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# Evaluating Geologic and Soils Issues at the Federal Energy Regulatory Commission

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## Regulations Governing Geologic and Soils Resources

The following regulations govern geologic and soils resources. Which regulation applies depends on the type of application being prepared.

An applicant must address the impacts of constructing and/or operating a hydropower project on geologic and soils resources. These regulations give an applicant only limited guidance. As a result, when we review an application, we must frequently ask for additional information so we can analyze site conditions and decide if the applicant is proposing appropriate mitigative measures.

The sections of the regulations that follow are intended to help you go beyond the letter of the regulations and make sure that any data gaps in the areas of geologic and soils resources do not cause delays in processing your application.

### Subpart E - Application for License for Major Unconstructed Project and Major Modified Project

Section 4.41 (f) Exhibit E (6) Report on geological and soil resources.

The applicant must provide a report on the geological and soil resources in the proposed project area and other lands that would be directly or indirectly affected by the proposed action and the impacts of the proposed project on those resources. The information required may be supplemented with maps showing the location and description of conditions. The report must contain:

- (i) A detailed description of geological features, including bedrock lithology, stratigraphy, structural features, glacial features, unconsolidated deposits, and mineral resources;
- (ii) A detailed description of the soils, including the types, occurrence, physical and chemical characteristics, erodability and potential for mass soil movement;

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(iii) A description showing the location of existing and potential geological and soil hazards and problems, including earthquakes, faults, seepage, subsidence, solution cavities, active and abandoned mines, erosion, and mass soil movement, and an identification of any large landslides or potentially unstable soil masses which could be aggravated by reservoir fluctuations;

(iv) A description of the anticipated erosion, mass soil movement and other impacts on the geological and soil resources due to construction and operation of the proposed project; and

(v) A description of any proposed measures or facilities for the mitigation of impacts on soils.

#### **Subpart F - Application for License for Major Project-Existing Dam**

Section 4.51 (f) Exhibit E (1) General Description of the Locale.

The applicant must provide a general description of the environment of the project and its immediate vicinity. The description must include general information concerning climate, topography, wetlands, vegetative cover, land development, population size and density, the presence of any floodplain and the occurrence of flood events in the vicinity of the project, and any other factors important to an understanding of the setting.

#### **Subpart G - Application for License for Minor Water Power Projects and Major Water Power Project 5 Megawatts or Less**

Section 4.61 (d) Exhibit E is an Environmental Report.

(2) For Minor projects and major projects at existing dams 5 MW or less.

The Environmental Report must contain the following information:

(i) A description, including any maps or photographs which the applicant considers appropriate, of the environmental setting of the project, including vegetative cover, fish and wildlife resources, water quality and quantity, land and water uses, recreational uses, historical and archeological resources, and scenic and aesthetic resources.

(ii) A description of the expected environmental impacts from proposed construction or development and the proposed operation of the power project, including any impacts from any proposed changes in the capacity and mode of operation of the project if it is already generating electric power, and an explanation of the specific measures proposed by the applicant, the agencies, and others to protect and enhance environmental resources and values of the project on such resources.

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## Typical Issues

An applicant should begin by examining the issues in order to identify what type of investigations are needed to address a project's impacts on geologic and soils resources. The scope of such investigations and appropriate level of detail depends primarily on:

- the type and extent of land-disturbing activities, and
- actual site conditions--including existing areas of erosion and slope or bank instability.

After identifying issues, the applicant should consult with resource agencies--including the land-management agency (if applicable), the Soil Conservation Service, state water resources agencies responsible for water quality certification, and federal and state fish and wildlife agencies.

### Identifying Issues at Existing Projects

- Existing areas of erosion, slope instability, or streambank or reservoir shoreline erosion should be stabilized where needed to prevent erosion of fine-grained materials.
- Areas of new land-disturbance should be protected during construction and stabilized following construction.

