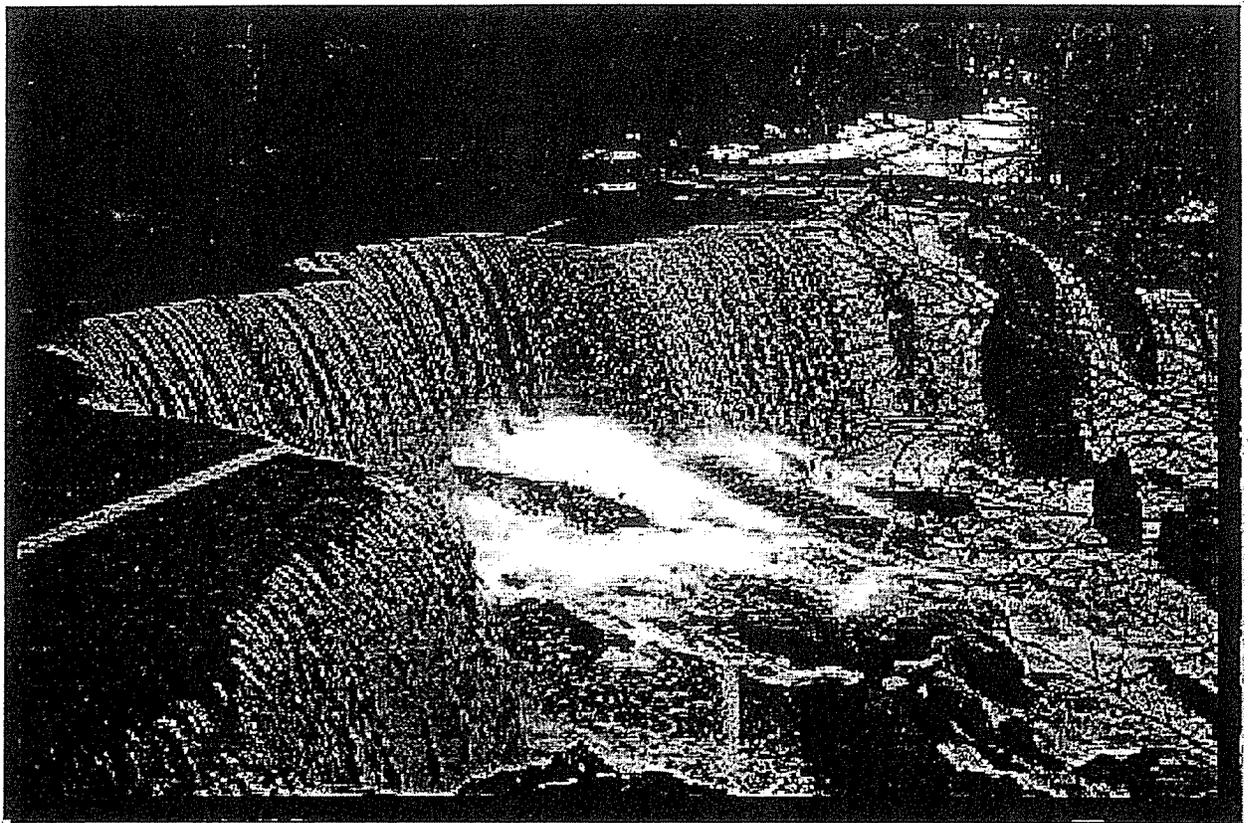


III. Water Quality



Mansfield Creek at Road 46 - February 1996

II. PHYSICAL DOMAIN

D. Water Quality

1. Characterization

a) **What aquatic-dependent beneficial uses occur in the watershed?*

Beneficial uses, dependent on aquatic resources, in this watershed are: domestic water use; resident and anadromous fisheries; aquatic non-fish species; riparian dependent species; water-related recreation; hydroelectric power generation; and water-related fire suppression and road maintenance needs.

- Domestic water is obtained from the Breitenbush River, Devils Creek and associated tributaries for summer homes, the Breitenbush Community, and several campgrounds. In addition, the City of Detroit uses the lower Breitenbush River as a supplemental intake system for their domestic water supply. Water from the Breitenbush flows into the North Santiam River which serves as a domestic water supply for several downstream municipalities, including Gates, Mill City, Lyons, Mehema, Stayton and Salem, which are all located below Detroit and Big Cliff dams.
- Fisheries are found in the main stem of the Breitenbush River, other major tributaries, and large lakes in the watershed. This fisheries resource is not extensive because of steep channel gradients. Kokanee, which are a landlocked anadromous fishery, are present in the watershed. Historically, the Breitenbush provided anadromous habitat for winter steelhead and spring Chinook prior to the construction of Detroit and Big Cliff dams further downstream.
- Aquatic non-fish species can be found in all waters within the basin. A large wetland complex at the headwaters of the North Fork of the Breitenbush River provides highly diverse habitats.
- Riparian-dependent species occur along the edges of water bodies in the watershed.
- Historically, water-related recreation use has been extensive, especially at the geothermal hot springs. All recreation facilities in the Breitenbush are in riparian zones and approximately 80% of dispersed sites are within riparian reserves.
- The Breitenbush River is potentially eligible for Wild and Scenic River status. Outstandingly remarkable values for the river include scenery, geology, and recreation.

