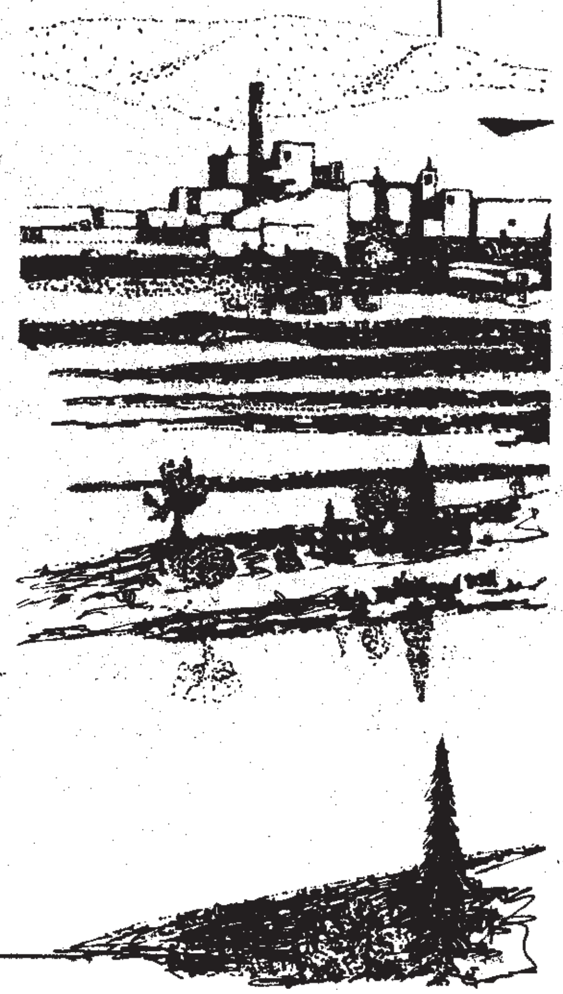
Champion International
Frenchtown Mill

Discharge Permit
MT-0000035

MAR 17 1986

Addendum



Montana
Department of Health
and
Environmental Sciences

Montana Department of Health

and

Environmental Sciences

Addendum

Draft Environmental Impact Statement

Champion International
Frenchtown Mill

Missoula County

March, 1986

In accordance with the Montana Environmental Policy Act, Section 75-1-101, et. seq., MCA, and the Water Quality Act, Section 75-5-101, et. seq., MCA, and ARM 16.20.901, et. seq., and 16.20.601, et. seq., the following EIS was prepared by the DHES, Environmental Sciences Division, concerning a request for the renewal of Montana Pollutant Discharge Elimination System (MPDES) Permit Number MT-0000035 for the Champion International Frenchtown Mill near Frenchtown, Montana.

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SUMMARY

The Champion International Corporation pulp and paper mill west of Missoula has been operating under a two-year discharge permit from the Montana Department of Health and Environmental Sciences (DHES). The permit allows the mill to discharge treated wastewater into the Clark Fork River year-round, according to prescribed conditions.

Last fall Champion applied to the DHES for renewal of the present permit, and asked that it be reissued for a five-year period (the standard amount of time for discharge permits).

For the last two years the department has been conducting an extensive study of the Clark Fork River and its tributaries from Turah to the Montana-Idaho border. Some studies were done by the DHES, while others were contracted to other agencies and individuals. The studies centered on the quality of water and life associated with the river. The information derived from the research served as the basis for preparing a draft environmental impact statement (DEIS) on the requested permit renewal.

The DEIS was sent to interested persons and organizations on December 26, 1985, for review and comment. The important water quality issues discussed in the impact statement include:

Nutrients:

Nutrient concentrations decrease downstream along the course of the Clark Fork due to dilution by the Blackfoot, Bitterroot and Flathead rivers. However, discharges from the Missoula Wastewater Treatment Plant (WWTP) and Champion mill add measurably to the load of nutrients carried by the Clark Fork River. Most of the nitrogen and about half of the phosphorus introduced to the river by Champion reach Lake Pend Oreille. In water year 1985, Champion contributed about 6 percent of the phosphorus carried into the lake by the Clark Fork River. (About another 6 percent came from the Missoula WWTP.) The potential exists for water quality degradation and accelerated eutrophication of Lake Pend Oreille resulting from activities in the Clark Fork River drainage. However, a perceived decline in lake water quality cannot be directly or conclusively linked to the Champion discharge given the present information and the absence of a comprehensive limnological investigation of the lake.

