Construction Sediment:
The Greatest Threat to Water Quality

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Organization of presentation

- **Introduction**--how construction sediment contaminates water resources
- **The Threat**--why construction sediment is the greatest threat to water quality
- **Contamination Examples**--Central Texas examples of water resource contamination from construction sediment
- **Local Controls**--construction controls most used in Texas
- **Available Controls**--construction controls used throughout the U.S.
- **Model Ordinances**--existing and model construction sediment ordinances
- **Additional Information**--references and sources for more information

Beginning of each section designated by blue type at top of slide

Introduction

Construction typically involves building highways, roads, structures, parking lots, utility lines, and work access roads. Soils are disturbed and vegetation often removed during construction. Many tons of loose sediment typically are created during this process.

Rainfall and wind then often transport tons of sediment to receiving streams, reservoirs, and aquifers, causing water quality degradation. Additionally, vegetation attenuates much of the contaminants in overland flow, thus its removal causes additional water-quality degradation of receiving streams.

Stream crossing construction

The Threat

Because of the facts presented on the next 5 slides, many earth scientists, including the author of this presentation, deem construction sediment to represent the greatest single threat to water resources.

Sediment in Barton Creek flood through Barton Springs pool

Threat 1. **Sediment is the only water-quality contaminant that exists throughout all stream basins. Within a few hours, a single small construction site can generate a sediment load sufficient to contaminate entire receiving streams, lakes, and aquifers.**

Sediment from construction of motel on Lady Bird Lake

Threat 2. **Along with sediment, typical construction site pollutants include fluids from construction equipment, adhesives, paints, cleaners, masonry, cement, fertilizers, pesticides, and wastes from electrical, plumbing, heating, and air conditioning installations.**

Bee Cave Galleria in Barton Creek basin

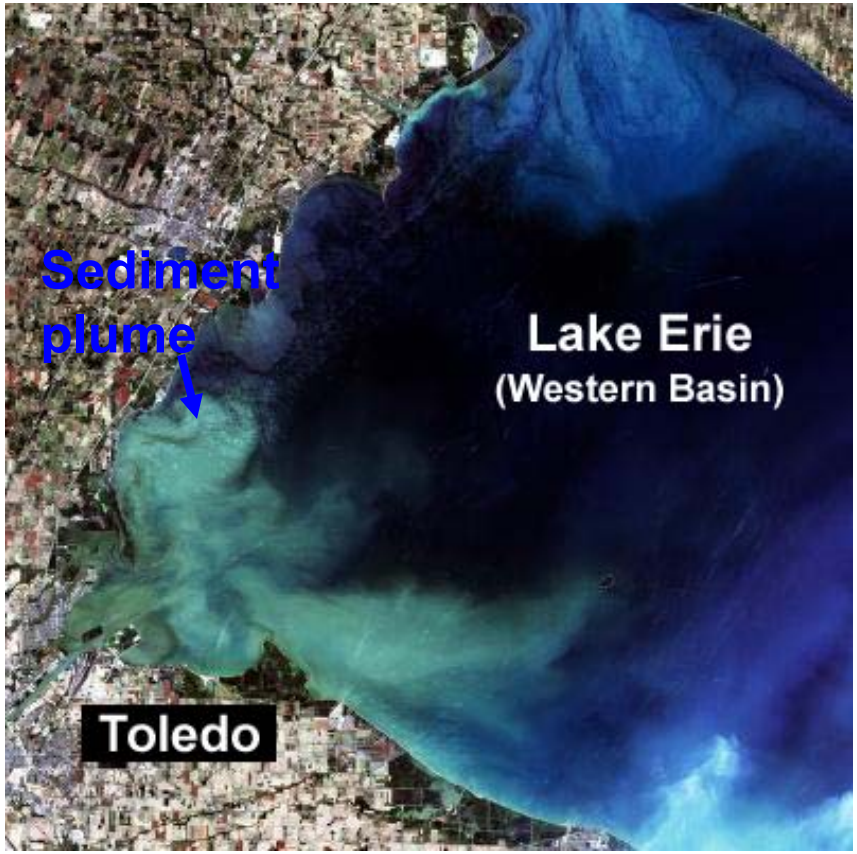

Pesticide washed into creek from improperly stored bags

Dead fish in receiving stream

Example of pesticides in runoff from Bee Cave Galleria development in the Barton Creek basin.

