Guideline for Survey of Debris-Flow-Prone Streams and Survey of Debris Flow Hazard Areas (Proposal)

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Sabo Division, Sabo Department,
River Bureau,
Ministry of Construction

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Section 1 ..... General

1-1 Outline

This Guideline is consisted of: (1) Survey for sampling of debris-flow-prone streams, (2) Survey for establishing debris flow hazard areas, (3) Classification of debris-flow-prone streams, (4) Survey of factors that cause debris flow and survey of sabo facilities, (5) Preparation of "clinical chart" of debris-flow-prone streams, and (6) Compilation of survey results.

(Comments)

(1) Survey for sampling of debris-flow-prone streams sets forth the methods of sampling debris-flow-prone streams.

(2) Survey for establishing debris flow hazard areas is conducted in order to designate debris flow hazard areas with the aim of contributing to the promotion of comprehensive efforts to protect human lives and people's properties from debris flows.

(3) Classification of debris-flow-prone streams sets forth classifications of sizes of the objects to be conserved from debris-flow-prone streams.

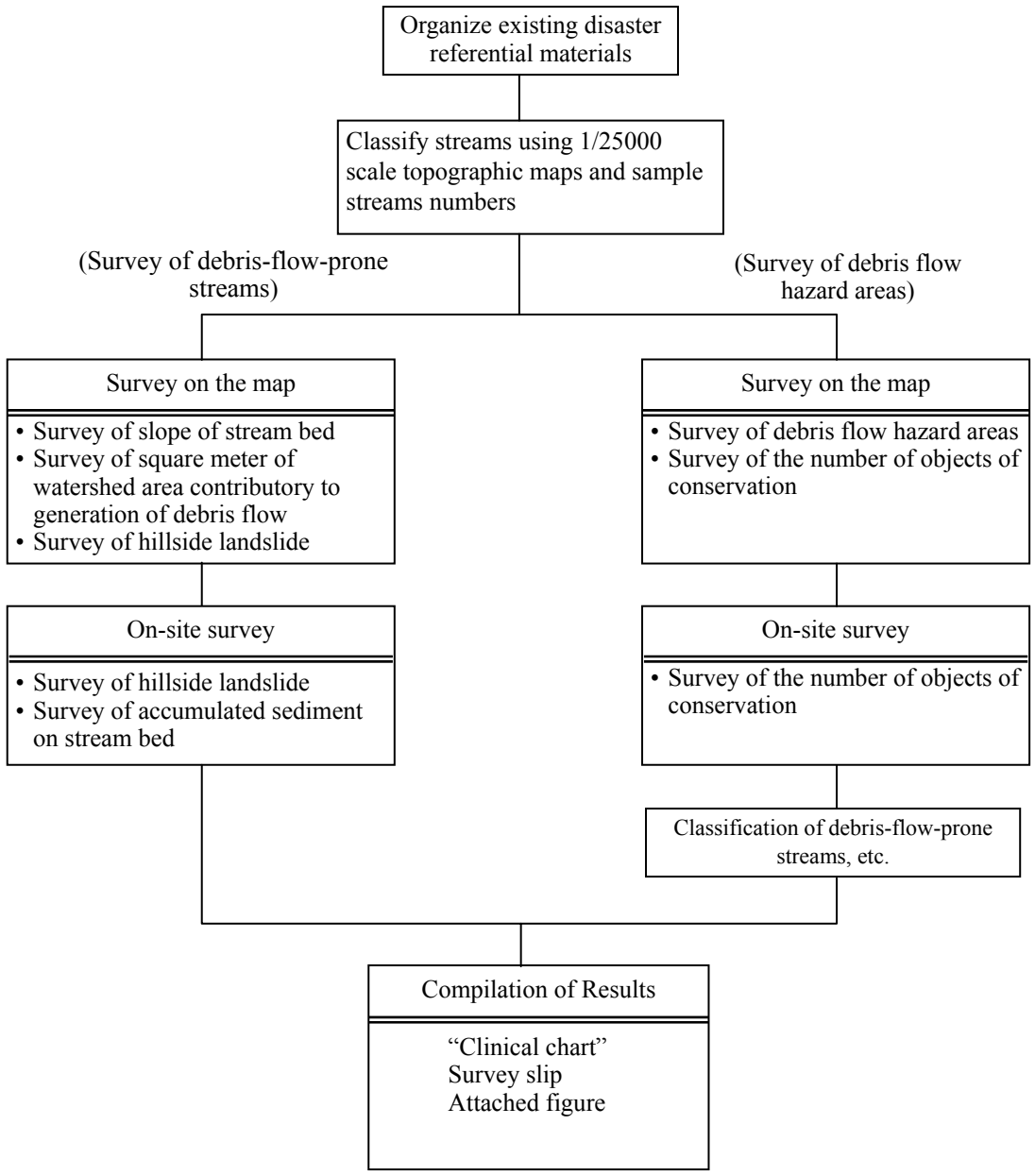
(4) Survey of factors that cause debris flow and survey of sabo facilities sets out the methods to grasp the current status of watershed areas and sabo facilities at streams that are classified as Debris-Flow-Prone Streams I and Debris-Flow-Prone Streams II.

(5) Preparation of "clinical chart" of debris-flow-prone streams organizes the results of the surveys stated in the above (2), (3), and (4) in forms of chart, table, etc. so that changes in the conditions of streams will be made available at the time of the next survey.

(6) Compilation of survey results serves as a lead table of the "clinical charts" of debris-flow-prone streams and it shows the results of surveys stated in the above (1), (2), (3), (4), and (5) in a clear and concise manner.

1-2 Concept of Survey

The concept of the survey of debris-flow-prone streams and the survey of debris flow hazard areas are as shown in the flowchart below.



Note) The above flowchart shows a concept of the surveys. Actual surveys are conducted in accordance with the Flowchart of the Implementation of Survey described on page 6.

1-3 Procedures of Survey

This survey is conducted in accordance with the flowchart stated in the below.

(Comments)

The procedures of this survey are to classify debris-flow-prone streams based on the results of the sampling survey of debris-flow-prone streams and the survey for establishing debris flow hazard areas, to conduct on-site surveys with respect to debris-flow-prone streams around which there are objects of conservation, such as people, houses, and public facilities, exist, and to prepare "clinical charts" of debris-flow-prone streams so that "clinical charts" will be made available as references for corporations implementing conservation measures. Furthermore, "clinical charts" are to be summarized and compiled as a lead table.

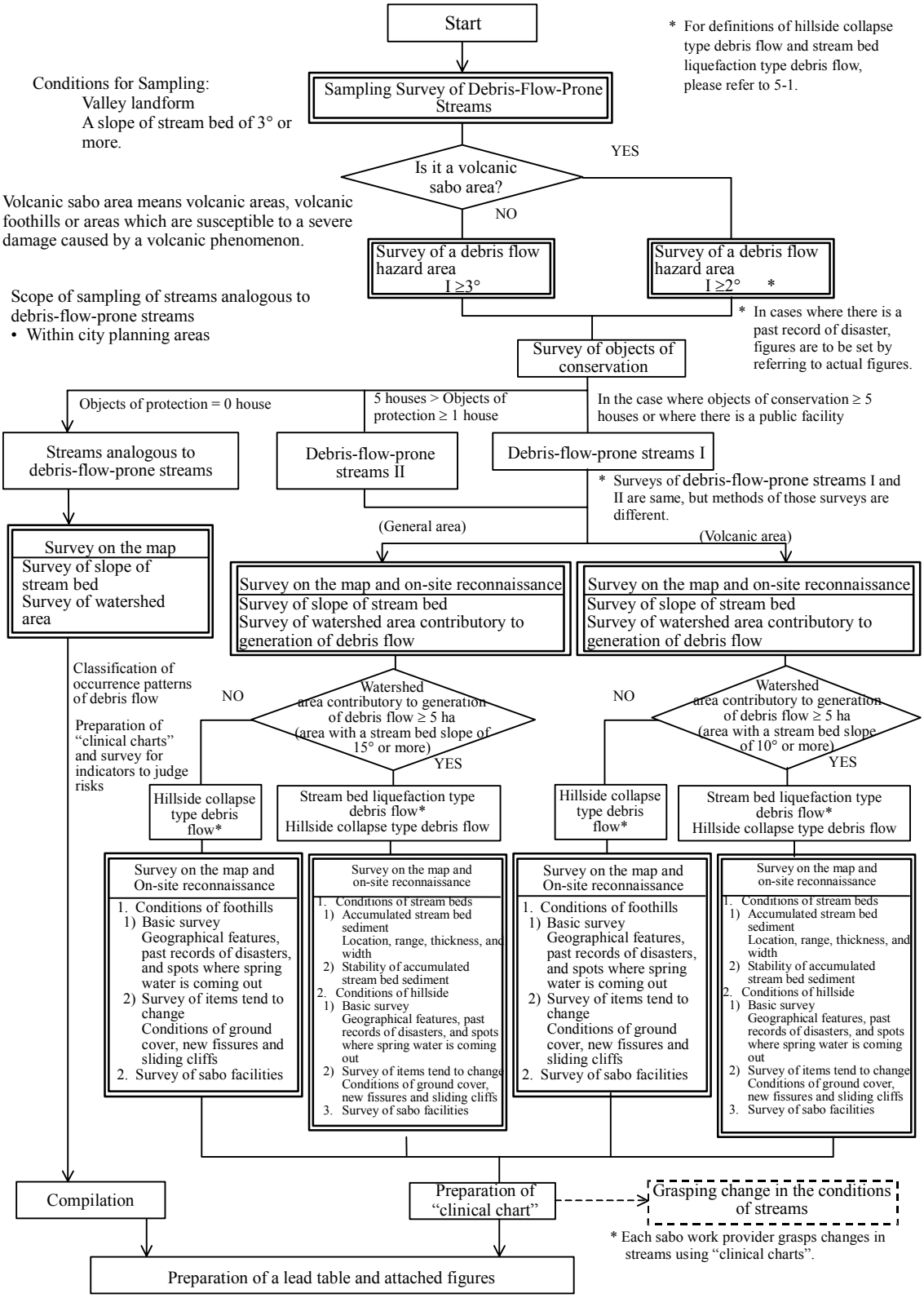


Figure 2 Flowchart of the Implementation of Survey

Section 2 Survey for Sampling of Debris-Flow-Prone Streams

2-1 Streams to Be Surveyed

Streams to be surveyed shall be those forming a valley landform.

(Comments)

(1) A stream specifically means a stream forming a valley landform when it is observed using a 1/25,000 scale topographical map. Debris-flow-prone streams means an area with the starting point set at a place forming a first-stage valley landform (Figure 2-1) and with the ending point set at a place where the stream bed is inclined at an angle of 3 degrees (1/20) (In the case of a volcanic sabo area, 2 degrees (1/30)).

