

## Foreword

According to the requirements of Document JIANBIAO[2014] No.189 issued by the Ministry of Housing and Urban-Rural Development (MOHURD) — "Notice on Printing and Distributing 'the Development and Revision Plan of National Engineering Construction Standards in 2015'", after extensive research, the standard preparation group has carefully summarized the engineering experience, referred to relevant national standards and international advanced standards, and formulated this standard on the basis of extensive solicitation of opinions.

The standard consists of 5 chapters and 5 appendixes, covering: general provisions, terms, basic requirements, soil and water conservation schemes, and requirements for design of soil and water conservation measures, etc.

The main revisions of this standard are:

1. Specifying the technical work contents and technical requirements of soil and water conservation for a production and construction project (PCP in brief hereinafter) and improving the restrictive stipulations for the principal part of a project (PPP in brief hereinafter) and special stipulations on areas with different types of soil erosion;

2. Refining the contents and requirements for the evaluation of soil and water conservation, as well as for the layout of soil and water conservation measures;

3. Updating the design requirements of soil and water conservation measures;

4. Defining the tasks of each design stage, and listing the requirements for the contents in the chapter of soil and water conservation in a pre-feasibility study report (project proposal), the preparation rules of soil and water conservation scheme, and the contents and arrangement of a special chapter in the preliminary design report of soil and water conservation into appendixes.

The provisions printed in bold type in this standard are mandatory ones and must be implemented strictly.

This standard is under the jurisdiction of, and its mandatory provisions are interpreted by the Ministry of Housing and Urban-Rural Development. The Ministry of Water Resources is responsible for the routine management of this standard. Monitoring Center of Soil and Water Conservation, the Ministry of Water Resources of the People's Republic of China (MWR) is in charge of the explanation of technical specifications. During implementation of this standard, any comments and advices can be posted or passed on to Monitoring Center of Soil and Water Conservation, MWR. (Address: No. 2, Baiguang Road, Xicheng District, Beijing. Postcode: 100053).

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## 1 General provisions

**1.0.1** This standard is formulated to prevent and control soil erosion caused by production and construction activities, protect and rationally utilize soil and water resources, improve ecological environment, and ensure sustainable economic and social development.

**1.0.2** This standard is applicable to the prevention and control of soil erosion in the production and construction projects (PCPs) that may cause soil erosion in the process of construction or production.

**1.0.3** The prevention and control of soil erosion caused by the PCPs shall stick to the principles of focusing on prevention, prioritizing protection, adapting to local conditions, and being safe, reliable, technically feasible, and economically viable, and it is encouraged to adopt advanced technologies, innovative technics, and new materials.

**1.0.4** The technologies of soil and water conservation for the PCPs shall comply with not only this standard, but also current relevant standards of the nation.

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## 2 Terms

### 2.0.1 responsibility range for soil and water conservation

An area where a production and construction entity shall be responsible for soil erosion prevention and control according to laws.

### 2.0.2 principal part of project (PPP)

A collective definition of main and affiliated parts of a production and construction project.

### 2.0.3 line-type production and construction project (PCP)

A PCP with a large layout span in linear distribution.

### 2.0.4 block-type production and construction project (PCP)

A PCP with relatively concentrated layout in block distribution.

### 2.0.5 constructive project

A completed project without any further land disturbance such as excavation, earth (rock, sand) borrow, and spoil (rock, dreg, fly ash, mullock, tailings) disposal during its operation period.

### 2.0.6 constructive and productive project

A completed project still with land disturbance such as excavation, earth (rock, sand) borrow, and spoil (rock, dreg, fly ash, mullock, tailings) disposal during its production period.

### 2.0.7 target year of design

The year that soil and water conservation measures determined in a soil and water conservation scheme are implemented and initially generate benefits.

### **3 Basic requirements**

#### **3.1 General requirements**

**3.1.1** The technical work of soil and water conservation for the PCP shall mainly include the compilation of soil and water conservation scheme, soil and water conservation measure design, construction, supervision and monitoring, and the acceptance of soil and water conservation facilities. The technical work of soil and water conservation for the PCP shall be conducted simultaneously with each stage of the project. The soil and water conservation chapter in preliminary feasibility study stage (project proposal) report, the contents of soil and water conservation scheme and the contents of the special chapter in the preliminary design report of soil and water conservation measures shall comply with the provisions in Appendixes A, B and C, respectively.

**3.1.2** The soil erosion prevention and control for the PCP shall meet the following requirements:

**1** During the whole process of project, the disturbance and destruction on original topographic features, vegetation, and water systems shall be controlled and minimized, and the original vegetation, topsoil, crust and sand crust, lichen, etc. shall be protected. Water use and land occupation shall be reduced by utilization efficiency improvement.

**2** Prevention and control measures such as retaining, slope protection, water interception and drainage shall be taken for the areas of excavation, filling, and disposal.

**3** The spoil (rock, dreg) shall be comprehensively utilized, and the unusable should be piled up in a special storage place.

**4** Temporary protective measures shall be taken during civil construction.

**5** Land remediation shall be timely carried out for finished construction sites to restore its utilizing function.

**3.1.3** The soil erosion prevention and control for the PCP shall achieve the following targets:

**1** Increased soil erosion in the construction scope of a project shall be controlled effectively, and original soil erosion shall be treated.

**2** Soil and water conservation facilities shall be safe and efficient.

**3** Soil and water resources, as well as forest and grass vegetation shall be protected and restored to the greatest extent.

**4** The six indicators including the percentage of controlled soil erosion area, proportion of soil erosion control, percentage of blocked dregs and soil, percentage of protected topsoil, percentage of recovered forest and grass, and percentage of forest and grass coverage shall meet the requirements of current national standard, GB/T 50434 *Standard of Soil Erosion Control for Production and Construction Projects*.

#### **3.2 Restrictions on projects**

**3.2.1** Site (line) selection for the PPP shall avoid the following areas:

**1** Key zone of soil erosion prevention and key zone of soil erosion control.

**2** Plant protection zones located on both sides of rivers, around lakes and reservoirs.

3 Soil and water conservation monitoring sites and key test areas in the national soil and water conservation monitoring network, and long-term fixed observation stations determined by the national government.

**3.2.2** Construction scheme shall meet the following requirements:

1 For highways or railways sections with massive filling or deep excavation, more bridges and tunnels shall be used in order to minimize filling and excavation. An alternative plan for using bridges or tunnels shall be studied if the filling height is greater than 20m or the excavation depth greater than 30m. On the premise of ensuring slope stability, vegetation protection measures or combined protection solution of vegetation and engineering shall be taken for embankment or trench.

2 Construction projects in city and town shall adopt higher standard of vegetation planting, emphasize landscape effects, and be equipped with irrigation, drainage and rainwater utilization facilities.

3 The tower base of power transmission project in hilly regions shall adopt unequal height foundation. A transmission tower passing through a forest zone shall be heightened.

4 For the PCP that cannot avoid the key zone of soil erosion prevention or the key zone of soil erosion control, construction scheme shall meet the following requirements:

1) The scheme shall be optimized to minimize land occupation and earthwork. Highways, railways and other projects with filling height greater than 8m should adopt bridge scheme. Pipeline-crossing engineering should adopt the scheme of tunneling, directional drilling, or pipe-jacking. Industrial sites in hilly regions should adopt step layout with priority.

2) Engineering grade and flood control standard for water interception and drainage projects and blocking engineering shall be upgraded by one level.

3) Facilities for rainwater collection and storage, and sediment deposition should be arranged.

4) Vegetation measures standard shall be upgraded. The percentage of forest and grass coverage shall be increased by 1% to 2%.

**3.2.3 Earth (rock, sand) borrow sites must not be located in collapse and landslide risk areas and debris flow prone areas.**

**3.2.4** The locating of earth (rock, sand) borrow sites shall meet the following requirements:

1 Meet the requirements in urban and scenic spot planning, and coordinate with surrounding landscape.

2 Meet the related requirements of river management if earth (rock, sand) is borrowed from river course.

3 Consider land use comprehensively after earth (rock, sand) borrow.

**3.2.5 Spoil (rock, dreg, fly ash, mullock, tailings) fields must not be set up in regions that have significant impacts on public facilities, infrastructures, industrial enterprises, and residential areas, etc.**

**3.2.6** The locating of spoil (rock, dreg, fly ash, mullock, tailings) fields shall meet the following requirements:

1 For projects involving river courses, disposal sites locating shall follow the requirements of flood control planning and river course regulation lines, and disposal sites shall not be located in the control areas of river courses, lakes or reservoirs.

2 For projects in hilly regions, disposal sites should be located in desolate gullies, concave grounds or branch gullies. For projects in plains, disposal sites should be located in concave grounds or



bare lands. For projects in wind erosion regions, disposal sites should avoid wind vents.

3 Earth (rock, sand) borrow sites, abandoned mining pits and subsidence areas shall be fully utilized.

4 Land use shall be comprehensively considered after spoil (rock, dreg, fly ash, mullock, tailings) disposal.

**3.2.7** Construction organization design shall meet the following requirements:

1 Minimize land occupation for construction sites, and avoid areas with considerable vegetation coverage and basic farmland area.

2 Schedule construction rationally, avoid repeated excavation and repeated transport, and minimize exposed time and scope.

3 Design special facilities such as dreg aqueducts, dreg chutes, etc. to export excavated earth-rock if excavation is on the steep slopes of river banks, or if there are river channels, highways, railways, residential areas, and other important infrastructure under excavation slopes.

4 Sort and stack abandoned earth, rock and dreg.

5 Use abandoned earth (rock, dreg) by other projects with priority as borrow earth and rock, or select suppliers with compliant borrow area for purchased earth (rock, material).

6 Excavate stepwise and control excavation depth for large-scale borrow pits. And control charging quantity and blasting range for blasting excavation.

7 Divide project sections in consideration of rational earthwork allocation to reduce earth (rock) borrow and spoil (rock, dreg), and to minimize temporary land occupation.

**3.2.8** Engineering construction shall meet the following requirements:

1 Construction activities shall be constrained within the designed temporary roads and sites for construction.

2 At the beginning of construction, topsoil shall be stripped or protected first. The stripped topsoil shall be piled up with protection measures.

3 Exposed land surface shall be protected in time to shorten exposure time. Timely excavation, delivery, filling and compaction shall be done for earthwork filling.

4 Temporarily stocked earth (rock, dreg) shall be piled up, and temporary measures such as blocking, covering, drainage, sedimentation, etc., shall be taken.

5 Mud produced during construction shall be deposited first through setting basin and then be treated with other measures.

6 Effective measures shall be taken during cofferdam filling and removal to reduce soil loss.

7 Blocking measures for spoil (rock, dreg) fields shall be taken in advance, and spoil (rock, dreg) shall be placed in order.

8 Measures for water interception and drainage, and sediment deposition shall be taken before earth (rock, sand) borrow sites excavation.

9 Protective measures shall be taken to avoid spilling in the transportation of earth (rock, material, dreg and mullock).

