Module 2: Selection of Controls and Site Planning for Construction

Site Erosion Prevention

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Recommended Controls for Small Construction Sites (EPA Guidance)

- Best control accomplished through proper planning, installation, and maintenance of controls.
- Non-Structural Controls:
  - Minimize disturbance
  - Preserve natural vegetation
  - Good housekeeping

Recommended Controls for Small Construction Sites (cont.)

- Small sites have less space that prevent use of some controls, plus less access to qualified help.
- Structural Controls:
  - Erosion controls (mulch, grass, and stockpile covers)
  - Sediment controls (silt fence, inlet protection, check dams, stabilized construction entrances, and sediment traps)

Typical Local Erosion Control Requirements (Storm Water Management Authority, Inc.)

- All surface waters flowing towards construction areas shall be either passed through the site in protected channels or diverted using berms or channels.
- All slope or fill areas which have been graded shall within 14 days of the completion of grading, or the completion of any phase of grading, be planted or otherwise provided with ground cover to retrain erosion.
Typical Local Erosion Control Requirements (cont.)

- All upslope and downslope controls must be in place before any on-site construction begins.
- No visible floating scum, oil or other matter allowed in discharge.
- All controls shall be checked and repaired monthly and within 24 hrs after any rainfall at the site of 0.75 inch occurring within 24 hrs.

Typical Local Erosion Control Requirements (cont.)

- The control plan must include the size of the disturbed areas and a schedule of the starting and completion dates of land disturbing activities.
- Written descriptions of controls and schedule of their implementation
- Description of procedures for proper storage, handling, and disposal of construction materials.

Typical Erosion Control Plan Contents

(Storm Water Management Authority, Inc.)

- Present contours and drainage facilities on property
- Drainage facilities on adjacent property
- Proposed contours after development (intervals of 2 ft, or less)
- Description of existing site conditions (erosion characteristics of soils, potential problem areas, soil stabilization specifications)

Erosion Controls

General Approach

- Divert upland drainage
- Mulch exposed ground
- Control site discharges
- Good housekeeping
- Proper maintenance
Erosion Control Manuals

• There are many erosion control manuals that have been produced over the past 10 years, or so:
  – Alabama Handbook for Erosion Control, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas. Alabama Soil and Water Conservation Committee and the SCS. 1993 and 2003 (they recently produced an update targeted for Phase II communities). This is an example of the type of manual produced by the SCS (now NRCS) for local governments. http://swcc.state.al.us/erosion_handbook.htm

Erosion Control Manuals (cont.)

• Other manuals have included:
  – Wisconsin Construction Site Best Management Practice Handbook, revised. Wisconsin Department of Natural Resources. 1994. This is an example based on the above VA manual, but with some local modifications.

Important Local Considerations for Guidance Manuals

• It is critical that construction site erosion control practice design manuals consider local conditions, especially:
  – Rainfall conditions. Most practices are strongly affected by site hydrologic and hydraulic conditions. Rainfall has a direct effect on the amount of runoff and flow velocities. Devices that can withstand conditions in a generally mild area will frequently fail during the more common severe conditions found in Alabama.

Important Local Considerations for Guidance Manuals (cont.)

– Erosion rates. Maintenance is strongly influenced by the amount of sediment produced. In Alabama, these rates can be much greater than in other areas, requiring special considerations for sediment storage and frequent maintenance access.
– Sediment characteristics. Very high concentrations of suspended solids and small particle sizes also require modifications of “standard” designs.
Primary Erosion Control Requirements

- Minimize upslope water contributions
  - General diversion structures
  - Temporary diversion structures
  - Permanent diversion structures
  - General channel stabilization
  - Check dams
  - Riprap
  - Waterway drops
  - Stream crossings
  - Grassed waterway
  - Slope down drain structure
Primary Erosion Control Requirements (cont.)

- Provide Downslope Controls:
  - General sediment fence
  - Filter fabric fences
  - Straw bale fences
  - Sediment basins
  - Outlet protection

Erosion Controls
Filter fences create small ponding areas

Erosion Controls
Control Site Discharges

- Filter fencing for small sites (but only for slope lengths less than about 100 ft). Expect about 10 to 50% control of suspended solids.

- Sediment ponds for areas larger than 10 acres. Expect up to 80% control of suspended solids.
Primary Erosion Control Requirements (cont.)

- Protect Disturbed Areas:
  - Mulching
  - Local vegetation information
  - General seeding
  - Temporary seeding
  - Permanent seeding
  - Sodding
  - Trees and shrubs
  - Maintenance of vegetation

Erosion Controls
Slope Protection with Hydroseeding and Blankets

Supporting Erosion Control Requirements

- Control wastewater from dewatering operations
  - Dewatering settling basins
- Properly dispose of construction debris
- Control tracking of sediment off-site
  - Entrance controls
  - Site road controls
  - Dust control
On-Site Good Housekeeping Controls
Gravel Driveways

Clean Vehicles before Traveling on Public Roads

Supporting Erosion Control Requirements (cont.)