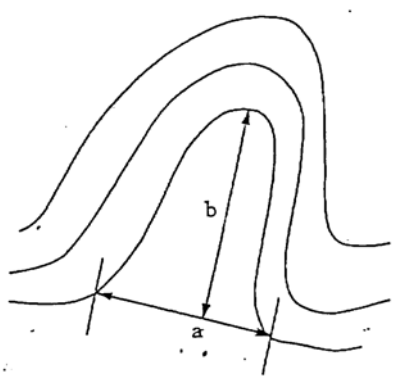


Figure 2-1 A first-stage valley

Please note that “a” on the right figure shows the width of a valley on a same contour line and “b” shows the longest distance from front to back on a same contour line.

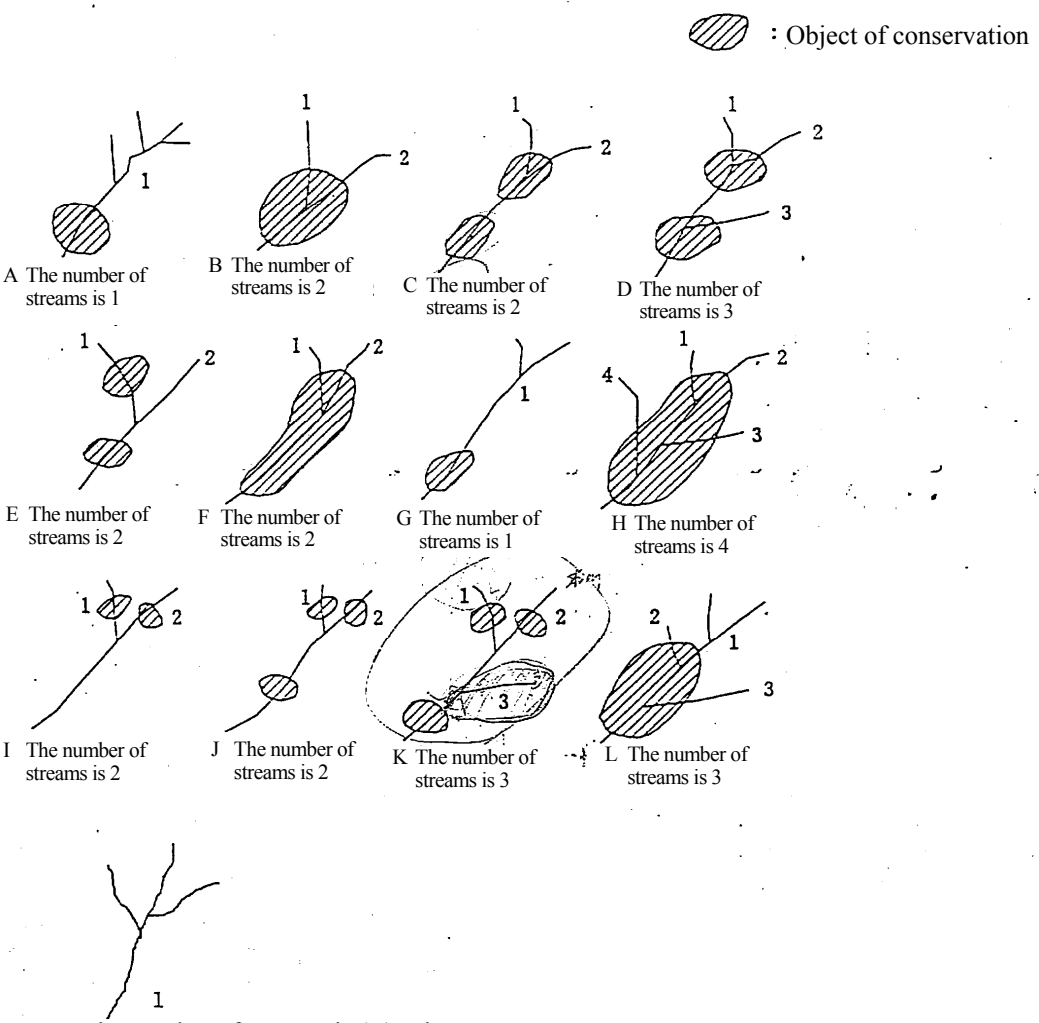
(2) Method to Make a Judgment on a First-stage Valley

(a) A spot with a < b is to be a first-stage valley.

(b) Even if a spot is with a > b, the spot is to be regarded as a first-stage valley if one of the followings apply.

- A stream which is running debris flow or which has a past record of debris flow. (including fan-like form topographies)
- A stream which may be considered as with threat of debris flow in light of its topographical and geological features.
  (Collapsed soil, bare field, etc.)

(3) The counting method of streams are as stated in the below.



Numbers in the drawing designates number of streams.

Figure 2-2 Counting Method of Debris-Flow-Prone Streams

2-2 Scope of Survey

Debris-Flow-Prone Streams I and Debris-Flow-Prone Streams II shall cover all areas and shall be divided into volcanic sabo areas and all the other areas separately. Also, in the case of streams analogous to debris-flow-prone streams, in principle only those located in the city planning areas are to be included in the objectives of this survey. (Please refer to Section 4: Classification of Debris-Flow-Prone Streams)

(Comments)

(1) Volcanic sabo areas shall mean 97 volcanoes described in Table 2-1, to which the business of planned evacuation measures against volcanic eruptions applies, and the bounds of those volcanoes.

(2) ”Streams analogous to debris-flow-prone streams” are intended to be surveyed in advance in consideration of areas which may become objects of conservation in the future because of expansion of residential areas. Therefore, city planning areas in which such a possibility is high are included in the scope. However, even in the case of a stream inside a city planning area, if it is considered unlikely to become a residential area in light of its topographical and social features, such as a place without any flat area, nearby road, etc, such a stream may be excluded from the scope.

(3) Debris-flow-prone streams means streams which have a danger of the occurrence of debris flow and which has a possibility to cause damage to one house or more (including cases where there is no house but there is a facility related to people who are most vulnerable to disasters, such as a government office, school, hospital, and social welfare facility, or a public facility, such as a railway station, inn, and power plant.).
As for the definition of facilities related to people who are most vulnerable to disasters, please refer to the Comments of 3-3.

Table 2-1 Volcanic Sabo Areas

Volcanic sabo area	Name of Prefecture	Size of volcanic sabo area (km²)	Volcanic sabo area	Name of Prefecture	Size of volcanic sabo area (km²)
Shiretoko/ Akan/Mashu	Hokkaido	6,549.0	Mt. Gassan/ Hayama	Yamagata	1,443.9
Daisetsu/Tokachi	〃	3,992.3	Mt.Shirataka	〃	216.7
Mt. Irumukeppu	〃	477.8	Mt. Agatsuma	Yamagata/ Fukushima	999.5
Mt. Rishiri	〃	181.7	Mt. Asakusadake	Fukushima	95.1
Eniwa/ Tarumae	〃	2,148.0	Numazawako	〃	285.7
Touya/Usu	〃	73.0	Bandai/Nekoma	〃	167.5
Niseko/ Mt. Youtei	〃	826.3	Mt. Adatara	〃	316.5
Mt. Hokkaido Komagatake	〃	461.0	Mt. Nasudake	Fukushima / Tochigi	655.0
Mt. Esan	〃	55.0	Nikko	Tochigi	1,109.4
Mt. Iwaki	Aomori	335.6	Mt.Takahara	〃	318.5
Mt. Hakkoda	〃	1,336.4	Mt. Akagi	Gunma	1,468.4
Mt. Osore	〃	472.8	Asama/Kusatsu/ Shirane	Gunma/Nagano	1,359.8
Mt. Hiuchidake	〃	113.0	Oshima	Toyo	91.0
Iwate-Hachimantai	Iwate	2,032.2	Niijima	〃	23.4
Mt. Yakeishidake	〃	621.0	Kouzushima	〃	18.6
Mt. Kurikoma	Iwate/Miyagi/ Akita	258.0	Miyakejima	〃	55.1
Mt. Naruko	Miyagi	68.3	Hachijojima	〃	68.3
Mt. Funagata	〃	509.2	Aogashima	〃	5.2
Mt. Kohinai/ Takamatsudake	〃	195.8	Mikurajima	〃	15.6
Mt. Zao	Miyagi/ Yamagata	691.0	Hakoneyama	Kanagawa/ Shizuoka	608.6
Mt. Akiyoshi	Akita	311.3	Mt. Sumondake/ Asakusadake	Niigata	145.8
Mt. Akita Komagatake	〃	5.9	Mt. Iiji	〃	23.4
Hachimantai	〃	714.3	Niigata-Yakeyama	〃	45.1
Mt. Kanpu	〃	43.3	Naeba/Shiga	Niigata/Nagano	873.8
Toga	〃	9.0	Mt. Myoko/ Kurohime	〃	747.3
Towadako	〃	453.1	Mt. Yatsugatake/ Kayagatake	Yamanashi	963.0
Mt. Tashirodake	〃	101.4	Hakuba Norikura	Nagano	1,300.8
Mt. Fujisato-Komagatake	〃	31.9	Mt. Norikura/ Yakedake	Nagano/Gifu	23.0
Mt. Chokai	Akita/ Yamagata	1,047.0	Mt. Ontake	Nagano	259.5

Volcanic sabo area	Name of Prefecture	Size of volcanic sabo area (km²)	Volcanic sabo area	Name of Prefecture	Size of volcanic sabo area (km²)
Mt. Tateshina/ Yatsugatake	Nagano	1,359.6	Kunimi/Yahazu	Kumamoto/ Miyazaki/ Kagoshima	1,103.6
Mt.Tateyama/ Takamine	Toyama	607.8	Kirishima	Miyazaki/ Kagoshima	844.9
Mt. Hakusan	Gifu/Ishikawa	1,302.7	Sakurajima	Kagoshima	134.8
Dainichizan	Ishikawa	254.4	Satsuma Chu-bu	〃	1,092.0
Tomuroyama	〃	71.6	Kunimi Yahazu	〃	420.0
Norikura/Ontake	Gifu	900.4	Kimotsu	〃	59.2
Mt. Fuji	Yamanashi/ Shizuoka	1,819.2	Nansatsu	〃	146.4
Izuhanto	Shizuoka	789.6	Mt. Kaimondake	〃	228.8
Mt. Kyogatake/ Mt. Dainichigatake	Fukui	774.8	Nagashima	〃	88.0
Mt. Kunimidake	〃	47.3	Tokara	〃	165.2
Mt. Aobadake	〃	32.7	Total		59,655.4
Mt. Hyonosen/ Mt. Hachibuse	Hyogo	382.3			
Mt. Ohyama	Tottori/Okayama	881.7			
Mt. Ouginosen	Tottori	59.3			
Mt. Suganosen	〃	47.9			
Mt. Sanbe	Shimane	165.0			
Mt. Ohetaka	〃	201.1			
Mt. Aono	〃	67.4			
Abu Hagi	Yamaguchi	58.2			
Nagato	〃	54.0			
Shunan	〃	8.1			
Yanai	〃	9.4			
Mt. Taradake	Nagasaki	317.9			
Unzen	〃	390.7			
Nagasaki	〃	867.8			
Kobukuro/ Kinpo	Kumamoto	316.8			
Mt. Aso	〃	1,773.8			
Tsurumi/Kujuh	Kumamoto/Oita	3,868.6			
Udo	Kumamoto	124.7			

Section 3 Survey for Establishing Debris Flow Hazard Areas

3-1 Definition of Debris Flow Hazard Area

Debris flow hazard area means an area with threat of accumulated sediment or flooding of debris flow in light of its topographical conditions, etc.

