Oregon Department of Forestry
Forest Practices
Technical Note FP1
April 11, 1994

Water Classification

The purpose of a water classification system is to match the physical characteristics and beneficial uses of a water body to some set of protection measures. The following water classification system was developed to meet this purpose and provide a relatively simple method for delineating the various types of waters found on forest lands.

For purposes of the Forest Practices Rules the waters of the state are classified as either streams, wetlands, or lakes. The various types of streams, wetlands, and lakes are described in detail below.

STREAMS

Streams are classified according to their size and according to one of the following beneficial use categories:

> Streams that are used by fish, including fish-bearing streams that have domestic use, are classified as **Type F.**
>
> Streams that have domestic water use but are not fish-bearing are classified as **Type D.**
>
> All other streams are classified as **Type N.**

Fish use

A Type F stream is any stream used by anadromous fish, game fish, or fish listed as threatened or endangered under the federal or state endangered species acts. Fish use can be either seasonal or year-round.

A stream is not considered to be Type F if fish were introduced through a fish stocking permit and there is documentation showing that the stream had no fish prior to stocking.

The Department of Forestry, with assistance from the Department of Fish and Wildlife, will conduct a comprehensive field survey to identify all forest streams with fish use. The department may use reliable field survey information collected by others, such as landowners, state or federal agencies, or universities to supplement this field inventory.

This survey will take a number of years to complete. So, an interim process for identifying the extent of fish use in a watershed will be in effect until this comprehensive survey has been done for the watershed. This process is described below:

- The department will assume that streams have fish use if they were Class I under the previous classification system. Streams that were Class I solely because of a domestic water use are excluded.

- If streams within a proposed operation were not Class I under the previous classification system and fish use is unknown, then:

  The department will conduct a field survey for fish use after a notification of operation is received by the department;

  OR

  The department will approximate the upstream extent of fish use in a watershed by considering the connection of the water with downstream waters where fish use is known. Fish use will be assumed to occur upstream of the known fish use until the first natural barrier to fish use is encountered.

Where fish use is unknown, an operator may request that the department conduct a field survey for fish use for reaches of a stream that will be included within an operation that is scheduled to start at least 12 months following the request. The operator shall limit such requests to operations that are part of a landowner's planned harvest schedule and will be conducted. The department, with assistance from the Oregon Department of Fish and Wildlife when needed, shall attempt to complete such surveys within 12 months following the request. If the survey cannot be conducted in the time indicated, the stream will be

considered to have no fish use. However, if the operation is not commenced within 6 months of the time originally indicated, the stream will again be considered to have unknown fish use.

The department may use other reliable fish survey information when determining whether or not a stream has fish use. This information could include surveys done by landowners, federal or state agencies, universities, or other persons or entities. The department will determine whether such information is reliable.

Domestic use

Type D streams do not contain fish and are located upstream of any domestic water intake for which a water use permit has been issued by the Oregon Water Resources Department.

The procedure for determining how far upstream from an intake that Type D classification applies depends on whether the intake is for a community water supply or not. This difference is explained below:

- If the domestic use is a community water system (has 15 or more service connections used by year-round residents, or which regularly serves 25 or more year-round residents) Type D classification shall initially apply to the length of stream that was designated Class I under the classification system that was in effect on April 22, 1994 (as shown on district water classification maps).

- If the domestic use is not a community water system, Type D classification shall initially be applied for the shortest of the following distances:

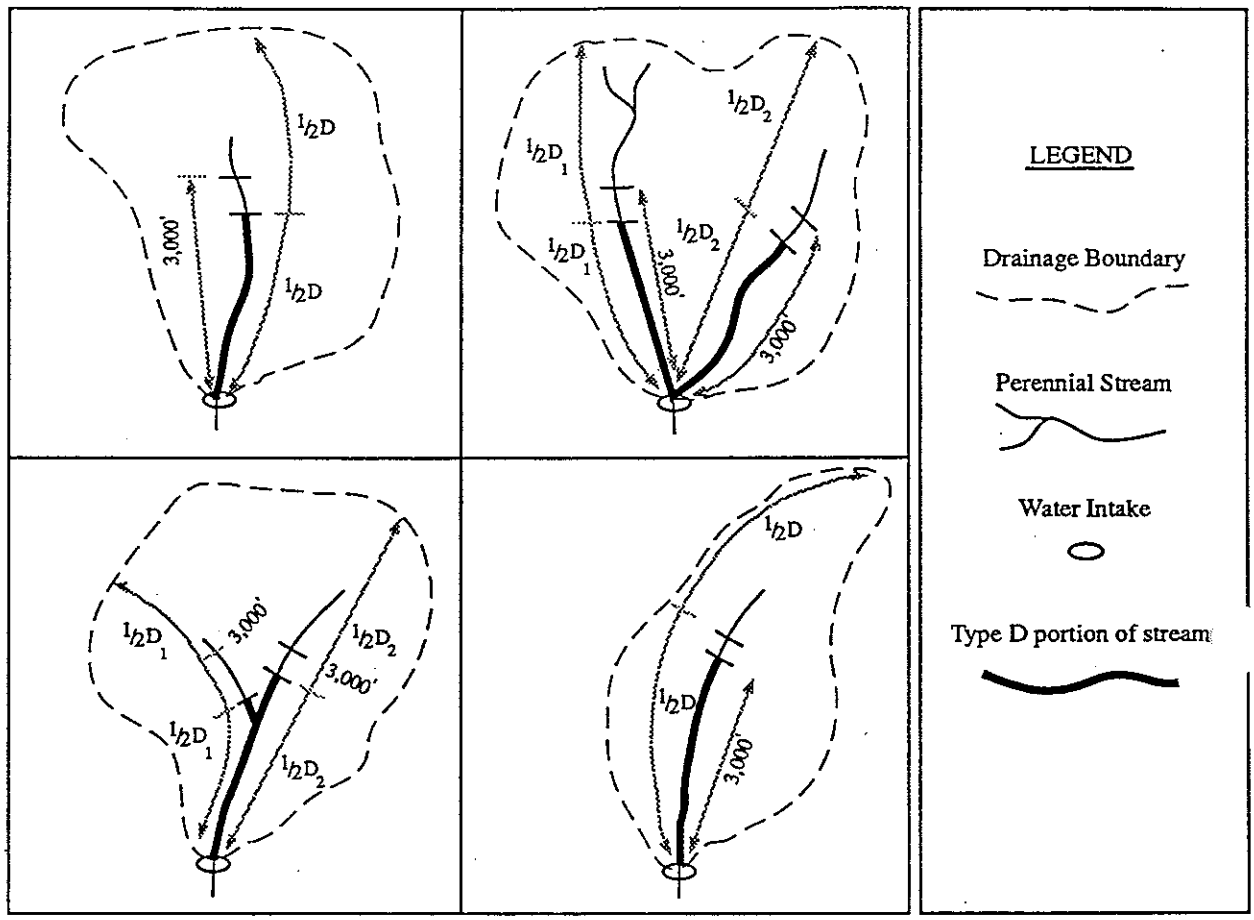
  The distance upstream from the intake to the farthest upstream point of summer surface flow,

  Half the distance from the intake to the drainage boundary, or

  3000 feet upstream from the intake.

  Type D classification shall apply also to tributaries off the main channel as long as the above conditions apply (see diagram on the next page).

Diagram showing the distance for Type D classification for domestic water uses that are not community water systems.



A representative of a community water system or other domestic use water permit holder may request that the department designate additional lengths of channels upstream from a domestic water intake or reservoir as Type D. The representative or permit holder must present evidence that the additional stream protection is needed.