Threat 3. **Many studies throughout the Nation document sediment loads to be as much as 1000 times greater from construction sites than from static land use sites.**

Threat 4. **Degradation of water quality from construction sediment often is severe enough to limit or even prohibit water use and often kills biological species and vegetation in receiving waters.**



Sediment load into Onondaga Lake from Onondaga Creek. In the foregroung is Metro- the recently upgraded sewage facility for the City of Syracuse.

Threat 5. **Expensive remedial action sometimes can remove sufficient volumes of deposited and suspended sediment in order to restore limited water use. However preventive action usually is much cheaper than remedial action and aquifers and many ponds and reservoirs cannot be restored.**

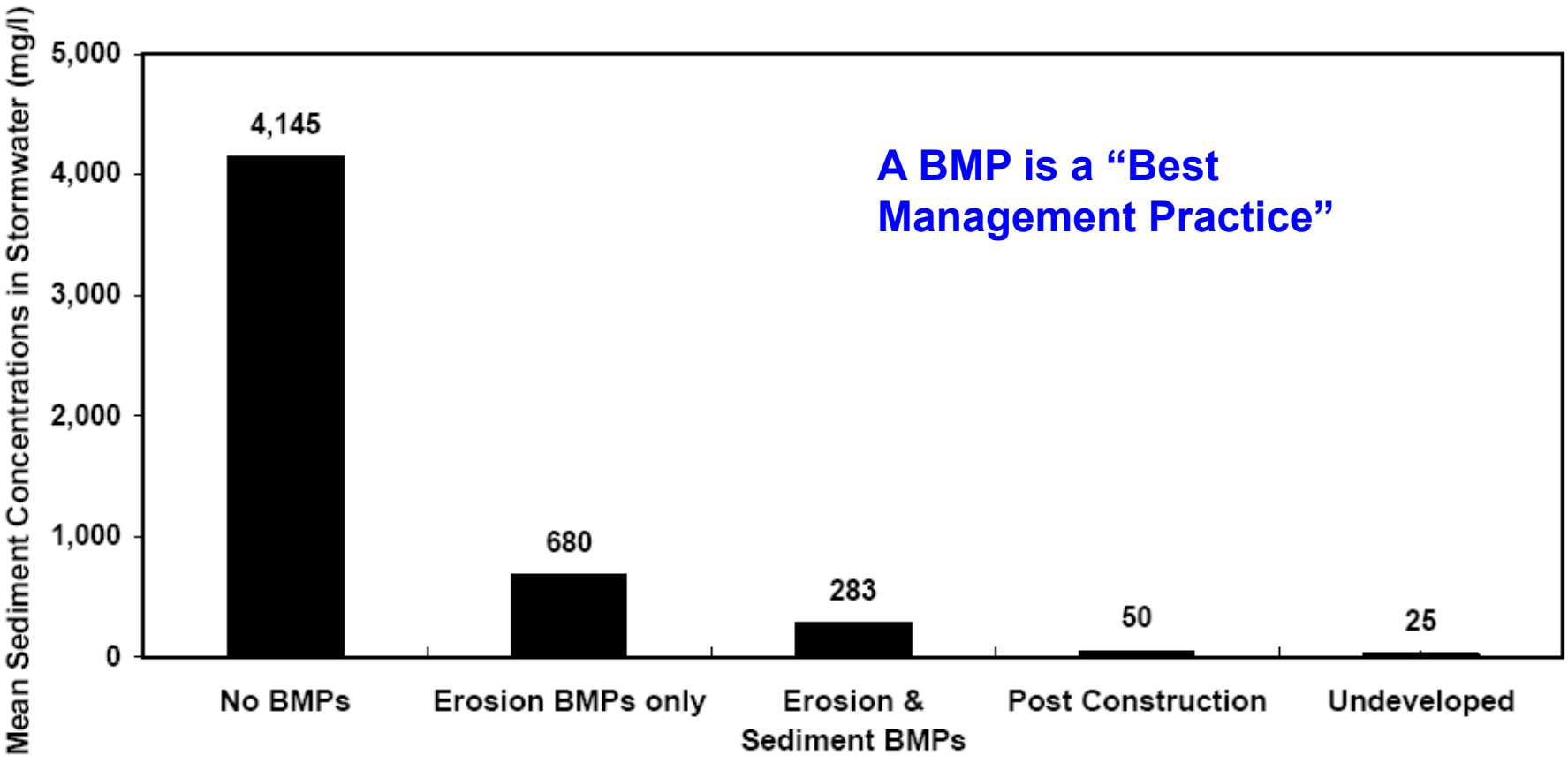
Dredging and pumping to remove sediment

Removing deposited sediment from stream