(Comments)

Debris flow hazard areas are set out in order to identify areas where it is anticipated that flooding of debris flow may be caused and also in order to be used as materials when establishing a warning and evacuation system, etc.

3-2 Establishment of Debris Flow Hazard Area

Debris flow hazard area shall mean the extent of an area in which it is anticipated that the flooding of a debris flow at the largest scale possible may occur in light of its topography, distribution of sediment accumulated in the past, actual records of past flooding of debris flows, etc.

(Comments)

A debris flow hazard area shall be established in a comprehensive manner in view of topography, distribution of accumulated sediment caused by debris flow, past records of flooding of debris flow, neighboring debris-flow-prone streams and neighboring topography, status of floods of debris flow of debris-flow-prone streams which are similar in terms of geography and other features.

In principle, a debris flow hazard area shall include a stream bed ranging from an area where a debris flow is generated to an area where a stream bed starts being inclined at an angle of 3 degrees (In the case of volcanic sabo areas, if it has a past record of the occurrence of flooding of debris flow, the actual figure shall be used as reference, and if there is no such record, 2 degrees shall be used.) and a flat area (a fan-like form area and a flat area at the bottom of a ravine) which has a relative height from stream bed of within a few meters. Also, area contributory to generation of debris flow shall be a watershed area with a stream bed sloping at 15 degrees or more (in the cases of volcanic sabo areas, 10degrees or more).

The followings are some of points to be used when making judgment on whether it is a stream hazard area in view of its topography and sediment:

a Fan-like form topography

b Existence of a boulder group

c Accumulated sediment mixed with gravel without forming a layer

By comparing a stream bed sloping at 3 degrees (In the case of volcanic sabo areas, if it has a past record of the occurrence of flooding of debris flow, the actual figure is to used as reference, and if there is no such record, 2 degrees is to be used.) and the tip of the downstream of the distribution of accumulated sediment, the downstream side is to be set as the tip of the downstream of a debris flow hazard area. As for a transverse direction, a hazard area shall be set by using the above a, b, and c as major source of materials in making a judgment.

Also, in cases where any of the followings applies, even if an area is not a volcanic sabo area, it has to be established as a hazard area to the extent that the steam bed is inclined at an angle of 3 degrees.

(a) Depending on the nature of debris flow and topographical conditions, there were cases where damage was caused to houses even in areas with a stream bed sloping at 3 degrees or less in the past. Therefore, in the cases of debris flow which includes a number of fine debris in particular and in the cases of streams which discharge debris flow, an area with an even lower gradient shall be established as a hazard area by referring to its past actual records.

(b) In cases where the distance from a point where a stream bed is inclined at an angle of 3 degrees to sea, lake, swamp, or main river is short, an area including the sea, lake, swamp, and main river are to be established as a debris flow hazard area.

Upon the completion of a rough survey using topographic maps and aerial photo images, an on-site survey is to be conducted.

3-3 Objects of Conservation

Objects of conservation in this survey shall mean people, houses, farming lands, public facilities, etc. which are to be conserved and which are located in a debris flow hazard area.

(Comments)

The method of counting the number of objects of conservation is as stated in Table 3-1.

In cases where a debris flow hazard area of debris-flow-prone streams to be surveyed is overlapped with another debris flow hazard area of debris-flow-prone streams, it is recommended to count the number of objects of conservation other than the objects of conservation in the overlapping debris flow hazard area beforehand.

Please note that public facilities in this document mean facilities associated with people who are most vulnerable to disasters (Please refer to Attachment 1), such as a government or municipal office, school, hospital, and social welfare facility, railway station, power plant, etc.

Because surveys of debris-flow-prone streams related to people who are most vulnerable to disasters were already conducted by No 44, River Gravel Hatsu and No. 62, River Slope Hatsu, Ministry of Construction, September 3, 1998, this survey is to be conducted by utilizing those results.

Attachment -1

Scope of Facilities Associated with People Who Are Most Vulnerable to Disasters

(a) Welfare facility for children (Ministry of Health and Welfare)

→ Facilities based on Article 7 of the Child Welfare Law

Delivery space for women with medical and financial problems, home for infants, home of living assistance for mothers and children, nursery school, children's recreational facility, protective care homes for children, facility for children with mental retardation, day-care center for children with mental retardation, facility for children with visual and hearing impairments, home for children of physical difficulty, home for severely physically and mentally handicapped children, short-term treatment home for emotionally handicapped children, homes for the aid of juvenile self-support and reliance, children and families support center

(b) Welfare facility for the aged (Ministry of Health and Welfare)

→ Facilities based on Article 5-3 of the Welfare Law for the Aged

Day nursing service center for the aged, Daily care facility for the aged of short-term stay, nursing home for the aged, special nursing home for the aged, low-cost home for the aged, welfare center for the aged, in-home care support center for the aged

(c) Rehabilitation facility for physically disabled persons (Ministry of Health and Welfare)

→ Facilities based on Article 5-(1) of the Law for the Welfare of Physically Disabled Persons

Rehabilitation facility for physically disabled persons, medical care center for physically disabled persons, welfare home for physically disabled persons, sheltered work center for physically disabled persons, welfare center for physically disabled persons, facility for production of artificial appliances, information service facility for the visually and hearing impaired

(d) Welfare facility for mentally disabled persons (Ministry of Health, Labour and Welfare)

→ Facilities based on Article 5 of the Law for the Welfare of Mentally Handicapped Persons

Rehabilitation facility for mentally disabled persons, sheltered work center for mentally disabled persons, commuting dormitory for mentally disabled persons, welfare home for mentally disabled persons

(e) Medical institution (Ministry of Health and Welfare)

→ Facilities based on Article 1-2-(2) of the Medical Service Law

Hospitals, medical clinics, and geriatric medicine centers

(f) Kindergarten (Ministry of Education , Science and Culture)

→ Kindergartens based on Article 77 of the School Education Law.

Kindergartens based on Article 77 of the School Education Law

(g) Others

→ A Facilities based on Article 38-(2), (3), and (4) of the Livelihood Protection Law (Ministry of Health and Welfare)

Aid station, rehabilitation facility, medical facility

→ B Facilities based on Article 71 of the School Education Law (Ministry of Education, Science and Culture)

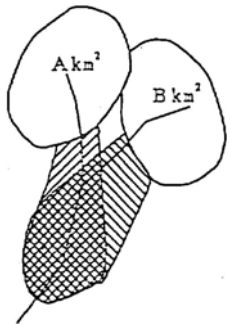
School for people with visual impairments, school for people with hearing impairments, school for physically handicapped or mentally retarded children

→ C Other facilities which are effectively associated with people who are most vulnerable to disasters.

Table 3-1 Method of Counting the Number of Houses Being Protected (for Reference)

Conduct a survey on the number of houses to be conserved, the number of people to be conserved, farming lands to be conserved, public facilities to be conserved, etc. in a debris flow hazard area. In cases where part of the objects of conservation is overlapped with objects of conservation associated with other stream with a danger of debris flow, first conduct a survey on the area where a overlapping of streams exist and then conduct a survey on the remaining areas which have no overlapping of streams.

A)



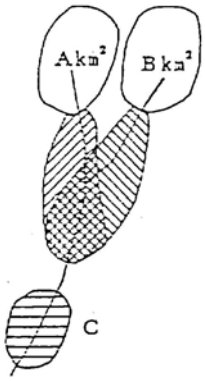
A Stream: a: person, a: house, farming land, public facility, etc.
B Stream: b: person, b: house, farming land, public facility, etc.

: a: person, a: house (A stream's debris flow hazard area)

: b: person, b: house (B stream's debris flow hazard area)

(Objects of conservation without overlapping of A and B: P: person, P: house, farming land, public facility, etc.)

B)



A Stream: (a + c) person, (a + c) house, farming land, public facility, etc.

B Stream: (b + c) person, (b + c) house, farming land, public facility, etc.

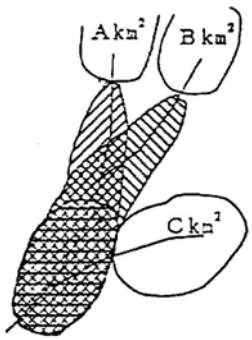
: a: person, a: house

: b: person, b: house

: c: person, c: house

(Objects of conservation without overlapping of A and B: P: person, P house, farming land, public facility, etc.)

C)



A Stream: (a + c) person, (a + c) house, farming land, public facility, etc.
B Stream: (b + c) person, (b + c) house, farming land, public facility, etc.
C Stream: c: person, c: house, farming land, public facility, etc.

: a: person, a: house

: b: person, b: house

: c: person, c: house

(Objects of conservation without overlapping of A, B and C: P person, P house, farming land, public facility, etc.)

D) In the cases of a place having one stream and one debris flow hazard area, the objects of a debris flow hazard area associated with the stream are to be recorded as they are.

Section 4 Classification of Debris-Flow-Prone Streams

4-1 Classification of Debris-Flow-Prone Streams

Sampled debris-flow-prone streams are to be classified into “Debris-Flow-Prone Streams I”, “Debris-Flow-Prone Streams II”, and “Streams Analogous to Debris-Flow-Prone Streams”.

(Comments)

(1) Based on the objects of conservation surveyed in accordance with Section 3, classify the sampled debris-flow-prone streams in accordance with Section 2.

(2) This classification is to be made in consideration of future measures to be taken and in a manner making three categories as shown in the below depending on types and number of objects of conservation.

(a) Debris-Flow-Prone Streams I

A stream that flows into an area where there are 5 houses or more or where, even if there are less than 5 houses, where there is a government or municipal office, school, hospital, station, power plant, etc.

(b) Debris-Flow-Prone Streams II

A stream that flows into an area where the number of houses to be conserved is 1 or more but less than 5.

(c) Streams Analogous to Debris-Flow-Prone Streams

A stream that flows into a place where currently there is no house to be conserved but in the future it is likely that there will be new houses, etc.

(3) We will not further subdivide the watershed areas inside the Debris-Flow-Prone Streams I and II to establish Streams Analogous to Debris-Flow-Prone Streams. Also, in cases where there is an area in which it is possible to expand the scope of conservation into a main river or its branch rivers, only one main river shall be designated as Streams Analogous to Debris-Flow-Prone Streams. According to the method of counting the number of debris-flow-prone streams shown in Figure 2-3, the number of streams in the Case I is turned out to be 2 streams and in other cases, the number is to be counted as 1. Please note that an area in which it is possible to expand the scope of conservation means an area where an alluvial fan or river terrace is existed along the side of a stream and also where there is a road passable by a vehicle.