### **3.3 Special regulations for areas with different types of soil erosion**

**3.3.1** In the black soil region of Northeastern China, the following requirements shall be satisfied:

1 Black soil resources shall be protected and rationally utilized.

- 2 In hilly regions, runoff drainage system should be arranged on slopes.
  - 3 For protective measures, the effects of freezing damage shall be considered.
- 3.3.2** In sandstorm region of Northern China, the following requirements shall be satisfied:
- 1 The scope of construction disturbance shall be controlled to protect surface crust, sand crust, and desert pavement.
  - 2 Measures, such as gravel (rubble, cobble) stone covering, sand barrier, plant sand fixation, chemical consolidation, etc., may be taken to prevent and control wind erosion.
  - 3 Vegetation measures should be equipped with irrigation facilities.
- 3.3.3** In the earth-rock mountain region of Northern China, the following requirements shall be satisfied:
- 1 Soil resources shall be reserved and comprehensively utilized.
  - 2 Water conservation measures shall be taken in the upstream water conservation areas of rivers.
- 3.3.4** In the Loess Plateau region of Northwest China, the following requirements shall be satisfied:
- 1 Water interception and drainage, as well as drainage connection and energy dissipation measures shall be taken on slopes.
  - 2 Rainwater collection and utilization facilities should be arranged.
- 3.3.5** In the red soil region of Southern China, the following requirements shall be satisfied:
- 1 Runoff drainage systems shall be arranged on slope surface to prevent disasters such as Benggang<sup>①</sup>, landslide, etc.
  - 2 Emergency protection measures shall be taken for rainstorm and typhoon.
- 3.3.6** In the purple soil region of Southwestern China, the following requirements shall be satisfied:
- 1 Attention shall be paid to flood control, drainage and retaining measures for spoil (rock, dreg) fields.
  - 2 Water conservation measures shall be taken in the upstream water conservation areas of rivers.
- 3.3.7** In the karst region of Southwestern China, the following requirements shall be satisfied:
- 1 Soil resources shall be reserved and comprehensively utilized.
  - 2 Underground stream system such as underground rivers and karst caves shall not be destroyed.
- 3.3.8** In the Qinghai-Xizang Plateau Region, the following requirements shall be satisfied:
- 1 Disturbance area during construction shall be strictly minimized to protect land surface and vegetation.
  - 2 Attention shall be paid to the stripping, protection and utilization of the turf in plateau meadow areas.
  - 3 For protective measures, the effects of freezing damage shall be considered.
- 3.3.9** In plain regions, the following requirements shall be satisfied:
- 1 The soil in cultivated layer shall be reserved and utilized.
  - 2 Sediment trapping measures shall be taken to avoid river channel siltation.
  - 3 The excavation of earth (rock, sand) borrow sites should be wide and shallow, and attention shall be paid to measures for restoration and utilization.
  - 4 Measures such as optimization of designed elevation of sites and road surface shall be taken to reduce the volume of borrowed earth and rock.

<sup>①</sup> A special type of gully erosion, associated with a permanent collapsing gully on a low hillslope developed from granite red soil, is present in Southern China.

**3.3.10** In urban regions, the following requirements shall be satisfied:

**1** Measures, such as sunken lawns, permeable pavement, etc., shall be taken to increase precipitation infiltration.

**2** Surface runoff shall be comprehensively utilized by setting up rainwater and flood utilization and storage facilities such as impounding pools.

**3** Measures, such as blocking, covering, drainage, and sedimentation shall be taken for temporarily stocked earth (rock, dreg). To prevent flying dust and silt from entering municipal pipeline network, the compartments of vehicles transporting soil and dreg shall be covered with their wheels washed.

**4** The disposal of borrowed earth (rock, sand) and spoil (rock, dreg) should be managed coordinately with other related construction projects.

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## **4 Soil and water conservation schemes**

### **4.1 General requirements**

**4.1.1** The main contents of soil and water conservation scheme shall include the brief introduction of a project and the project area, the evaluation of soil and water conservation for the project, soil erosion prediction, layout of soil and water conservation measures, and investment estimation of soil and water conservation.

**4.1.2** Soil and water conservation scheme shall specify the range of responsibility and objectives for the soil erosion prevention and control of the project.

**4.1.3** The target year of design shall be the completion year of the PPP or the following year, which is determined comprehensively according to the completion date of the PPP and the implementation progress of soil and water conservation measures.

**4.1.4** The national policy for soil and water conservation shall be implemented in formulating soil and water conservation scheme, which shall follow the principles of "adjust measures to local conditions, apply prevention and control measures in different areas, take overall consideration, pay attention to ecology, be technically feasible and economically reasonable, link up with principal projects, and coordinate with surrounding environment".

### **4.2 Investigation and survey**

**4.2.1** Investigation items shall include the basic information of a project, project component and layout, construction organization, land occupation, earthwork balance, project investment, construction schedule, removal or resettlement, special facilities reconstruction or relocation, and spoil (rock, dreg, fly ash, mullock, tailings) during production process and its disposal plan. Meanwhile, the investigation shall satisfy the following requirements:

**1** The basic information of a project shall include project name and location, construction nature and task, engineering grade and scale, total investment and investment for civil works, construction period, etc.

**2** Project component and engineering layout shall include the following items:

**1)** Basic contents of project construction, the name, construction scale, horizontal and vertical layout of single work. For a project with dependency relationship, the relevant situation of the dependency project shall be investigated.

**2)** Power supply system, water supply and drainage system, communication system, and internal and external transportation, etc.

**3** Construction organization shall include the following items:

**1)** The location, quantity, land occupation, etc. of production and living areas.

**2)** The location, length, width, land occupation, etc. of temporary roads for construction.

**3)** Water source and arrangement of water supply system, their land occupation, etc., as well as power source and arrangement of power-supply facilities, and their land occupation, etc. for construction.

- 4) The locations of earth (rock, sand) borrow sites, topographical conditions, borrowed quantity of earth (rock, sand), land occupation, etc.
- 5) The locations, topographical conditions, capacity and catchment area of spoil (rock, dreg) fields, quantity and land occupation of spoil (rock, dreg), as well as important facilities and residential areas downstream of the sites.
- 6) Earthwork construction methods and technics for land preparation, foundation excavation, roadbed construction, trench excavation and filling for pipe laying, etc. related to soil and water conservation.

4 According to the project component and construction organization, the land occupation area, nature and type of the project shall be collected and re-checked on site.

5 According to the project component and construction organization, the volumes of excavation, filling, borrow (indicating source), and surplus (indicating destination) and the allocation situation of earthwork balance shall be collected and re-checked by zones.

6 Demolition and relocation (resettlement) shall include the relocation scale and mode. Special facilities reconstruction (relocation) shall include its contents, scale, and scheme.

7 Project investment shall include total investment, civil works investment, capital composition and source.

8 Construction schedule shall include total construction period (including preparation period), commencement date, completion date, and work progress of zoned or segmented engineering.

9 The treatment plan of disposed earth (rock, dreg, fly ash, mullock, tailings) from production shall include its source, quantity, category, and disposal mode.

**4.2.2** Project investigation may use the method of data collection and field investigation.

**4.2.3** The details of project investigation shall meet the following requirements:

1 Topographic map (with a scale of no less than 1:10 000) and remote sensing image data shall be collected for spoil (rock, dreg, fly ash, mullock, tailings) fields. The range of topographic map shall meet the requirements on catchment area calculation of earth (rock, dreg, fly ash, mullock, tailings) disposal area, and can reflect downstream topographical features. For earth (rock, dreg, fly ash, mullock, tailings) disposal sites with capacity above 100 000m<sup>3</sup>, relevant engineering geological data shall be collected.

2 For the earth (rock, sand) borrow sites with a capacity above 100 000m<sup>3</sup>, topographic map (with a scale of no less than 1:10 000) and engineering geological data shall be collected.

**4.2.4** Project investigation results shall be presented in accordance with the following requirements:

1 Drawings shall include the general layout and plan layout of a project. Drawings of linearly arranged projects such as highways, railways, etc. shall also include plane section and longitudinal sketches, as well as the typical section drawings.

2 The nature, type and area of the land occupation of a project shall be illustrated respectively according to the project component and the administrative district of county level, and the table of total land occupation shall be listed. Land occupation types shall be classified according to relevant requirements of current national standard, GB/T 21010 *Current Land Use Classification* and soil and water conservation requirements.

3 Earthwork balance sheet shall be listed, and flow diagram shall be drawn. Topsoil balance shall be calculated separately, and a balance sheet shall be produced.

4 Location map shall be attached for earth (rock, sand) borrow sites and spoil (rock, dreg) fields.

**4.2.5** The investigation and survey of a project area shall include general natural conditions, the current situation of soil erosion, the sensitive area of soil and water conservation, etc., and shall satisfy the following requirements:

1 General natural conditions shall include topography, geomorphology, geology, meteorology, hydrology, soil and vegetation of the project area, and shall meet the following requirements:

- 1) Topography and geomorphology investigation shall include the topographic features and geomorphic types of the project area, as well as ground slope, elevation and surface material composition, etc. within the project site.
- 2) Geological investigation shall mainly include the depth of groundwater, and harmful geological conditions such as landslide, collapse, debris flow, etc. within the project site.
- 3) Meteorological investigation shall include the climate type, annual mean air temperature, accumulated temperature greater than or equal to 10°C, annual evaporation, annual precipitation, frost-free period, annual mean wind speed and predominant wind direction, gale days, periods of rainy season, periods of windy season, the maximum depth of frozen ground, etc. in the area where the project is located.
- 4) Hydrological investigation shall include the names and scales of watershed, rivers and lakes, water function zoning, tidal conditions, etc. in the area where the project is located. The water level, discharge, flood control planning, etc. of corresponding rivers (gullies) shall be investigated if a dreg disposal area involves rivers (gullies).
- 5) Soil investigation shall include the soil types of the project area, and the thickness of topsoil, strippable range and area within the land occupation area of the project.
- 6) Vegetation investigation shall include the vegetation type, main native tree and grass species and growth situation, and percentage of forest and grass coverage in the project area.

2 The investigation of current soil erosion situation shall include soil erosion types, intensity and modulus, and soil loss tolerance of the project area.

3 The investigation of sensitive area of soil and water conservation shall include whether the project area involves key zones of soil erosion prevention and control, conservation regions of drinking water source, protected and reserved areas of the primary water functioning regions, nature reserves, world cultural and natural heritage sites, scenic areas, geological parks, forest parks and important wetlands. For the project involving the above-mentioned regions, the position relationship between the region and the project shall be stated.

**4.2.6** The investigation of project area shall adopt the method of combining data collection and field survey. The thickness of topsoil within the project area shall be measured.

**4.2.7** Details of project area investigation and survey shall meet the following requirements:

1 The scale of topographic map used for the investigation of project area shall be no less than 1:50 000.

2 Recent hydrological and meteorological data shall be taken, and their sequence period shall be over 30 years.

**4.2.8** The investigation and survey results of project area shall meet the following requirements:

1 For block-type PCP, general natural profile shall be expressed in units of towns or counties level, while for linear-type PCP, it shall be expressed in units of counties or cities.

2 Maps of water system of project area, key zones of soil erosion prevention, key zones of soil erosion control and soil erosion intensity distribution shall be collected.

### **4.3 Evaluation of soil and water conservation for projects**

**4.3.1** The evaluation of soil and water conservation for projects shall include assessment on site (line) selection, construction scheme and layout.

**4.3.2** The site (line) selection evaluation for the PPP shall meet the requirement of Article 3.2.1 in this standard.

**4.3.3** The evaluation of construction scheme and layout shall be conducted from the perspective of soil and water conservation for the following items one by one: the construction scheme, land occupation, earthwork balance, arrangement of earth (rock, sand) borrow sites and spoil (rock, dreg, fly ash, mullock, tailings) fields, construction method and technique, and the works with soil and water conservation functions in the PPP design.

