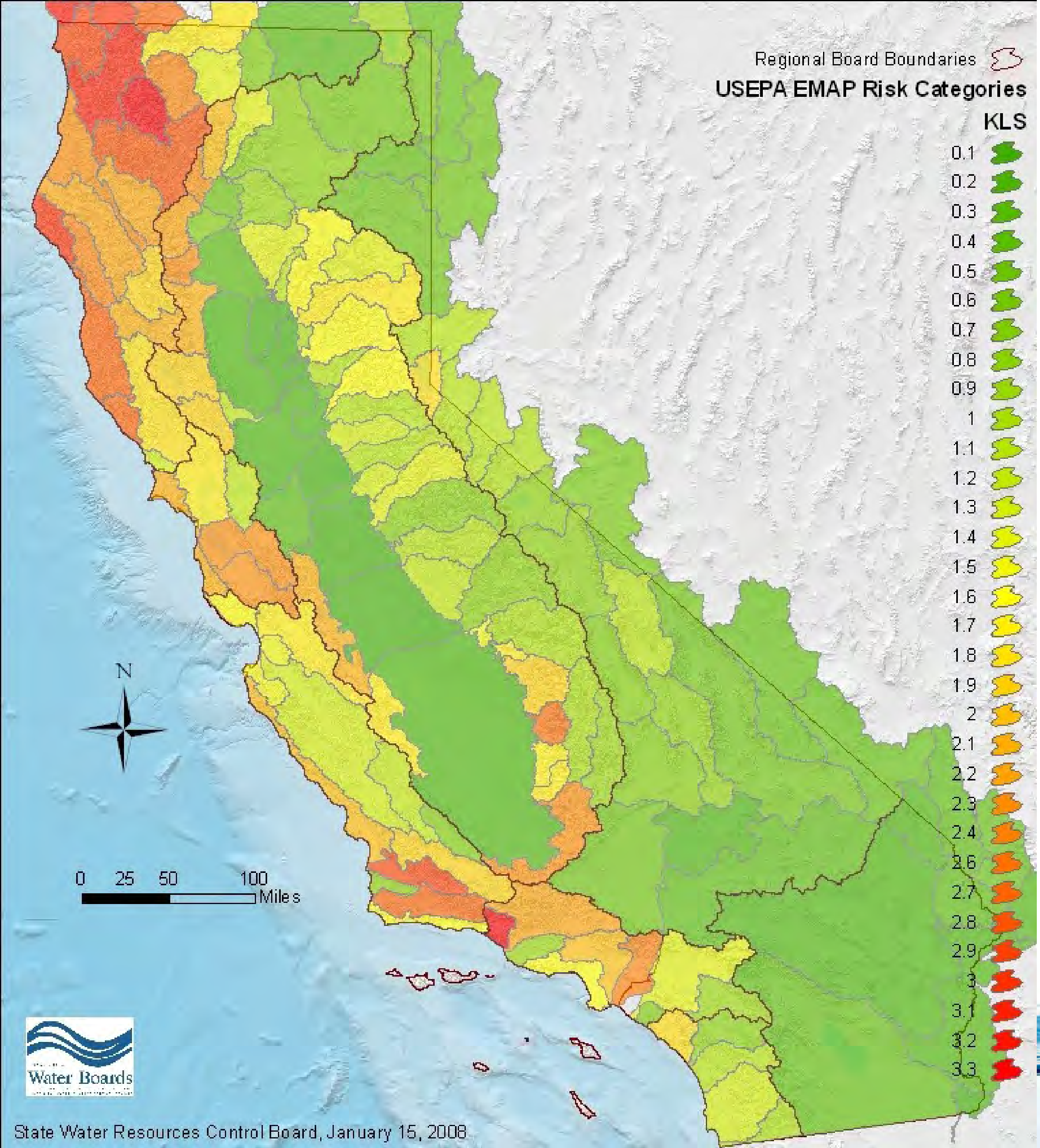
start | 3:29 PM

Enter K Factor

B) K Factor (weighted average, by area, for all site soils)	
The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Refer to GIS Map provided or site-specific data (requires submittal of supporting data).	
K Factor Value	0.46

Enter LS Value

C) LS Factor (weighted average, by area, for all slopes)	
The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use GIS Map provided or LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.	
LS Factor Value	0.13

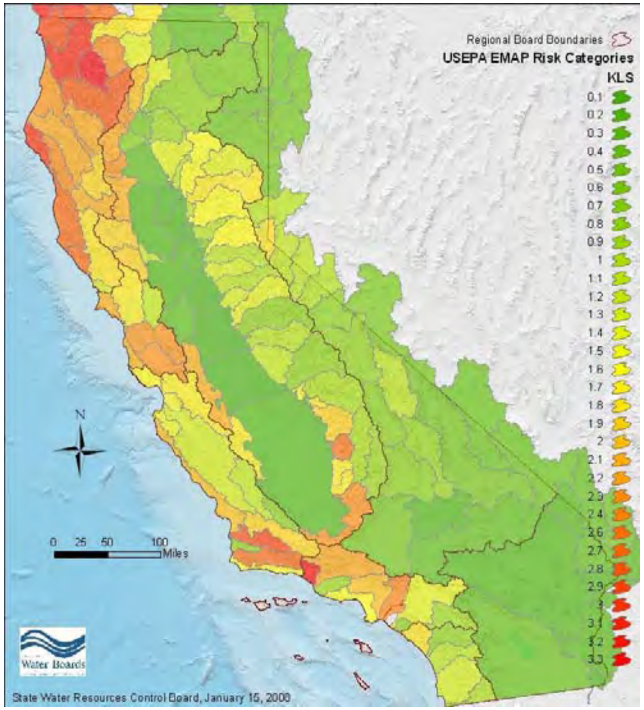


- KLS Map

Stormwater RBF CONSULTING

Comparison of KLS value vs. K*LS

USEPA EMAP Risk Categories, KLS Value



KLS Value 0.3

Soil Survey, K Factor and Site LS Factor

Tables — K Factor, Whole Soil — Summary By Map Unit

Summary by Map Unit — San Diego County Area, California

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AtE	Altamont clay, 15 to 30 percent slopes	.20	13.6	49.0%
AtE2	Altamont clay, 15 to 30 percent slopes, eroded	.20	0.0	0.0%
HrC	Huerhuero loam, 2 to 9 percent slopes	.37	4.3	15.5%
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded	.37	0.1	0.2%
LeE	Las Flores loamy fine sand, 15 to 30 percent slopes	.37	0.8	2.7%
LsE	Linne clay loam, 9 to 30 percent slopes	.17	9.0	32.6%
Totals for Area of Interest			**27.8**	**100.0%**

LS determined as 0.13 from topo review, so computed K*LS = .45*.13=0.06

K*LS Value 0.06

Compute Site Sediment Risk

Sediment Risk Factor Worksheet	Entry

A) R Factor

Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.

http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm

R Factor Value	84

B) K Factor (weighted average, by area, for all site soils)

The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.