- Sedimentation studies (models) may be needed to evaluate existing and future sedimentation within a reservoir.
- Accumulated sediments within a reservoir may have to be removed and spoil disposal areas stabilized.
- Flushing flows may be needed in bypassed reaches downstream of the dam.

### Identifying Issues at Proposed Projects

- Site-specific information on geology and soils should be developed at a sufficient level of detail to identify existing or potentially unstable or highly erodible areas and to develop appropriate control measures.
- Detailed conceptual erosion and slope stability control plans should be prepared before licensing.
- If dam construction could alter sediment transport and deposition in such a way that flooding could occur in the reservoir headwaters, sedimentation studies may be needed:
- If important fisheries resources are present, sedimentation studies (models and baseline sampling) may be needed.

- If there could be cumulative impacts from multiple hydropower development, a risk assessment may be needed.

## Preparing a Report on Geologic and Soils Resources

### A. Describing the Affected Environment

Site-specific investigations of geologic and soil conditions within a project area are essential to ensure that the project can be built and operated without causing excessive slope instability and erosion. Geologic conditions and soils can vary considerably in a short distance: a given slope may be stable, but a nearby or adjacent slope may not be.

Unconsolidated deposits--such as glacial, stream channel alluvium, lacustrine, or talus (rock debris)--may be present, and have varying degrees of stability. Rock and soil types vary in response to precipitation with differing amounts of runoff and infiltration. These varied responses affect the erodability of soils and the location of springs and seeps as well the presence of groundwater that may be encountered in excavations or when constructing underground facilities.

It is important to determine bedrock lithology (rock type), stratigraphy (rock sequence), structural features and type and degree of weathering at a site, because

these characteristics affect inherent slope stability which directly affects the stability of project features. Rock types differ in strength and become weaker in different ways when they weather; these differences affect the stability of foundations or places where a structure is tied into a slope. The rock sequence also can affect slope stability; a hard rock layer, underlain by softer rock, may be prone to landsliding where the softer rock is being undercut by streamflow or wave action.

Structural features such as jointing, faults, and foliations are planes of weakness. If the planes of weakness are oriented so that they dip into a slope, the slope will remain stable even with a fairly steep road cut. If the planes of weakness dip in the same direction as the slope however, cutting into the slope may cause slope failure (figure 1). Jointed rock that forms cliffs may be subject to sporadic rockfall. Highly jointed or fractured rock also can contain large amounts of groundwater.

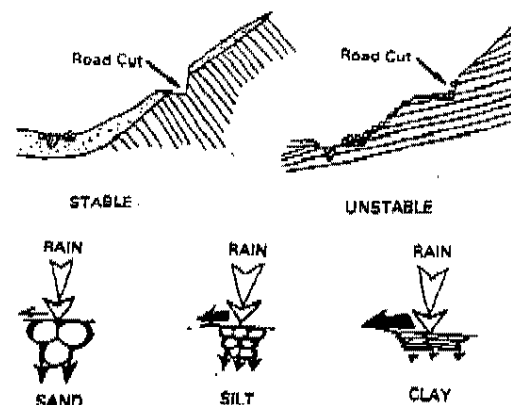


Figure 1. How geology and soils influence stability in a project area (Source: FERC Staff).

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Unconsolidated deposits often have layers that vary in permeability and size--from boulders and gravels to sand, silt, and clay. Larger-sized rock is often well-drained with increased slope stability; but because loose rock is noncohesive, slope failure may occur if support is removed from the toe of a steep slope. Layers of finer grained material, such as silt or fine sand, may impede drainage and contribute to slumping or other unstable conditions on slopes or banks. Loosely consolidated stream alluvium may be very permeable, so cutoff walls may be needed to prevent excessive seepage under the dam.

Steepness of slope and soil texture (distribution of particle sizes) affect soil erodability, soil mass movement, runoff, and infiltration. Soils with larger particle sizes (coarse sand and gravelly or rocky soils) have good infiltration and less runoff which enhances stability, but because they are non-cohesive, coarse-textured soils are highly erodible when vegetation is removed.