Suspended solids:

It appears unlikely that discharges at the maximum allowable rate for total suspended solids (TSS) would produce a measurable impact on the river or aquatic life.

Dissolved Oxygen (DO):

It is doubtful that the biochemical oxygen demand (BOD) within the Champion discharge results in any significant changes in dissolved oxygen concentrations downstream from the mill.

Color:

Color is presently the most important factor in controlling the rate at which Champion can discharge wastewater. Champion is allowed to increase the color in the river by up to five color units.

Toxics:

Ammonia and metals in the Champion wastewater discharge do not appear to pose a toxic threat to the Clark Fork. Results from several biological tests indicate that Champion's wastewater did not have a toxic affect on aquatic life.

Algae and Aquatic Plants:

Wastewater disposal under the provisions of the permit appear to have little effect on algae and aquatic plants.

Macroinvertebrates:

The species and distribution of macroinvertebrates found by the researchers indicate the river is not heavily stressed. The DHES and Champion will continue to sample the Clark Fork for macroinvertebrates.

Aesthetics:

The most noticeable problem is the appearance of foam. Although all of the foam cannot be directly attributed to Champion's discharge, the effluent is likely a contributing factor. Additionally, a number of reported aesthetically unpleasant materials thought to be attributable to Champion proved to be organic matter commonly found in nature. Colored water from seepage appears in the mill's mixing zone. Investigations concerning complaints of bad tasting and smelling fish proved inconclusive.

Groundwater:

Some degradation of the shallow aquifer north of the Frenchtown Mill property has occurred. The DHES Montana Groundwater Pollution Control System (MGWPCS) regulations contain groundwater quality standards and prohibit degradation of groundwater quality off Champion property beyond that quality which existed as of October 29, 1982. Although it may be difficult to establish the exact extent of degradation as of 1982, additional subsurface investigations can be carried out to determine the current extent of the problem and whether it is tending to increase. The determination of whether or not degradation is occurring in noncompliance with MGWPCS can then be made. Eventually, an adjustment of groundwater gradients may be necessary to alleviate the problem.

Airborne Hydrogen Sulfide from Wastewater Ponds:

Several ponds in the Champion wastewater treatment system have been identified as producing high concentrations of hydrogen sulfide. Violations are subject to provisions of the Montana Clean Air Act.

Comments received in writing and at a January public hearing in Missoula prompted the DHES to write an addendum which would discuss, in greater detail, certain portions of the impact statement.

The major areas of importance in the addendum include:

MPDES Permitting Procedures:

This section describes the laws and regulations that are the basis for Montana Pollutant Discharge Elimination System (MPDES) permits--more commonly referred to as discharge permits. It also tells how the DHES administratively processes permit applications.

Weston Report:

The report is discussed in greater depth, with particular emphasis on explaining some of Champion's future wastewater treatment options and estimated costs.

Nondegradation:

Following the definition of nondegradation, the DHES explains how it considered nondegradation in relation to parameters in the Champion discharge permit. The department concludes that current information does not indicate there are any nondegradation violations.

Mixing Zone:

The mixing zone fluctuates depending on river flow and the amount of wastewater discharged, seeped and infiltrated. Mixing occurs between the mill and Huson. Due to its fluctuating nature, the mixing zone is difficult to determine; however, DHES studies are being planned to more accurately define it.

Water Quality Monitoring:

This section discusses past, present and future water quality monitoring. Concerning the future monitoring, the DHES outlines six particular areas of interest and lists them in order of importance.

Fisheries:

The text portion of the Department of Fish, Wildlife and Parks (DFWP) fisheries report, which was included verbatim in Volume II of the DHES' Data Report and issued in conjunction with the DEIS, is reprinted, and includes some comments by the DHES. The DFWP report suggests Champion effluent affects intergravel water quality for more than 25 miles downstream. It also says it will take a minimum of five years to produce a reliable assessment of the impacts. The fisheries section also enlarges upon a rainbow trout chronic toxicity bioassay done by the Environmental Protection Agency (EPA) and mentioned in the DEIS; discusses the impact of hydroelectric facilities on the fishery below the confluence of the Flathead River; and presents the results of fisheries studies done by the National Council of the Paper Industry for Air and Stream Improvement (ncasi).