Site-specific K factor guidance

K Factor Value	0.45

C) LS Factor (weighted average, by area, for all slopes)

The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.

LS Table

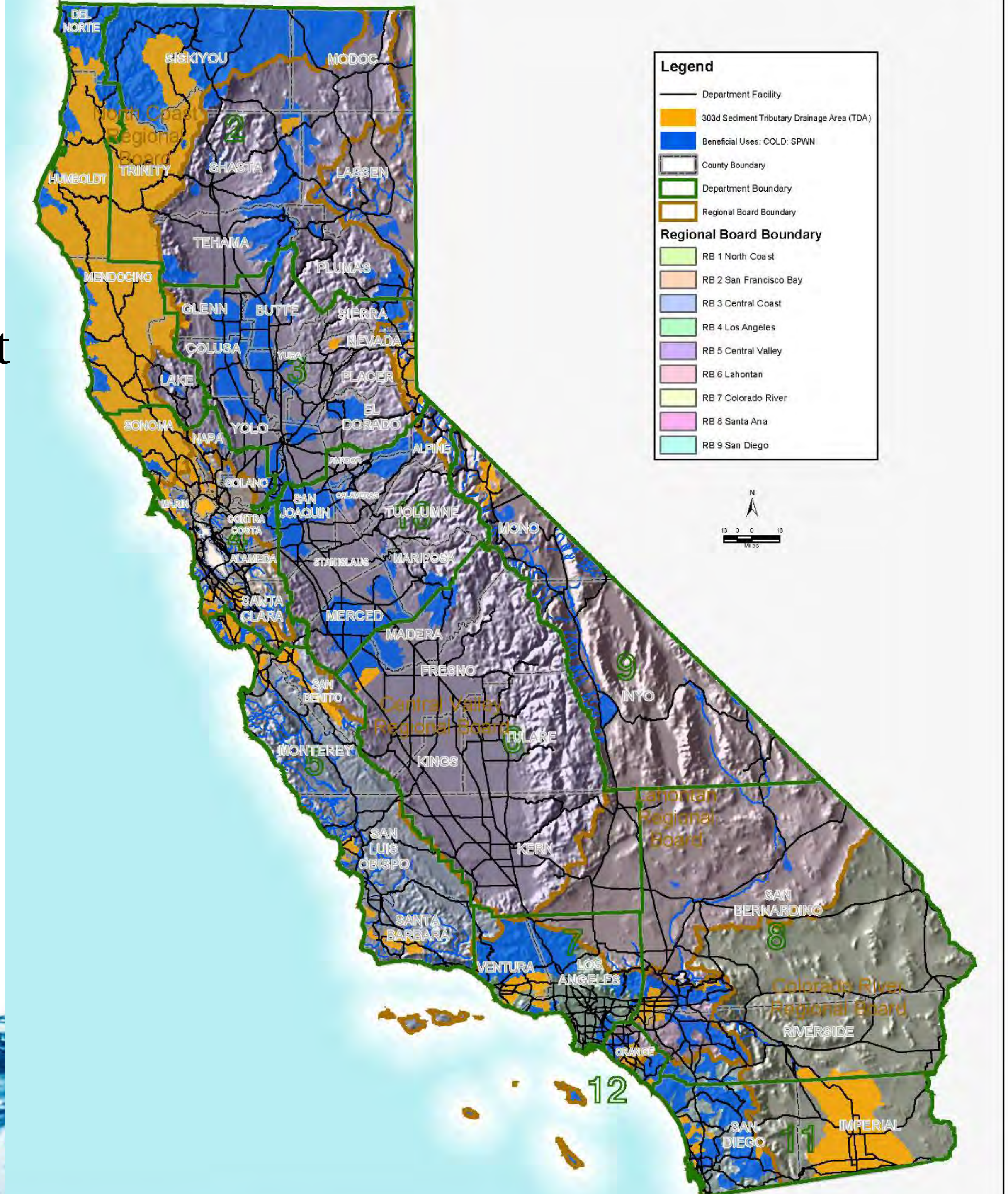
LS Factor Value	0.13
Watershed Erosion Estimate (=RxKxLS) in tons/acre	4.914
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >=15 and <75 tons/acre High Sediment Risk: >= 75 tons/acre	Low

← Human Consumptive Uses →

← Aquatic Life Uses →

COUNTY Waterbody	AGR	MUN	FRSH	GWR	IND	PROC	COMM	SHEL	COLD	EST	MAR	MIGR	RARE	SPWN	WARM	WILD (Wildlife Use)	REC-1 (Recreational Uses)	REC-2 (Recreational Uses)	NAV
San Francisco Bay South					E		E	E		E		E	E	P		E	E	E	E

303d List



water

Receiving Water Risk

Combined Risk Level Matrix

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level 1	Level 2	
High	Level 2		Level 3

Project Sediment Risk:	Low
Project RW Risk:	Low
Project Combined Risk:	Level 1

Owner Info | Developer Info | Site Info | Addtnl Site Info | Risk | Billing Info | Attachments | Certification | Print | Status History | NOTs

SEDIMENT RISK FACTOR WORKSHEET
Instructions: Enter R,K and LS factor values.System will calculate watershed erosion estimates and site sediment risk factor
A. Sediment Risk

A) R Factor Value:(What's this?)	* Find R Factor
B) K Factor Value (weighted average, by area, for all site soils)(What's this?) ***If not using the SWRCB map(Populate K Factor) upload your analysis on the Attachment Tab prior to submitting to the SWRCB.	* Populate K Factor Statewide Map of K Values
C) LS Factor (weighted average, by area, for all slopes)(What's this?) ***If not using the SWRCB map(Populate LS Factor) upload your analysis on the Attachment Tab prior to submitting to the SWRCB.	* Populate LS Factor Statewide Map of LS Values
Watershed Erosion Estimate (=R*K*LS) in tons/acre	
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >/= 15 and <75 tons/acre High Sediment Risk: >/= 75 tons/acre	