Fine sands and silts are the most highly erodible soils because flowing water or wind can easily detach and transport them. Fine-textured clay soils are more cohesive and can stand in cuts on steeper slopes; however they have limited infiltration and higher runoff (Figure 1).

Surface and subsurface hydrology affects slope stability and erosion and instream sedimentation. The pattern of surface runoff directly affects the erosion potential of disturbed areas. Diverting and

filtering runoff is essential to controlling erosion and sedimentation during land-disturbing activities, and providing proper drainage is crucial for maintaining long-term stability of land surfaces and project features.

The applicant must provide information on site-specific vegetation, because the type and denseness of the vegetative cover affects soil erodability and ability to filter runoff from disturbed areas.

## **B. Conducting Appropriate Studies**

### **Geotechnical and Soils Investigations**

Geotechnical investigations are generally limited to reconnaissance level surface investigations and shallow borings to determine (1) if the rock type or unconsolidated deposits are stable and (2) if critical areas are present (i.e., areas that require special treatment or control measures). If critical areas are present, they should be avoided whenever possible by relocating project features.

If critical areas cannot be avoided, the applicant should make further geotechnical investigation of these specific areas to determine the nature and extent of potential stability problems and to identify appropriate control measures.

Slope stability problems are generally solvable, but may be quite costly, especially (1) if the slope is actively unstable and involves a large amount of

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material or (2) If conditions for anchoring a structure are unsatisfactory (i.e., placing a pipeline on a steep slope underlain by loose rocks).

### **Identifying Critical Areas for Erosion/Slope Stability Control**

An initial site suitability survey should look closely at the following types of conditions, which are likely to be critical areas that need specific measures to control erosion or prevent potential slope stability problems.

- Active or dormant mass movements and slope failures
- Unfavorable rock structures or unstable overburden
- Soils prone to mass movement or highly erodible soils
- Existing erosion-gullies-streambank or shoreline erosion
- Drainageways-swales-stream crossings

The following items should also be considered when determining if critical areas are present in the project area.

- Aerial photo interpretation and field check
- Probability of slope failure
- Frequency and potential magnitude of failure

- Risk of material entering stream and type of material

### **Sedimentation Studies**

The nature and extent of sedimentation studies depends on (1) the presence of important aquatic resources, (2) potential for cumulative impacts, and (3) existing or potential sediment accumulation in a reservoir or affected stream reach.

### **Sediment Modeling**

A wide variety of models are available for modeling the movement of sediment. Selecting a model should be based on the type of information that is needed and the nature of the stream channel and substrate. A good reference for a survey of some available sediment models is Twelve Selected Computer Stream Sedimentation Models Developed in the United States (Subcommittee on Sedimentation Interagency Advisory Committee on Water Data, 1988). Limited copies of this report can be obtained directly from Dr. Shou-shan Fan, Special Assistant, Office of Hydropower Licensing, Federal Energy Regulatory Commission, R.S. HL-1, 825 North Capitol Street, NE., Washington, DC 20426.

### **Baseline Sediment Sampling of Aquatic Habitat "At Risk" from Sedimentation**

Sediment sampling of the stream substrate is used to characterize baseline (pre-project) conditions of aquatic habitat

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that could be adversely affected by sediment generated by construction of a proposed project. Data from sediment sampling can be compared to threshold levels of sediment that have been found to cause adverse effects to hatching of eggs and emergence of fry. An example of such research is "Success of Pink Salmon Spawning Relative to Size of Spawning Bed Materials" (McNeil and Ahnell, 1964). This publication also gives information on the substrate sampler referred to below.

Sediment sampling should be conducted along transects across the streambed that should be marked so they can be sampled again to obtain additional data points. Sometimes transects selected for the Instream Flow Incremental Methodology analysis (IFIM) can be used to evaluate minimum flows for fishery resources can be used for sediment sampling. Such transects may also be used during and after construction of a project to monitor changes in sediment accumulation.

When developing a sediment sampling program, the following elements should be considered.