Economics:

Interest in assessing the economic benefits derived from the recreational use of the lower Clark Fork River is becoming more widespread. Some work has taken place, but no definitive study has been done to date. One of the key elements in providing greater future potential for recreational use and tourism in the lower Clark Fork Basin is to maintain or improve water quality in the river.

Alternatives:

DHES alternatives apply to permit decisions, not treatment alternatives. The alternatives include:

Alternative 1 - Deny issuing a permit.

Alternative 2 - Renew the existing permit for five years with existing conditions and limitations.

Alternative 3 - Renew the permit for five years, and require a study of nutrients and foam sources within the plant, followed by the development of a contingency plan to reduce both parameters in the discharge, if necessary.

Alternative 4 - Renew the permit for five years, with tighter controls on TSS and biochemical oxygen demand (BOD) in the discharge.

Alternative 5 - The Clark Fork Coalition Citizens' Alternative proposed a five-year permit, a review of certain parameters and conditions after two years, a return to discharge conditions prior to the 1984 permit plus additional permit conditions, and for Champion to submit a plan within 1 1/2 years to enhance waste treatment and management.

Recommendation:

The DHES recommends that a combination of Alternatives 3 and 5 be selected. The proposed permit would be issued for five years, with a review planned during the mid-term of the permit period. Champion would be required to evaluate nutrients and foaming agents, and prepare a plan to reduce both, if necessary. The DHES and other interested concerns, including the Technical Advisory Committee, would continue to survey water quality relationships in the river and in Lake Pend Oreille.

This addendum to the DEIS is being sent to all the persons, organizations and public libraries that received copies of the draft. Like the DEIS, the addendum may include some words that are unfamiliar to you; if so, refer to the glossary in the DEIS.

There is a 30-day period, from the date of this addendum, during which you may comment on the document. Please send your comments to: Water Quality Bureau, DHES, Cogswell Building, Helena, MT 59620.

INTRODUCTION

The purpose of this addendum to the DHES' DEIS on Champion International's Frenchtown Mill Discharge Permit is to discuss, in greater detail, certain portions of the impact statement.

In the DEIS it was noted that Stone Container Corporation of Chicago, Illinois, proposed purchasing the Frenchtown Mill from Champion International. The sale was approved by Stone Container's stockholders and the mill changed ownership on February 27, 1986. Even though the mill is now referred to as the Stone Container Corporation's Missoula Mill, for the ease of continuity and public recognition, the mill is still referred to as "Champion International" or "Champion" in this addendum. Until the Montana Environmental Policy Act (MEPA) process is completed for this project, the DHES will continue to refer to the mill by its former name.

The addendum incorporates by reference all the material in the DEIS (issued December 26, 1985). It also adopts all the material in the DHES Data Report Volumes I and II.

The DEIS was mailed to 402 persons and organizations. Copies of the draft and the data report also were sent to public libraries along the Clark Fork River from Missoula to Sandpoint, Idaho, and to libraries outside the Clark Fork Basin in Coeur D'Alene, Idaho, and Spokane, Washington.