The department will decide whether or not to extend Type D classification to these other channels based on evidence presented by the requesting party showing that protection measures associated with Type N classification would be insufficient to prevent adverse temperature increases, turbidity increases, or other water quality changes at the domestic water use intake or reservoir. This criteria also will be used to evaluate the extent of Type D classification for new community water systems. The department will decide whether or not to extend the length of Type D classification within 30 days of the presentation of evidence.

The domestic water use classification may be waived by the department at the request of the landowner where a landowner is the sole domestic water use permit holder for an intake and who owns all the land along upstream channels that would be affected by the classification related to that intake. The waiver is not intended to affect the classification related to downstream domestic water use intakes.

Stream size

For each of the three beneficial use categories (Type F, Type D, and Type N), streams are categorized further according to three size categories: **large, medium, and small.**

The combination of three beneficial use categories and three size categories creates a total of nine potential stream types as is shown below:

	FISH USE OR FISH AND DOMESTIC USE TOGETHER Type F	DOMESTIC USE ONLY Type D	NO FISH OR DOMESTIC USE Type N
LARGE			
MEDIUM			
SMALL			

The stream size categories are based on the average annual flow of a stream. Average annual flow is measured in cubic feet per second (cfs) and is simply the total volume of water (in cubic feet) transported by a stream during a normal year divided by the total seconds in a year.

Stream size categories were included in the classification system because they allow the tailoring of protection measures to fit site conditions. For example, fewer trees need to be retained along small streams than along large streams because the depletion of woody debris in a small stream is less during high flows and less debris volume is required to create the needed habitat in a channel.

Small streams have an average annual flow of 2 cfs or less. Medium streams have an average annual flow greater than 2 cfs but less than 10 cfs. Large streams have an average annual flow of 10 cfs or greater.

The average annual flow at any point along a stream is calculated using a relationship that is based on the upstream drainage area and annual precipitation. However, actual measurements of average annual flow may be substituted for the calculated flows. This may be necessary when it is obvious that the flow is unusually influenced by a spring or lava tube. An example of where the measured flow should be used is the Metolius River, which exits the ground as a large stream. Here, recent lava flows have obscured the actual drainage area and so the relationship between flow and drainage area would not apply.

Any stream with a drainage area less than 200 acres shall be assigned to the small stream category regardless of the calculated value.

The assignment of size categories to streams on forestland will be done by the department.

The equation that relates average annual flow to drainage area and average annual precipitation was developed using data from gauging stations on forested streams in eastern and western Oregon. Streams where gauge data were greatly influenced by water storage or withdrawals were not included in the analysis.

The relationship between flow and drainage area and precipitation were determined by multiple linear regression analysis. The independent variables in the data set (drainage area and precipitation) were transformed logarithmically (base e) to increase the linearity of the various relationships with the dependent variable. The dependent variable (flow) was assumed to be log-normally distributed. Analysis of the transformed data resulted in the following equation:

Western Oregon

$$\log_e(FLOW) = -11.972 + 0.990 * \log_e(AREA) + 1.593 * \log_e(PRECIP)$$

n = 48; adjusted squared multiple R^2 = 0.96
standard error of estimate = 0.31

Eastern Oregon

$$\log_e(FLOW) = -15.712 + 1.176 * \log_e(AREA) + 2.061 * \log_e(PRECIP)$$

n = 23; adjusted squared multiple R^2 = 0.83
standard error of estimate = 0.55

where: FLOW = average annual flow (cfs, cubic feet per second)
AREA = upstream drainage area (acres)
PRECIP = average annual precipitation (inches)

By rearranging the terms in the above equations, the relationships can be expressed as:

Western Oregon

$$AREA = 178600 * FLOW^{1.010} * PRECIP^{-1.609}$$

Eastern Oregon

$$AREA = 634300 * FLOW^{0.850} * PRECIP^{-1.753}$$

Using these last two equations, the drainage area corresponding to the division points between small and medium (2 cfs) and medium and large (10 cfs) streams can be calculated for various precipitation values, as shown in Table 1 and Table 2

Contour lines on topographic maps are used to define the boundaries of a basin and determine where the division points between small and medium and between medium and large streams occur. As shown in Figure 1, the line defining the boundary of a basin is always perpendicular to the contour lines.