- a. The location of areas to be sampled, the method, and timing of baseline sampling should be identified and developed in consultation with agencies and tribes.
- b. Typical locations of baseline sampling
  - Low gradient reaches in bypass reaches

- Low gradient reaches below powerhouse
  - Reach above diversion site
  - Mouth of creek
  - Important habitat in overlap zones from multiple projects
- c. Typical information to be collected at each transect
    - Photographs of transect
    - Survey of cross-sections
    - McNeil core samples
    - Measurements of embeddedness
    - Characterize bank stability
    - Description of sediment characteristics across transect (using IFIM protocol)
    - Measurement of channel scour and fill using rebar-pipe sleeve
    - Note discharge at stream gage

### **Risk Assessment**

Risk assessment combines number of factors to evaluate the likelihood of a project causing an adverse effect on aquatic habitat from increases in stream sedimentation due to construction of a proposed project. Risk assessment also evaluates the potential magnitude of such

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impacts in comparison with existing sediment sources. The following factors are considered in risk assessment.

- Project area stability and erosion control plans
- Watershed stability and sediment yield
- Sediment modeling
- Baseline sediment sampling
- Nature and abundance of potentially affected aquatic habitat, especially spawning areas
- Scarcity or abundance of potentially affected species

### C. Identifying Appropriate Mitigative Measures

The objective of limiting instream sedimentation can be reached primarily by minimizing and controlling erosion on-site. Project-area stability and appropriate control measures are essential. The extent and level of detail needed for control plans depends largely on (1) the amount of land-disturbance, (2) the nature of project-specific soils and geologic conditions, and (3) the presence of existing or potential problem areas.

#### **Elements to Consider When Selecting Site-Specific Erosion Control Measures**

- Divert water away from disturbed areas
  - berms and ditches

- Collect and filter runoff
  - ditches, check dams, sediment ponds
- Perimeter control
  - silt fences (filter cloth), straw bales, berms, rock filters
- Permanent drainage
  - ditches, culverts, energy dissipation structures
- Stabilize critical areas (avoid if possible)
  - adequate drainage, slope stability control measures (rock bolts or anchors, buttressing, riprap, gabions, geotextiles, biotechnical measures, interim seeding or vegetation)
- Revegetation
  - appropriate species, seeding mix and rates, mulch
- Spoil disposal
  - identify and stabilize sites
- Avoid sidecasting on steep slopes and end haul to remove excess material
- Monitoring and maintenance

A complete erosion control plan should include: (1) a description of the site conditions (geology, soils, hydrology, and vegetation); (2) a narrative describing the erosion control plan; and (3) topographic map locations and functional design drawings of the control measures.



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## Approving Erosion Control Plans

When an applicant has developed a detailed site-specific erosion control plan, the Commission generally approves the plan as part of the license, sometimes with modifications. When an erosion control plan has been sufficiently developed to be approved in the license, the licensee files final drawings and specifications for the plan along with drawings and specifications for construction of project features. This is done after the license has been issued, but before construction begins.

Even in cases where the erosion control plan is approved in the license, agency consultation may be required in developing final drawings and specifications for erosion control plans. In this case, licensees are expected to address agency concerns before submitting final drawings and specifications. Documentation of agency consultation should be included within the filing.

An example of a license article where an erosion control plan is approved in the license follows.

Article . The erosion control plan filed on (date) and consisting of (pages and drawings) is approved and made part of this license and shall be implemented (with the following modifications, if needed). Final drawings and

specifications shall be filed along with drawings and specifications required by Article 3XX (construction drawings for project features). The Commission may require changes to the erosion control plan to ensure adequate protection of the environmental, scenic, and cultural values of the project area.

In some cases, however, the plan does not contain enough detail to be approved in the license, or final design of control measures depends on completing additional soils or geologic investigations. The erosion control plan must then be approved after the license is issued, and the licensee cannot begin construction until the Commission approves the plan.

An example of a license article requiring approval of the erosion control plan follows.