Construction site runoff
Environmental Impacts

- Transports toxic pollutants and nutrients
- Turbidity limits sunlight penetration and photosynthesis
- Reduces oxygen availability
- Clogs fish gills
- Fills spawning and breeding grounds
- Smothers bottom Communities
- Reduces visibility for feeding and upsets food chain

Effect of erosion and sediment controls on suspended sediment concentrations



Data from Piedmont, Ca.
(Schueler and Lugbill, 1990)

Dozens of studies throughout the Nation document erosion rates from natural areas (established urban, forest, rangeland) to be less than 1.0 ton per acre per year.

Many dozens of other studies document erosion from construction sites to range from 7.2 to greater than 1,000 tons per acre per year.

--EPA 840-B-92-002 report

Contamination Examples

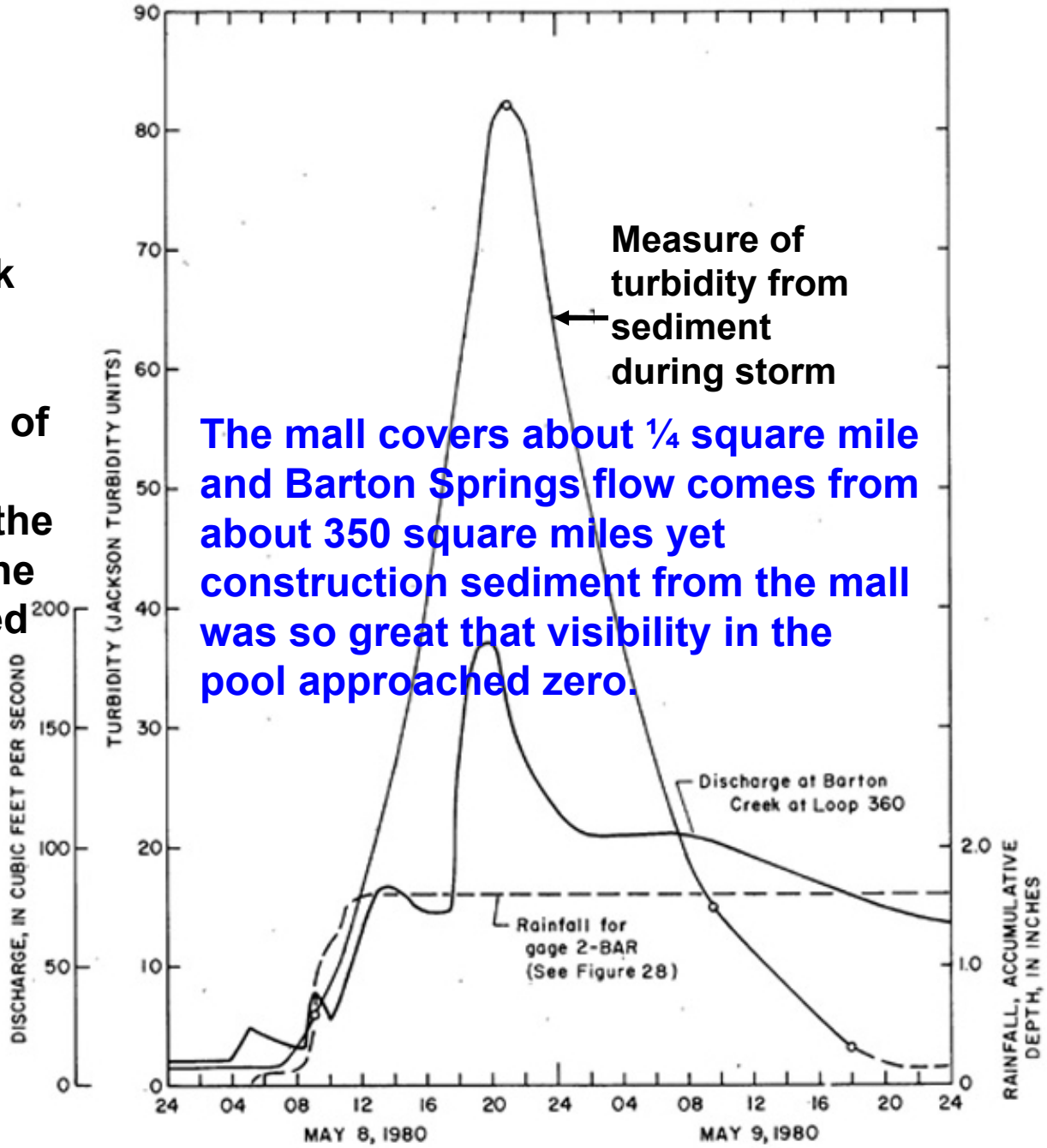
Central Texas examples of water resource contamination from construction sediment

