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WR-28

GOSS & GOSS

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Water Rights Resolution • Paralegal Services

1881 Fieldbrook Rd., Arcata, CA, 95521

May 5, 1995

Bill,

Thank-you for your 5/2 memo re: Stanshaw CK. The apparent conflict between the 1/30/81 (winter) measurement of 3.43 cfs @ Young's Ranch diversion (2/2/81: Randy Scott (USFS) letter to Bob Young) and the 3/17/90 report to Jeff Meith, item 5, citing Current Diversion Capability for Young's Ranch as 1.25 cfs appears to resolve as follows:

While the term "Current Diversion Capability" may be somewhat ambiguous, that's what is most likely available at the receiving end of the intake leading to the Pelton Wheel at the Ranch. The flow going into the intake at the diversion on Stanshaw Creek must be drastically reduced enroute since no construction or other provisions have been made (to the best of my knowledge) at the initial diversion to bypass high flow and heavy bedloads nor to reduce the direct inflow into the system (see enclosed 11/1/71 letter from Robert Ettner (USFS) to USFS Forest Supervisor, Klamath Nat'l. Forest). The majority of any flow in excess of 2.5 cfs is dispersed by the "Sediment Trap" located several hundred feet downstream from the diversion through an overflow. Additionally, evidence of further losses in flow existed at 3 locations along the flume (ditch) where overflows had recently occurred, when I inspected the system between 1974 and 1977.

My flow measurement is based on the capacity of the flume at its "weakest link" where the 1% gradient flume with 10" deep by 24" wide dimensions and a thick matting of detritus yields a flow of 1.29 cfs. The simple formula for determining flow (v) is $v=C\sqrt{rs}$, where C=Coefficient of friction, r=cross-section of the channel, and s=gradient. Using Bazin's empirical determination of $C=\frac{87}{0.552+\frac{m}{\sqrt{r}}}$, where m=1.75 (earthbed in poor condition), $r=\frac{1}{2}(.833')=0.417$, and s=0.01 yields a flow of 1.29 cfs. Although the 1.29 cfs figure is slightly in conflict with the 1.25 cfs cited in my 3/17/90 report, I am convinced that both figures are much closer to the reality of actual use than the 3.43 cfs figure cited by Mr. Scott. While my 1915 cite is rather old, the laws of physics (hopefully) haven't changed! However, if the gradient of the flume was greater, size (most importantly, depth) were to be increased, or the condition to be better maintained, a significantly greater flow would be obtained. Of further interest, the design flow for operation of the Pelton Wheel (a nonconsumptive use) was limited to about 1 cfs and consumptive uses at the Ranch were so limited during my period of investigation, that the major portion of the diverted flow was routed directly into Irving Creek.

I hope this information proves useful. Don't hesitate to contact me if you have any further questions.

Marvin Goss
Owner

ENCLOSURE

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Shasta-Trinity National Forest
1615 Continental Street, Redding, Ca 96001

REPLY TO: 2520 (7500) Watershed Protection and Management November 1, 1971

SUBJECT: Hayes Water System - Turbidity and Sediment Problems
(Stanshaw Creek)

TO: Forest Supervisor
Attn: District Ranger, Ukonom R.D.

The following comments regarding the Hayes water system were formed in response to field observations of July 29, 1971. Due to the specific nature of this report, it was separated from the Stanshaw Creek Watershed study made July 28-30, 1971, by George Badura, Soil Scientist, and Bob Ettner, Hydrologist.

From review of upstream conditions in Stanshaw Creek watershed, it is quite apparent that timber sale activities greatly increased sedimentation and turbidity within the Hayes water system. Prior to 1964, background turbidity levels probably degraded domestic water quality for short periods during high intensity storms and associated peak flows. Rapid clearing of turbid conditions immediately followed cessation of the storms.

After 1965, logging and road construction not only increased sediment quantity, but aggravated conditions to such an extent that duration of turbid water was prolonged. Degradation still persists above background levels, and probably will continue for another five to ten years. High rates of sedimentation, though, have decreased considerably from levels experienced in the 1- to 3-year post-logging period.

Of considerable importance to any direct diversion water supply is the sediment reduction and entrapment features designed within the system. Without this integral part, few systems diverting from steep streamcourse in granitics or high clay content soils could hope to produce clear, silt-free water throughout the year. The diversion from Stanshaw Creek is very old and, unfortunately, was not engineered for reducing suspended sediment or bedload material. Problems with this system are related to the intake, the sediment trap, and ditch gradient. The potential for inexpensive and feasible improvement of water quality exists. Availability of this excellent source has been of unquestioned value in providing water for irrigation, power, and domestic purposes (Photo A, Hayes ranch and rental cabins).