**4.3.4** Construction scheme evaluation shall meet the requirement of Article 3.2.2 in this standard.

**4.3.5** The land occupation evaluation of a project shall meet the following requirements:

- 1 The area and disturbance shall be minimized concerning land occupation.
- 2 Temporary occupied land shall meet the requirements of construction.

**4.3.6** The evaluation of earthwork balance shall meet the following requirements:

- 1 Quantity of earthwork excavation and filling shall be optimized.
- 2 Earthwork allocation shall comply with the principles of reasonable segmentation, feasible schedule and transport distance.
- 3 Comprehensive utilization of surplus earthwork shall be considered first.
- 4 The requirements of Items 5 and 7 in Article 3.2.7 in this standard shall be met.

**4.3.7** The evaluation about the arrangement of earth (rock, gravel) borrow sites shall meet the requirements of Articles 3.2.3 and 3.2.4 in this standard.

**4.3.8** The evaluation about the arrangement of spoil (rock, dreg, fly ash, mullock, tailings) fields shall meet the requirements of Articles 3.2.5 and 3.2.6 in this standard.

**4.3.9** The evaluation of construction method and technique shall meet the following requirements:

- 1 Soil erosion shall be minimized.
- 2 If it is not specified clearly in engineering design, the requirements for soil and water conservation shall be added.

**4.3.10** The evaluation of the works with soil and water conservation functions in the PPPs design shall meet the following requirements:

- 1 Evaluation scope shall include ground protection works designed for the PPP.
- 2 Evaluation contents shall include the type, amount and standard of the works.
- 3 It shall be made clear whether the PPP design meets the requirements of soil and water conservation. If the requirements are not met, supplementary and improvement suggestions shall be provided.
- 4 Soil and water conservation measures shall be defined.

**4.3.11** The definition of soil and water conservation measures shall satisfy the following requirements:

1 In the PPP design, works mainly designed with the function of soil and water conservation shall be defined as soil and water conservation measures.

2 If it is difficult to identify whether the works are mainly designed with the function of soil and water conservation, the principle of failure tests may be applied for identification. That is, assuming that there are no such works, the PPP may still function, but it will cause greater soil erosion, so this kind of works shall be identified as soil and water conservation measures.

3 Particular identification may follow the requirements of Appendix D in this standard.

**4.3.12** The evaluation results of soil and water conservation of a project shall be presented in accordance with the following requirements:

1 It shall be clarified whether there is soil and water conservation constraint to the site (line) selection of the PPP. If there is constraint, adjustment requirements for the site (line) selection or design scheme of the PPP shall be proposed.

2 The conclusion of construction scheme evaluation shall be clarified, and optimization suggestions may be proposed.

3 The conclusion of evaluation for land occupation, earthwork balance and construction method shall be clarified.

4 The conclusion of evaluation for arrangement of earth (rock, sand) borrow sites, and spoil (rock, dreg, fly ash, mullock, tailings) fields shall be clarified.

5 For the works identified as soil and water conservation measures, the location, amount and investment of each works shall be specified by zoning and table listing.

6 The problems that need to be further studied in the following stage of project design may be proposed.

#### **4.4 Responsibility range for soil and water conservation and zoning for soil erosion control**

**4.4.1** Responsibility range for the soil erosion prevention and control of the PCP shall include permanent requisitioned land, temporary occupied land (including leased land), and other areas of use and administration.

**4.4.2** Zoning for soil erosion prevention and control shall satisfy the following requirements:

1 According to field investigation (survey) and within the defined range of responsibility, zoning for soil erosion prevention and control shall be determined on the basis of project layout, construction disturbance characteristics, construction schedule, geomorphic features, natural properties, impacts of soil erosion, etc.

2 The principle for zoning shall satisfy the following requirements:

1) There shall be significant differences among zones.

2) The dominant factors of soil erosion, as well as prevention and control measures shall be similar in the same zone.

3) The prevention and control zones may be divided into one or multiple grades according to the complexity of a project and the natural situations of the project area.

4) The first-grade zones shall be dominant, integral and general. The first-grade zones for linear-type project shall be determined according to soil erosion type, topography and geomorphology, climate type, etc. The secondary and sub-grade zones shall be determined grade by grade according to project layout, component, nature of land occupation and disturbance characteristics.



5) All zones with different grade shall be clearly structured, correlated and systematic.

3 Zoning shall be based on the combined methods of field investigation and survey, information collection and data analysis.

4 The results of zoning shall be illustrated in texts, figures and tables.

#### 4.5 Soil erosion prediction

4.5.1 Soil erosion prediction shall include the quantity prediction of soil loss and the hazard analysis of soil erosion.

4.5.2 The range of soil erosion prediction shall be the responsibility area of soil erosion prevention and control.

4.5.3 Soil loss quantity prediction shall be calculated according to the following formula. When the soil erosion intensity of a prediction unit is recovered below the soil erosion modulus of original landforms, further calculations are not necessary.

$$W = \sum_{j=1}^2 \sum_{i=1}^n F_{ji} M_{ji} T_{ji} \quad (4.5.3)$$

Where,  $W$ —soil loss quantity ( $t$ );

$j$ —prediction period,  $j=1, 2$ , i.e. construction period (including preparation period) and natural recovery period;

$i$ —prediction unit.  $i=1, 2, 3, \dots, n-1, n$ ;

$F_{ji}$ —the area ( $\text{km}^2$ ) of the  $j$ th prediction period for the  $i$ th prediction unit;

$M_{ji}$ —the soil erosion modulus [ $\text{t}/(\text{km}^2 \cdot \text{a})$ ] of the  $j$ th prediction period for the  $i$ th prediction unit;

$T_{ji}$ —the duration ( $\text{a}$ ) of the  $j$ th prediction period for the  $i$ th prediction unit.

4.5.4 Prediction unit shall be determined according to the principle of similarity in topographic conditions and landforms, disturbance mode, surface material composition after disturbance, and meteorological characteristics.

4.5.5 The determination of soil erosion modulus shall meet the following requirements:

1 The soil erosion modulus of a prediction unit in original landform condition shall be determined by comprehensive analysis about isograms of soil erosion modulus and field investigation.

2 Soil erosion modulus after disturbance may be determined by mathematical model, experimental observations, etc.

4.5.6 The determination of prediction period shall meet the following requirements:

1 Prediction period shall be divided into construction period (including preparation period) and natural recovery period.

2 The construction period and natural recovery period of each prediction unit shall be respectively determined according to construction schedule. The construction period is the actual duration of land disturbance. The natural recovery period is the duration that soil erosion intensity after disturbance is naturally recovered to the original status without any soil and water conservation measures. It shall be determined according to local natural conditions, generally, 2, 3 and 5 years are taken for humid areas, semi-humid areas, and arid and semi-arid areas, respectively.

3 The prediction time of construction period shall be calculated as one year for 12 consecutive months. If it is less than 12 months, but lasts a whole rainy (windy) season, it shall be calculated as one year. If the time is less than a whole rainy (windy) season, it shall be calculated as the proportion of the

length of the rainy (windy) season.

**4.5.7** The determination of prediction unit area shall meet the following requirements:

1 The area of prediction unit shall be determined according to engineering layout and topographic map.

2 The areas of buildings, ground hardening and water body surface shall be deducted from the predicted area of natural recovery period.

**4.5.8** Analysis about soil erosion hazards shall include the form, extent and scope of potential hazards to the local, surrounding and downstream areas and the project itself, as well as the risk of landslides and debris flows.

**4.5.9** The results of soil erosion prediction shall be presented in accordance with the following requirements:

1 The total soil loss and increased soil loss during construction and natural recovery period for each prediction unit shall be listed and illustrated in tables.

2 Suggestions for soil erosion prevention and control as well as monitoring shall be proposed according to the comprehensive analysis of prediction results.

#### **4.6 Layout of soil and water conservation measures**

**4.6.1** The layout of soil and water conservation measures shall include the overall layout of the measures, zoning measures layout and construction requirements.

**4.6.2** The overall layout of the measures shall combine the actual situation of a project with soil erosion characteristics in the project area, adapt measures to local conditions, implement prevention measures according to hazards. It is also necessary to propose an overall prevention and control idea, to determine a comprehensive prevention and control measure system, and to combine engineering measures, vegetation measures and temporary measures rationally.

**4.6.3** The overall layout of the measures shall meet the following requirements:

1 The layout of prevention and control measures shall be based on the evaluation of works with soil and water conservation functions in the PPP design described in Articles 4.3.10 and 4.3.11 in this standard, and refer to the prevention and control experiences of local similar PCPs.

2 The protection of topsoil resources shall be emphasized.

3 In order to prevent hazards to the downstream, attention shall be paid to the drainage, diversion, retention and utilization of precipitation, as well as the connection between drainage and the downstream.

4 Attention shall be paid to the protection of spoil (rock, dreg) fields and earth (rock, sand) borrow sites.

5 Attention shall be paid to land surface protection to avoid land surface exposure. Vegetation measures shall be implemented with priority, and the hardened ground area shall be minimized.

6 Attention shall be paid to temporary protection measures during construction. Temporarily stocked earth and uncovered surface shall be timely protected.

**4.6.4** The layout of zoning measures shall combine characteristics of each zone with the applicable conditions of various soil and water conservation measures, to set up corresponding soil and water conservation measures in different positions of each zone. The layout of various measures shall meet the requirements of Articles 4.6.5 to 4.6.14 in this standard. The layout of typical measures shall be

conducted on the basis of various measures, and shall meet the specific requirements of Appendix E in this standard.

**4.6.5** The layout of topsoil conservation measures shall meet the following requirements:

1 In excavation or backfilling construction area, topsoil stripping measures shall be taken before construction.

2 Protection measures shall be taken for stocked topsoil.

3 Topsoil shall be filled back to greening or reclamation area after construction. If there is surplus topsoil, the destination of utilization shall be clarified.

4 Topsoil with a disturbed depth less than 20cm within the scope of temporary land occupation may not be stripped, and protection measures such as bedding should be taken.

5 The extent, thickness, quantity and stock location of stripped topsoil, and the location and area of bedding for protecting the stripped topsoil shall be preliminarily determined.

**4.6.6** The layout of dreg blocking measures shall meet the following requirements:

1 Blocking measures shall be applied at the downstream or surroundings of spoil (rock, dreg) fields.

2 Dreg blocking dam or wall shall be built if spoil (rock, dreg) fields are located in gullies.

3 Retaining walls shall be built if spoil (rock, dreg) fields are located on slopes.

4 Dreg blocking embankments or retaining walls shall be set up according to flood control regulation lines, if spoil (rock, dreg) fields are located along a river (gully) bank.

5 The location, grade, structure, section form and length of dreg blocking wall, dam and embankment shall be preliminarily determined.

**4.6.7** The layout of slope protection measures shall meet the following requirements:

1 Slope protection measures shall be applied for stable slopes in the PPP design, mainly including vegetation measures, engineering measures, and the combination of the two measures.

2 Vegetation protection measures shall be applied for low and gentle slopes where precipitation is within an appropriate range.

3 Engineering protection measures shall be applied for the slopes in arid areas where vegetation measures are not suitable or the slope foot is vulnerable to water scouring.