RECEIVING WATER (RW) RISK FACTOR WORKSHEET
A. Watershed Characteristics

A.1. Does the disturbed area discharge (either directly or indirectly) to a 303(d)-listed waterbody impaired by sediment? If answer is "yes," the project is automatically a high receiving water risk project - proceed to "total risk" worksheet. For help with impaired waterbodies please see below: 2006 Approved Sediment Impaired WBs Worksheet http://www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists2006_epa.shtml http://atlas.resources.ca.gov/imaps/atlas/app.asp OR A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of COLD and SPAWN and MIGRATORY? Please see below: http://www.ice.ucdavis.edu/geowbs/asp/wbquse.asp	Populate Receiving Water Risk Select * Yes = High, No = Low Statewide Map of High Receiving Water Risk Watersheds	

C. Combined Risk Level Matrix

		Sediment Risk		
		Low	Medium	High
Receiving Water Risk	Low	Level1	Level2	Level2
	High	Level2	Level2	Level3

Project Sediment Risk:

Project Receiving Water Risk:

Project Combined Risk:

Risk Assessment The Easy Way

Save & Exit | Save & Continue

Project Sediment Risk: Revised Universal Soil Loss Equation (RUSLE)

$C = 1$

$P = 1$

$$A = \boxed{R \times K \times LS} \times \boxed{\cancel{C \times P}}$$

A = the rate of sheet and rill erosion (tons/acre)

R = rainfall erosivity factor

K = soil erodibility factor

LS = length slope factor

Receiving Water Risk: Sediment Sensitive Waterbodies

1. Receiving water has Beneficial Uses of COLD ***and*** SPAWN ***and*** MIGRATORY
2. CWA 303(d) list for waterbodies impaired for a sediment pollutant (TSS, turbidity, siltation)
3. TMDL for sediment, silt, or turbidity

Receiving Water Risk Traditional Projects

If any of the receiving water risk conditions 1-3 are met, the project has ***HIGH*** receiving water risk.

If none of the conditions above are met, the project has ***LOW*** receiving water risk.

Traditional Project Risk Matrix

		Sediment Risk		
		Low	**Medium**	**High**
Receiving Water Risk	**Low**	Level 1	Level 2	Level 2
	High	Level 2	Level 2	Level 3

Receiving Water Risk
Linear Projects

If :

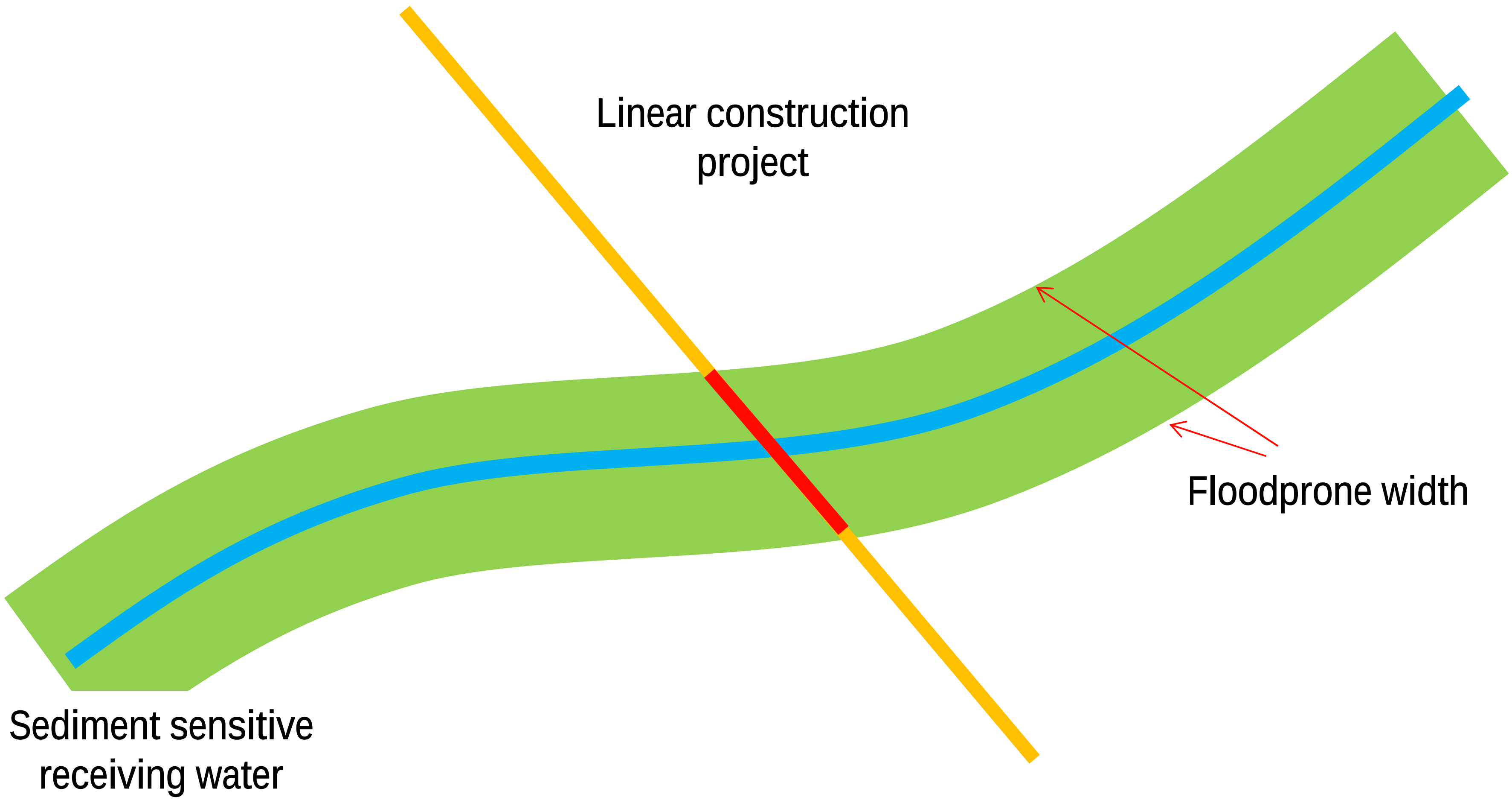
(1) any of the receiving water risk conditions 1-3 are met, AND the land disturbance is within the floodprone zone of the receiving water, the project has ***HIGH*** receiving water risk.

(2) Any of the receiving water risk conditions 1-3 are met, AND the land disturbance is NOT within the floodprone zone of the receiving water, the project has ***MEDIUM*** receiving water risk

(3) If none of the conditions above are met, the project has ***LOW*** receiving water risk.