Section 5 Survey on Factors for Causes of Debris Flow and Survey on Sabo Facilities

5-1 Occurrence Patterns of Debris Flow and Factors for Causes

Occurrence patterns of debris flow include liquefaction of accumulated stream bed sediment, formation of debris flow brought about by a collapsed hillside, and a dam failure. As for sampled streams, a survey is to be carried out on occurrence factors of debris flow stated in the below to identify whether any of these patterns occur to cause debris flow flowing down.

(1) Slope of stream bed
(2) Watershed area
(3) Conditions of stream bed
(4) Conditions of hillside

(Comments)

(1) As occurrence patterns of debris flow, there are liquefaction of accumulated stream bed sediment, formation of debris flow brought about by a collapsed hillside, a dam failure, and others. Of the 4 factors above, (1) ~ (3) are factors for causes of types of debris flow formed as a result of liquefaction of accumulated stream bed sediment (hereinafter referred to as "stream bed liquefaction type debris flow") and (4) is a factor for causes of a type of debris flow formed as a result of liquefaction of a collapsed hillside (hereinafter referred to as ("hillside collapse type debris flow").

(2) As factors related to occurrence of debris flow, in addition to the 4 items above, although there are quality of accumulated stream bed sediment and amount of rainfall (appearance of surface moisture), we exclude those factors because it is difficult to make a judgment on each factor vis-à-vis each stream.

(3) A large scale landslide dam is formed as a result that a moving clay lump caused by a large scale collapse of hillside or landslide runs on the other side of a river causing damming up the river. Although it has become clear qualitatively that such a mechanism to cause a collapse, etc., is greatly influenced by underground water, it is difficult to accurately forecast an occurrence point of such a collapse. For this reason, debris flow caused by collapse of a large scale landslide dam is not included in this survey. Debris flow caused by collapse of a small scale landslide dam shall be covered by surveys on hillside collapse type debris flow.

(4) As for streams analogous to debris-flow-prone streams, only surveys on the map are carried out regarding 5-2-1 and 5-2-2.

5-2 Survey of Each Factor

5-2-1 Survey of Slope of Stream Bed

Survey item:	Slope of Stream Bed
Method of survey:	Reading from topographic maps (using the most precise map per each stream) or on-site survey.

(Comments)

It is known that the common relationship between occurrence of debris flow and slope of stream bed is as shown in Table 5-1. Streams are to be colored in accordance with the categories shown in Table 5-1.

Table 5-1 Classification of Slope of Stream Bed (θ: Slope of Stream Bed)

Category	Occurrence Category	Coloring
$20° \leq \theta$	Occurrence range	Red
$15° \leq \theta < 20°$	Occurrence range, flow-down range (In the case of volcanic areas, occurrence range of debris flow)	Orange
$10° \leq \theta < 15°$	Sediment of debris flow, range of sediment flow	Pink
$3° \leq \theta < 10°$	Debris flow/range of sedimentation of sediment flow	Green
$2° \leq \theta < 10°$	(In the case of volcanic areas, debris flow/range of sedimentation of debris flow)	Green

* As in the case of debris flow containing a number of fine debris, there were cases where a debris flow reached an area with a stream bed sloping at 3 degrees or less (in the case of volcanic sabo areas, a slope of a stream bed of 2 degrees or less) depending on its nature and topographic conditions.
* Table 5-1 is a reference for the stream bed liquefaction type debris flow.

(1) Method to Read from a Topographic Map

Measure the slope of stream bed using a 1/25,000 scale topographic map (The more precise the map is, such as a 1/5,000 scale topographic map or a 1/10,000 scale topographic map, the better).

If there are even more precise topographical maps, etc. are available, such as an aerial photo map, use such materials.

(2) Method of On-Site Reconnaissance

If here are no topographic maps with high accuracy, such as 1/5,000 scale topographic maps and 1/10,000 scale topographic maps, carry out a survey of the slope of stream bed related to occurrence of debris flow, flowing down, sedimentation, etc. by conducting an on-site reconnaissance. During the on-site reconnaissance, measure points where change of slope of stream bed occurs, gradients of a place around the front and the rear of a work, gradients of a place where a valley starts developing and others using a portable compass, etc.

5-2-2 Survey of Square Meter of a Watershed Area

Survey item: (a) Square meter of a watershed area upstream of the point where flooding starts (referred to as square meter of watershed area)

(b) A watershed area upstream of the point where a stream bed gradient is 15 degrees (In the case of volcanic sabo areas, a stream bed gradient of 10 degrees) (referred to as watershed area contributory to generation of debris flow)

Method of survey: Mark the point with a stream bed gradient of 15 degrees confirmed using a topographic map or through an on-site reconnaissance (In the case of volcanic sabo areas, a stream bed gradient of 10 degrees) and the point where flooding starts on a topographic map and measure the area upstream of them.

(Comments)

(1) A survey of square meter of a watershed area upstream of the starting point of flooding is carried out to grasp general features of the watershed area.

(2) A watershed area of the position of occurrence is an indicator to show a volume of water which is one of the factors for generation of debris flow and it is surveyed assuming that the survey is capable of grasping the size of sediment discharge to some extent.

5-2-3 Survey of Conditions of Stream Bed

Survey Items:	Range & position, thickness (m), width of sediment (m), and stability of an accumulated stream bed sediment of a stream with a square meter of a watershed area contributory to generation of debris flow of 5 ha or more.
Method of Survey:	Based on on-site reconnaissance and existing referential materials.

(Comments)

For the stream bed liquefaction type debris flow, the existence or non-existence and the volume of an accumulated stream bed sediment that serves as the source of generation become essential elements. Therefore, in this survey, the existence or non-existence of accumulated stream bed sediment, thickness of sediment, width of sediment, and its stability are surveyed.

(1) Method of Survey

The method of survey is to first confirm, for example, a cross section view of a work, such as a sabo dam under construction using photos and other items using existing referential materials and then to conduct an on-site reconnaissance. During an on-site reconnaissance, make a field investigation on cross sections of parts under constructions if applicable, confirm places with bare rocks, and survey the depth of the accumulated stream bed sediment while making a comparison with surrounding topography and vegetation. In cases where it is difficult to estimate the thickness of an accumulated stream bed sediment, leave the column of thickness of sediment on "clinical chart" 3 of debris-flow-prone streams stated in Section 6 and later fill it in after confirmation is made by excavation at the time of construction of a target work, etc.

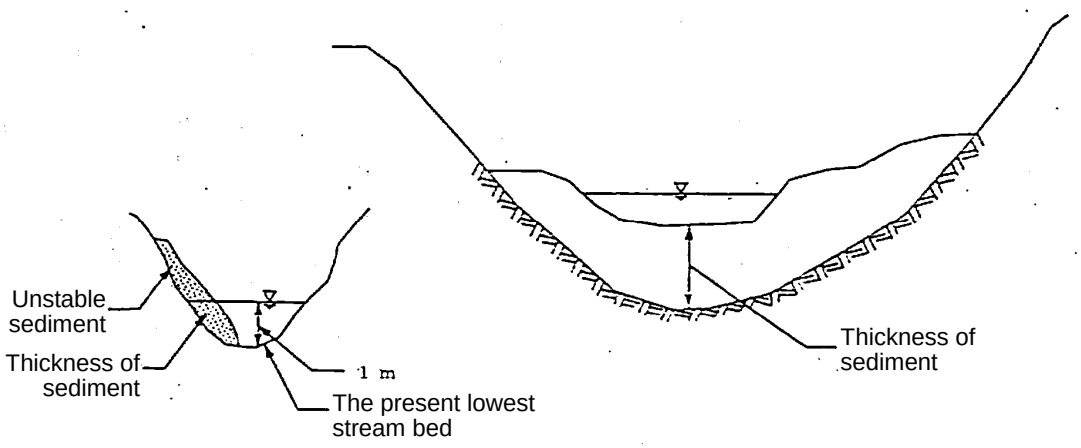


Figure 5-1

In the case of a stream in which debris that may cause danger of collapse at a hillside is existed, such as a case shown in the left drawing of Figure 5-1, the thickness of sediment shall be the maximum depth of sediment existing in the range from the lowest stream bed to the height of 1 m.

In addition, width of sediment must be also surveyed.

(2) Survey of Stability of Accumulated Stream Bed Sediment

As for accumulated stream bed sediment, configuration of sediment (bumpiness of surface), cross section of erosion (water route), and vegetation on it must be recorded and also its stability must be recorded in view of those factors in a comprehensive way.

5-2-4 Survey of Conditions of Hillside

Objects of survey:	(a) Survey of occurrence of collapses of mountain slope failure related to all of the streams to be surveyed
Content of survey:	Conduct an examination on geographical features of hillsides, collapsed places, spring water, vegetation, etc. using aerial photos, topographical maps, and geographical maps for all of the watershed areas of streams.
Procedures of survey:	With regard to streams to be surveyed, conduct a survey with respect to items of each of (1) Conditions of Hillside I and (2) Conditions of Hillside II and record the results on "clinical chart" of each debris-flow-prone streams.

(Comments)

In cases where a case with "collapsed area being 1,000m² or more per area" occurs within a watershed area, there is a danger of occurrence of debris flow as a result of liquefaction of collapsed debris. This survey is conducted to evaluate the risk of the occurrence of a relatively large-scale collapse of hillside such as one to cause debris flow. In particular, in the case of a small stream of a watershed area of 5 ha or less in which the possibility of occurrence of stream bed liquefaction type debris flow is low, there is a danger that the hillside collapse type debris flow may occur.

This survey may be classified into a basic survey that targets items remained unchanged, such as geographical features and records of past collapses, and a survey that target items changing as time passes such as vegetation.

(1) Conditions of Hillside I (Basic survey)

(a) Conditions for Geological Features

Survey item:	Status of development of surface soil (thickness of surface soil), existence of a colluvium zone, existence of a weathered rock zone, existence of a volcanic rock waste bed or a pyroclastic flow sediment bed, existence of a volcanic ash zone, existence of a shattered zone, existence of a tertiary or quaternary deposit zone
Method of survey:	Collection of existing materials, such as a geographical map, analysis, and on-site reconnaissance.

(Comments)

Conduct a survey on existence or non-existence of each item using a geographical map, etc. and a survey on the states of development of surface soil through an on-site reconnaissance.

When conducting a survey, it is recommended to use the following points as a reference.

1) Status of Development of Surface Soil

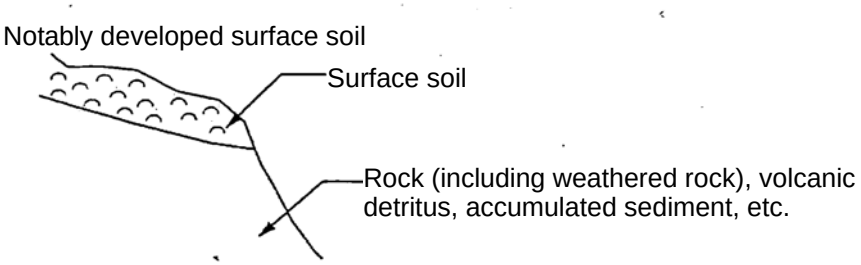
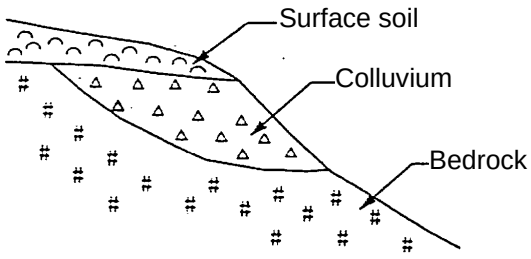


Figure 5-2 Status of Development of Surface Soil

2) Colluvium Zone



* Colluvium: Colluvium means surplus soil from a collapse which was moved a short distance mainly by gravitation. Typical colluviums include hydrated sediment and slided soil due to a landslide.