The following slides present 5 examples where construction sediment has contaminated streams, ponds, and springs in Central Texas. For each example, the construction site represented only a very small part of the watershed area that provides runoff to the contaminated site. Each of these instances of sediment contamination could have been prevented with proper control measures.

Barton Springs

Throughout much of 1980, sediment in runoff from the construction of Barton Creek Square Mall entered Barton Creek and discharged from Barton Springs within hours of many rainfall events. The sediment concentrations at the Springs were so great that the springs pool had to be closed during such events.

Sediment in water sample from Barton Springs



Lick Creek

Green Hole on Lick Creek, West Travis County, Summer 2003

Green Hole on July 27, 2004, after rainfall caused overflow from the West Cypress Hills subdivision detention pond for development construction

Dead Mans Creek

Dead Mans Hole on Dead Mans Creek, North Hays County, before construction of a small dam in the watershed in Spring 2005

Dead Mans Hole after construction of the dam

Hamilton Creek

Hamilton Pool, West Travis County, prior to June 2007

Road cut for land development in Hamilton Creek basin began June, 2007

Hamilton Creek (cont.)

Road cut along Hamilton Creek

Hamilton Pool after a small storm flushed construction sediment to the pool

Bee Creek

Bee Creek near Hwy 71, West Travis County, prior to development in basin

Bee Creek, August 2007, immediately after development began in basin

Local Controls

Construction controls most used in Texas

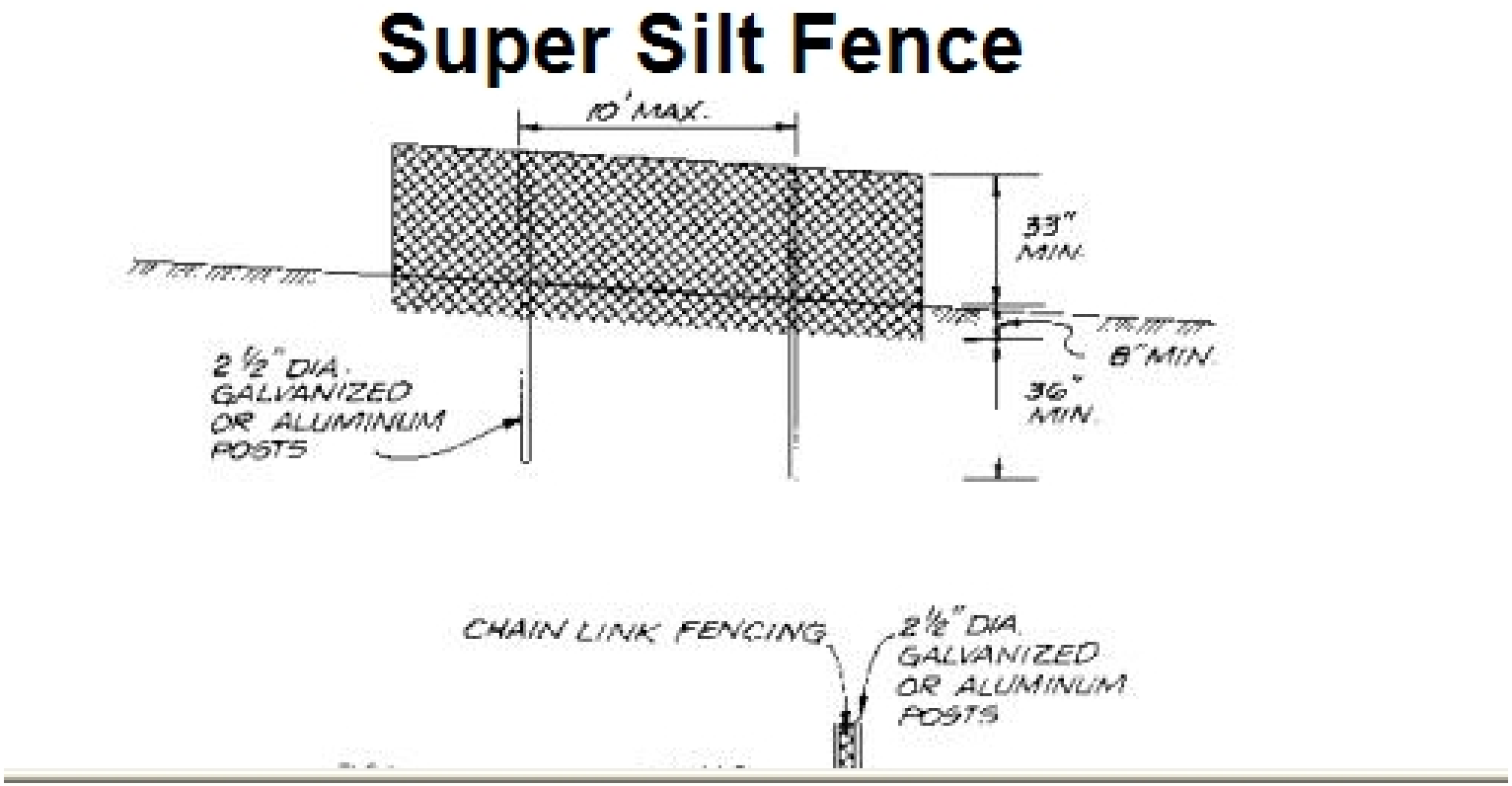
Silt fences which often fail during large storms

April 2007 photograph of sediment-saturated runoff from the AMD construction site, fouling stream waters with mud that was supposed to be stopped by a silt fence

Could this be the next construction sediment problem?

Construction of the Rocky Creek Ranch subdivision on the south side of Hamilton Pool Road about 4.5 miles west of Highway 71. The photo shows the clearing, cutting and filling pursuant to the first phase of development on the east side of Rocky Creek (a tributary of Barton Creek). June 2008 photo

A better silt fence



In some watersheds, it may be necessary to radically change fence design. There are several alternative methods to increase silt fence efficiency.