Linear Project Risk Matrix

		Project Sediment Risk		
		Low	**Medium**	**High**
Receiving Water Risk	**Low**	Type 1	Type 1	Type 2
	Medium	Type 1	Type 2	Type 3
	High	Type 2	Type 3	Type 3


Linear construction project
Floodprone width
Sediment sensitive receiving water

SMARTS Demo

- Traditional Project Risk Assessment
- Linear Project Risk Assessment
- See next slide for test project location – UC Irvine

Vallejo Ave
Greenmore Way
Junction Blvd
Junction Blvd
Washington Blvd
Southern Pacific
Corporation Yard Rd
Alta Vista Ave
Cortez Ave
Encinal Ave
Washington Blvd
All America City Blvd
All America City Blvd
Los Vegas Ave
Stanford Ave
Washington Blvd
Southern Pacific
Lincoln St
Lawton Ave
Niles Ave
Vallejo Ave
Elefa St
Elefa St
Elefa St
Elefa St
mapquest
50 m
150 ft

Stormwater

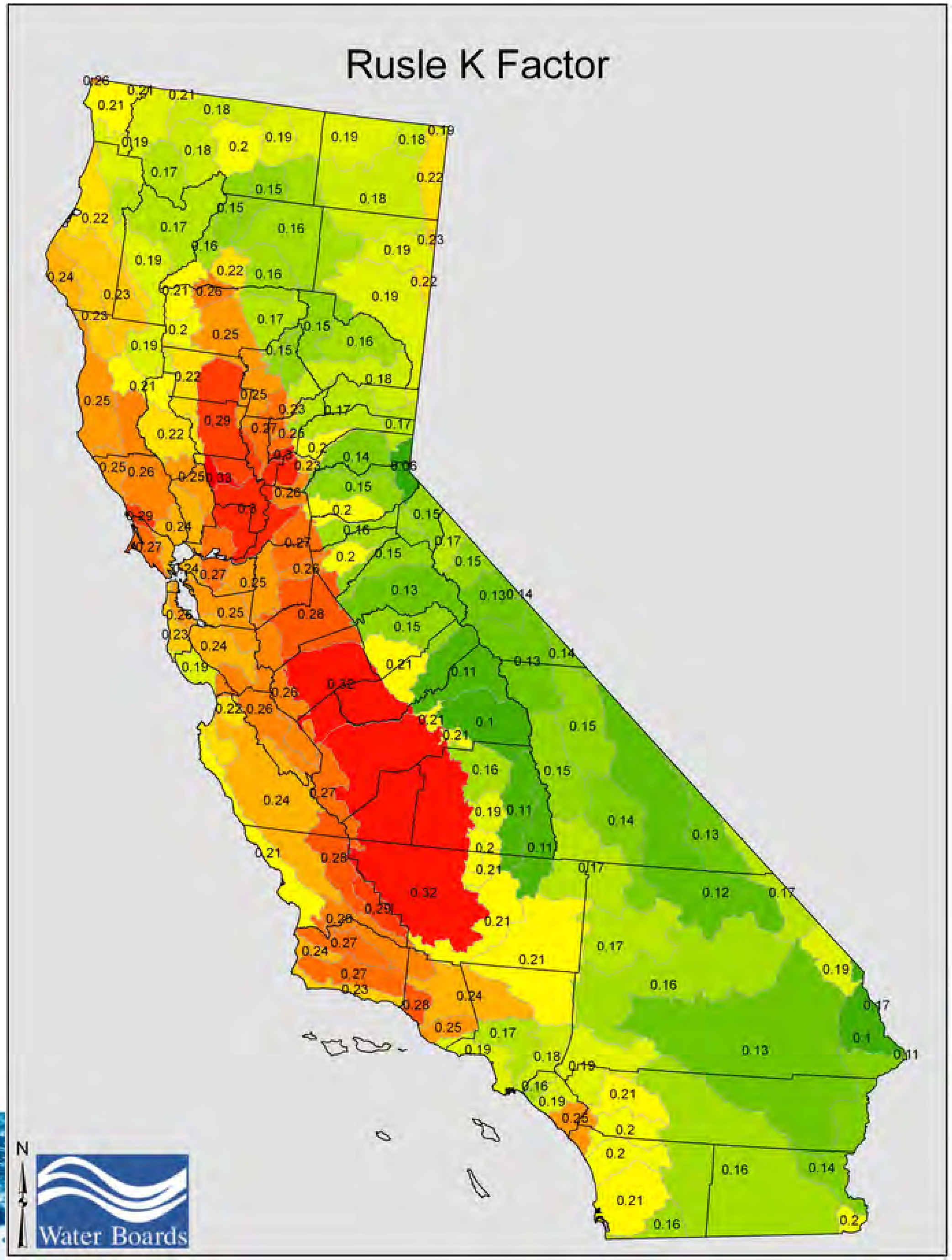
SMARTS Demo

- Click to reach SMARTS
- Click to reach the SMARTS Beta System

Average Watershed Slope (%)

Sheet Flow Length (ft)	0.2	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
<3	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.35
6	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.37
9	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.38
12	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.39
15	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.40
25	0.05	0.07	0.10	0.16	0.21	0.26	0.31	0.36	0.45	0.57
50	0.05	0.08	0.13	0.21	0.30	0.38	0.46	0.54	0.70	0.91
75	0.05	0.08	0.14	0.25	0.36	0.47	0.58	0.69	0.91	1.20
100	0.05	0.09	0.15	0.28	0.41	0.55	0.68	0.82	1.10	1.46
150	0.05	0.09	0.17	0.33	0.50	0.68	0.86	1.05	1.43	1.92