The area enclosed by this boundary is the drainage area.

In this western Oregon example the annual precipitation is 65 inches so channels where the upstream drainage area is less than 440 acres are classified as small in size. The average annual precipitation for a location is obtained using the 1993 map produced by the Oregon Climate Service, Oregon State University.

The determination of stream size using watershed area and annual precipitation may underestimate the size of some spring-fed streams in eastern Oregon. In cases where the watershed area and annual precipitation relationship clearly does not estimate a stream's size, the alternative process of using direct measure of stream flow will be used. Spring-fed streams have relatively uniform flow throughout the year. Therefore, direct measurement of flow at any time of the year except during late summer and early fall or during spring runoff would provide a reasonable approximation of average annual flow.

Direct measurement of flow involves determining both the velocity and wetted cross-sectional area of the stream. Velocity is best measured using a flow meter, but a rough estimate of velocity can be made by measuring the time it takes for a wood chip to float a distance downstream and applying a correction factor. The wetted cross-sectional area is commonly measured using a level, level rod, and measuring tape. Figure 2 can be used to determine stream sizes for various combinations of velocity and wetted cross-sectional area.

Before this water classification goes into effect, the department will develop maps for all forest lands in Oregon, showing the size classes for all streams. Streams and their classification will be displayed on 1:24000 scale USGS topographic maps. Copies of these maps will be available at department field offices and master maps will be updated and maintained at the Salem office.

Table 1. Drainage areas that represent the break points between small and medium and between medium and large streams for western Oregon.

WESTERN OREGON

Average Annual Precipitation (inches)	DRAINAGE AREA (acres)	
	Small / Medium 2 cfs	**Medium / Large** 10 cfs
30 or less	1510	7680
35	1180	5990
40	950	4830
45	790	4000
50	660	3370
55	570	2890
60	500	2520
65	440	2210
70	390	1960
75	350	1760
80	310	1580
85	280	1440
90	260	1310
95	240	1200
100	220	1110
105	200	1020
110	200	950
115	200	880
120	200	830
125	200	770
130	200	730
135	200	680
140 or more	200	640

Table 2. Drainage areas that represent the break points between small and medium and between medium and large streams for eastern Oregon.

EASTERN OREGON

Average Annual Precipitation (inches)	DRAINAGE AREA (acres)	
	Small / Medium 2 cfs	**Medium / Large** 10 cfs
15 or less	9930	39000
20	6000	23600
25	4060	15900
30	2950	11600
35	2250	8840
40	1780	7000
45	1450	5690
50	1200	4730
55 or more	880	4000