Article . At least 90 days before the start of any land-disturbing or land-clearing activities, the Licensee shall file with the Commission, for approval, a plan to control erosion, to control slope instability, and to minimize the quantity of sediment resulting from project construction and operation.

The plan shall be based on actual-site geological, soil, and groundwater conditions and on project design, and shall include, at a minimum, the following four items:

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- (1) a description of the actual site conditions;
  - (2) measures proposed to control erosion, to prevent slope instability, and to minimize the quantity of sediment resulting from project construction and operation;
  - (3) detailed descriptions, functional design drawings, and specific topographic locations of all control measures; and
  - (4) a specific implementation schedule and details for monitoring and maintenance programs for project construction and operation.

The Licensee shall prepare the plan after consultation with appropriate federal and state soil conservation, water quality, fish and wildlife agencies; and each federal agency having managerial authority over any part of project lands. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make

recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on geological, soil, and groundwater conditions at the site.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

## **Final Erosion Control Plans**

When control plans are approved, while detailed and site-specific, they are conceptual in nature. These plans are similar to Exhibit F drawings, which are conceptual designs when approved in the license.

Final drawings and specifications for actual construction of project features, which are prepared after the license is issued, are considerably more detailed than the Exhibit F drawings. The final drawings and specifications therefore, contain a higher level of detail and reflect the final design of the project features and the erosion control measures.

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Figures 2 and 3 are examples of a conceptual plan drawing and an associated functional design drawing, prepared for an erosion control plan that would be approved as part of a license.

The silt fence between the buried penstock and the creek, shown as a straight line on Figure 2 and detailed in Figure 3, illustrates the conceptual nature of the plan. Although the actual line of the silt fence will be adjusted to the contours of the land during construction, the location shown in the conceptual plan drawing shows the reviewer that the silt fence is in the proper location to filter runoff over the disturbed area before it reaches the creek.

Similarly, the proposed sediment ponds may not be of the exact size and shape shown on the conceptual drawing, but this drawing gives the reviewer enough information to see if the ponds are in the appropriate locations. After the Commission issues a license, the contractor will prepare final drawings and specifications that include further details. These would include (1) the materials to be used in constructing the silt fence and spacing the stakes, and (2) the proper size and depth of sediment ponds, which will be based on the size of the drainage area and the materials to be used to construct the pond.

This allows flexibility in implementing the goals and objectives of the erosion control plan such that the contractor can propose an approach that is workable and will achieve the desired end result of containing sediment on-site and preventing it from reaching watercourses.

The Commission's Regional Office must approve the final location and construction of erosion control facilities as dictated by actual field conditions viewed by inspection staff of the Regional Office, such as a small dam that will be used for a sediment pond.

## **Implementing, Monitoring, and Maintaining an Erosion Control Plan**

No matter how well conceived, the success of an erosion and sediment control plan depends on how well it is implemented. Control measures must be installed properly at the appropriate time and maintained, in order to function effectively. Silt fences and straw bale barriers are ineffective if they are not anchored below the ground surface or if the sediment that accumulates behind them is not removed. Sediment ponds must be sized to accommodate runoff over the design area, have a stable outlet, and be cleaned regularly in order to be effective.

Erosion control measures should be inspected and maintained on a regular basis so that the measures can be modified as necessary, during construction, to deal with actual field conditions.

When preparing final plans and specifications for building the project features, the licensee will develop the actual construction sequence and grading