Chronology

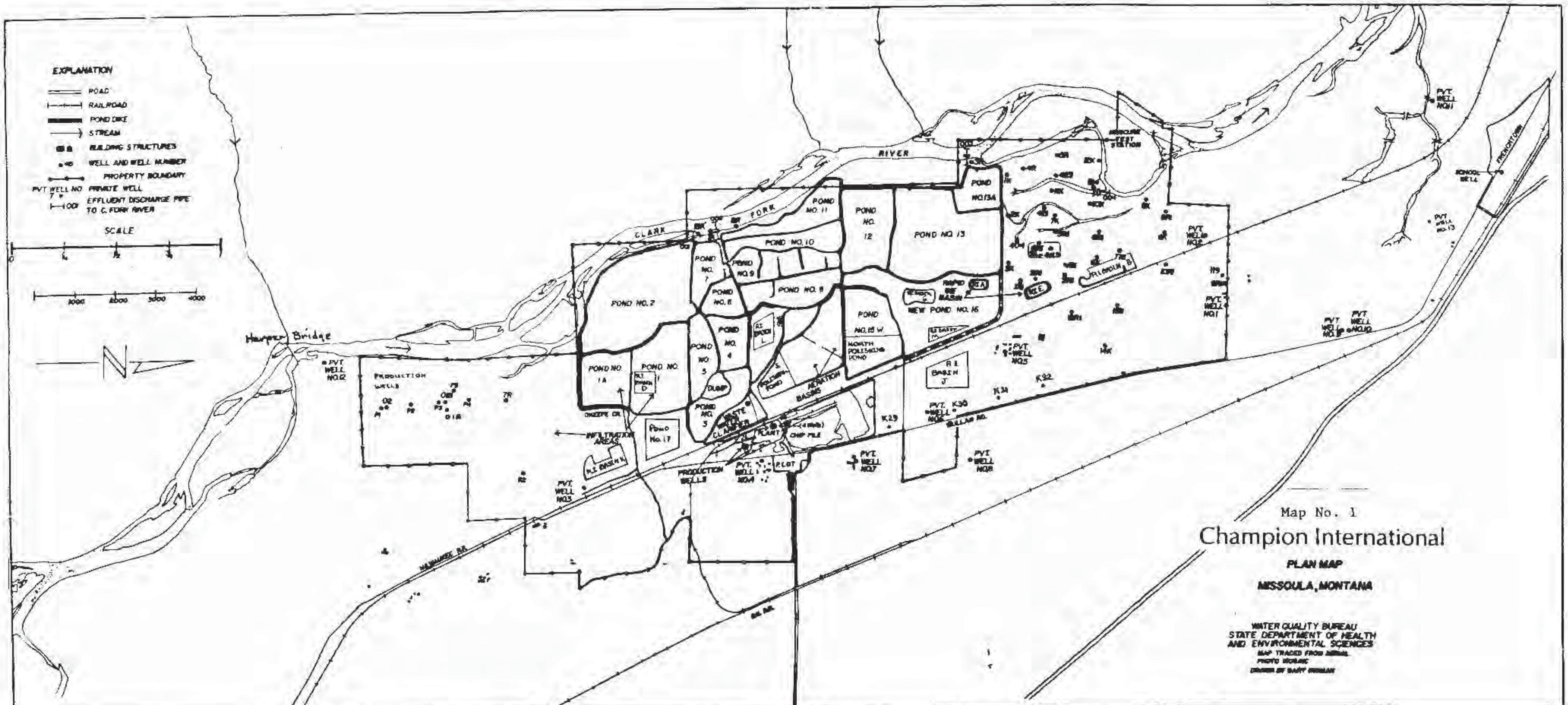
Champion International's Frenchtown Mill, 15 miles west of Missoula near Frenchtown on the Clark Fork River (Map No. 1), began operation in 1957. No wastewater treatment was provided during the first year of operation. A fish kill occurred that summer, and treatment ponds were constructed soon after. Some of the wastewater seeped from the ponds into the river, and the rest was stored and discharged directly into the river during high spring flows.

The DHES has had stream water quality standards since 1958, and a wastewater discharge permit program since 1968.

The mill was issued a permit in 1968. Prior to that, the DHES and Champion negotiated on when to discharge wastewater.

Permits that were issued to Champion between 1968 and 1984 allowed direct discharges to the Clark Fork only in the spring. The amount was initially based on the toxicity of the effluent as determined by static bioassays, with a safety factor then applied. After aeration was installed in 1974, toxicity was greatly reduced and meeting the instream standard for color became the primary limitation to discharging.

In 1983, Champion applied for a permit which would allow it to directly discharge a portion of the wastewater into the river throughout the year, instead of only during high flows in the spring. This resulted in public concern, mostly over the lack of scientific information available to support


EXPLANATION
ROAD
RAILROAD
POND DIKE
STREAM
BUILDING STRUCTURES
WELL AND WELL NUMBER
PROPERTY BOUNDARY
PVT WELL NO. PRIVATE WELL
EFFLUENT DISCHARGE PIPE TO C. FORK RIVER
SCALE
1000
2000
3000
4000
N
Harper Bridge
CLARK FORK RIVER
POND NO. 2
POND NO. 1A
POND NO. 3
POND NO. 4
POND NO. 5
POND NO. 6
POND NO. 7
POND NO. 8
POND NO. 9
POND NO. 10
POND NO. 11
POND NO. 12
POND NO. 13
POND NO. 13A
POND NO. 15 W
NORTH POLISHING POND
NEW POND NO. 16
POND NO. 17
DUMP
AERATION BASINS
PRODUCTION WELLS
INFILTRATION AREAS
PLANT
CHIP PILE
PLOT
PVT. WELL NO. 12
PVT. WELL NO. 3
PVT. WELL NO. 4
PVT. WELL NO. 5
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PVT. WELL NO. 7
PVT. WELL NO. 8
PVT. WELL NO. 1
PVT. WELL NO. 2
PVT. WELL NO. 10
PVT. WELL NO. 11
PVT. WELL NO. 13
SCHOOL WELL
K29
K30
K31
K32
MILWAUKEE RR.
Map No. 1
Champion International
PLAN MAP
MISSOULA, MONTANA
WATER QUALITY BUREAU
STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES

discharging on a year-round basis. In a response to the concerns, the DHES began a number of scientific studies to determine the effects of discharging throughout the year during the term of a two-year permit, which was issued in April 1984.

The department received a letter from Champion International on September 16, 1985, requesting the renewal of the permit.

The DHES analyzed the information collected during the two-year study period and issued a DEIS December 26, 1985. The draft recommended renewing the permit for a five-year period. A public hearing was held January 28, 1986, in Missoula to allow interested persons and groups to comment on the DEIS.

The present permit expires at midnight, March 31, 1986. Due to the decision to write an addendum, the DHES will administratively extend the renewal date of the permit to enable review of this addendum by the public.

MPDES PERMITTING PROCEDURES

The Montana Water Quality Act states that it is unlawful to discharge sewage, industrial wastes or other wastes into any state waters without a current permit from the DHES. The MPDES regulations, promulgated under Section 75-5-401 of the Montana Water Quality Act, outline a specific procedure to be followed in the consideration of an application for a waste discharge permit.

The procedure begins when the DHES receives an application from a person or business to renew an existing MPDES permit, modify an existing permit or obtain a new MPDES permit to discharge wastewater. Applications are required at least 180 days prior to the date of expiration or the date a discharge will commence.

After the DHES receives an application, a statement of basis, tentative permit, public notice and preliminary environmental review are drafted. The statement of basis explains the rationale behind the various tentative permit discharge limitations and conditions. The discharge limitations and conditions are based on a review of the quality and quantity of the discharge and of the receiving water. The review must show that certain regulations will be satisfied by the conditions of the permit. These regulations include the state rules on Nondegradation of Water Quality and the Surface Water Quality Standards, along with the federal Effluent Guidelines.

The nondegradation rules apply to "new or enlarged point sources" and are generally the most difficult to satisfy. As the name implies, their purpose is to prevent "degradation" of state waters where existing quality is higher than that required by Montana water quality standards. The Surface Water Quality Standards are set to define and protect the established beneficial uses of all state surface waters. They contain a combination of narrative and numerical standards, and define such things as minimum levels of dissolved oxygen required for a trout stream and maximum levels of fecal coliform bacteria acceptable for contact recreational use.

The federal Effluent Guidelines consist of minimum acceptable effluent standards for various categories of industries and for municipal wastewater discharges. These minimum standards are set by the EPA based on nationwide studies of reasonable "state of the art" treatment technology employed in the various categories for wastewater treatment.

The effluent limits or conditions of the MPDES permit must ensure a discharge that satisfies the most restrictive of all the applicable rules and standards. Often a permit will contain some conditions based on one regulation and other conditions based on another. The Champion permit is a case in point; it has some limitations based upon Effluent Guidelines and other limitations based upon meeting Surface Water Quality Standards.

After the statement of basis is drafted, the conditions and limitations are translated into a tentative permit. This permit is not final and valid, but is for review and comment by the applicant and other interested persons. A preliminary environmental review is drafted in compliance with MEPA and is used to determine if an environmental impact statement is required by the permit decision.

If an EIS is required, the DHES completes the MEPA process before issuing a public notice that describes the proposed discharge and permit. Regarding Champion, the DHES is in the draft EIS stage of the procedure.

The public notice briefly describes the proposed discharge and the DHES' tentative permit. It is posted by the applicant in local public places, such as the post office and courthouse, and mailed by the department to both a general and regional mailing list of potentially interested parties. The notice informs the public that comments are being solicited by the DHES for 30 days. It also informs the public that a hearing will be held if sufficient interest is shown.