4 Combined engineering and vegetation measures for slope protection shall be applied for high (or steep) slopes where precipitation is within an appropriate range.

5 The location, structure (plant combination), section form and areas of engineering, vegetation and combined protection measures shall be preliminarily determined.

**4.6.8** The layout of interception (drainage) measures shall meet the following requirements:

1 For the areas where original surface water system has been damaged and confluence mode changed by project construction, intercepting ditches, flood discharge canals (ditches), drainage ditches, side ditches, drainage pipes and structures with smooth connection to the downstream shall be set up, in order to safely discharge and divert surface runoff from project area and its surroundings to downstream natural gullies.

2 The location, standard, structure, section form and length of interception (drainage) measures shall be preliminarily determined.

**4.6.9** The layout of precipitation storage and infiltration measures shall meet the following requirements:

1 For projects in arid, water-shortage and urban areas, measures such as impounding pools, infiltration wells, infiltration ditches, permeable pavement and sunken lawns shall be taken to collect and store runoff from buildings and hardened ground.

2 The capacity of impounding pools shall be determined according to catchment, water usage and drainage conditions.

3 The location, structure and section form of impounding pool, infiltration well and infiltration ditch, as well as the location and area of sunken lawns and permeable pavement shall be preliminarily determined.

**4.6.10** The layout of land improvement measures shall meet the following requirements:

1 After construction or excavation, land improvement shall be implemented for spoil (rock, dreg) fields, earth (rock, sand) borrow sites, production and living areas, construction roads, construction sites, greening areas and vacant land, abandoned mining areas, etc.

2 Land improvement measures include site cleaning, land leveling, earth filling (including topsoil backfill), etc.

3 The range and area of land improvement shall be preliminarily determined.

4 The land utilization purpose after land improvement shall be clarified, including trees and grass planting, recultivation, etc.

**4.6.11** The layout of vegetation measures shall meet the following requirements:

1 Vegetation measures shall be applied in all areas suitable for plant growth, except for lands occupied by buildings (structures), hardened ground and recultivation.

2 Native species of trees (grasses) shall be preferentially selected.

3 Vegetation standard shall be upgraded in office and living areas, and garden style greening should be taken.

4 In arid and semi-arid areas, irrigation measures should be equipped with.

5 The location, species, area or quantity for trees, shrubs, and grasses shall be preliminarily determined.

**4.6.12** The layout of temporary measures shall meet the following requirements:

1 Temporary protective measures shall be taken during construction.

2 Blocking and covering measures shall be set up for temporarily stocked earth (material, dreg). Temporary drainage and sedimentation measures shall be set up for construction disturbance areas. Temporary bedding or covering measures should be set up for relatively fixed uncovered sites, and temporary grass planting measures for long-time uncovered sites.

3 The location, form, and quantity of measures such as temporary blocking, covering, drainage, sediment deposition, bedding, and grass planting shall be preliminarily determined.

**4.6.13** The layout of wind-break and sand-fixation measures shall meet the following requirements:

1 Wind-break and sand-fixation measures shall be applied in areas vulnerable to wind and sand hazards.

2 Wind-break and sand-fixation measures mainly include sand barriers and their supporting sand-fixing plants, gravel or rubble cover, etc.

3 The form, location and quantity of sand barriers, gravel or rubble cover, as well as plant species, area or quantity of supporting vegetation measures shall be preliminarily determined.

**4.6.14** The grade of soil and water conservation measures shall meet the requirements specified in

current national standard, GB 51018 *Code for Design of Soil and Water Conservation Engineering*, and the grade of dreg disposal field shall be preliminarily determined if a dreg disposal field is involved.

**4.6.15** The construction requirements of soil and water conservation measures shall meet the following requirements:

1 The adopted method of each single measure for soil and water conservation shall be clearly defined in construction method.

2 Construction schedule shall meet the following requirements:

1) It shall coordinate with the construction schedule of the PPP and specify the schedule arrangement corresponding to single works of the PPP.

2) Temporary measures shall be implemented synchronously with the construction of the PPP.

3) Protection measures shall be taken timely for the uncovered construction sites to minimize exposure time.

4) Spoil blocking measures shall be applied in spoil (rock, dreg) fields according to the principle of "blocking before discarding".

5) Vegetation measures shall be arranged rationally according to the biological characteristics of plants and climatic conditions.

**4.6.16** The results for the layout of soil and water conservation measures shall be presented in accordance with the following requirements:

1 The system diagram for soil and water conservation measures shall be drawn.

2 For block-type prevention and control areas, a general layout of measures shall be drawn for each zone. For a prevention and control area that includes multiple zones, the layout of general measures shall be drawn for each zone with a scale of no less than 1:10 000.

3 For linear-type prevention and control areas, typical section shall be selected to draw general layout of measures by combining the layout of typical measures, with a scale of no less than 1:2 000.

4 The scale for the plan of typical measures layout shall be no less than 1:2 000.

5 The layout location, type, structural form and work amount of each measure shall be preliminarily determined.

6 Construction schedule shall specify the construction sequence of measures corresponding to each single works of the PPP, and list the construction schedule of soil and water conservation in each zone.

## **4.7 Soil and water conservation monitoring**

**4.7.1** Monitoring range, period, contents, methods, frequency and positions shall be preliminarily determined in soil and water conservation scheme, and required labor and material consumption shall be estimated.

**4.7.2** The scope of soil and water conservation monitoring shall be the range of responsibility for soil erosion prevention and control.

**4.7.3** Monitoring period shall start from construction preparation period to the end of the target year of design. Original situation monitoring shall be implemented before the construction preparation period for all projects.

**4.7.4** Soil and water conservation monitoring items shall include land disturbance, earth (rock, material) borrow, spoil (rock, dreg), soil erosion as well as the implementation and effects of soil and

water conservation measures.

**4.7.5** Soil and water conservation monitoring shall adopt the method of combining investigative monitoring and fixed position observation. Remote sensing monitoring shall be added for a project with large area and long distance.

**4.7.6** Monitoring frequency shall meet the following requirements:

**1** For investigative monitoring, monitoring frequency shall be determined according to monitoring items and construction schedule. The quantity of borrowed earth (rock, sand), the area of spoil (rock, dreg), the construction situations of ongoing soil and water conservation measures, and the area of land disturbance shall be investigated and recorded at least once a month. The construction progress and growth situation of soil and water conservation vegetation shall be investigated and recorded at least once a season. Monitoring on soil erosion disaster event shall be completed within one week after its occurrence.

**2** For fixed position monitoring, continuous or regular observations shall be conducted according to monitoring items and methods. Drainage and sediment concentration monitoring shall be implemented continuously in rainy season.

**3** Wind erosion monitoring shall be implemented continuously in windy season.

**4.7.7** The layout of monitoring points shall comply with the principles of representativeness, convenience and less interference. Each monitoring zone shall have at least one monitoring point, and two additional monitoring points shall be added per 100km for the monitoring zone with its length exceeding 100km.

**4.7.8** Staff, facilities and equipment required for soil and water conservation monitoring shall be proposed according to the items and methods of monitoring.

**4.7.9** Monitoring results shall include reports, data, maps and drawings, and images.

## 5 Requirements for design of soil and water conservation measures

### 5.1 General requirements

**5.1.1** The design of soil and water conservation measures for the PCPs shall include preliminary design and detailed design.

**5.1.2** The special part or chapter of the preliminary design on soil and water conservation shall be based on soil and water conservation scheme, requirements in approval document and relevant engineering data, and satisfy the requirements of Appendix C in this standard.

**5.1.3** The contents of preliminary design for soil and water conservation shall meet the following requirements:

1 Clarify the implementation of the requirements in soil and water conservation scheme and approval document.

2 Re-check the range of responsibility for soil erosion prevention and control.

3 Re-check the quantity of borrowed earth (rock, sand) and spoil (rock, dreg), and the locations of earth (rock, sand) borrow sites and spoil (rock, dreg) fields.

4 Design engineering, vegetation and temporary measures for soil and water conservation.

5 Soil and water conservation measures designed for the PPP shall be included in the special part or chapter of the preliminary design for soil and water conservation, and the number of design drawings and the amount of engineering works shall be clarified.

6 The construction organization design of soil and water conservation shall be combined with the construction organization design of the PPP.

7 Draw up budget estimation for soil and water conservation.

8 The objectives of soil erosion prevention and control shall not be inferior to those proposed in soil and water conservation scheme.

**5.1.4** The design of soil and water conservation measures at preliminary design phase shall meet the following requirements:

1 Soil and water conservation measures shall be designed according to the prevention and control zones and with subproject as basic unit.

2 Measures design shall satisfy the requirements of current national standard, GB 51018 *Code for Design of Soil and Water Conservation Engineering*.

3 In areas with landscape requirements, vegetation measures shall be designed in accordance with landscaping standards.

4 The design of vegetation measures shall include tending management, and irrigation measures shall be designed according to actual demand.

5 The design of temporary measures shall specify demolition requirements after construction.

6 The protective functions of each measure shall not be inferior to those proposed in the layout of typical measures of soil and water conservation scheme.

7 The design drawings of soil and water conservation measures shall satisfy relevant drawing standards.

**5.1.5** The detailed design for soil and water conservation measures shall meet the following requirements:

1 Design drawings shall include those of layout, section structure, detailed structure, reinforcement, vegetation measure construction, etc.

2 Design shall satisfy the requirements of current national standard, GB 51018 *Code for Design of Soil and Water Conservation Engineering*.

## **5.2 Measures for topsoil conservation**

**5.2.1** The design of topsoil conservation measures shall meet the following requirements:

1 Stripping extent and thickness shall be determined according to the structure of soil layer, the current situation of land use and construction method within the scope of construction disturbance.

2 Stripped topsoil shall be piled up with protective measures, such as temporary blocking, covering, and drainage.

3 Stripped topsoil shall be used for recultivation and vegetation recovery, and may also be used for land improvement in other regions.

4 In alpine meadow areas, surface meadow shall be stripped off, preserved by special measures and laid back after construction.

**5.2.2** Basic information for the design of topsoil conservation measures shall meet the following requirements:

1 Land use data and topographic maps within the range of land acquisition and land occupation shall be collected.

2 Soil and its distribution within the range of land acquisition and land occupation shall be defined.

3 The information of covering soil thickness required for recultivation or vegetation recovery measures shall be collected.

4 Relevant information for other possible uses of topsoil shall be collected.

## **5.3 Measures for blocking dregs**

**5.3.1** The design of blocking measures for spoil (rock, dreg) fields shall meet the following requirements:

1 Blocking measures include blocking wall, embankment and dam, enclosed blocking weir, etc., which shall be rationally selected according to the factors such as the type of spoil (rock, dreg) fields, piling scheme, topography, geology, meteorology, hydrology, building materials, construction machinery, etc.

2 Blocking engineering design shall be coordinated with those of flood control and drainage engineering, as well as land improvement engineering. The requirements on the overall stability and safe operation of spoil (rock, dreg) fields shall be satisfied.

3 The design of dreg blocking measures shall comply with the principles of safety, reliability, and economic rationality.

**5.3.2** Basic information for the design of dreg blocking measures shall meet the following requirements:

1 Hydro-meteorological information shall include general meteorological data and the



hydrological information of rivers or gullies involved.

2 Topographic information shall include the topography, geomorphology, land type and topographic maps of spoil (rock, dreg) fields.