Figure 5-3 Colluvium zone

3) Weathered Rock Zone

Decomposed granite, solfataric clay

4) Volcanic Rock Waste Bed or Pyroclastic Flow Sediment Bed

Weathered agglomerate, tuff breccia, etc.

5) Volcanic Ash Zone

Shirasu, loam

6) Shattered Zone

It is a zone in which rocks are crushed as a result of faulting and groups of irregular fissures run in a certain direction, forming a zone with a certain width. (Sabo Glossary).

7) Tertiary or Quaternary Deposit Zone

During the tertiary, volcanic activities were very active. There are many deposits of volcanic rocks and tuffs and there are many tertiary deposit zones widely distributed in Japan. While many of aqueous rocks and tuffs of Neogene are in semi-solid state, some of aqueous rocks and tuffs of Paleogene are much more solidified. Also, as for

quaternary deposit zones, the relationship between topographic features of flatlands and hills and sediment is strong and sediment is in non-solidified state. Therefore there are many problem points existed for civil engineering works. (Dictionary of civil engineering works terms)

As it is difficult to measure the size of each item, treat an object which is only partially visible at most located in an area to be surveyed as an existing object.

(b) Past Record of a Collapse in Relatively Large Scale

Survey item:	Scales of collapses occurred in the past (Existence or non-existence of a collapsed area of 1,000m² per area, location, and number of areas.)
Method of survey:	Based on past disasters reports, topographical maps, aerial photos, and on-site reconnaissance.

(Comments)

If there were available results of surveys on hillside collapse (such as a report on disaster), refer to such materials. Also, survey the scale of past collapses using aerial photos and through on-site reconnaissance.

Even if there is only one collapse area being 1,000 m² or more, the place is regarded as having had a collapse in the past (having a record of collapse). Therefore, survey whether there is a collapsed area of 1,000m² or more. Also, in cases where a collapsed area is judged as being stable due to hillside works, etc., as danger of collapse is still existed in the neighboring areas, do not evaluate the reconstruction works, etc. but survey whether there is a collapsed area being 1,000 m² or more and the number of collapsed areas.

In a “clinical chart” of Debris-Flow-Prone Streams, record an approximate area of a collapsed area, location, and number of collapsed areas.

(c) Spot Where Spring Water Coming Out Continuously

Survey item:	Existence or non-existence of a place where spring water can be taken on a hillside, number of the places
Method of survey:	On-site reconnaissance

(Comments)

Carry out a survey whether there is a spot in which spring water is coming out on a continuous basis and the number of such spots.

This survey is conducted targeting hill slopes but it is impossible to carry out an on-site reconnaissance throughout a watershed. Therefore, it is a good way to estimate places where spring water is coming out by referring to topographical maps, aerial photos, and status of vegetation and then confirm them during an on-site reconnaissance.

When there is a salient spot where spring water is coming out around the clock, recognize it as existence of a spot where spring water is coming out.

When carrying out an on-site reconnaissance, it is recommended to use the following points as a reference.

On a “clinical chart” of debris-flow-prone streams, record the locations of spots where spring water is coming out all the time and the number of such spots.

(1) From topographical perspectives, many such spots tend to be discovered at knick points, such as one shown in Figure 5-4.

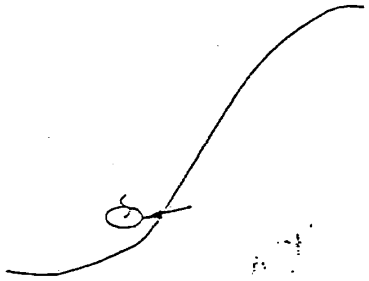


Figure 5-4 Spring water at a knick point

(2) From geographical perspectives, many such spots tend to be discovered at the upper part of a layer with low permeability.

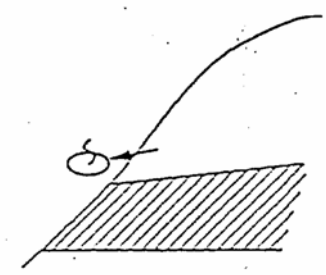


Figure 5-5 Spring water at the upper part of a layer with low permeability

(3) From vegetation perspectives, soil moisture tends to be comparatively low in places where there are many Japanese red pines and Japanese cypresses and comparatively high in places where there are many bamboos and cedars.

(2) Conditions of Hillside II (Survey of Items Tend to Change)

(a) Ground Cover Condition

Survey item:	Existence of a bare field, bare rock, and cutover area and the ratio of an watershed area
Method of survey:	Topographical maps, aerial photos, and on-site reconnaissance.

(Comments)

Carry out a survey on ground cover condition as of the time of the survey and identify how much percentage such an area accounts for in the watershed area. Cutover areas include places where five years have not yet passed since plantation.

(b) New Fissures and Sliding Cliffs

Survey item:	Existence or non-existence of a new fissure or a new sliding cliff.
Method of survey:	Conduct a survey on the number of new fissures in a watershed area to be surveyed based on topographical maps, aerial photos and on-site reconnaissance.

5-2-5 Survey of Sabo Facilities

Survey item:	Insufficient storage of sediment at a sabo dam or other sabo facilities which has been already built in a stream.
Method of survey:	Measure height of insufficient sediment, width of sediment, and current length of sediment, and calculate volume of insufficient storage of sediment under a planned sediment surface.

(Comments)

(1) As for debris flow, it is already known that a sabo dam is effective in curving draining due to insufficient storage of sediment.

(2) Planned sediment gradient is to be set as an amount which is 1/2 of an original riverbed gradient (i_0). Measure height of insufficient storage of sediment (ΔH), width of sediment (B_1), and planned width of sediment (B_2) on a dam' axis cross-section surface and calculate insufficient storage of sediment using the following numerical formula.

(3) In cases where there is more than one facility, such as a sabo dam, records must be entered in "clinical chart" of debris-flow-prone streams by each of them.

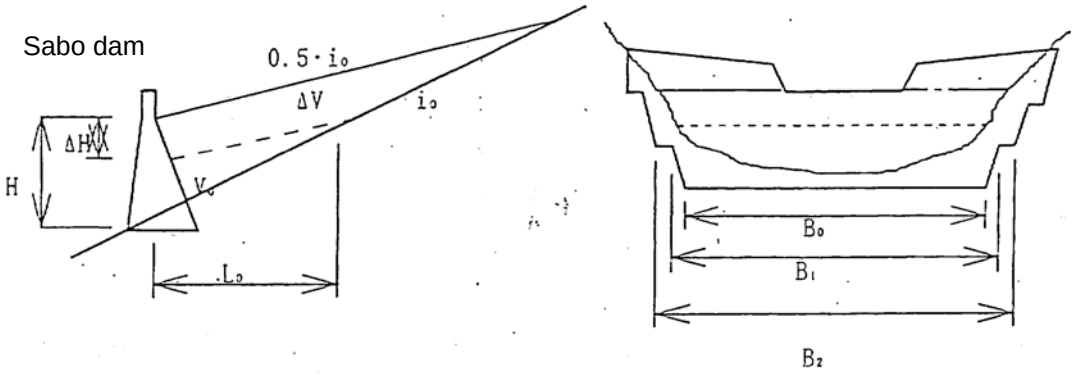


Figure 5-6 Sabo Dam

Current volume of sediment $V_0 = 0.25(B_0 + B_1)(H - \Delta H) \cdot L_0$

Planned volume of sediment $V = 0.5(B_0 + B_2)H^2 / i_0$

Insufficient storage of sediment $\Delta V = V - V_0$

where

i_0 : Original slope of river bed

B_0 : Basic length of sabo dam

B_1 : Current width of sediment

B_2 : Planned width of sediment

L_0 : Current status of expansion of sediment

H : Height of sabo dam

ΔH : Height of insufficient storage of sediment

Section 6 Preparation of "Clinical Chart" of Debris-Flow-Prone Streams

6-1 Purpose of "Clinical Chart" of Debris-Flow-Prone Streams

The purpose is to grasp conditions of a watershed area, conditions of stream beds and hillside slopes in particular, and houses to be conserved in a chronological order so that measures can be taken swiftly in the event of the occurrence of debris flow.

(Comments)

In order to be able to protect lives of local residents from debris flow, it is important to inspect and examine conditions of stream beds and hillside slopes and houses to be conserved on a regular basis to grasp their situations from various information concerning stream beds, hillsides, and houses to be conserved. Although survey of debris-flow-prone streams has been carried out every 5 to 9 years, results of those surveys concerning conditions of watersheds of streams surveyed have not been sorted out in a chronological manner after those surveys were conducted and therefore changes of watersheds have not been grasped.

With this background and with the aim of helping to prevent sediment-related disasters in the future, "clinical chart" of debris-flow-prone streams in which situations of streams, hillsides, and houses to be conserved of "debris-flow-prone streams I" and "debris-flow-prone streams II" are summarized is to be prepared and an extraordinary inspection in addition to a regular inspection is to be carried out using those "clinical charts" in the event of a sediment-related disaster caused by debris flow in order to make preparations with the aim of being able to take measures swiftly in the event of a sediment-related disaster caused by debris flow.

6-2 Preparation of "Clinical Chart" of Debris-Flow-Prone Streams

In initial stage of a "clinical chart" of debris-flow-prone streams, conditions of stream bed and hillside and information obtained through past surveys such as debris flow hazard areas are to be precisely entered in a "clinical chart". During the period until the next comprehensive inspection, changes in conditions of stream beds, hillsides, and houses to be conserved are to be grasped by adding latest data into a "clinical chart" of debris-flow-prone streams.

(Comments)

The first step to appropriately manage debris-flow-prone streams is to grasp current conditions of watershed. Therefore, during the initial stage of a "clinical chart" of debris-flow-prone streams, a "clinical chart" must be prepared by using a designated sabo register, results of survey concerning debris-flow-prone streams, and others, and results of surveys thereafter must be added in the "clinical chart". By doing so, it becomes possible to grasp the risk of debris flow.

6-3 Structure of "Clinical Chart" of Debris-Flow-Prone Streams

"Clinical chart" of debris-flow-prone streams contains columns for basic data for grasping the danger of debris flow and columns for past survey results, and also columns to enter freely at the time of on-site reconnaissance, and it is consisted of "clinical chart" of debris-flow-prone streams 1 to 4.