- The Breitenbush Community uses the Breitenbush River to generate hydroelectric power for their community. Water from this watershed also contributes to the hydroelectric operation of Detroit Reservoir.
- Water use for fire suppression and road maintenance are periodic in nature. Use depends upon the amount of activity in the area. Historically, due to the fire frequency and the fire suppression efforts, water sources were developed to aid in the control of fire. These sources would then be utilized during road maintenance.

b) *Which water quality parameters are critical to these uses?

Water quality parameters critical to beneficial users are temperature and type and timing of sediment input. Another potential critical parameter is biological contaminants.

Temperature: As is typical in the western Cascades, water temperature controls the type and distribution of aquatic species in the watershed. The primary influence on water temperatures in the Breitenbush is solar radiation. Broad, unvegetated floodplains in some areas, act as solar conductors transferring latent heat to the water.

The Breitenbush is atypical of most western Cascade streams, in that it has a geothermal influence on water temperatures. Although the geothermal interaction is not well understood, there appears to be a localized influence on aquatic species composition. As for its contribution to stream temperatures, locally it has a dramatic effect, but further downstream there is insufficient information to determine the magnitude of its effects at this time.

Sediment: The next critical parameter is sediment. Sediment movement through the watershed is critical for various aquatic, domestic, recreation and hydroelectric resources. The timing, type and amount of sediment have varied effects on beneficial users, including the following:

- regeneration success of certain aquatic species is reduced when fine sediment inputs occur during egg incubation
- transportation systems can be damaged by coarse bedload deposition that plugs culverts
- impellers on hydroelectric facilities can be eroded by fine grained material
- water treatment costs increase as a result of turbidity from suspended colloidal material
- spawning habitat for various aquatic species is created by stream deposition

- beaches for recreation are created from fine grain deposition
- riparian habitat for riparian-dependent species can be created as a result of depositional areas creating flood plains that later become vegetated

As illustrated above, sediment can have both the positive and negative impacts on various other resources. Thus supporting the critical nature of sediment movement, and its properties; (turbidity; bedload, mode of movement, suspended, rolled, skipped) as a water quality parameter.

Biological contaminants: The third, potentially, critical parameter for water quality is biological contaminants. Contaminants, such as water borne diseases, can impact both domestic and aquatic users. In the Breitenbush, there is potential contamination from human waste because of the amount of recreation use the area receives, and from stocking non-native fish species such as hatchery rainbow trout. At this time, the degree to which this is a concern is unknown.

c) *What influence does geothermal have on water quality?*

In the central landform block, there is at least one tributary to the main stem Breitenbush river that is influenced by geothermal activity. Outflow from the geothermal source has, at least, localized effects on water temperature and mineralization. Downstream affects are less understood.

2. What values are associated with water quality?

- a) Water and water quality have life-sustaining, economic, aesthetic, recreational and spiritual value (i.e. domestic and industrial water supplies, swimming, geothermal hot springs, etc.)

3. What are the highest priority issues or resource concerns associated with water quality?

- a) The highest priority issues are temperature, type and timing of turbidity, and other potential contamination.

4. What are the management direction/activities, human uses, or natural processes that affect water quality?

a) *Current Conditions*

i) * *What are the current conditions and trends of beneficial uses and associated water quality parameters?*

Stream temperatures exceed State standards of 58 degrees during portions of the summer. It appears as though this condition will remain constant until instream structure is effective in reducing erosion on the flood plains, so shade-providing vegetation can be reestablished along stream channels.

Currently, the mainstem of the Breitenbush erodes its flood plain yearly, removing vegetation that provides shading and a moderating influence on stream temperatures. A possible hindrance to the ultimate goal of reestablishing shade-producing vegetation along stream channels, is fire suppression, which reduces sediment input into stream channels. By reducing the amount of sediment, streams will not build up their channels and reconnect them to their historic flood plains, so stream energies can be reduced and shade-producing vegetation can become established to moderate temperatures.

Water quality for domestic water use is generally high in the Breitenbush. Episodic storms temporarily reduce water quality, as sediment increases along with rising waters. This sediment is flushed out of the watershed and water quality returns to previous conditions, under normal flows. Domestic water users downstream of Detroit and Big Cliff dams, have not historically been affected by these pulses of sediment because of the metering of these sediments by the dams.