3 Geological information shall include stratum lithology, overburden composition and thickness, defective geological condition and relevant physical and mechanical parameters.

4 The quantity and composition information of spoil (rock, dreg) shall include its source and composition, quantity, piling scheme, recycled quantity, physical and mechanical parameters, etc.

#### **5.4 Measures for slope protection**

**5.4.1** The design of slope protection measures shall meet the following requirements:

1 For slopes formed by activities such as engineering excavation, filling, dreg disposal, and materials borrow shall be protected for slope stability through toe and slope protection measures, according to the topographic, geomorphic, meteorological, hydrological and geological conditions of the slopes.

2 The design shall coordinate with that of water interception and drainage measures. Vegetation measures or vegetation and engineering integrated measures should be taken for slope protection to meet the stable and safe conditions.

3 Protective measures shall coordinate with surrounding environment.

**5.4.2** Basic information for the design of slope protection measures shall meet the following requirements:

1 Hydro-meteorological information shall include precipitation, wind speed, the maximum depth of frozen ground and necessary hydrological data.

2 Topographic and geological information shall include topographic maps, geological maps, and hydrogeological and geological survey data, etc.

3 Other information shall include the material composition of slope surface, source of covering soil, suitable tree and grass species, etc.

#### **5.5 Measures for water interception and drainage**

**5.5.1** Water interception and drainage measures design shall meet the following requirements:

1 If original surface water system is damaged by the construction of a PCP, measures for water interception and drainage shall be taken. According to the specific conditions of the project and the characteristics of the area where the project is located, measures such as intercepting ditches, drainage ditches, and flood discharge canals (ditches) shall be applied in accordance with local conditions.

2 The drainage design of spoil (rock, dreg) field shall be coordinated with the design of spoil (rock, dreg) fields. Slope drainage shall be combined with slope protection measures.

3 Intercepting ditches, drainage ditches, and flood discharge canals (ditches) shall be smoothly connected with natural water system, and energy dissipation and scouring prevention measures shall be taken.

**5.5.2** Basic information for the design of water interception and drainage measures shall meet the following requirements:

1 Hydro-meteorological data shall include precipitation, surface water system, observed

flood level and discharge of a river (gully), or hydrologic manual and rainstorm atlas (books) of project area.

2 Topographic and geological data shall include topographic maps and geological survey data. If groundwater is involved, the type, depth, flow direction and velocity, recharging source and spring exposure of the groundwater shall be investigated.

## **5.6 Measures for precipitation storage and infiltration**

**5.6.1** The design of precipitation storage and infiltration measures shall meet the following requirements:

1 In arid and water-shortage areas, precipitation storage and infiltration measures shall be properly taken according to local conditions, such as impounding pool, infiltration well, infiltration ditch, permeable pavement, sunken lawns, etc.

2 Precipitation storage and infiltration measures shall be coordinately arranged according to precipitation, catchment area, water demand, etc. Other water source may be used as supplementary for precipitation storage facilities if possible.

**5.6.2** Basic information for the design of precipitation storage and infiltration measures shall meet the following requirements:

1 Hydro-meteorological data shall include precipitation and its annual distribution, local hydrological manual and relevant calculation formulas and parameters, relevant regional aquifer and groundwater distribution, soil type and permeability coefficient, etc.

2 Topographic information of project area shall be collected.

3 Other information to be collected shall include peripheral drainage and pipe network information, the property, area and permeability coefficient of underlying surface within the catchment after construction, water storage facilities designed for the PPP, as well as vegetation species, areas and water consumption quota for irrigation.

## **5.7 Measures for land improvement**

**5.7.1** The design of land improvement measures shall meet the following requirements:

1 Disturbed and exposed land within project area shall be improved, except the area occupied by buildings (structures) and hardened ground. Land improvement shall mainly include site cleaning, leveling and soil covering.

2 Land use purpose shall be determined according to the attribute, type and suitability of occupied land. Land improvement shall be determined according to disturbed land situation, covering soil source, designed land use purpose, etc.

3 If spoil (rock, dreg) fields are covered by large-sized dregs and need to be recovered to arable land, an impervious clay layer with a depth of no less than 0.3m after compaction shall be laid after surface flattening and rolling compaction, and then topsoil shall be covered. The land improvement of mine slag dump and tailings pond shall also satisfy relevant industry regulations of land reclamation.

4 Quarry pit and mining subsidence area may be backfilled or converted to impounding pools or aquaculture ponds.

**5.7.2** Basic information for the design of land improvement measures shall meet the following

requirements:

- 1 Hydro-meteorological data shall include precipitation, irrigation water sources, etc.
- 2 Topographic and geological data shall include topographic maps, necessary survey maps, etc.
- 3 Other data shall include surface material composition and covering soil.

## **5.8 Measures for vegetation**

**5.8.1** The design of vegetation measures shall meet the following requirements:

1 Vegetation measures shall be considered with priority for exposed land after engineering disturbance, and for undisturbed land within the scope of project management.

2 Vegetation measures layout shall meet ecological and landscaping requirements, and shall be combined with urban greening if cities (towns) are involved.

3 Vegetation measures shall be designed according to site conditions. Tree (grass) species, land preparation methods, and planting methods shall be determined under the principle of "suitable trees (grass) for suitable sites". Native tree (grass) species shall be taken with priority.

4 Irrigation measures shall be taken in water-shortage arid areas and areas with high standard demands of vegetation measures.

**5.8.2** Basic data for the design of vegetation measures shall meet the following requirements:

1 Meteorological data shall include precipitation, air temperature, etc.

2 Topographic and geological data shall include land slope, surface material composition, soil texture, topographic maps and necessary survey maps.

3 Other data shall include irrigation water sources, topsoil sources, as well as vegetation planting experience and experimental results of similar projects in comparable areas.

## **5.9 Temporary protective measures**

**5.9.1** The design of temporary protective measures shall meet the following requirements:

1 Temporary protective measures are applicable to exposed areas prone to soil erosion during construction, such as temporary soil stacking, earth (rock, sand) borrow sites, spoil (rock, dreg) fields, and construction sites. The measures include temporary blocking, covering, drainage, sediment deposition, grass planting, etc.

2 Appropriate measures shall be selected according to the factors such as land exposure time, region, rainfall, wind velocity, etc., with attentions on integrating permanent and temporary measures for the best protection effects.

**5.9.2** Basic data for the design of temporary protective measures shall meet the following requirements:

1 Meteorological data shall include precipitation, wind velocity, etc.

2 Other data shall include the construction organization design and production plan of a project.

## **5.10 Measures for windbreak and sand-fixation**

**5.10.1** The design of windbreak and sand-fixation measures shall meet the following requirements:

1 Windbreak and sand-fixation measures shall be taken in wind erosion regions such as desert, sandy land, gobi, etc.

2 In moving dune and semi-fixed dune areas, vegetation, mechanical and chemical sand-

fixation measures shall be taken according to local conditions. In gobi area, gravel covering measures should be taken.

**5.10.2** Basic information for the design of windbreak and sand-fixation measures shall meet the following requirements:

**1** Meteorological data shall include precipitation and its annual distribution, wind velocity and predominant direction, sand hazards, etc.

**2** Topographic data shall include the composition of surface materials, topographic maps, necessary survey maps, etc.

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## **Appendix A Requirements for contents of soil and water conservation in preliminary feasibility study report (project proposal)**

**A.0.1** The contents of soil and water conservation chapters in pre-feasibility study report (project proposal) shall include the analysis and evaluation of restrictive factors that affect soil and water conservation, the analysis and prediction of soil erosion, the objectives and measures layout of soil erosion prevention and control and the investment estimation of soil and water conservation.

**A.0.2** The analysis and evaluation of restrictive factors that affect soil and water conservation shall clarify whether project site selection and construction plan conform to the provisions of laws, regulations and technical specifications of soil and water conservation.

**A.0.3** The analysis and prediction of soil erosion shall meet the following requirements:

**1** The impacts of engineering construction on soil erosion shall be preliminarily analyzed. The disturbed area of original landform and the damaged area of land and vegetation shall be preliminarily determined.

**2** Increased soil loss quantity caused by project construction shall be preliminarily predicted.

**3** Potential soil erosion hazards shall be analyzed.

**A.0.4** The objectives and measures layout for soil erosion prevention and control shall meet the following requirements:

**1** The standard grades and objectives of soil erosion prevention and control shall be preliminarily determined according to current national standard, GB/T 50434 *Standard of Soil Erosion Control for Production and Construction Projects*.

**2** The general layout of prevention and control measures shall be proposed preliminarily according to the characteristics of a project and its construction area.

**3** The engineering work amount of soil and water conservation measures shall be estimated.

**A.0.5** Soil and water conservation investment shall be estimated according to the relevant basis of project construction investments. Estimation about the special investment of soil and water conservation shall cover the investment of engineering measures, vegetation measures and temporary measures, as well as independent expenses and compensation fee for soil and water conservation.

## Appendix B Requirements for preparation of soil and water conservation scheme

### B.1 Contents and chapters of soil and water conservation scheme report

B.1.1 Contents and chapters of soil and water conservation scheme report are shown in Figure B.1.1.

#### 1 Comprehensive descriptions

##### 1.1 Outlines of a project

###### 1.1.1 Basic information of a project

Briefly introduce the necessity of the project construction, project location (block-type details to township, and line-type details to county), construction attribute, scale and grade, project component, the quantity and mode of demolition (resettlement), the reconstruction (relocation) of special facilities, commencement and completion dates, total construction period, total investment and civil engineering investment, etc. Specify the land occupation area of the project, quantity of earthwork (excavation, filling, borrow and surplus/disposals), and the number of earth (rock, sand) borrow sites and spoil (dreg, fly ash, mullock, tailings) fields. For a mining project, geological reserves, the location of the first mining area, service duration, and the quantity of annual dreg disposal during production period shall also be defined.

###### 1.1.2 Progress of construction preparation work

Briefly introduce engineering design and scheme preparation process. If soil and water conservation scheme is submitted after construction commencement, the progress of construction shall be presented.

###### 1.1.3 General nature conditions

Briefly state the geomorphic type, climatic type and major meteorological factors, soil type, vegetation type and coverage, zoned regions of soil and water conservation and soil loss tolerance, soil erosion type and intensity, key zones of soil erosion prevention and control, and the situation of the sensitive areas of soil and water conservation involved.

##### 1.2 Basis for scheme preparation

List the main laws and regulations, technical standards and technical archives of soil and water conservation on which soil and water conservation scheme is based. Other relevant laws and regulations, regulatory documents and technical standards shall be noted in relevant chapters of the report.

##### 1.3 Target year of design

Determine the target year of design for soil and water conservation scheme according to Article 4.1.3 in this standard.

##### 1.4 Range of responsibility for soil erosion prevention and control

Determine the range and area of responsibility for soil erosion prevention and control according to the administrative region at county grade (for projects that cross counties, a table of the range of responsibility for prevention and control shall be appended to the report), as well as meet the requirements of Article 4.4.1 in this standard.

##### 1.5 Objectives of soil erosion prevention and control

###### 1.5.1 Implementation standard grade

Determine the implementation standard grade for the soil erosion prevention and control of a project.

###### 1.5.2 Objectives of soil erosion prevention and control of the project

Define the objectives of soil erosion prevention and control based on the requirements of Article 3.1.3 in this standard. For linear-type project, if the project has objective index for different sections, objective index of each section and comprehensive objective index should be clarified (for a project with large range, an index calculation table of prevention and control standards shall be attached to the report).