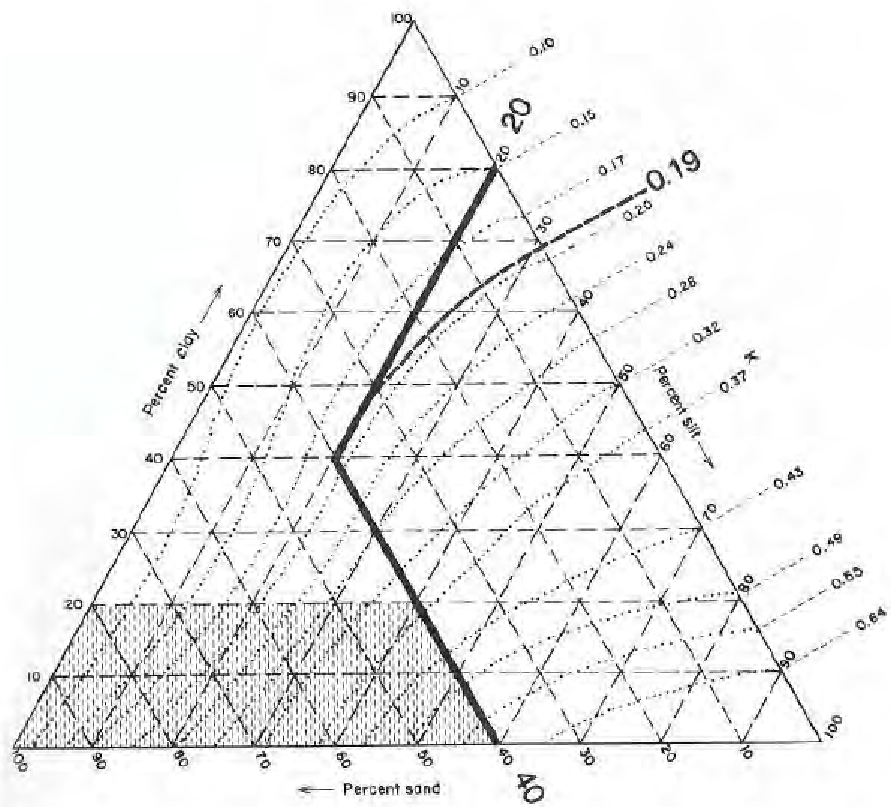
K Factor GIS Map



K Factor Soil Analysis Method

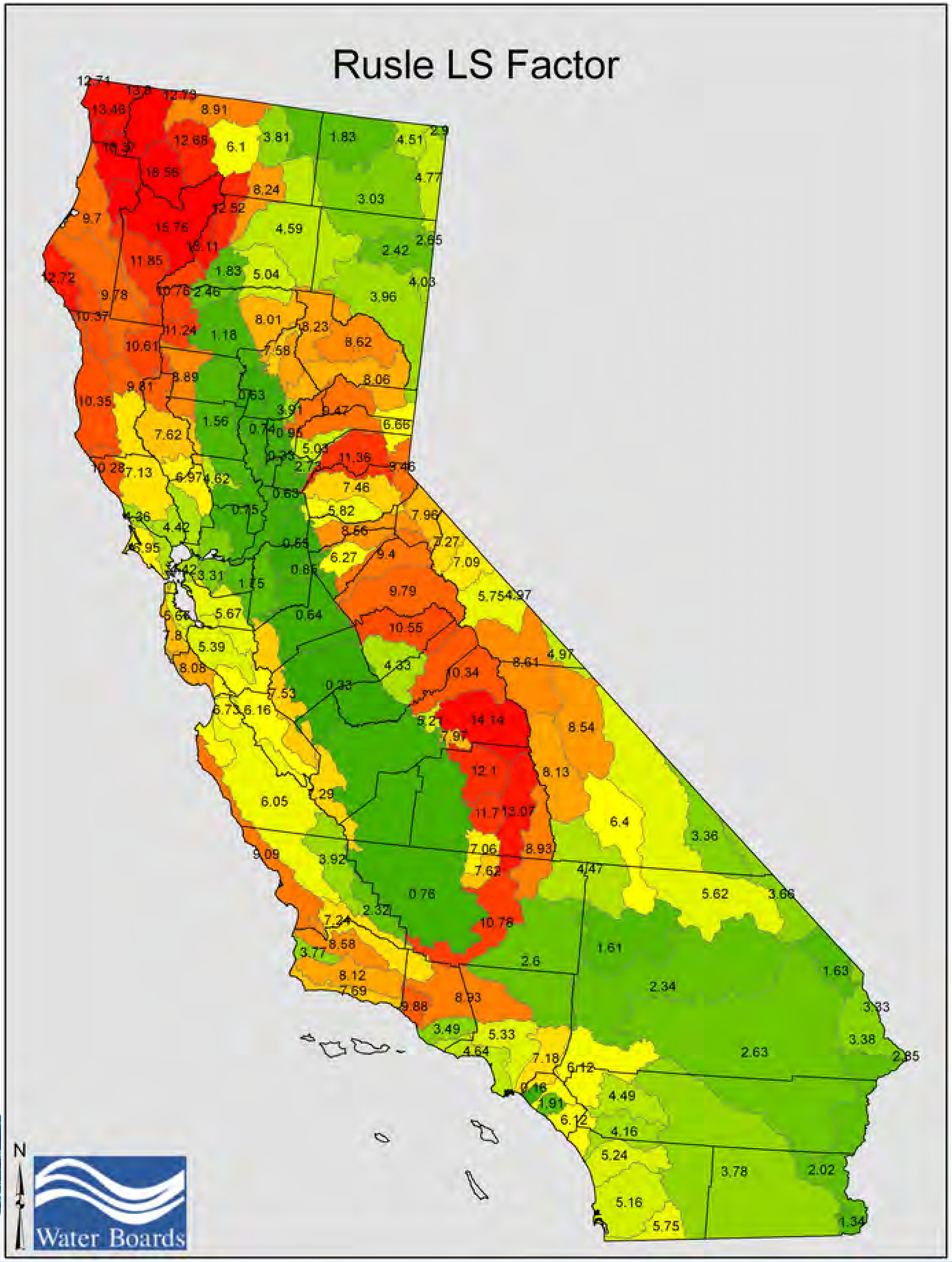
Soil Erodibility Factor (K)

The K factor can be determined by using the nomograph method, which requires that a particle size analysis (ASTM D-422) be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure below to determine appropriate K value.



Erickson triangular nomograph used to estimate soil erodibility (K) factor.
The figure above is the USDA nomograph used to determine the K factor for a soil, based on its texture (% silt plus very fine sand, % sand, % organic matter, soil structure, and permeability).
Nomograph from Erickson 1977 as referenced in Goldman et. al., 1986.