(Comments)

(1) As for "Clinical chart" of debris-flow-prone streams 1, outline of streams and basic data such as past disaster records, etc. are to be entered in and a location map of target streams of survey and a watershed map (it is better to use an accurate map) are to be attached to. Please note that the places for which an on-site reconnaissance is carried out, spots sketched, and spots images taken are to be recorded on a watershed map so that those places and spots can be visited at the time of the next survey.

(2) On a "clinical chart" of debris-flow-prone streams 2, a debris flow hazard area map (It is recommended to use a map that allows you to distinguish houses separately (for example, a 1/5,000 scale map)) has to be attached with the following entries.

(a) Debris flow hazard areas have to be entered in yellow ink.
(b) Sabo facilities in use or for which works started have to be entered in black ink.
(c) Names of river system, river, stream, mountain stream, and mountain stream numbers must be entered.
(d) The starting point of flooding has to be entered in green ink.
(e) Objects of conservation have to be entered in blue ink.

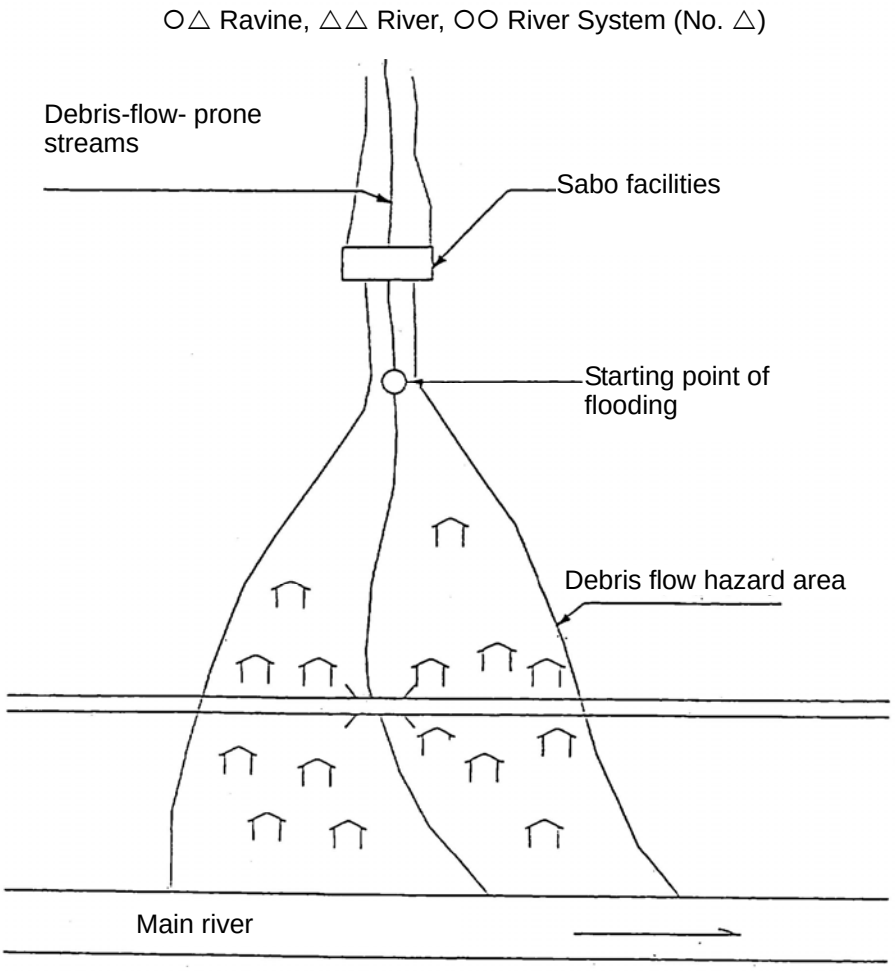


Figure 6-1 Debris Flow Hazard Map

(3) In a "clinical chart" of debris-flow-prone streams 3, results of on-site reconnaissance for establishing debris flow hazard areas, on-site reconnaissance on conditions of stream beds and hillsides, and on-site reconnaissance at sabo facilities.

(4) On a "clinical chart" of debris-flow-prone streams 4, sketches and photos of streams and hillsides at the time of on-site reconnaissance are to be attached.

Standard “clinical charts” of debris-flow-prone streams are shown in Table 6-1 to 6-4.

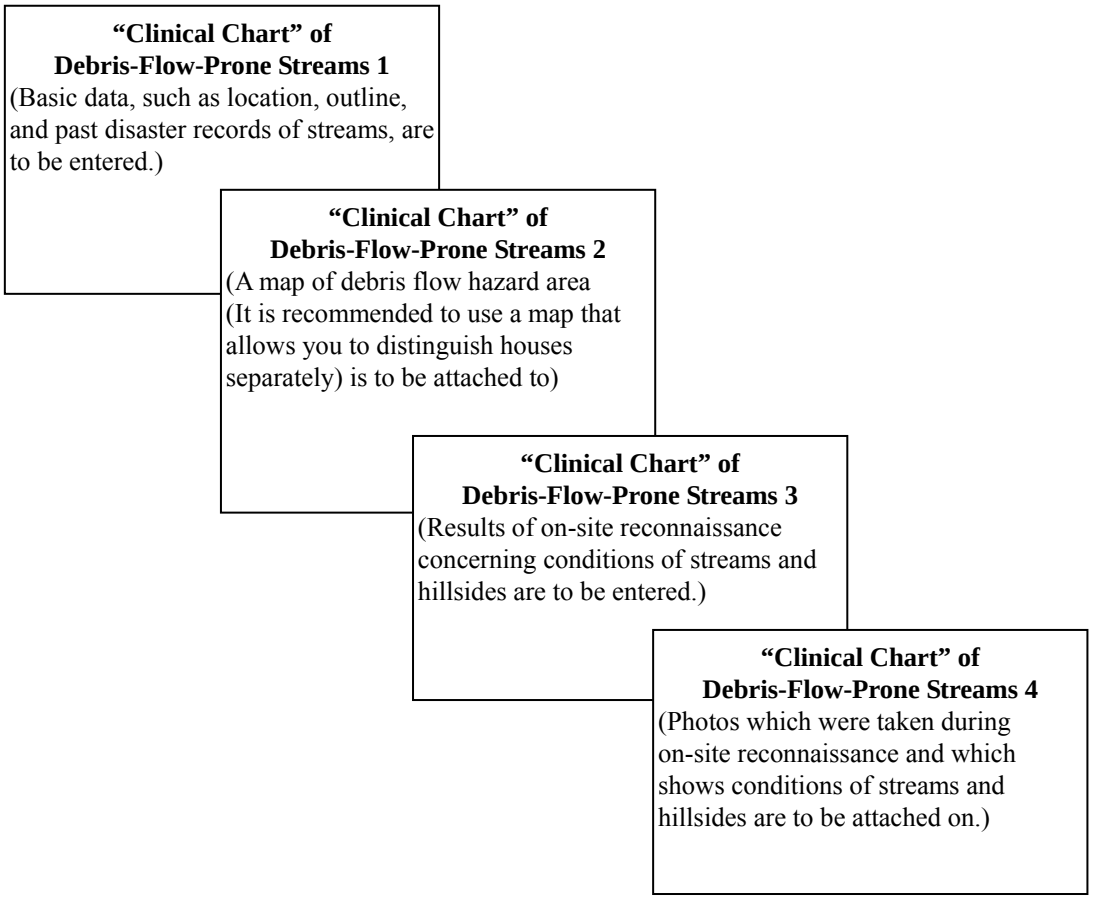


Figure 6-2 Structure of “Clinical Chart” of Debris-Flow-Prone Streams (Image Schema)

Table 6-1 “Clinical Chart” of Debris-Flow-Prone Streams 1

(A standard referential example)

<table>
<tr><td colspan="8">“Clinical Chart” of Debris-Flow-Prone Streams 1</td></tr>
<tr><td>Number of stream</td><td></td><td>Name of river system</td><td></td><td>Name of river</td><td></td><td>Name of stream</td><td></td></tr>
<tr><td>Address</td><td colspan="2">Prefecture and city</td><td></td><td>Town and village</td><td></td><td>Aza</td><td></td></tr>
<tr><td>Outline of streams</td><td colspan="2">Watershed area</td><td>km²</td><td>Area contributory to generation of debris flow</td><td>km²</td><td>Major geographical features</td><td></td></tr>
<tr><td>Conditions of geographical features</td><td colspan="3"></td><td colspan="2" rowspan="2">Past records of comparatively large-scale collapses and other past records</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Number of spring water spots (on a continuous basis)</td><td colspan="3"></td></tr>
<tr><td>Category of debris-flow-prone streams</td><td colspan="7">Debris-Flow-Prone Streams I ・ Debris-Flow-Prone Streams II</td></tr>
<tr><td colspan="8">Location map and watershed map of debris-flow-prone streams</td></tr>
</table>

Table 6-2　“Clinical Chart” of Debris-Flow-Prone Streams 2

(A standard referential example)

<table>
<tr><td colspan="6">“Clinical Chart” of Debris-Flow-Prone Streams 2</td></tr>
<tr><td colspan="2">Survey for establishing debris flow hazard areas</td><td colspan="4">Date of survey:　Month Date Year in Heisei (Preparer:　　)</td></tr>
<tr><td>Topography of debris flow hazard area</td><td colspan="5"></td></tr>
<tr><td>Starting point of flooding of debris flow</td><td>Conditions</td><td colspan="2"></td><td>Gradient</td><td></td></tr>
<tr><td>Ending point of flooding of debris flow</td><td>Conditions</td><td colspan="2"></td><td>Gradient</td><td></td></tr>
<tr><td colspan="3">Distance from starting point to ending point of flooding of debris flow</td><td colspan="3"></td></tr>
<tr><td>Maximum width of debris flow flooding area</td><td colspan="2"></td><td colspan="2">Area of debris flow flooding area</td><td></td></tr>
<tr><td colspan="6">Map of debris flow hazard area</td></tr>
</table>

Table 6-3 “Clinical Chart” of Debris-Flow-Prone Streams 3

(Standard referential example)

“Clinical Chart” of Debris-Flow-Prone Streams 3													
Survey factor	Survey item	Date of survey: Month Date Year in Heisei (Preparer:)											
Objects of conservation	Debris flow hazard area	* Area must be entered in “clinical chart” of debris-flow-prone streams 2											
	Number of houses												
	Types and number of facilities related to people who are most vulnerable to disasters												
	Types and number of public facilities other than the above												
	Transportation network (roads and railways)												
	Farming lands												
Conditions of stream bed	Existence or non-existence of stream bed sediment	* In the case it exists, enter it in “clinical chart” of debris-flow-prone streams 1											
	Existing range (m)												
	Its thickness (m)												
	Its width (m)												
	Configuration of surface												
	Vegetation on accumulated sediment												
	Section of erosion												
Conditions of hillside II	Conditions of ground cover	* In cases where there are a bare field, bare mountain, cutover area, or new fissure or sliding cliff, those must be entered in “clinical chart” of debris-flow-prone streams 1.											
	Ratio of area of bare field and bare rock												
	Ratio of area of cutover												
	New fissure and sliding cliff												
Effect of sabo facilities	Base number												
	Volume of insufficient storage of sediment (total volume)	m^3											
	Name	Supervisory Unit	Specifications of dam (Planned figures)					Result of on-site reconnaissance					
			Height H (m)	Basic length B_0 (m)	Planned width of sediment B_2 (m)	Original slope of river bed i_0	Volume of storage V (m^3)	Volume of insufficient storage ΔH (m)	Length of sediment L_0 (m)	Current width of sediment B_1 (m)	Current volume of sediment V_0 (m^3)	Volume of insufficient storage of sediment $V-V_0$ (m^3)	
Planned volume of sediment to be drained (m^3)													
Survey remarks													

Table 6-4 “Clinical Chart” of Debris-Flow-Prone Streams 4

(Standard referential example)

Photos or sketches of conditions of streams and hillsides.	(Month Date Year)
Photos showing conditions of objects of conservation	(Month Date Year)

6-4 Method to Utilize “Clinical Chart” of Debris-Flow-Prone Streams and Others

It is possible to use prepared “clinical charts” of debris-flow-prone streams in ways such as the followings:

- Making a judgment on the risk of debris flow.
- Using as check items when conducting an inspection or examination.
- In cases where it is anticipated that a sediment-related disaster may occur as a result of debris flow, grasping information about local streams in advance to make preparations against unexpected emergencies.