The Super Silt Fence uses a strong, thick geotextile backed by a chain link fence. The additional strength prevents failure.

www.stormwatercenter.net/Slideshows/ESC.htm

Available controls

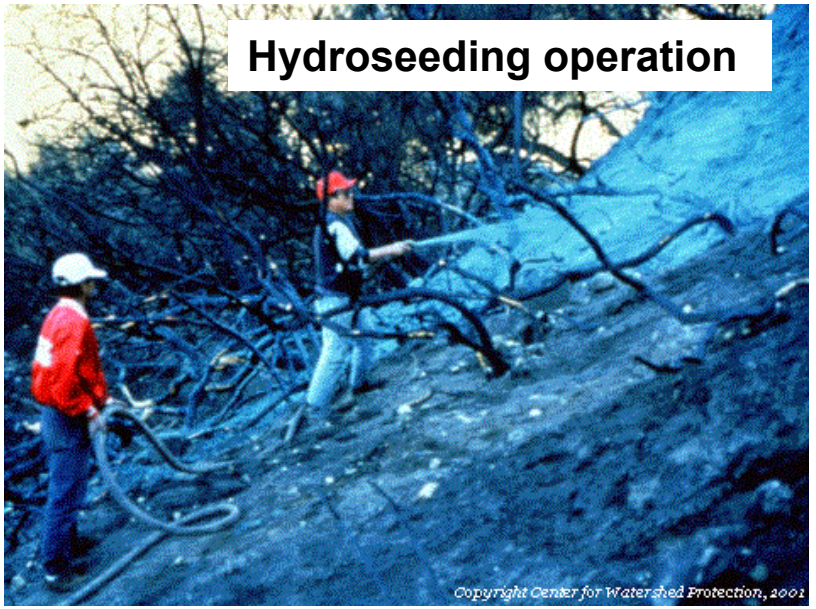
Construction controls used throughout the U.S.

Note: Most of these practices are not commonly used in Texas

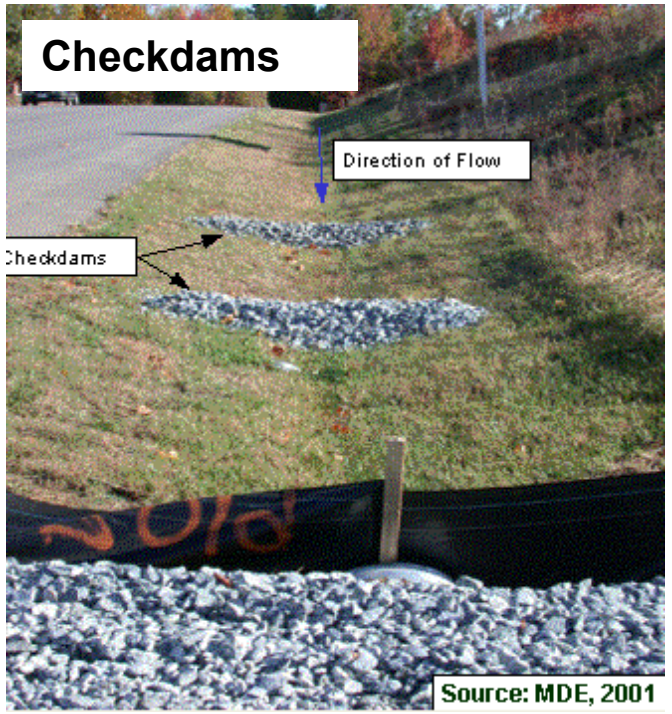
1. Minimize Clearing
2. a. Protect Waterways
   - Buffers and special crossings for waterways
2. b. Stabilize Drainageways
   - Checkdams, sod, erosion control blankets, rip rap
3. Phase Construction
4. Rapid Soil Stabilization
   - hydroseed, mulch, erosion control blankets
5. Protect Steep Slopes
6. Perimeter Controls
   - Earth dikes, diversions, silt fences, stabilize construction entrance
7. Employ Advance Settling Devices
   - sediment traps & sediment basins
8. Certified Contractors Implement Plan
9. Adjust Plan as Field Conditions change
10. Assess and Revise Practices After Storms
    - Repair damage, modify practices, reinforce, cleanout