LS Factor GIS Map



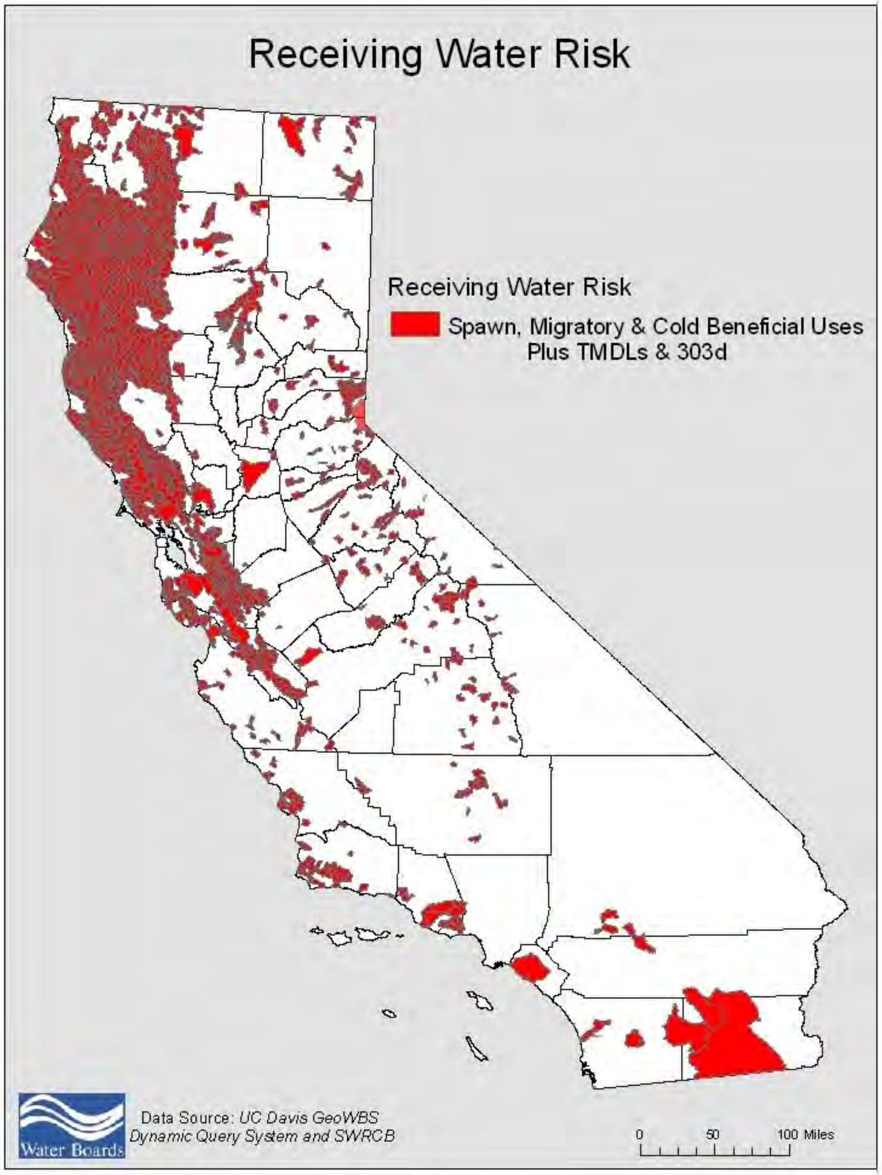
ter RBF CONSULTING

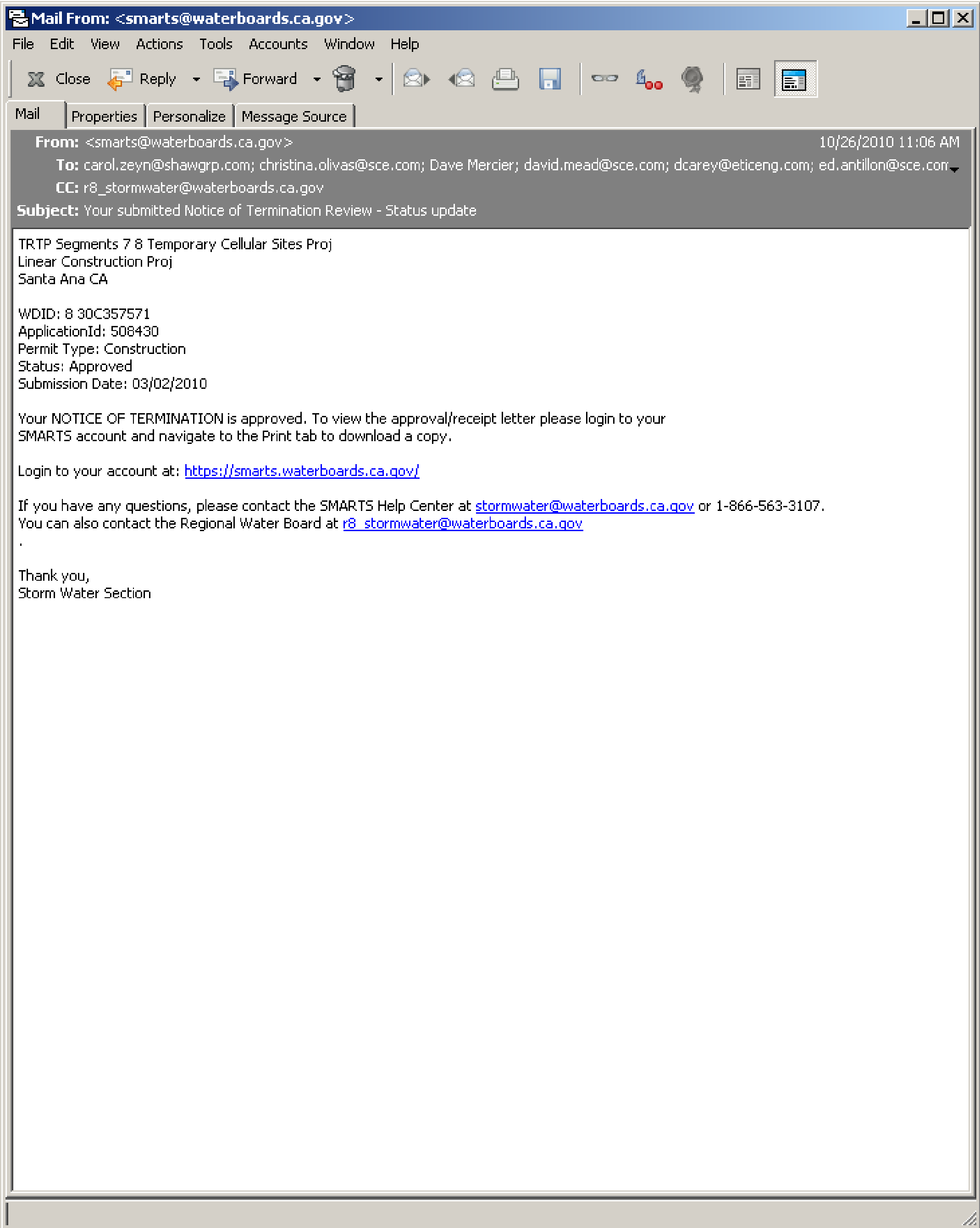
Receiving Water Risk

Sediment Sensitive Waterbodies

- Use a map or a list to determine the following:
  - CWA 303(d) list for waterbodies impaired for a sediment pollutant (TSS, turbidity, etc.)
  - USEPA approved Total Maximum Daily Load implementation plan for sediment
  - Beneficial uses of COLD, SPAWN, and MIGRATORY

Spawn, Migratory & Cold Beneficial Uses, TMDLs & 303d




Mail From: <smarts@waterboards.ca.gov>

File Edit View Actions Tools Accounts Window Help

Close Reply Forward

Mail | Properties | Personalize | Message Source

From: <smarts@waterboards.ca.gov> 10/26/2010 11:06 AM

To: carol.zeyn@shawgrp.com; christina.olivas@sce.com; Dave Mercier; david.mead@sce.com; dcarey@eticeng.com; ed.antillon@sce.com

CC: r8_stormwater@waterboards.ca.gov

Subject: Your submitted Notice of Termination Review - Status update

TRTP Segments 7 8 Temporary Cellular Sites Proj
Linear Construction Proj
Santa Ana CA

WDID: 8 30C357571
ApplicationId: 508430
Permit Type: Construction
Status: Approved
Submission Date: 03/02/2010

Your NOTICE OF TERMINATION is approved. To view the approval/receipt letter please login to your SMARTS account and navigate to the Print tab to download a copy.