- Protect storm drain inlets
  - Storm drain inlet protection
  - Inlet protection barriers
  - Inlet insert baskets
- Minimize area disturbed
  - Land grading
- Control erosion scour from roof runoff

On-Site Good Housekeeping Controls
Inlet Protection
Special Controls for Working within Waterways

Alabama Procedures for Developing Plans for Erosion and Sediment Control

- The following are the minimum components of the plan:
  - Location or vicinity map and a clear and concise narrative describing existing site conditions, along with the proposed sediment and erosion control measures and rationale.
  - Specifications for planned erosion and sediment control measures. Reference standard design manual and describe pre-approved innovative measures.
  - Site plan or treatment map. Site development drawing showing the type and locations of planned conservation practices.

Step-by-Step Procedure for Plan Development

- **Step 1 – Data Collection.** Inventory existing site conditions which will help the planner develop the most effective control plan. The following information should be shown on a map and verbally explained in the plan narrative:
  - **Topography** (1 to 5 ft contours)
  - **Drainage patterns** (all existing drainages and swales)
  - **Soils** (major soil types, especially the soil erodibility factor k and the hydrologic soil type).
  - **Ground cover** (existing vegetation)
  - **Adjacent areas** (roads, streams, houses, utilities, etc. should be shown).

Step-by-Step Procedure for Plan Development (cont.)

- **Step 2 – Data Analysis.** Identify the site potential and limitations and associated critical erosion hazards.
  
  A. **Topography.** Slope steepness and length determine critical hazards associated with topography. If the following are exceeded, the erosion hazard becomes critical:

  0 to 2% and 300 feet
  2 to 5% and 150 feet
  Over 5% and 75 feet
Initial Topography (grubbing and clearing phase)

Pink: low hazard
Blue: Moderate hazard
Yellow: High hazard
Orange: High hazard

Step-by-Step Procedure for Plan Development (cont.)

- **Step 2 - Data Analysis (cont.)**
  
  B. **Drainage Patterns.** Natural drainage features collect and concentrate water. These need to be identified so they can be avoided by site development. The natural drainages should also be utilized for future site drainage, after proper management.

  C. **Soils.** Many soil characteristics affect erosion control. The NRCS county soil maps contain general information of interest, especially depth to bedrock, depth to seasonable water table, permeability, shrink-swell potential, texture, hydrologic soil group, and erodibility. If it is likely that critical soil problems exist on the site, then more detailed and site specific soil investigations to supplement the mapped data are warranted.
Step-by-Step Procedure for Plan Development (cont.)

- **Step 2 - Data Analysis (cont.)**
  
  **D. Ground Cover.** This is the most important factor in terms of preventing site erosion. Any existing vegetation that can be saved will be a great benefit. In areas where existing vegetation cannot be saved, construction needs to be carefully staged and temporary mulching or vegetation controls will be needed soon after grading operations cease.
  
  **E. Adjacent Areas.** Downslope/downstream areas are the most important. However, upslope areas that contribute flowing water to the construction site also need to be examined and considered. Controls will be needed to divert or safely convey this upslope water, and downslope controls are needed to protect the downstream resources.

Step-by-Step Procedure for Plan Development (cont.)

- **Step 3 – Facility Plan Development.** A site plan needs to consider site limitations. Locate buildings, roads, parking areas, etc., to minimize site and downstream problems.
  
  **A. Fit development to terrain.** Existing site conditions need to be considered to minimize land disturbance, erosion hazards, and development costs.
  
  **B. Confining construction activities to least critical areas.**
  
  **C. Cluster buildings together.**
  
  **D. Minimizing impervious areas.**
  
  **E. Utilizing the natural drainage system.**

Step-by-Step Procedure for Plan Development (cont.)

- **Step 4 – Planning for Erosion and Sediment Control.** The following general procedure is recommended in the *Alabama Manual* for erosion and sediment control planning:
  
  **A. Divide the site into drainage areas.**
  
  **B. Determine the limits of clearing and grading.**
  
  **C. Select erosion and control measures.**
    
    - Vegetative controls (consider first due to cost-effectiveness, but must carefully consider site conditions)
    
    - Structural controls (more costly, but can be designed for site specific conditions and desired levels of control)
    
    - Management controls (sequencing construction, etc.)
  
  **D. Plan for stormwater management.**

Step-by-Step Procedure for Plan Development (cont.)