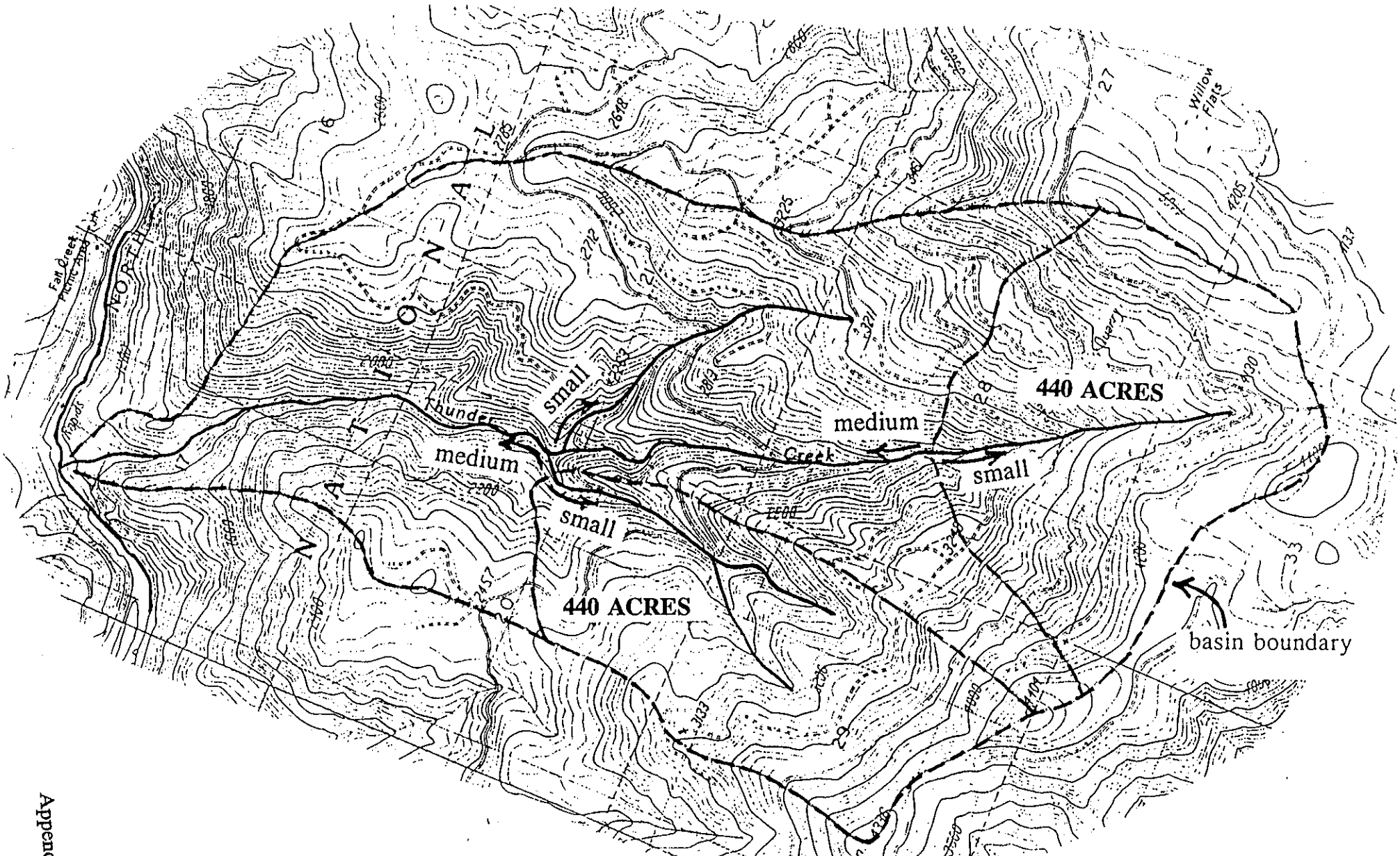


Fig 1. Example of basin boundaries that define small ar edium stream segments in a watershed. The average annual precipitation is 65 inches so stream segments draining less than 440 acres are considered small.