Login to your account at: https://smarts.waterboards.ca.gov/

If you have any questions, please contact the SMARTS Help Center at stormwater@waterboards.ca.gov or 1-866-563-3107.
You can also contact the Regional Water Board at r8_stormwater@waterboards.ca.gov
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Thank you,
Storm Water Section

Project Status Emails from SMARTS

R-Factor Sensitivity Analysis				
Location	**Start Date**	**End Date**	**Duration**	**R-Factor**
Santa Barbara	1/1	1/30	1 month	9
	8/1	8/30	1 month	2.08
	1/1	1/1	1 year	91.14
	1/1	1/1	2 year	189.14
Fresno	1/1	1/30	1 month	1.04
	3/1	3/30	1 month	1.38
	1/1	1/1	1 year	13.94
	1/1	1/1	2 year	27.94
	10/1	3/1	5 month	8.89
	12/1	5/1	5 month	8.83
	3/1	8/1	5 month	4.07
Indio	1/1	1/1	1 year	10.03
	1/1	1/1	2 year	20.06
	10/1	12/1	2 month	2.15
Berkeley	10/1	12/1	2 month	4.97
	10/1	12/2	2 month, 1 day	5.23
	11/1	1/1	2 month	14.8
	7/1	9/1	2 month	0.09

Risk Assessment Tips

- Know where to find your references
- Understand how to manipulate R-Factor
- Use K and LS maps/SMARTS as a first step
- If risk comes out high or borderline, do a second check using more detailed methods
- LS map in SMARTS is likely to overestimate in flat areas
- Receiving waters may be difficult to determine
  - not all receiving waters are listed in Basin Plan or 303(d)
  - Sometimes GIS is the only tool
- Know where to find help

Three Ways to Reduce Risk

- Construct during the dry season (in general May 1 to October 1) only (this will reduce the R-factor)
- Shorten project duration (this will reduce the R-factor)
- For linear projects, divide the project into segments. Discrete segments may have different risk levels (this will reduce the size of high risk segments)

Bioassessment Monitoring

Bioassessment Monitoring

Required for projects that meet all of the following:

- Rated Risk Level 3 or LUP Type 3
- Directly discharges runoff to a freshwater wadeable stream that is either:
    1. Listed by the State Water Board or USEPA as impaired due to sediment <u>and/or</u>
    2. Tributary to any downstream water body that is listed for sediment; <u>and/or</u> have SPAWN & COLD & MIGRATORY beneficial use
- Total project-related ground disturbance is > 30 acres.

Bioassessment Monitoring

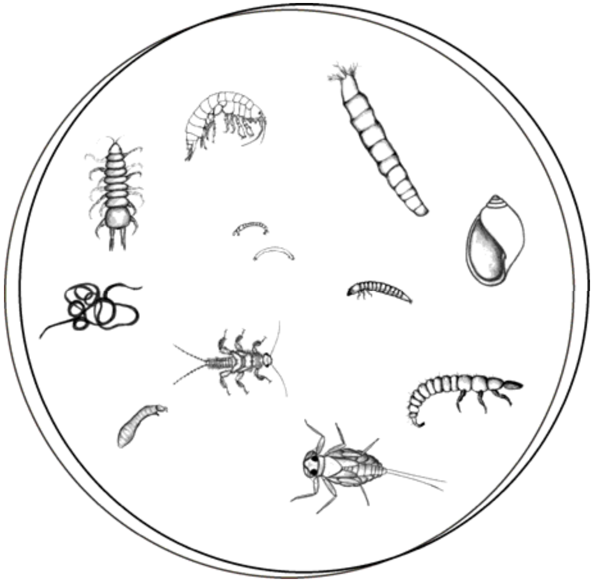
Objectives

- Measure the population of freshwater benthic macroinvertibrates.
- Assess the effect of the project on the biological integrity of receiving waters.
- The collection and reporting of:
  - Specified biological data
  - Specified physical habitat data

Bioassessment Monitoring

What are Freshwater Benthic Macroinvertibrates?

- Animals without backbones and larger than ½ millimeter.
- Live on rocks, logs, sediment, debris and aquatic plants.
- Includes crustaceans such as crayfish, mollusks such as clams and snails, aquatic worms and the immature forms of aquatic insects such as stonefly and mayfly nymphs.



http://www.umass.edu/tei/mwwp/wkshdes.html

Bioassessment Monitoring

Where can they be found?

- Can live on all bottom types, even on manmade objects.
- In hot springs, small ponds and large lakes
- Expand their distribution by drifting with currents to a new location during the aquatic phase of their life or by flying to a new stream during their terrestrial phase.
- They remain in the water for most of their lives (typically 1 month to 4 years).

Bioassessment Monitoring

Why use them for bioassessments?

- Less able to escape the effects of sediment and other pollutants that diminish water quality.
- Give us reliable information on stream and lake water quality.
- Extremely diverse group of aquatic animals, and the large number of species possess a wide range of responses to stressors such as organic pollutants, sediments, and toxicants.
- Many are long-lived, allowing detection of fast paced pollution events such as pesticide spills and illegal dumping.

Bioassessment Monitoring Exception

If construction commences <u>out of an index period</u>, for the site location, the discharger shall:

- Receive Regional Water Board approval for the sampling exception
- Invest $7,500 x # of samples required into the SWAMP program as compensation (upon Regional Water Board approval).
- Make a check payable to: Cal State Chico foundation or San Jose State Foundation (SWAMP Bank Accounts) and include the WDID number on the check for the amount calculated for the exempted project.
  - Must be documented in PRDs
- Send a copy of the check to the Regional Water Board office for the site's region
- Conduct bioassessment monitoring, as described in Appendix 3.

Bioassessment Monitoring

Sampling Frequency

- Samples are to be collected *within the sampling index period* for both:
  - **Before** ground disturbance is initiated, and
  - **After** the project is completed.
- The “after” samples shall be collected after at least one winter season resulting in surface runoff has transpired after project-related ground disturbance has ceased.
  - NOT can be filed prior to collecting “after” sample if conditions for filing have been met per the permit requirements.