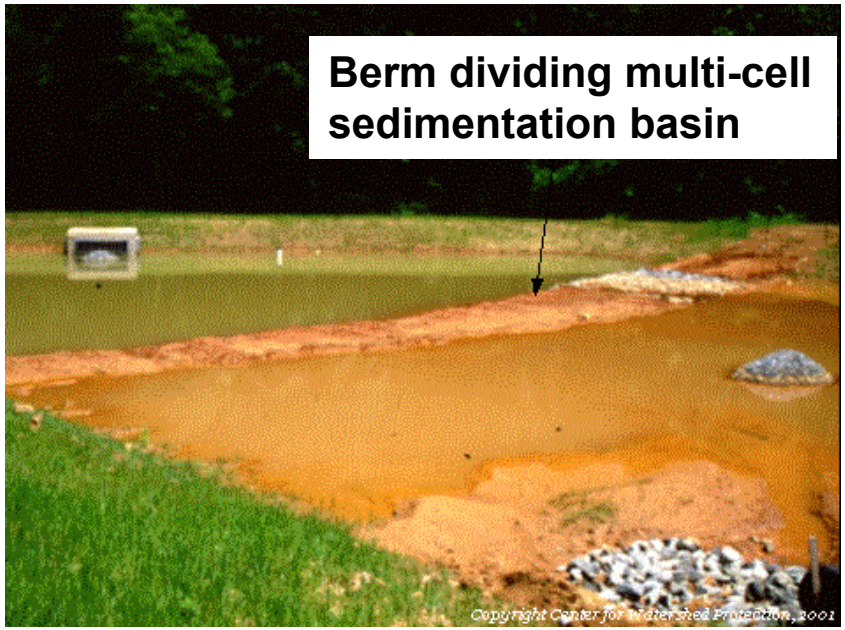
http://www.stormwatercenter.net/Slideshows/ESC.htm

Available sediment construction controls



Available sediment construction controls (cont.)





Available sediment construction controls (cont.)

Mats and hay to stabilize channel

Swale to divert runoff around construction site in non-erosive manner

Rock to stabilize channel

Bonded Fiber Matrix

Bonded Fibre Matrix has been reported to be a very effective product for controlling erosion, especially on steep slopes. It is a unique class of hydroseeding erosion control product, a hydraulically applied product that does the job as well as or better than erosion control blankets. The matrix is a continuous layer of elongated fiber strands held together by a water-resistant bonding agent. It keeps raindrops from hitting the soil because it has no holes larger than one millimetre. It allows no gaps between the product and the soil. It has a high water-holding capacity. It will not form a water-insensitive crust that can inhibit plant growth. It biodegrades into materials that help plant growth (Wikipedia).




Model Ordinances

Existing and model construction sediment ordinances

Many cities, counties, states and other governmental agencies have adopted ordinances that address all aspects of contamination from construction. Many such ordinances are presented by the Stormwater Center at http://www.stormwatercenter.net/

Click on "ordinance" on left side of page

Selected recommendations for construction sediment control in the Hill Country Area

- **A phased plan for simultaneous construction should be prepared and approved by a licensed engineer or other specialist**
- **The size of the disturbed area under construction should be no greater than that for which sediment in runoff from a 10-year storm would be contained on site.**
- **A licensed engineer or other specialist should design and approve the plan and practices for construction sediment control to assure the above.**
- **A licensed engineer or other specialist should be responsible for inspection and maintenance of the construction sediment controls and plan throughout the construction period.**