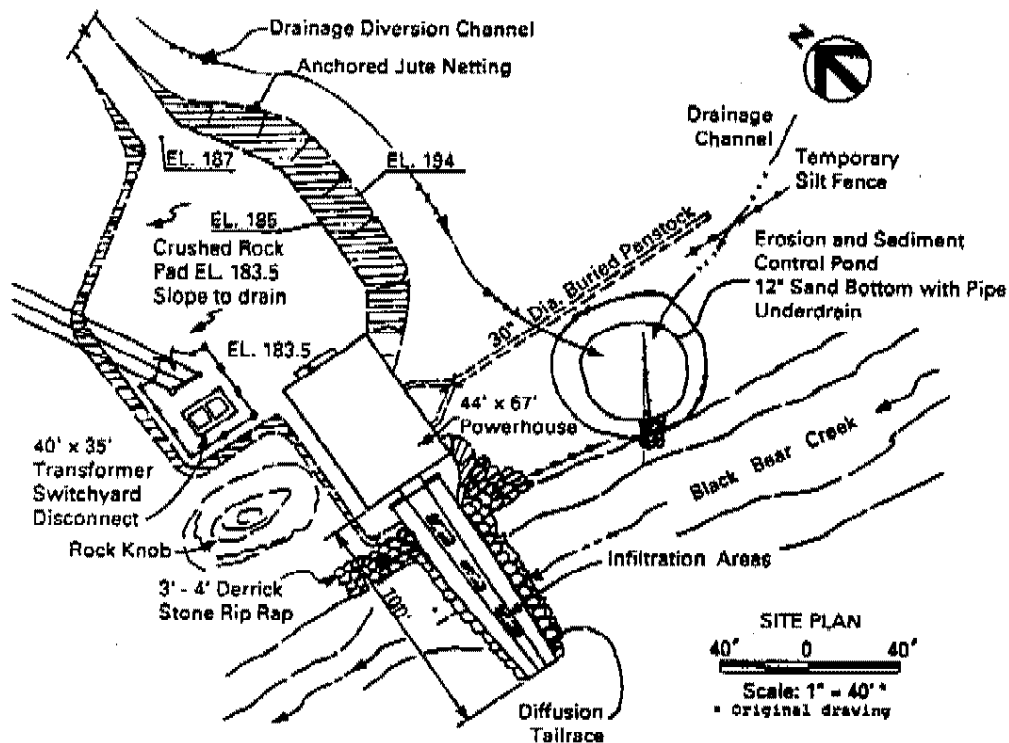
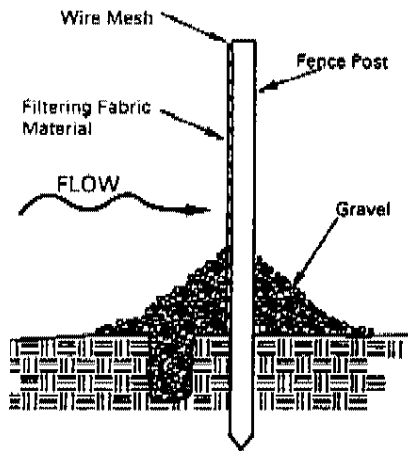


Figure 2. Example of conceptual drawing for an erosion control plan (Source: HDR Engineering, 1991).



TYPICAL CROSS SECTION OF SILT FENCE

Figure 3. Example of a functional design drawing for a silt fence (Source: HDR Engineering, 1991).

plans and if needed, should make appropriate design changes in the erosion control plan. Before construction begins, licensees are required to file a quality inspection program for approval by the Commission's Regional Office Director as required under Section 12.40 of Subpart E - Other Responsibilities of the Applicant or Licensee.

Because erosion control measures require continuous inspection and monitoring, and the structures and other facilities are generally engineering solutions to control erosion and sediments, developers must include an inspection and monitoring program for erosion and

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sediment control measures as part of their construction quality control program.

The Commission's Regional Offices conduct periodic construction inspections to ensure that the project is being constructed in accordance with the plans and specifications and that the contractor is providing a quality product. However, direct and continuous on-site surveillance by the Commission is not possible because of budget limitations.

Developers are instructed to include in their monthly construction inspection reports a discussion of erosion control measures and their effectiveness. When appropriate, the report would include (1) a discussion of any instances where sediments or other construction discharges entered a stream, (2) the extent of the discharges, (3) an assessment of any damage to a stream, and (4) corrective actions taken, including measures to prevent further problems.