Bioassessment Monitoring

Site Locations and Frequency

- "Before" and "after" samples shall be collected both upstream and downstream of the project's discharge.
- Upstream samples should be taken immediately before the sites outfall and downstream samples should be taken immediately after the outfall ("when safe").

Bioassessment Monitoring

Site Locations and Frequency

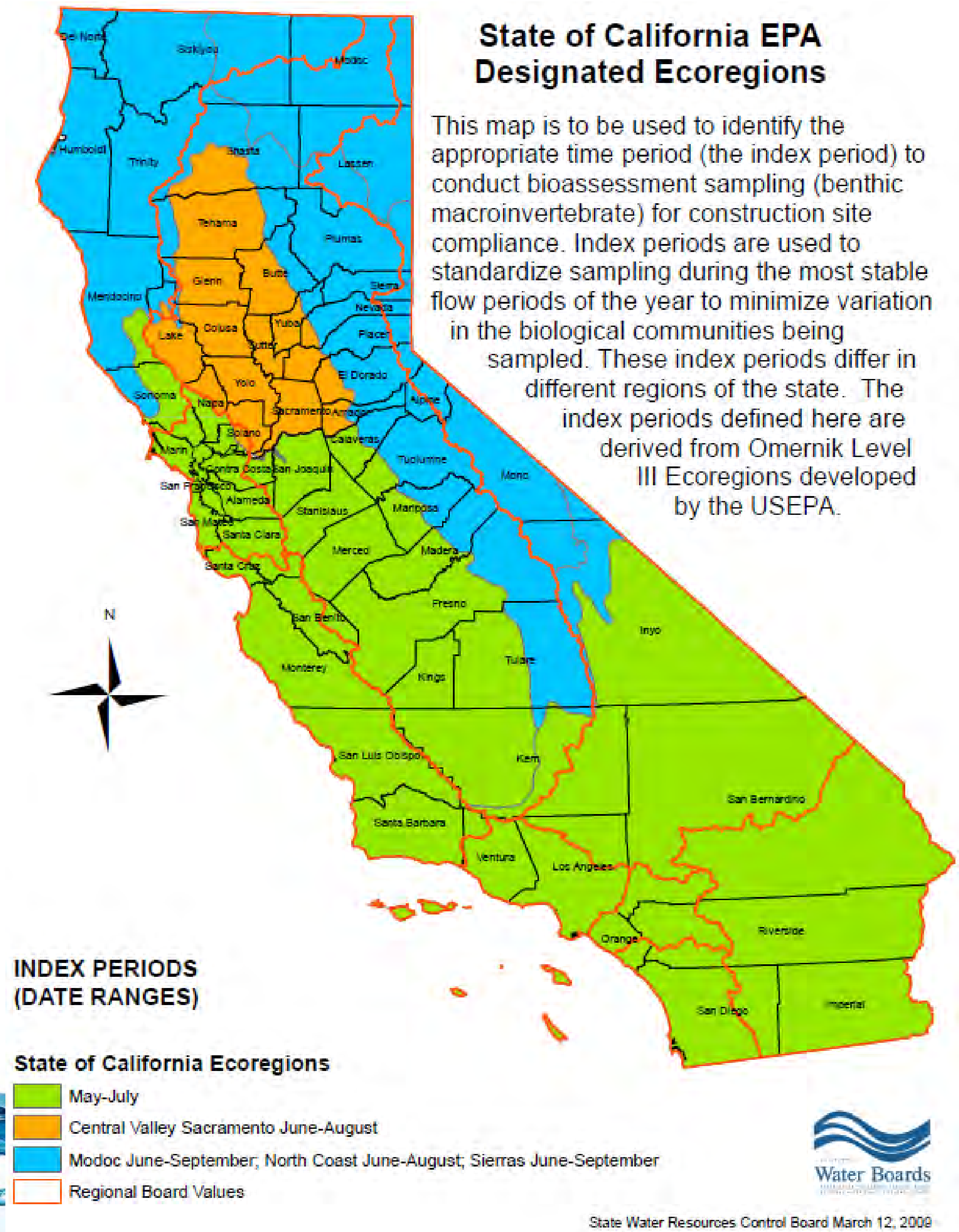
- Samples should be collected for <u>each</u> freshwater wadeable stream that is listed as impaired due to sediment, or tributary to a water body that is listed for sediment.
- Habitat assessment data shall be collected concurrently with all required macroinvertibrate samples.

Bioassessment Monitoring

Index Period

- Shall be conducted during the index period most appropriate for bioassessment sampling (depends on ecoregion).
- (Not required if the construction of the project is to be performed <u>outside</u> of the sampling index period).

Designated Ecoregions Map



Bioassessment Monitoring

Planning for Monitoring

- Know your Project's specific Ecoregion.
- Use qualified personnel to perform field sampling
  - "Reachwide Benthos (Multi-habitat) Procedure" as well as the full suite of physical characterization.
- Use qualified Laboratories to perform the analysis
  - per Standard Taxonomic Effort (STE) Level 1 of the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT)
  - fixed-count of 600 organisms per sample.

Bioassessment Monitoring

Planning for Monitoring

- Have a quality assurance (QA) plan in place that covers the required bioassessment monitoring.
- The QA plan is to include, or be supplemented to include, a specific requirement for external QA checks (i.e., verification of taxonomic identifications and correction of data where errors are identified).
- Budget and schedule for external QA checks to be performed by the California Department of Fish and Game's Aquatic Bioassessment Laboratory.

Bioassessment Monitoring

Planning for Monitoring

- Plan and budget for samples for each taxon id to be stored for 3 years after completion of all QA evaluations.
  - e.g., a sample with 45 identified taxa would be archived in a minimum of 45 vials, each containing all individuals of the identified taxon.
- External QA checks shall be performed on randomly selected samples collected per calendar year, or 10% of the samples per year (whichever is greater).
- An alternate laboratory may be used once approved.

Bioassessment Monitoring

Data Submittal

- The macroinvertebrate results are to be submitted to the State Water Board in electronic format.
- SWAMP is currently developing standardized formats for reporting bioassessment data.
- Until available, the biological data is to be submitted in MS-Excel (or equivalent) format.
- The physical/habitat data shall be reported using the standard format titled *SWAMP Stream Habitat Characterization Form – Full Version.*

Bioassessment Monitoring

Invasive Species Protection

- Precautions shall be taken to prevent the introduction or spread of aquatic invasive species.

- At minimum, the recommendations of the CDFG to minimize the introduction or spread the New Zealand mudsnail are to be followed.

Images from Department of Fish and Game
http://www.dfg.ca.gov/invasives/mudsnail/

Questions?