PROBLEM

(1) Intake (Photo B)

Diversion of flow directly into the Hayes ditch from Stanshaw Creek is so pronounced that little sediment (especially bedload) is allowed to bypass. During the summer and fall period the ditch and stream channel are aligned in such a manner that bulk of streamflow and accompanying sediment is forced directly into the ditch inlet. The stream carries an equivalent or lesser amount of water below the diversion in the dry months.

During periods of high flow, considerable suspended sediment and heavy turbidity enters the ditch. No construction or other provisions have been made to bypass high flow and heavy bedloads, nor to reduce direct inflow to the system.

(2) Sediment Trap (Photo C)

Several hundred feet from the intake is a short section of culvert which serves as a sediment trap. The upended culvert, with its inlet at grade with the ditch, has overflow and sluice openings. Water-borne sediment passing over the pipe opening will supposedly settle and be flushed from the bottom of the unit. The principle may be good, but the functioning is totally inadequate. First, the entrapment or stilling area is far too small in relation to incoming flow volume to allow settling of suspended material (time for settling too short). Secondly, flow velocity creates such a turbulence in the drum-like trap that any sand that might otherwise sink and be flushed from the bottom opening is kept in a suspended state and either continues on down the ditch or is passed through the overflow.

(3) Ditch Gradient (Photo D)

It is most evident that tremendous quantities of sediment are removed by hand near the ditch intake. As distance increases from the intake, less removal has taken place. The process is quite normal considering the heavy concentrations of coarse sediment entering the ditch tend to immediately deposit with the lesser flow. In viewing the bottom composition of sand and gravel, particle size decreases with distance. Considerable material, though, does continue to move and redeposit throughout the system. This is directly related to the ditch gradient. Being somewhat steep, flow velocity is high and therefore the ditch is self-cleansing to some degree. Much of the finer sand now terminates in Hayes drinking water.

(4) Turbidity

Turbidity originating during storm events is much more difficult to treat than coarser, settleable material entering the system. Erosion of the reddish soils high in clay content is no doubt the

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cause. Very little erosion of these red soils can create considerable turbidity. Eliminating the source by vegetative stabilization and other watershed prescriptions would be quite expensive, and probably would not be totally effective.

RECOMMENDATIONS

(1) Intake

The present intake is so positioned as to accept flow and sediment loads directly into the system. A properly designed dam and intake is required to reduce sediment deliverance by "skimming" or taking water from an upper layer. Velocities at dam would be reduced and, in turn, would allow agitated heavy material to resettle as bedload and be sluiced through a lower opening in the dam. Water entering the ditch would be tapped from the upper level and side of the pool (perpendicular to the flow direction).

(2) Sediment Trap

The existing make-shift trap is totally inadequate.. A box-type trap of sufficient size - miniature to those often used at intakes to hydropower aquaducts - could be most beneficial in reducing most sediment entering the system. Adequate bottom slope and flow release would be required to keep the trap self-cleansing. Either a designed intake or the sediment trap would greatly reduce sediment in the system. Both together could possibly cut sediment loads 80 to 90 percent.

(3) Stilling Basin (Forebay)

A large pond near the ditch terminus not only would supplement items 1 and 2 in sediment reduction, but would also allow stilling and some lessening of turbid water conditions. Or, in case of high turbidity in Stanshaw Creek, the pond could provide clear water for domestic purposes until turbid conditions passed.

Another possibility is to use Hayes' large cylindrical tank. By feeding ditch water into the tank near the top, the large capacity within would still the water somewhat and allow additional settling of coarse material (similar principle to upended culvert already in system). A release valve would provide flushing. Withdrawal of water for the system would be near or above the intake level.

(5) Watershed Treatment

Restoration activities in badly eroded reaches of the watershed will assist in reducing bedload sediment and turbidity, but cannot solve the problem alone without a better water system design. Emphasis should be placed on rehabilitation of the most chronic sediment source areas. The success of treatment and its affect on downstream water quality, though, would depend on the amount of effective restoration work and the element of time.

COMMENT

It is my feeling that while Forest Service activities substantially degraded water quality in Stanshaw Creek, the Hayes water system -- being completely obsolete in coping with bedload sediments -- is also a contributor. The intake, ditch gradient, and unsuccessful stilling well add nothing in the way of sediment removal. They, in fact, contribute - by design - more material than most conventional direct-diversion systems. Also, prior to road construction and logging, accounts by people who lived at the ranch relate that water was not all that good during storm periods.

Any management activity by the Forest Service would have created some disturbance to the pristine conditions. The degree of disturbance, in this instance, was most pronounced.

It may therefore be argued that several factors have or continue to affect water reaching the tap. The division of responsibility is questionable and subject to considerable litigation.

ROBERT F. ETTNER
Hydrologist