##### 1.6 Conclusion of soil and water conservation evaluation for a project

###### 1.6.1 Evaluation of site (line) selection for the PPP

Briefly state the evaluation conclusions for site (line) selection of the PPP from the perspective of soil and water conservation.

###### 1.6.2 Evaluation of construction scheme and layout

Briefly state the evaluation conclusions of construction scheme, land occupation, earthwork balance, arrangement of earth (rock, sand) borrow sites and spoil (dreg, fly ash, mullock, tailings) fields, construction methods and techniques, and works with soil and water conservation function from the perspective of soil and water conservation.

### 1.7 Prediction results of soil erosion

Briefly state the potential quantity of soil erosion, increased soil erosion, key locations of soil erosion, and major soil erosion hazards.

### 1.8 Results of soil and water conservation measures layout

Briefly introduce the layout of measures in each conservation zone. For engineering measures, the name of works, structural form, layout position, and construction period shall be clarified. For vegetation measures, vegetation species, layout position, and implementation period shall be clarified. For temporary measures, the name of works, layout position, and construction period shall be clarified.

Define the major work amount for soil and water conservation measures. For vegetation measures, the statistical results of area shall be provided. For engineering measures, the statistical results of the volume of blocking measures, length of drainage system, area of slope protection, area of land improvement, and quantity of topsoil stripping shall be provided. For temporary measures, the statistical results of the quantity of temporary blocking measures, quantity of drainage ditches and the area of covering shall be provided.

### 1.9 Soil and water conservation monitoring scheme

Briefly introduce the items, duration, method, and observation points of soil and water conservation monitoring.

### 1.10 Investment of soil and water conservation and benefits analysis results

Briefly state the total investment for soil and water conservation, investments for engineering measures, vegetation measures and temporary measures, independent fees (including monitoring and supervision fees for soil and water conservation) and compensation fee for soil and water conservation.

Introduce briefly the possible fulfillment of the indexes for soil erosion prevention and control after implementation of the scheme, as well as the area of soil erosion that may be controlled, the area of vegetation construction and the reduced amount of soil erosion.

### 1.11 Conclusions

Specify whether the project construction meets the provisions in laws, regulations and technical standards of soil and water conservation in terms of site selection, construction scheme and soil erosion prevention and control, etc., and whether the objectives of soil erosion control, and environmental and ecological protection could be achieved after the implementation of soil and water conservation measures. In addition, propose requirements on the design, construction and management of the project from the perspective of soil and water conservation.

A table for the characteristics of soil and water conservation scheme shall be provided at the end of the comprehensive descriptions. Its format is shown in Table 1.

**Table 1 Table for characteristics of soil and water conservation scheme**

Project name		River basin authority		
Involved province (municipality or autonomous region)	Involved city (or number of involved cities)	Involved county (or number of involved counties)		
Project scale	Total investment (ten thousand RMB)	Civil engineering investment (ten thousand RMB)		
Commencement date	Completion date	Target year of design		
Land occupation (hm <sup>2</sup> )	Permanent land occupation (hm <sup>2</sup> )	Temporary land occupation (hm <sup>2</sup> )		
Earthwork quantity (ten thousand m <sup>3</sup> )	Excavating	Filling	Borrow	Surplus (Disposing)
Name of key zone of soil erosion prevention and control				
Geomorphic type		Zoning of soil and water conservation		
Type of soil erosion		Intensity of soil erosion		
Range of responsibility for soil erosion preven- tion and control (hm <sup>2</sup> )		Soil loss tolerance [t/(km <sup>2</sup> ·a)]		
Prediction of total soil erosion (t)		Increased soil loss (t)		

Table 1(continued)

Implementation grade of standard for soil erosion prevention and control				
Prevention and Control indexes	Percentage of controlled soil erosion area (%)		Proportion of soil erosion control (%)	
	Percentage of retained dreg and soil (%)		Percentage of protected topsoil (%)	
	Percentage of forest and grass recovery (%)		Percentage of forest and grass coverage (%)	
Prevention and control measures and engineering work amount	Engineering measures	Vegetation measures		Temporary measures
Investment (ten thousand RMB)				
Total investment of soil and water conservation (ten thousand RMB)			Independent fees (ten thousand RMB)	
Supervision fee (ten thousand RMB)		Monitoring fee (ten thousand RMB)	Compensation fee (ten thousand RMB)	
Investment of soil and water conservation measures by province (ten thousand RMB)			Compensation fee for soil and water conservation by province (ten thousand RMB)	
Compilation agency			Construction agency	
Legal representative			Legal representative	
Address			Address	
Postcode			Postcode	
Contact and phone number			Contact and phone number	
Fax number			Fax number	
Email address			Email address	
<p>Notes: 1 Commencement date refers to the start date of construction preparation period.</p> <p>2 The zones of soil and water conservation shall refer to the first grade regions in <i>Zoning of National Soil and Water Conservation</i>.</p> <p>3 Prevention and control index shall refer to the comprehensive index for the target year of design.</p> <p>4 Prevention and control measures and engineering work amount refer to the quantity of different type of measures during construction period, i.e. for engineering measure, the quantity of blocking measures, length of drainage system, protected area of slopes, area of land improvement, volume of topsoil stripped; for vegetation measures, areas of forest and grass measures; for temporary measures, the quantity of temporary blocking measures, length of drainage system and area of stacking cover measures.</p> <p>5 Investment in soil and water conservation refers to that during construction period.</p>				



## **2 Project overview**

### **2.1 Composition of a project and engineering layout**

It shall be prepared in accordance with the requirements of Items 2 and 9 of Article 4.2.1 in this standard, and complied with the relevant requirements of Article 4.2.4 in this standard. A list of the project composition and major technical indexes shall be provided.

### **2.2 Construction organization**

It shall be prepared in accordance with the requirements in Item 3 of Article 4.2.1 and complied with the relevant requirements of Article 4.2.4 in this standard.

### **2.3 Project land occupation**

It shall be prepared in accordance with the requirements in Item 4 of Article 4.2.1 and complied with the relevant requirements of Article 4.2.4 in this standard. If the project land occupation is adjusted by the soil and water conservation scheme, an explanation shall be provided.

### **2.4 Earthwork balance**

It shall be prepared in accordance with the requirements in Item 5 of Article 4.2.1 and complied with the relevant requirements of Article 4.2.4 in this standard. If earthwork quantity is adjusted by the soil and water conservation scheme, an explanation shall be provided.

There shall be a storage and re-use plan for the surplus topsoil of the project. For surplus earthwork, considerations for giving priority on comprehensive utilization shall be described. For surplus earthwork that cannot be reused, the quantity of disposed soil and rock (dreg), as well as the classified storage plan shall be provided.

### **2.5 Resettlement and special facilities reconstruction (relocation)**

It shall be prepared in accordance with the requirements in Item 6 of Article 4.2.1 in this standard.

### **2.6 Construction schedule**

It shall be prepared in accordance with the requirements in Item 8 of Article 4.2.1 in this standard. If soil and water conservation scheme is submitted after construction commencement, the progress of the construction shall be introduced.

### **2.7 General natural conditions**

It shall be prepared in accordance with the requirements in Item 1 of Article 4.2.5 and Article 4.2.8 in this standard.

## **3 Evaluation of soil and water conservation of a project**

### **3.1 Evaluation on soil and water conservation for the site (line) selection of the PPP**

Evaluation shall be conducted according to relevant soil and water conservation laws, regulations and standards, as well as the requirements in Article 3.2.1 of this standard. The conclusion of evaluation shall follow relevant requirements of Article 4.3.12 in this standard.

### **3.2 Evaluation of construction scheme and layout of soil and water conservation**

#### **3.2.1 Evaluation of construction scheme**

It shall be conducted according to the requirements in Article 3.2.2 of this standard, and its conclusions shall follow the requirements in Article 4.3.12 of this standard. If soil and water conservation scheme is submitted after construction commencement, the evaluation on construction scheme and layout may be simplified. If any sensitive area of soil and water conservation is involved, as listed in the requirements in Item 3 of Article 4.2.5 in this standard, the relationship between the sensitive area of soil and water conservation and the project location shall be described, and the evaluation conclusion shall follow the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.2 Evaluation on land occupation**

Evaluation shall be conducted according to the requirements in Article 4.3.5 of this standard, and its conclusions shall follow the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.3 Evaluation of earthwork balance**

Evaluation shall be conducted according to the requirements in Article 4.3.6 of this standard, and its conclusions shall follow the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.4 Evaluation on arrangement of earth (rock, sand) borrow sites**

Evaluation shall be conducted according to the requirements in Article 4.3.7 of this standard, and its conclusions shall follow the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.5 Evaluation on arrangement of spoil (rock, dreg, fly ash, mullock, tailings) fields**

Evaluation shall be conducted according to the requirements in Article 4.3.8 of this standard, and its conclusions shall follow the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.6 Evaluation on construction methods and techniques**

Evaluation shall be conducted according to the requirements in Articles 3.2.7 and 4.3.9 of this standard, and its conclusions shall follow

the relevant requirements in Article 4.3.12 of this standard.

#### **3.2.7 Evaluation on works with soil and water conservation function in PPP design**

Evaluation shall be conducted according to the requirements in Article 4.3.10 of this standard.

#### **3.3 Identification of soil and water conservation measures in PPP design**

The identification of soil and water conservation measures in PPP design shall be based on the requirements in Article 4.3.11 of this standard, and identification opinions shall be given according to the relevant requirements in Article 4.3.12 of this standard. If soil and water conservation scheme is submitted after construction commencement, the implementation of soil and water conservation measures shall be introduced.

#### **4 Analysis and prediction of soil erosion**

##### **4.1 Current situation of soil erosion**

Analysis and prediction shall be conducted in accordance with the requirements in Item 2 of Article 4.2.5 in this standard.

##### **4.2 Analysis of impact factors of soil erosion**

Analyze the impacts of project construction and production on soil erosion according to natural conditions of the project area and construction characteristics. The area of disturbed surface and destroyed vegetation, and the quantity of spoil (rock, dreg, fly ash, mullock, tailings) shall be clarified.

##### **4.3 Prediction of soil loss amount**

###### **4.3.1 Prediction unit**

It shall be determined according to the requirements in Articles 4.5.4 and 4.5.7 of this standard.

###### **4.3.2 Prediction period**

It shall be determined according to the requirements in Article 4.5.6 of this standard.

###### **4.3.3 Soil erosion modulus**

It shall be determined according to the requirements in Article 4.5.5 of this standard.

###### **4.3.4 Prediction results**

Calculation shall be made according to the requirements in Article 4.5.3 of this standard and satisfy the relevant requirements of Article 4.5.9 in this standard. If soil and water conservation scheme is submitted after construction commencement, an investigation about eroded soil amount is also required.

##### **4.4 Analysis on soil erosion hazards**

Analysis shall be conducted according to the requirements of Article 4.5.8 in this standard and satisfy the relevant requirements of Article 4.5.9 in this standard. If soil and water conservation scheme is submitted after construction commencement, an investigation on occurred soil erosion hazards is also required.

##### **4.5 Guiding suggestions**

Key zones for soil erosion prevention and control, and monitoring shall be suggested according to the prediction results of soil erosion.