Inspection and examination using “clinical charts” of debris-flow-prone streams are to be conducted in such cases as stated below.

(a) Daily Inspection and Examination

In addition to daily inspection and examination, it includes inspection conducted before the start of a rainy season, such as one conducted during a Sediment-related Disaster Prevention Month.

(b) Extraordinary Inspection

Extraordinary inspection means inspection carried out in the event of an earthquake exceeded a certain level, a rain fall exceeded a certain amount, or a sediment-related disaster, such as a slope failure or debris flow in order to immediately grasp the conditions of watershed area.

(c) Regular Inspection

Regular inspection refers to inspection such as one conducted nationwide for inspection of debris-flow-prone streams and it is aimed at grasping the conditions of streams or hillsides in detail by carrying out close examination on those conditions. “Clinical charts” of debris-flow-prone streams can be used as references for a regular inspection.

Section 7 Compilation of Survey Results

7-1 Compilation of "Clinical Charts" of Debris-Flow-Prone Streams

"Clinical charts" of debris-flow-prone streams are to be compiled as stated in the below. Please note, however, that in the case of streams analogous to debris-flow-prone streams, classifications of debris-flow-prone streams, factors of causes of debris flow, and results of surveys on sabo facilities are to be compiled.

(a) Lead Table of "Clinical Chart" of Debris-Flow-Prone Streams (Form 1)
(b) Map of Locations of Streams (Areas of targeted streams, stream numbers, objects of conservation, works such as existing sabo facilities)
(Attached Figure 1)
(c) Map of Factors of Causes (Attached Figure 2)

(Comments)

(1) "Clinical chart" of debris-flow-prone streams is to be compiled in Form 1. In the case of streams analogous to debris-flow-prone streams, classifications of debris-flow-prone streams, factors of causes of debris flow, and results of surveys on sabo facilities are to be compiled in Form 1 to the extent grasped.

(2) Guidelines for preparation of Attached Figure 1 and Attached Figure 2 are as follows.
1. Prepare two 1/25,000 scale topographical maps (hereinafter referred to as "topographical map").
2. In Attached Figure 1, drawings of areas of targeted streams, stream numbers (same numbers as those in survey table), debris flow hazard areas, objects of conservation, and works such as existing sabo dam facilities are to be entered.
3. In Attached Figure 2, enter drawings of i) ~ iii) of the results of survey of factors of causes.
   i) In cases where the existence of an accumulated stream bed sediment which is always unstable has been confirmed in an area of streams with a stream bed slope of 10 degrees or more, it has to be entered on a topographical map as shown in an entry example of Figure 7-1. When making an entry not according to the entry example, figure out a best way separately.

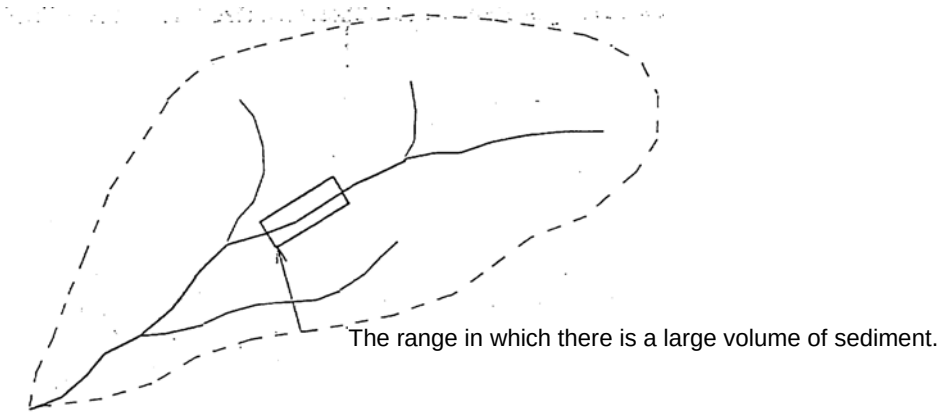


Figure 7-1 Entry Example of a Location of Stream Bed Sediment

ii) With respect to slopes of streams, differentiate streams by each slope (degree) surveyed and by each stream by coloring them. The relationship between slopes and colors is as shown in Table 7-1.

Table 7-1 Slopes of Streams and Coloring Categories

(θ: Slope of stream bed)

Category	Occurrence Category	Coloring
$20° \leq \theta$	Generation range	Red
$15° \leq \theta < 20°$	Generation range, flowing range (In the case of volcanic areas, debris flow generation range)	Orange
$10° \leq \theta < 15°$	Sediment as a result of debris flow flowing down, area of debris flow flowing down	Pink
$3° \leq \theta < 10°$	Debris flow and accumulated sediment range	Green
$2° \leq \theta < 10°$	(In the case of volcanic areas, debris flow and	Green
$\theta < 3°$ or $2°$	accumulated sediment range)	No coloring

iii) In cases where it is already known as to whether an accumulated stream bed sediment is proportionate (equal thickness) or disproportionate (unequal thickness), a topographical map must be entered according to the entry example of Figure 7-2.

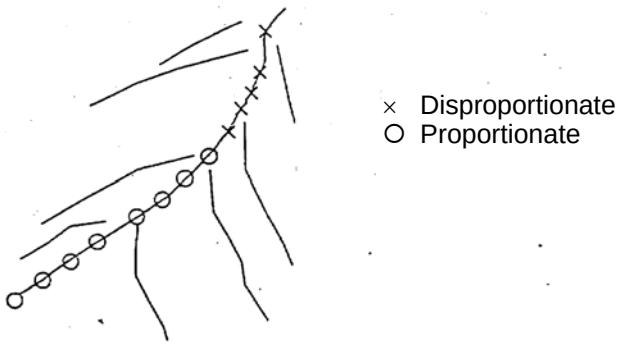


Figure 7-2 Entry Example of Quality of Stream Bed Sediment

Form 1 Landscape of A4 Sheet

Form 1 Lead Table of "Clinical Chart" of Debris-Flow-Prone Streams
Debris-Flow-Prone Streams I & II and "Streams Analogous to
Debris-Flow-Prone Streams (34)

[prefecture (Construction Office)]

Group	Subgroup	Item	Entry
		Stream number	
		Name of river system	
		Name of river	
		Name of stream	
Address		County/city	
		Town/village	
		Aza	
Outline of watershed area		Length of stream	Note (1)
		Square measure of watershed area	Note (2)
		Watershed area contributory to generation of debris flow	Note (3)
		Width of river	Note (4)
		Average slope of stream	Note (5)
		Typical conditions of geographical features	Note (6)
		Past records of comparatively large-scale collapses	Note (7)
		Spring water coming out continuously	Note (8)
Debris flow hazard area	Debris flow flooding area	Classification of topographical feature	Note (9)
		Slope of the starting point of flooding	Note (10)
		Slope of the ending point of flooding	Note (11)
		Extension of flooding area	Note (12)
		Maximum width of flooding area	Note (13)
		Square measure of flooding area	Note (14)
	Objects of conservation	Population	
		Number of houses	Note (15)
		Facilities related to people most vulnerable to disasters	Note (16)
		Public facilities other than the following	
		Square measure of farming land	
Conditions of stream bed	Accumulated stream bed sediment	Area of existence (the sum total)	Note (17)
		Average thickness	Note (18)
		Average width	Note (19)
		Typical configuration on the surface	Note (20)
		Typical vegetation on the surface	Note (21)
Conditions of hillside	Conditions of ground cover	The ratio of bare rock/bare field to watershed area %	Note (22)
		The ratio of deforested area to watershed area %	
		New fissures and sliding cliffs	Note (23)
		Planned volume of sediment to be drained m^3	Note (24)
Sabo facilities		Sabo facilities Existed Non-existed	Note (25)
		Volume of insufficient storage of sediment	Note (26)
		Sediment-related disaster Existed Non-existed	Note (27)
		Publication in a municipal government version local disaster prevention plan. Existed Non-existed	Note (28)
		Criteria of volume of rainfall for warning and evacuation Existed Non-existed	Note (29)
		Safe place of refuge Existed Non-existed	Note (30)
		Designated sabo location Existed Non-existed	Note (31)
		Comprehensive checks in 1990 Existed Non-existed	Note (32)
		Remarks	Note (33)

<How to Make Entries>

Note (1) Length of stream····· Of the river channels located in the upper course of a river above the starting point of flooding (but in the lower part of a river below the point of the primary valley), enter the longest length of a river channel in km and to the second decimal places (ex. 1.23km).

Note (2) Square measure of watershed area·····Enter the square meter of the watershed area of upstream above the starting point of flooding in km and to the second decimal places (ex. 0.05km^2).

Note (3) Watershed area contributory to generation of debris flow ····· Enter the square meter of watershed area of upstream above the point where a stream bed slope is 15 degrees (in the case of volcanic sabo area, 10 degrees) to the second decimal places (ex 0.05km^2).

Note (4) Width of river····· Enter the width of a river around a point where a stream bed slope is 15 degrees (in the case of volcanic sabo area, 10 degrees) to the first decimal place (ex 1.2m).

Note (5) Average slope of stream·····Enter the average stream bed slope of upstream above the starting point of flooding (ex.13 degrees).

Note (6) Typical conditions of geographical features····· In the case of places belong to a volcanic sabo area, enter "volcano" and in other cases enter "general" and record its typical geographical features of the watershed in document named ( ).

Note (7) Existence or nonexistence of a past record of a comparatively large-scale collapse ·····Enter existence or nonexistence of a place where a collapsed area is 1,000m^2／place or more. If it exists, enter the number of places.

Note (8) Existence or nonexistence of spring water coming out continuously·····Enter existence or nonexistence of a spot where spring water is coming out continuously. If it exists, enter the number of spots.