Since actual site conditions can vary during the course of construction, modifications to the erosion and sediment control plan must be accomplished in the field as conditions dictate, through the quality control program or at the direction of the Commission's Regional Office.

There may be situations where erosion control measures are not working effectively or must be modified because of unforeseen conditions. For example, an extra line of silt fencing may be needed on a steep slope, a straw bale barrier may

need to be replaced with a rock check dam where flow becomes too concentrated, or the location of a sediment pond may need to be adjusted so that it functions more effectively. These modifications can be required on site by the Commission's Regional Offices or through formal correspondence, and can be documented in the monthly construction inspection reports.

Due to the need to react to changing conditions as they arise, most modifications should be made in the field with the agreement of the Regional Offices. It is neither practical nor feasible to attempt a more formal process. It would require too much time to react to a need for modifications. There are cases, however, where changing an element of an erosion control plan would be significant and would require formal amendment to the plan, such as disposal of contaminated sediments. Unless the modifications are significant, they should not require additional approval or formal amendment to the plan, as long as the objectives of minimizing soil erosion, containing sediment on-site, and preventing it from entering watercourses are being met.

These objectives are further specified and required by Standard L-Form Article 19, which states: "In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. . ."

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## **Complying With Erosion Control Plans**

The Licensee's quality inspection program and the Commission's inspections provide a mechanism for meeting the objectives of the erosion control plan. The Commission's Division of Project Compliance and Administration (DPCA) handles compliance with the erosion control plan article and with Standard L-Form Article 19. DPCA also approves amendments to erosion control plans.

If there is a question whether an amendment is needed, the licensee should notify the Commission's Regional Office then DPCA can make a determination if needed. If a project must be amended because of a change in the location of project features, the erosion control plan should be amended as well to reflect such changes. If a problem arises with implementation or maintenance of control measures and is not corrected expeditiously, it may be reported to DPCA. The Commission's Regional Offices report over 90 percent of all alleged violations received in DPCA. The remaining allegations of noncompliance activities are received from the public and other state and federal agencies.

Noncompliance may be with the provisions of the approved erosion control plan or with Standard L-Form Article 19 if the problem involves something that was

not specified in the approved plan. Evidence of noncompliance might be (1) poorly maintained control measures, (2) measures that were not installed or installed improperly or incompletely, or (3) sediments deposited outside the construction perimeter or within a stream. DPCA considers the success of temporary and permanent revegetation as well as structural measures.

When DPCA receives a noncompliance report, an investigation is initiated. If no violation of the license is found, a letter finding no violation is sent to the Licensee. If a potential violation of the license has occurred, an initial contact letter is sent, usually providing 30 calendar days for the Licensee to respond.

In most cases, the Licensee responds with a detailed explanation of why the violation occurred and states that corrective action has been taken. Depending on the nature of the violation, the Commission's Regional Office may conduct a follow-up verification inspection to confirm that corrective action has been taken, before DPCA issues a letter that completes the investigation.

If the Licensee fails to respond to the initial contact letter, DPCA will issue a compliance order. Violation of a compliance order may result in the initiation of a civil penalty proceeding and become a factor in the amount of penalty assessed.

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## Other Issues Involving Geologic and Soils Resources

### A. Contaminated Sediment Test and Disposal Plan

Federal and state environmental legislation passed since the early 1970's has stopped or significantly reduced the discharge of toxic effluents into the Nation's rivers and lakes by factories, mining operations, and electric utilities. Nevertheless, some toxic materials, discharged before then, have been trapped in the sediment build-up behind existing dams.

The presence of toxic material in sediments usually does not produce adverse environmental consequences to water quality and fishery resources unless the contaminated sediments are disturbed by dredging or by the construction of bridges, piers, or hydropower projects.

Consequently, the staff may require an applicant who proposes to construct a hydropower project at an existing dam, located on a river segment that previously received industrial pollutants, to (1) conduct tests for the presence of contaminated sediments and spoils and (2) develop and implement measures to avoid the disturbance or to dispose of all disturbed toxic sediments and spoils in the project impact area.