#### **5 Soil and water conservation measures**

##### **5.1 Zoning of soil erosion prevention and control**

Zoning shall be conducted according to the requirements in Article 4.4.2 of this standard.

##### **5.2 General layout of measures**

It shall be prepared according to the requirements of Articles 4.6.2 and 4.6.3 in this standard and shall satisfy the relevant requirements of article 4.6.16.

##### **5.3 Measures layout for each zone**

It shall be prepared according to the requirements from Articles 4.6.4 to 4.6.14 in this standard and shall satisfy the relevant requirements of Article 4.6.16. If the soil and water conservation scheme is submitted after construction commencement, it is required to specify the soil and water conservation measures that have been implemented. The implemented soil and water conservation measures do not require to have typical measures layout. The engineering work load is accounted according to the actual completion of the amount of work.

##### **5.4 Construction requirements**

It shall be prepared according to the requirements in Article 4.6.15 of this standard, and satisfy the relevant requirements of Article 4.6.16. If soil and water conservation scheme is submitted after construction commencement, there is no need of construction requirements for the completed measures.

#### **6 Soil and water conservation monitoring**

##### **6.1 Scope and duration**

It shall be determined according to the requirements of Articles 4.7.2 and 4.7.3 in this standard.

## **6.2** Content and method

It shall be determined according to the requirements of Articles 4.7.4 to 4.7.6 in this standard.

## **6.3** Arrangement of observation points

It shall be prepared according to the requirements of Article 4.7.7 in this standard.

## **6.4** Implementation condition and result

It shall be prepared according to the requirements of Articles 4.7.8 and 4.7.9 in this standard.

## **7** Investment estimation and benefit analysis of soil and water conservation

### **7.1** Investment estimation

#### **7.1.1** Preparation principles and basis

Principles and basis shall meet the following requirements:

**1** The price reference year, labor unit price, price of main materials, hour cost of construction machinery, estimated quota, fee collection items and rates of investment estimation for soil and water conservation shall be the same as those for the PPP.

**2** The quota, fee collection items and rates not clarified in the PPP should adopt those of soil and water conservation or relevant industries.

**3** The preparation basis of investment estimation shall include the relevant requirements on the investment quota and estimation of soil and water conservation of the PCP, investment quota and estimation of the PPP, and investment quota and estimation for other relevant industries.

#### **7.1.2** Preparation description and estimation result

**1** List total investment estimation, investment on measures for each zone (including engineering measures, vegetation measures and temporary measures), yearly investment estimation, calculation for independent fees, calculation of compensation fee for soil and water conservation, summary of engineering unit price, summary of hour cost of construction machinery, and summary of unit price for major materials, based on relevant requirements.

**2** Total investment estimation table for soil and water conservation shall consist of measures fee for each zone, independent fees, basic reserve fee, and compensation fee for soil and water conservation.

**3** Fees for research, survey and design, and supervision fee for soil and water conservation shall be estimated according to actual work load with reference to relevant documents.

**4** Soil and water conservation monitoring fee shall include labor fee, civil works facility fee, monitoring equipment usage fee and consumable material fee. It shall be estimated according to actual work load with reference to relevant documents.

The table of project unit price analysis shall be attached to the report of soil and water conservation scheme.

If soil and water conservation scheme is submitted after construction commencement, the investment of completed soil and water conservation measures shall be counted on the basis of actual finished work.

### **7.2** Benefit analysis

Benefit analysis mainly refers to ecological benefits after the implementation of soil and water conservation scheme, including the degree of soil erosion impact control, the protection, recovery and rational utilization of soil and water resources, as well as the protection, restoration and improvement of ecological environment. It shall clarify controlled soil erosion area, forest and grass planting area, reducible soil erosion amount, dreg blocking quantity, and striped and protected topsoil quantity. The achievements of six indices for soil erosion prevention and control, i.e. the percentage of controlled soil erosion area, the proportion of soil erosion control, the percentage of retained dregs and soil, the percentage of protected topsoil, the percentage of recovered forest and grass, and the percentage of forest and grass coverage, shall be analyzed and calculated.

## **8** Soil and water conservation management

### **8.1** Organization management

Clarify the soil and water conservation management organization, personnel and management mechanism of a construction agency.

### **8.2** Follow-up design

Clarify the requirements on the preliminary design of soil and water conservation, and the design of construction drawing.

### **8.3** Soil and water conservation monitoring.

Clarify and implement the requirements on soil and water conservation monitoring.

### **8.4** Soil and water conservation supervision

Clarify and implement the requirements on soil and water conservation supervision.

### **8.5** Soil and water conservation construction

Clarify and implement the requirements on soil and water conservation construction.

#### 8.6 Acceptance of soil and water conservation facilities

Clarify the acceptance procedure and related requirements of soil and water conservation facilities, and propose management requirements on soil and water conservation after the acceptance.

Appendix tables:

- 1 Table of responsibility range for soil erosion prevention and control (required for several county-level administrative regions involved).
- 2 Table of index computation for soil erosion prevention and control standard (required for multiple zonal standards).
- 3 Table of unit price analysis.

Attachment: Related documents for project approval and other related documents shall be included.

Appendix maps and drawings:

- 1 The location map of a project shall include administrative regions, major cities (towns) and traffic routes.
- 2 The water system map of a project area shall include major rivers, main canals for irrigation and drainage, reservoirs, lakes, etc.
- 3 The soil erosion intensity map of a project area.
- 4 The general layout drawings of a project shall reflect each content of the project composition. Contracted drawings of plane and longitudinal section shall be required for highway and railway projects.
- 5 The general layout drawings of zonal prevention and control measures (with monitoring points indicated).
- 6 The layout drawings of typical measures for soil and water conservation.

Notes:

- 1 A responsibility page shall be attached to the cover of the report, and it shall note the posts of personnel for approval, check and review, as well as the work division of drafters.
- 2 Appendix maps and drawings may be compiled separately.

Figure B.1.1 Examples for contents and chapters of soil and water conservation scheme report

### B.2 Contents and chapters of soil and water conservation measures alteration report

B.2.1 Contents and chapters of soil and water conservation measures alteration report are shown in Figure B.2.1.

#### 1 Project overview

Briefly introduce the location, composition and implementation of a project, as well as the approval of soil and water conservation scheme.

#### 2 Alteration of soil and water conservation measures

##### 2.1 Soil and water conservation measures in approved scheme

Briefly state the approved general layout of soil and water conservation measures in each zone.

##### 2.2 Contents of soil and water conservation measures alteration

Indicate reasons and contents of the alteration. The changed layout of soil and water conservation measures shall be prepared in accordance with the requirements of Section 4.6 in this standard.

#### 3 Investment estimation of alteration

Estimate the investment of soil and water conservation after the alteration and indicate investment change (increase or decrease) compared to that of original scheme.

Figure B.2.1 Examples of contents and chapters of soil and water conservation measures alteration report

### B.3 Contents and chapters of soil and water conservation scheme supplementary report for earth borrow and spoil fields alteration

B.3.1 Contents and chapters of soil and water conservation scheme supplementary report for earth borrow and spoil fields alteration are shown in Figure B.3.1.

#### 1 Project overview

Briefly state the location, composition, and implementation of a project, as well as the approval of soil and water conservation scheme.

#### 2 Alteration of earth (rock, sand) borrow sites and spoil (rock, dreg, fly ash, mullock, tailings) fields

##### 2.1 Arrangement of earth (rock, sand) borrow sites and spoil (rock, dreg, fly ash, mullock, tailings) fields in approved scheme

Describe the location and quantity of approved earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields.
<b>2.2</b> Alteration of earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields Describe the reason of alteration and the location and quantity of changed earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields.
<b>3</b> Evaluation of earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields Evaluate the arrangement of earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields after alteration according to the requirements in Articles 4.3.7 and 4.3.8 of this standard, and clarify the evaluation conclusions. Analyze and evaluate the prevention and control measures proposed in main engineering design and clarify the evaluation conclusions.
<b>4</b> Layout of soil and water conservation measures Arrange the layout of soil and water conservation measures for earth (rock,sand) borrow sites and spoil (rock,dreg,fly ash,mullock,tailings) fields after alteration, according to the requirements in Section 4.6 of this standard.
<b>5</b> Modified investment estimation Estimate investment on soil and water conservation for earth (rock,sand) borrow sites and earth (rock,dreg,fly ash,mullock,tailings) fields after alteration, and indicate investment change (increase and decrease) compared to that of original scheme.

Figure B.3.1 Examples of contents and chapters of soil and water conservation scheme supplementary report for earth borrow and spoil fields alteration

#### B.4 Contents and format of soil and water conservation scheme report form

##### Report form for Soil and water conservation scheme of \_\_\_\_\_ Project

Project overview	Location				
	Construction contents				
	Construction attribute			Total investment (ten thousand RMB)	
	Civil engineering investment (ten thousand RMB)			Land occupation (hm <sup>2</sup> )	Permanent:
	Commencement date				Completion date
	Earthwork (m <sup>3</sup> )	Excavating	Filling	Borrow	Surplus (Disposing)
	Earth (rock,sand) borrow site	(Fill in location,number and borrow quantity)			
Spoil (rock,dreg) field	(Fill in location,number and disposal quantity)				
Project area overview	Involved key zone of soil erosion prevention and control			Geomorphic type	
	Original soil erosion modulus [t/(km <sup>2</sup> ·a)]			Soil loss tolerance [t/(km <sup>2</sup> ·a)]	
Evaluation of soil and water conservation for project site (line) selection					
Predicted total amount of soil erosion					
Range of responsibility for soil erosion prevention and control (hm <sup>2</sup> )					

(continued)

Grade and target of prevention and control standard	Grade of prevention and control standard				
	Percentage of controlled soil erosion area (%)		Proportion of soil erosion control		
	Percentage of retained dreg and soil (%)		Percentage of protected topsoil (%)		
	Percentage of recovered forest and grass (%)		Percentage of forest and grass coverage (%)		
Soil and water conservation measures	(Fill in the location, structure, section form and work amount of each engineering measure, the location, configuration form, area and quantity of each vegetation measure, and the location, form and work amount of each temporary measure)				
Investment estimation of soil and water conservation (ten thousand RMB)	Engineering measure		Vegetation measure		
	Temporary measure		Compensation fee		
	Independent fees	Construction management fee			
		Supervision fee			
		Design fee			
Total investment					
Compilation agency			Construction agency		
Legal representative and phone number			Legal representative and phone number		
Address			Address		
Postal code			Postal code		
Contactor and phone number			Contactor and phone number		
E-mail address			E-mail address		
Fax number			Fax number		
Notes: 1 A responsibility page shall be attached to the report cover. 2 Supporting documents, location maps and general layout drawings shall be attached to the report form. 3 Matters that are unclear with this form may be expressed in attachment.					

## Appendix C Contents and chapters arrangements of special report of soil and water conservation in preliminary design

**C.0.1** Contents and chapters arrangements of special report of soil and water conservation in preliminary design are shown in Figure C.0.1.