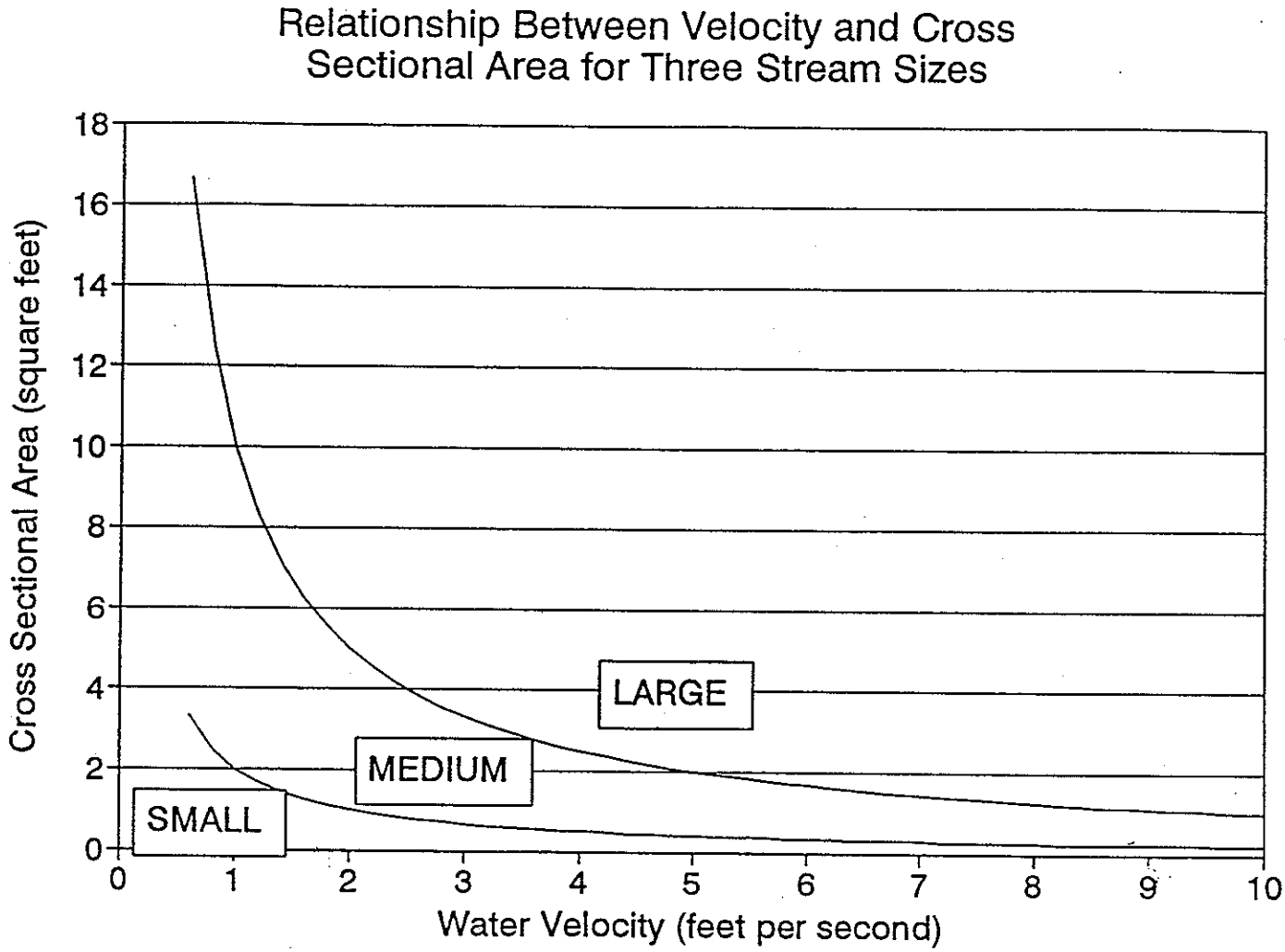


Figure 2. The relationship between stream velocity, wetted cross-sectional area, and stream size.

WETLANDS AND LAKES

Wetlands shall be classified further as indicated below:

The following types of wetlands are classified as "significant wetlands":

Wetlands that are larger than 8 acres;
Estuaries;
Bogs; and
Important springs in Eastern Oregon.

Stream- associated wetlands that are less than eight acres are considered to be part of the stream and are therefore classified according to the stream with which they are connected.

All other wetlands, including seeps and springs, are classified according to their size as either "other wetlands greater than one-quarter acre" or "other wetlands less than one-quarter acre."

Lakes shall be classified further as indicated below:

Lakes greater than eight acres are classified as "large lakes."

All other lakes are classified as "other lakes."

A lake is considered to have fish use if the lake is used by anadromous fish, game fish, or fish listed as threatened or endangered under the federal or state endangered species acts. Fish use can be either seasonal or year-round.

A lake is not considered to have fish use if fish were introduced through a fish stocking permit and there is documentation showing that the stream had no fish prior to stocking.