Note (9) Classification of topographical feature·····Enter whether it is a bottom of a ravine or a fan-like form area.

Note (10) Slope of the point where flooding starts····· Enter the gradient of the starting point of flooding in degrees. (ex. 10 degrees)

Note (11) Slope of the point where flooding ends····· Enter the gradient of the ending point of flooding in degrees. (3 degrees, 1 degree)

Note (12) Extension of flooding area····· Enter the distance from the starting point to the ending point of flooding. (ex. 250m)

Note (13) Maximum width of flooding area ····· Enter the maximum width of the hazard area.

Note (14) Square measure of flooding area····· Enter the square meter of the hazard area. (ex. 4,000m^2)

Note (15) Objects of conservation ····· Enter population, number of houses, facilities related to people who are most vulnerable to disasters and other public facilities, square meter of farming lands, etc. which are related to the streams. In the total column, enter an adjusted figure calculated by excluding overlapping portions associated with streams. With respect to facilities related to people who are most vulnerable to disasters, enter names, types, and administrator's names of the facilities.

Note (16) Public facilities, etc. ····· In the total column, figures must be entered by facilities related to people who are most vulnerable to disasters, by schools, by government offices, etc. In cases of roads and railways, figures must be entered in km with designations of type and route name. (National road No. ○○ △△ km, JR Route ○○ △△ km, Private rail line Route ○○ △△ km, and so on.)

Note (17) Area of existence ····· Enter the sum total of ranges in which accumulated stream bed sediment exists in m.

Note (18) Average thickness ····· Enter the average thickness of accumulated stream bed sediments for which survey of thickness is carried out in m.

Note (19) Average width ····· Enter the average width of accumulated stream bed sediments for which survey of width is carried out in m.

Note (20) Typical configuration on the surface ····· Enter the configuration of the surface of accumulated stream bed sediment (bumpiness of surface).

Note (21) Typical vegetation on the surface ····· Enter vegetation on the surface of accumulated stream bed sediment (No vegetation, herbs, shrubs, or forest).

Note (22) The ratio of bare rock/bare field to watershed area ····· Enter a percentage amount to show the ratio of the total square meters of bare rock/bare fields to the square meter of the watershed area.

The ratio of cutover area to watershed area ····· Enter a percentage amount to show the ratio of the total square meters of cutover areas to the square meter of the watershed area.

Note (23) New fissures and sliding cliffs ····· Enter the number of new fissures and sliding cliffs.

Note (24) Planned volume of sediment to be drained ····· Enter in m^3. Calculate the volume based on on-site reconnaissance at streams, and hillsides. If it is impossible, refer to Planning Version of "Standard sabo technologies for rivers (Proposal)". Enter the total amount in the total column.

Note (25) Existence or nonexistence of a sabo facilities ····· In cases where a sabo facilities is existed at a stream (sabo dam in particular), enter "existed" and the number of facilities and the volume of the insufficient storage of sediment. In cases where there is a facilities related to erosion control, make entries in the same manner in remarks column. In the case of streams belong to a national forest, enter National in the remarks column (In the case of a forest reserve or a special forest reserve, enter Reserve or Special Reserve respectively.). In the total column, enter the total amount of the existed or non-existed.

Note (26) Volume of insufficient storage of sediment ····· Enter the volume of insufficient storage of sediment of sabo facilities within the watershed in m^3.

Note (27) Existence or nonexistence of a sediment-related disaster ····· In cases where a sediment-related disaster occurred in the past, enter "Existed" and the date of the occurrence of the disaster. If it did not occur in the past, leave the column blank. In the total column, enter the total number of streams with past disaster records and the total number of streams without past disaster records.

Note (28) Existence or nonexistence of municipal government's local disaster prevention plan ····· In cases where it has been already published in a local disaster prevention plan, enter "Existed"

and where it has not been published, leave the column blank. In the total column, enter the total number of streams with the publication and the total number of streams without the publication. Please note that when confirming whether it has been already published in a local disaster prevention plan, the content to be referred to shall be data concerning debris-flow-prone streams (stream number, name of river system, name of river, name of stream, address of stream, outline of stream, objects of conservation).

Note (29) Existence or nonexistence of criteria of volume of rainfall for warning and evacuation ····· In cases where a standard rainfall volume for warning time has already been established, enter "Existed" and where there is no such a standard, enter "Non-existed". In cases where there is an established standard, enter the amount of rainfall for warning and evacuation (WL•EL).

Note (30) Existence or nonexistence of safe place of refuge ····· In cases where a safe place of refuge is existed, make entries specifically, such as ○○ Primary School, ○○ Community Center, etc. In cases where there is no such a place, leave the column blank. In the total column, enter the total numbers of places existed and non-existed.

Safe place of refuge means places not in danger of suffering sediment-related disasters, such as debris flow, land sliding, steep slope failure, etc.

Note (31) Existence or nonexistence of a designated sabo location ····· In cases where a designated sabo location currently exists, enter Existed. In cases where there is no such a location, leave the column blank. In the total column, enter the total numbers of locations existed and non-existed. Please note, however, that the classification of designation by Article 2 or designation of Article 6 of the Sabo Law is required.

Note (32) Existence or nonexistence of comprehensive checks in 1990 ····· In cases where streams were designated as hazardous streams at the time of the comprehensive checks in 1990, enter Existed and if not, leave the column blank. In the total column, enter the total number of streams with the designation and the total number of streams without the designation. In cases where streams become hazardous streams, or the vice versa, investigate the causes and compile the causes.

Note (33) In the remarks column, if the streams are city's streams, enter City. City's streams mean streams which meet the selection criteria for sabo works designated by city. Also, in the cases of streams that meet the selection criteria for volcanic sabo, enter Volcanic and in the case of streams that meet the selection criteria both for volcano and for city, enter City and Volcanic. Please note, however, that the entry must be made in Streams with Debris Flow I only.

Note (34) Enter classification of streams analogous to debris-flow-prone streams.

7-2 Compilation of Past and Existing Records of Sediment-related Disasters

With respect to streams or rives that caused sediment-related disaster in the past, their flooding areas are to be compiled as follows.

(a) Survey Slip of Sediment-Related Disasters and Flooding (Form 2)

(b) Map of Past Sediment-related Disasters and Flooding (Attached Figure 3)

(Comments)

(1) With respect to streams or rives that caused a sediment-related disaster in the past, outline of damage actually occurred, discharged sediment, scope of flooding, etc. are to be entered. As for sabo facilities, only sabo facilities which had been established before the occurrence of disaster must be entered. Also, as for designated sabo locations, those already designated at the time of the disaster are to be entered.

(2) As for Attached Figure 3, a 1/25,000 scale map is to be entered as follows.

(a) Enter areas of flooding of debris flow in yellow ink.

(b) Enter sabo facilities which were established before the occurrence of disaster in black ink.

(c) Enter date of the occurrence of disaster and factors of causes of disaster.

(d) Enter name of river system, name of river, name of stream, and stream number.

(e) Total size of sediment discharge

(f) Materials of size of rainfall that brought about debris flow.

(g) Enter distribution of thickness of accumulated sediment caused by flooding.

(h) Enter the sphere of flooding of water.

Prepare an enlarged aerial photo or topographical map on a scale of about 1/3,000 to 1/6,000 as needed in a same way.

Also, attach photos of disasters of debris flow to Attached Figure. It is needed also in view of archives of referential materials in the future.

(3) In cases where there is more than one record of flooding, prepare by each of them. Also, prepare a figure showing the outer edge lines of spheres of flooding of debris flow being superimposed on each other.

Form 2 Landscape of A4 Sheet

Form 2 Survey Slip of Sediment-Related Disaster and Flooding [prefecture (Construction Office)]

Stream number	Name of river system	Name of river	Name of stream	Address of stream			Outline of stream					Accumulated sediment area where flooding of debris flow occurred									Outline of disaster Note (11)						Occurrence of disaster	Name of weather	Designated sabo location	Sabo facilities, etc.	Local disaster prevention plan	Remarks
				County/city	Town/village	Aza	Length of stream	Average gradient of the flowing part	Width of flow	Area of watershed area	Major geographical features	Classification of topographical feature	Starting point of flooding: Slope	Starting point of flooding: Conditions	Ending point of flooding	Length of area	Maximum width	Square measure of area	Maximum thickness of accumulated sediment	Volume of accumulated sediment	Dead persons and missing persons	Injured persons	Number of houses	Facilities related to people most vulnerable to disasters	Public facility, etc. other than the following	Square measure of framing land	Time, date, month, year		Existed Non-existed	Existed Non-existed	Existed Non-existed	
							km	Note (1)	m Note (2)	km²		Note (3)	Note (4)		Note (5)	Note (6)	m Note (7)	m² Note (8)	m Note (9)	m³ Note (10)						ha						
Total												Bottom of a ravine/fan-like form area									people	people	houses			ha			Existed Non-existed	Existed Non-existed	Existed Non-existed	

<How to Make Entries>

In Form 2, enter actual damages suffered, discharged sediment, extent of flooding, etc. with respect to streams from which debris flow were discharged in the past. With respect to sabo facilities, enter only those sabo facilities which had been established before the occurrence of disaster. With respect to designated sabo locations, enter only those already designated at the time of the disaster.

Note (1) Average gradient of the flowing part ..... By setting the portion from the starting point of debris flow to the upper reach of accumulated sediment as the lower part, enter its average longitudinal slope (ex 15 degrees).

Note (2) Width of flow ..... Enter the width of a river channel after passing of debris flow in m. (ex 3m)

Note (3) Classification of topographical feature ..... Enter whether it is a bottom of a ravine or a fan-like form area. In the total column, enter the number of streams by each of them.

Note (4) Note (5) Starting point of flooding and ending point of flooding ..... Enter gradients in degrees in the columns of starting point of flooding and ending point of flooding (ex 10 degrees, 4 degrees). In the conditions column, in cases where the starting point is the exit of a ravine, enter “exit of ravine”, where it is the upper reach of a fan-like form area, enter “upper reach of a fan-like form area”, where it is a point where gradient changes, enter “gradient change”, and where the current topography’s gradient is 10 degrees or less, enter “current 10”, where it is at a bending point, enter “bending”, and so on.

Note (6) Length of area ..... Enter the length of accumulated sediment caused by flooding in m (ex. 320m).

Note (7) Maximum width..... Enter the maximum width of an accumulated sediment caused by debris flow (see the above figure) in m (ex. 40m).

Note (8) Square measure of area ..... Enter the square meter of areas with an accumulated sediment caused by debris flow in flooded area in m^2 (ex. 2,000 m^2).

Note (9) Maximum thickness of accumulated sediment .... Enter the maximum thickness of an accumulated sediment in flooded area in m and to the first decimal place (ex. 3.1 m).

Note (10) Volume of accumulated sediment ..... Enter the volume of an accumulated sediment caused by debris flow in m^3.

Note (11) Outline of disaster ..... Enter outline of damages caused by a sediment-related disaster. Of the total columns, enter total amount by schools, by government offices, etc. in the Public facility, etc. other than the following column.