During the 1996 water year this condition changed. Tighter requirements adopted by the State of Oregon reduced the acceptable level for turbidity in water available for domestic use. This change in standards, coupled with the February storm event, which flushed a lot of sediment into Detroit reservoir and stirred up existing sediment within the reservoir, piqued the interest of several downstream communities when turbid waters flowed past their water intake systems and they had to rely on alternate water sources for domestic use. Their main concern was determining where sediment sources originated which ended up in the Detroit and Big Cliff reservoirs. The character of sediment they were most concerned with was ultra fine clays or colloidal materials. In the Breitenbush, sources of these clays are failure zones of earthflows, weathering and subsequent leaching of old glacial deposits, and weak volcanic ash deposits. These types of soils are found in all landform blocks, but are probably most common in the Central landform block.

Recreational uses will be described within the social portion of this report. Generally

speaking, recreational uses are high in the watershed and are expected to increase in the future. The major impact of the increases will be on riparian and associated resources.

- ii) What and where are the “303d” water quality limited water bodies within the watershed?

Overall, water quality for recreation and aquatic dependent species is within acceptable State levels, except for occasional readings of high temperature during the summer. As a result of these occasional high temperatures, the Breitenbush was previously included on the States’ 303d list of water quality limited bodies for late summer fish production.. In 1996, after further analysis, it was taken off the list. Water temperatures in this area are still of interest and require monitoring.

As was discussed above, the unstable nature of the floodplains in the Breitenbush, reduce stream shade and contribute to high temperatures.

Additionally, in the vicinity of natural hot springs, the waters have a high mineral content, as well as high temperatures. Outflow from these areas has been measured as high as 180 degrees F. This has a marked affect, at least locally, on downstream water temperatures, until a point where mixing with cooler water offsets the temperature increases.

- iii) *Does the 303 water quality standard for temperature fit for the Breitenbush River system, given its geothermal influences?*

Water temperature monitoring is being established above and below geothermal influences to stream temperatures on the Breitenbush river. At this time, we know there are local effects, but insufficient information is available to determine how much impact geothermal influences have on overall temperature in the Breitenbush system. As data is collected and reviewed, it will be incorporated into future amendments to this analysis.

b) Reference Conditions

i) *What were the historical water quality characteristics of the watershed?

Historic water quality characteristics are difficult to determine quantitatively due to lack of data. Even with the data available, characterizing the watershed can only be done on how the system is operating today. Temperature records for the Breitenbush only go back to 1950. Upon reviewing the records one needs to remember weather changes that have occurred since this period of record, as well. From these records, the mainstem of the Breitenbush exceeded today's temperature standard of 58 degrees during the month of July.

Historically sediment characteristics can only be classed in relation to historic disturbance. The historic fire map, figure_, shows the extent of this disturbance. Sediment pulses more than likely came through the system during episodic events that created short term impacts. This sediment was transported into the North Santiam River and through to the Willamette River. Sediment particle size depended upon the source and location. First through fourth order streams contained boulder to clay size particles that were mobilized and fifth and greater order streams would move cobble to clay size particles. The difference between the two, related to the amount of woody material present to increase channel roughness and reduce energy.

Biological contaminants were likely lower in historic times than now, because less people used the area and there was no fish stocking program.

c) Comparison of Current and Reference Conditions

i) What are the natural and human causes of change between historical and current water quality characteristics of the watershed?

Historic records are not conclusive that high temperature during mid/late summer are characteristic of the Breitenbush River. The causes of change from historic to current conditions, relates more to the areas of solar radiation rather than if solar radiation was/is a problem. Historically due to the fire regime first to fourth order streams were burned. This burning reduced the vegetation next to the streams and allowed solar radiation to reach the water. This water would then continue down slope and be cooled by the stored reservoir of water contained in the flood plain.

Currently first to fourth order streams are vegetated, for the most part, and solar radiation does not have an opportunity to increase water temperature (some effect will occur due to changes in microclimate but in looking at the watershed as a whole this becomes minor). This cool water then reaches the floodplains of the fifth and greater order channels where lack of vegetation increases solar radiation

and the alluvial material on the flood plain acts like a heat sink to increase water temperatures.

It is assumed that geothermal influences on water temperature have not changed between current and reference conditions. Until information to the contrary becomes available, these influences will be assumed to be constant.

Historic sediment production characteristics have been impacted primarily by fire suppression/prevention activities and large scale wood removal during stream clean out. A reduction in sediment available to the system, as a result of fire management and a lack of wood to hold sediments, led to a change in sediment type. Failures following fires used to load channels with fine and coarse sediments, that would be retained by the large wood and would be slowly metered through the system.

Currently, sediment production is mainly due to in-channel recruiting and episodic pulses, during large storm events, which cause road failures and natural debris torrents. During storm events, these pulses of sediment pass through the system (due to the dysfunctional nature of channel and flood plain). Stream energies are so high, at this time, that sediment of all sizes, is moved.

It seems likely that biological contaminants are greater now than in the past, because of increased human use over time, as well as, the introduction of hatchery fish to the system.