The Commission has required recent applicants to test sediments and file a plan before issuing a license. If an applicant has not completed a sufficiently detailed plan to treat potential contaminated sediments and spoils, the staff includes the following license article, requiring the Licensee to develop and implement a plan for the avoidance or disposal of any contaminated sediments and spoils in the project area.

Article . At least 90 days before the start of any land-disturbing or land-clearing activities, the Licensee shall file with the Commission, for approval, a plan to conduct tests for, minimize inputs of, and safely dispose of contaminated sediments and spoils.

The plan shall include but not be limited to:

- (1) a description of the methods to be employed in testing bottom sediments for the presence of heavy metals and other toxic substances in the stream bed of the project area;
- (2) a description of the Licensee's mitigative measures to minimize inputs of sediment and other potentially toxic substances to the stream;
- (3) a description of Licensee's planned measures to avoid

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disturbing or to safely dispose of disturbed toxic substances and spoils;

- (4) an implementation schedule;
- (5) monitoring and maintenance programs during project construction and operation, and
- (6) provisions for periodic review and revision.

The Licensee shall prepare the plan after consultation with the Environmental Protection Agency, (federal and state fish and game agencies), and each federal agency having managerial authority over any part of project lands. The Licensee shall include with the plan documentation of consultation and copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval the Licensee shall implement the plan, including any changes required by the Commission.

**B. Developing a System to Automatically Detect a Conduit or Penstock Failure**

A high-head hydropower project developed in an isolated mountainous area of the west could cause significant environmental damage, if one of the project's pipelines or penstocks ruptures. To minimize the quantity of water spilled (and resulting damage to area soils, vegetation, wildlife, and water quality) if a pipeline or penstock fails, such a project should include a system for (1) the automatic detection of a conduit or penstock failure and (2) the immediate stopping of water diversion at the project headworks.

If there is a potential for conduit failure and therefore a need for an automatic mechanism to stop water diversion, the staff includes the following license article, requiring the licensee to design, install, and test an appropriate detection system.

Article . At least 90 days before the start of construction, the Licensee shall file with the Commission,



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for approval, a plan for the design and construction of a system that will automatically detect a conduit or penstock failure and immediately shut off flow in the conduit or penstock at the headworks in the event of such a failure.

The plan, at a minimum, shall include:

- (1) design drawings;
- (2) a schedule for installation and testing of the system prior to operation of the project;
- (3) a schedule for annual testing of the system for the life of the project; and
- (4) a description of a plan to manually close off the conduit or penstock until the system is operational if any malfunction is revealed during testing.

The Commission reserves the right to require changes to the plan. Project construction shall not begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval the Licensee shall implement the plan, including any changes required by the Commission.

### **C. Mineral Resources Impact Plan**

Hydropower projects proposed for development in the west may affect the potential extraction of economically important mineral resources. The Department of Interior's Bureau of Mines usually notifies the Commission if a project could affect existing mineral rights or mining claims. The staff then includes the following license article, requiring the licensee to conduct a field check for mineral deposits at the project and to prepare and implement a plan that will minimize project impacts on the development and utilization of the area's mineral deposits.

Article . At least 90 days before the start of any land-disturbing or land-clearing activities, the Licensee shall file with the Commission, for approval, a plan to minimize project impacts on the development and utilization of mineral deposits.

After consulting with the U.S. Bureau of Mines and each state and/or federal agency having managerial authority over any part of project lands, the Licensee shall conduct a field check for mineral deposits at the project, including the transmission line and access routes. The licensee shall then prepare a mineral resources impact plan based on the results of the field check. The plan, at a minimum, shall include:

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- (1) a description of the field check;
  - (2) a description of mineral deposits and claims at the project;
  - (3) maps showing their locations; and
  - (4) the Licensee's strategy for minimizing project impacts.

The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan.

The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations prior to filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No land-clearing or land-disturbing activities shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

## References

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