- **Step 5 – Plan Assembly.** This final step is consolidating the pertinent information into the mapping and narrative portions of the plan.
### Busiest Markets for Single-Family Housing Permits (1999)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td>25,066</td>
<td>+11%</td>
</tr>
<tr>
<td>Phoenix</td>
<td>21,290</td>
<td>+13%</td>
</tr>
<tr>
<td>Dallas-Ft. Worth</td>
<td>17,434</td>
<td>+6%</td>
</tr>
<tr>
<td>Chicago</td>
<td>14,954</td>
<td>+7%</td>
</tr>
<tr>
<td>Washington, DC</td>
<td>14,703</td>
<td>0.07</td>
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</tbody>
</table>


### Acres Converted from Undeveloped to Developed Uses Typical Large City

<table>
<thead>
<tr>
<th>Type of Land</th>
<th>Acres Converted to Development 1992-1997 (thousands) Annual Average</th>
<th>Percent Contribution by Type of Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland</td>
<td>574.8</td>
<td>26.6%</td>
</tr>
<tr>
<td>Conservation Reserve Program land</td>
<td>1.5</td>
<td>0.1%</td>
</tr>
<tr>
<td>Pastureland</td>
<td>301.2</td>
<td>17.4%</td>
</tr>
<tr>
<td>Rangeland</td>
<td>243.9</td>
<td>11.0%</td>
</tr>
<tr>
<td>Forest land</td>
<td>939.0</td>
<td>41.5%</td>
</tr>
<tr>
<td>Other rural area</td>
<td>89.1</td>
<td>4.0%</td>
</tr>
<tr>
<td>Water areas and federal land</td>
<td>1.8</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,243.4</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

### National Estimates of Land Area Developed per Year

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Total NRI Acreage</th>
<th>Acres Waived or not Covered</th>
<th>Adjusted NRI Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-family</td>
<td>546,783</td>
<td>12,905</td>
<td>533,878</td>
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<tr>
<td>Multifamily</td>
<td>253,616</td>
<td>6,434</td>
<td>252,182</td>
</tr>
<tr>
<td>Nonresidential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>1,377,070</td>
<td>44,594</td>
<td>1,332,476</td>
</tr>
<tr>
<td>Industrial</td>
<td>69,932</td>
<td>3,412</td>
<td>67,520</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,243,400</strong></td>
<td><strong>67,345</strong></td>
<td><strong>2,176,055</strong></td>
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</tbody>
</table>

### Example Unit Capital Costs for Construction Site Erosion and Sediment Control Measures (2002 estimates)

<table>
<thead>
<tr>
<th>Control</th>
<th>Unit</th>
<th>Typical Unit Cost</th>
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<tbody>
<tr>
<td>Temporary seeding</td>
<td>Sq yard</td>
<td>$0.15</td>
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<tr>
<td>Mulching</td>
<td>Sq yard</td>
<td>$0.45</td>
</tr>
<tr>
<td>Sodding</td>
<td>Sq yard</td>
<td>$3.60</td>
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<tr>
<td>Filter fabric fence</td>
<td>foot</td>
<td>$5.10</td>
</tr>
<tr>
<td>Inlet protection device</td>
<td>inlet</td>
<td>$195.00</td>
</tr>
<tr>
<td>3 ft deep diversion swale</td>
<td>100 ft</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>Sediment pond</td>
<td>1 acre</td>
<td>$73,400.00</td>
</tr>
</tbody>
</table>
Quantities of Silt Fencing Needed for Different Developments (at about $5/ft)

<table>
<thead>
<tr>
<th>Acres</th>
<th>Single-family</th>
<th>Multi-family</th>
<th>Commercial</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>621</td>
<td>722</td>
<td>361</td>
<td>361</td>
</tr>
<tr>
<td>7.5</td>
<td>1,553</td>
<td>1,143</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>25</td>
<td>5,175</td>
<td>3,129</td>
<td>2,087</td>
<td>2,087</td>
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<tr>
<td>70</td>
<td>14,490</td>
<td>5,238</td>
<td>3,492</td>
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<tr>
<td>200</td>
<td>41,400</td>
<td>8,853</td>
<td>5,902</td>
<td>5,902</td>
</tr>
</tbody>
</table>

Summary of Available Controls and Planning Efforts

- Many erosion control guidance manuals exist, but care is needed to ensure they are applicable for local extreme conditions.
- Redundant controls are needed (upslope water diversions, protect exposed soil, downslope controls, and good housekeeping).
- Many options are available for each component. These can be selected (and designed) to fit site conditions.

Module 2 Homework

- When your site selection is confirmed, prepare the initial portions of the erosion control plan, according to the AL Handbook outline (basically site and regional descriptions).
- Describe the work phases during the construction period (initial clearing and grubbing to final landscaping).
- Prepare hazard maps based on slope lengths and angles for at least the first clearing and grubbing and final contour conditions.