<p><b>1</b> Overview</p> <p>(1) Brief statement of the main contents and conclusions of the approved report for soil and water conservation scheme.</p> <p>(2) Basis for documents preparation, including investigation and survey data, main technical standards and related materials.</p> <p>(3) Major conclusions, including the layout of measures and major engineering work amount, investment budget, rechecked results of soil and water conservation scheme.</p> <p><b>2</b> Design of soil and water conservation measures</p> <p>The engineering measures, vegetation measures and temporary measures of soil and water conservation shall be designed for each zone. The engineering amount of soil and water conservation shall be clarified. The general layout drawing of soil and water conservation measures, as well as the design drawings of engineering, vegetation and major temporary measures shall be drafted for each zone.</p> <p><b>3</b> Construction organization design of soil and water conservation</p> <p>Construction conditions, methods, arrangements and schedule shall be clarified.</p> <p><b>4</b> Soil and water conservation monitoring</p> <p>The scope, duration, items, method, and frequency of monitoring shall be clarified. The monitoring points shall be determined, and the specification, facilities, equipment, and personnel for monitoring points shall be proposed.</p> <p><b>5</b> Investment budget of soil and water conservation</p> <p>The estimated budget of investment for soil and water conservation shall be proposed based on the design of measures and construction organization, and according to the relevant requirements. Investment for engineering, vegetation and temporary measures, independent fees, and compensation fees for soil and water conservation shall be clarified.</p> <p><b>6</b> Soil and water conservation management</p> <p>Clarify the organization and personnel of soil and water conservation management. Propose the management requirements or plans for construction and production periods.</p>
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Figure C.0.1 Examples of contents and chapters arrangements of special report of soil and water conservation in preliminary design

## Appendix D Identification of soil and water conservation measures for PPP design

**D.0.1** The identification of blocking and drainage measures for PCP may be determined according to Table D.0.1.

**Table D.0.1 Table for identification of blocking and drainage measures for a PCP**

Project type	Identified as soil and water conservation measures		Not identified as soil and water conservation measures	
	Blocking	Drainage	Blocking	Drainage
Thermal power	Blocking wall, dam and embankment of spoil (rock, dreg) field	Drainage pipe, drainage ditch, intercepting ditch and impounding pool for rain water collection in plant area; drainage and intercepting ditches around fly ash storage field	Blocking wall and bounding wall in plant area; windproof and dust suppression net for coal storage site; ash dam, flood detention dam and isolation embankment for fly ash storage field	Settling pond for coal storage site; drainage shaft, horizontal pipe, culvert and blind ditch for fly ash storage field, and impounding pool behind ash dam
Water resources and hydropower (including navigation and power generation project)	Blocking wall, dam and embankment of spoil (rock, dreg) field	Drainage pipe, intercepting ditch and drainage ditch in power plant, dam, office and living area; intercepting and drainage ditches for spoil (rock, dreg) field and borrow area	Blocking wall for power plant, dam, office and living area; building and dismantled cofferdam	Construction diversion work
Power transmission and transformation, and wind power	Blocking wall of spoil (rock, dreg) field (point)	Intercepting and drainage ditches in power transformation station; intercepting and drainage ditches and water retain embankment around tower base and wind turbine	Blocking wall of transformation station, tower base, and blocking wall, wind turbine	-
Metallurgy, nonferrous metal, and chemical engineering	Blocking wall, dam and embankment of rock disposal field and spoil field	Drainage pipe, drainage ditch, intercepting ditch, and impounding pool for rain water collection at factory area and industrial site; intercepting ditch and drainage ditch for mining pit and rock disposal field	Blocking wall and bounding wall for factory area and industrial site; tailings dam, dreg blocking embankment, and upstream water-blocking dam for tailings pond (red mud pond); dreg blocking dam for smelting slag field	Drainage shaft, horizontal pipe and culvert for tailings pond; blind drain for smelting slag field and rock disposal field
Well mining	Blocking wall and dam of mullock disposal area	Drainage pipe, intercepting ditch, drainage ditch and impounding pool for rain water collection at industrial sites; intercepting and drainage ditches for mullock disposal area	Blocking wall and bounding wall for industrial sites	-



Table D.0.1(continued)

Project type	Identified as soil and water conservation measures		Not identified as soil and water conservation measures	
	Blocking	Drainage	Blocking	Drainage
Opencast mining	Blocking wall,dam and embankment of spoil field and rock disposal field	Drainage pipe,intercepting ditch,drainage ditch and impounding pool for rain water collection at industrial sites; intercepting and drainage ditches for soil and rock disposal areas;water-intercepting cofferdam for mining sites	Blocking wall and bounding wall for industrial sites	Water collection and drainage facilities in pits
Highway and railway	Blocking wall,dam and embankment of spoil (rock,dreg) field	Drainage pipe,intercepting ditch and drainage ditch for rain water in service and maintenance work areas; intercepting ditch,side ditch, drainage ditch,chute, evaporation pond for roadbed; drainage pipe and drainage ditch for bridge;intercepting ditch and drainage ditch for tunnel entrance;intercepting and drainage ditch for spoil (rock, dreg) field and borrow site; diversion embankment around roadbed in gobi region	Blocking wall in service and maintenance work areas ,and roadbeds	Roadbed culvert, and drainage for road surface
Airport	Blocking wall of spoil (rock,dreg) field	Drainage pipe,drainage ditch, intercepting ditch,and impounding pool for rain water collection in flight area, terminal,office, and clearance area;intercepting and drainage ditches for spoil (rock,dreg) field and borrow site	Blocking wall in flight area, terminal,and office area	-
Port and pier		Drainage pipe and drainage ditch for storage yard and pier	Blocking wall in sea dike, storage yard and pier	-
Gas,oil and water pipeline	Blocking wall of spoil (rock,dreg) field	Intercepting and drainage ditches for station yard,pipeline operation belt,and crossing works	Blocking wall and bounding wall for station yard ;anchor block for stabilizing pipe and cut-off wall;blocking wall crossed by pipes	-
Oil and gas exploitation	Blocking wall of spoil (rock,dreg) field	Drainage pipe,intercepting ditch and drainage ditch for rain water on station yard and well site;intercepting ditch and drainage ditch for spoil (rock, dreg) field and earth (rock, sand) borrow site	Blocking wall for station yard and well site	-

**D.0.2** The identification of side slope protection measures of a PCP shall meet the following requirements:

- 1 Slope protection with vegetation shall be defined as soil and water conservation measures.
- 2 Comprehensive slope protection combining engineering and vegetation measures shall be defined as soil and water conservation measures.
- 3 Engineering slope protection designed in the PPP for stable side slopes shall be defined as soil and water conservation measures.
- 4 Slope protection measures (anchor, slide-resistant pile, slide-resistant wall, net-suspended spray, etc.) for harmful geology conditions shall not be defined as soil and water conservation measures.

**D.0.3** The identification of other measures in the PCP shall meet the following requirements:

- 1 Topsoil stripping and protection shall be defined as soil and water conservation measures.
- 2 Land improvement shall be defined as soil and water conservation measures.
- 3 Vegetation planting shall be defined as soil and water conservation measures.
- 4 Impounding pools for precipitation collection shall be defined as soil and water conservation measures.
- 5 Windbreak and sand-fixation measures shall be defined as soil and water conservation measures.
- 6 Ground hardening with water permeability techniques may be defined as soil and water conservation measures.
- 7 Flood embankment, breakwater (wave wall) and riprap protection of rivers, lakes and seas shall not be defined as soil and water conservation measures.

## **Appendix E Requirements for contents and depth of layout of typical measures for soil and water conservation**

**E.0.1** The following soil and water conservation measures shall be arranged as typical measures, and their contents and requirements shall meet the following stipulations:

- 1** Measures for dreg blocking:
  - 1) Determine the location of dreg blocking measures, and plot typical cross-section drawings with certain explanation in text.
  - 2) Cross-section dimensions may be determined by referring to similar project, and the stability shall be calculated and checked if necessary.
- 2** The area or section of slope protection measures shall be determined, and typical cross-section drawings shall be made, with certain explanation in text.
- 3** Measures for water interception (drainage):
  - 1) The area and section of water interception (drainage) measures shall be determined, and typical cross-section drawings shall be made, with certain explanation in text.
  - 2) The cross-section dimensions of water interception (drainage) measures shall be determined by the hydrologic and hydraulic calculations or the PPP design.
  - 3) The location of energy dissipation and sediment deposition measures shall be clarified, and the plan and typical cross-section drawings shall be made. Drainage direction and smooth connection measures shall be clarified, and typical cross-section drawings shall be plotted.
- 4** Measures for precipitation storage and infiltration:
  - 1) Determine the approximate locations of impounding pools, and infiltration ditches and wells, and draw plan and typical cross-section drawings. Determine the locations of water permeable brick and sunken lawns, and draw typical cross-section drawings, with certain explanation in text.
  - 2) The volume of impounding pools shall be determined by hydrological calculation.
- 5** The plan layout drawings of vegetation measures shall be drafted, and their configuration method, species and specifications, etc. shall be clarified with certain explanation in text.
- 6** The plan layout drawings of windbreak and sand-fixation measures shall be drafted, and sand barrier form, plant species and specifications, configuration method, etc. shall be clarified, with certain explanation in text.
- 7** The plan layout drawings of comprehensive measures and typical cross-section drawing of each single measure shall be drawn for earth (rock, sand) borrow sites and spoil (rock, dreg) fields, with certain explanation in text.

**E.0.2** For typical soil and water conservation measures, the engineering amount of unit measure shall be calculated. Unit engineering amount shall be determined, and the applicable scope for the same type of engineering amount shall be calculated.

**E.0.3** The selection of typical measures shall meet the following requirements:

- 1** Blocking measures shall be selected according to the type and amount of dregs to be retained.

2 Side slope protection measures shall be selected according to the type of side slope (excavation, filling) and the type of measures (engineering, vegetation, combination). The variations of topographic and geological conditions shall be considered for linear-type project.

3 Interception (drainage) measures shall be selected according to building materials and cross-section types. The variations of topographic and geological conditions shall be considered for linear-type project.

4 Measures for precipitation storage and infiltration shall be selected according to the type of measures (impounding pool, water permeable brick, water permeable concrete, sunken lawn, infiltration ditch, infiltration well, etc.).

5 Vegetation measures shall be selected according to the type of plant configuration (tree, shrub, grass and their configuration form).

6 Windbreak and sand-fixation measures shall be selected according to the type of the measures (sand barrier, configuration form of tree, shrub and grass).

7 Comprehensive prevention measures for earth (rock, sand) borrow sites shall be selected according to topographic conditions (sloping land, hilly land, flat land, floodplain) and the type of borrowed material (soil, rock, sand).

8 Comprehensive prevention measures for spoil (rock, dreg) fields shall be selected according to topographic conditions (gully, riverside land, sloping land, flat land, concave land), and the type and quantity of spoil (rock, dreg).

## Explanation of wording in this standard

1 Words used for different degrees of strictness are explained as follows in order to mark the differences in implementing the requirements of this standard.

1) Words denoting a very strict or mandatory requirement:

"Must" is used for affirmation, "must not" for negation.

2) Words denoting a strict requirement under normal conditions:

"Shall" is used for affirmation, "shall not" for negation.

3) Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:

"Should" is used for affirmation, "should not" for negation.

4) "May" is used to express the option available, sometimes with the conditional permit.

2 "Shall meet the requirements of..." or "shall comply with..." is used in this standard to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

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## List of quoted standards

GB/T 50434 *Standard of Soil Erosion Control for Production and Construction Projects*

GB 51018 *Code for Design of Soil and Water Conservation Engineering*

GB/T 21010 *Current Land Use Classification*

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