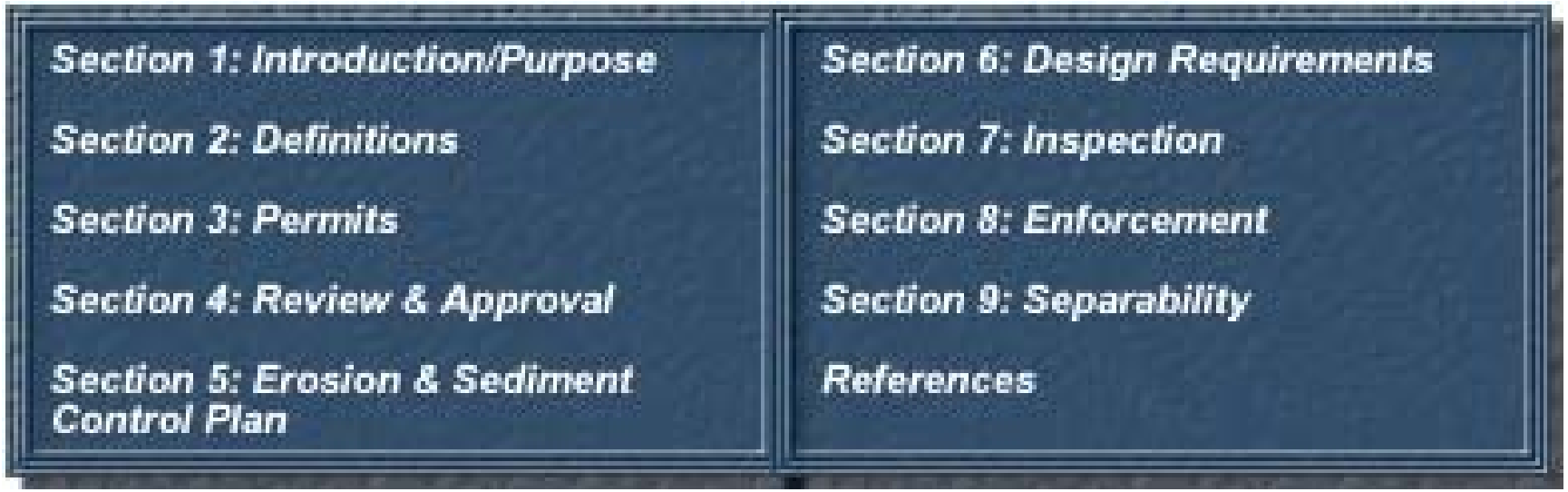
The Stormwater Center presents a model ordinance for controlling construction sediment at http://www.stormwatercenter.net/Model%20Ordinances/esc_model_ordinance.htm

Major components of the ordinance:

I. Introduction/ Purpose
II. Definitions
    Permits
    Review and Approval
    Erosion and Sediment Control Plan
III. Design Requirements
    Clearing and Grading
    Erosion Control
    Sediment Controls
    Waterways and Watercourses
    Construction Site Access
IV. Inspection
V. Enforcement
    Stop-Work Order; Revocation of Permit
    Violation and Penalties

Another model ordinance for erosion control is presented on the Internet by the EPA at

http://www.epa.gov/owow/nps/ordinance/mol2.htm



Additional Information

References and sources for more information

Keeping Soil in Its Place:

A Presentation on Erosion and Sediment Control (ESC) is online at

http://www.stormwatercenter.net/Slideshows/ESC.htm

Slideshows with additional information on stormwater management

- **Why watersheds**
  http://www.cwp.org/whywatersheds_files/frame.htm

- **Impacts of urbanization**
  http://www.stormwatercenter.net/Slideshows/impacts%20for%20smrc/sld001.htm

- **Better site design**
  http://www.stormwatercenter.net/Slideshows/bsd%20for%20smrc/sld001.htm

- **Eight tools for watershed protection**
  http://www.stormwatercenter.net/Slideshows/8tools%20for%20smrc/sld001.htm

- **Stormwater Best Management Practices**
  http://www.stormwatercenter.net/Slideshows/smps%20for%20smrc/sld001.htm