The DHES considers all comments received during the public notice period and during any public hearings before issuing a final permit. A final permit is valid for wastewater discharge in compliance with its conditions and limitations, and remains in effect for a specified period of up to five years. Periodic self-monitoring of the discharge and reporting of the results to the DHES are required of the permittee. The DHES reviews the self-monitoring results, conducts its own compliance monitoring of the discharge and does quality assurance checking of the permittee's laboratory. The DHES encourages permittees to improve the quality of their discharges, and offers some limited operation and maintenance advice or training if requested. If monitoring of the discharge or receiving stream indicate that current effluent limits or conditions are not providing adequate protection of state waters, the permit process may be reopened and modifications made to the limits to protect beneficial uses or to meet water quality or nondegradation standards.

<u>The Weston Report</u>

Comments were received at the public hearing in Missoula in January 1986 relative to the Weston report "Evaluation of Alternative Technologies for Wastewater Treatment". The capital and operating costs of the existing Champion treatment facility and a more thorough explanation of the report were requested. This report was prepared for Champion to evaluate the various means of further reducing BOD, TSS, color and nutrients. It reviewed literature on these subjects and summarized the processes that might be used to enhance the quality of the wastewater being discharged at the Champion mill. Even though these options were presented to Champion, it does not mean that it will use them. If discharge and instream standards are already being met, it is doubtful that Champion would place them into service. However, it does show what is available. The information provided in this review will also be of value to other mills. Copies of the complete Weston report are available at the Missoula, Superior, Plains, Thompson Falls and Sandpoint public libraries.

The DEIS contained an executive summary of the Weston report on pages 17-20. Table 2 on page 19 indicated the existing treatment and potential treatment alternatives available to upgrade the existing facility. The operation and maintenance costs shown in the table would be in addition to the present cost to Champion. This existing operation and maintenance cost is $1,232,000 per year for wastewater treatment. The capital cost of the existing wastewater treatment facilities, which includes the clarifier, aerated stabilization basins, polishing and holding ponds and rapid infiltration basins, and related appurtenances as estimated by Champion is $3,469,000.

The existing clarifier, aerated stabilization basins and polishing ponds are typical of the facilities that provide secondary treatment at many similar mills in the United States. The rapid infiltration basins and the large storage capacity of the Champion holding ponds provide treatment above that usually found at other mills.

The primary purpose of aerated stabilization basins is to reduce the BOD of the wastewater. Organic wastes are both oxidized and converted to biomass under conditions provided by mechanical aeration. Nutrient additions (nitrogen and phosphorus) are required to ensure that a suitable culture of biological organisms can be grown so that the waste organics can be degraded. The advantages of aerated basins include their inherent biological stability and their ability to treat heated wastewaters. Their disadvantages are the large area needed and a slightly lower effluent quality than some of the other secondary treatment processes can provide.

The activated sludge process as shown on Table 2 of the DEIS utilizes about 5 percent of the area that the aerated basins use. When activated sludge systems are properly designed and operated, they can produce a better quality effluent (lower BOD value) than aerated stabilization basins. The biomass in activated sludge systems is maintained at a much higher concentration since a portion of the solids which are settled out in the final clarifier are returned to the aeration compartment. This allows the incoming organic material to be decomposed at a much higher rate.

The Zurn-Attisholz and the trickling filter are other processes that provide secondary treatment. The activated sludge, Zurn-Attisholz and trickling filter systems are all capable of providing better treatment than the existing facilities, but are more susceptible to upset when waste loads change.

If additional suspended solids removal is required, the Weston consultants recommended the addition of chemicals to the existing clarifier and effluent polishing ponds to generate larger solids which would more readily settle. Another option is to use a clarifier following the aeration basins along with chemical treatment rather than the polishing ponds. Other means of further solids removal were granular media (such as sand) filters and microstraining. Microstraining utilizes screens with small openings to remove the solids.

Color removal from pulp and paper mill wastewaters by chemical treatment has been tried at only a few installations in the United States and these have not been too successful. Research is continuing by the paper industry to provide a better chemical and mechanical treatment process than is available.

The Weston report recommended that the nutrient additions to the aerated stabilization basins be more closely controlled so there would be a smaller amount of nutrients leaving the basins while still providing enough for the stabilization of organic material. The consultant thought this was the best method of lowering the amount of nutrients being discharged to the Clark Fork River. There are also chemical means of providing further reduction. However, where values are already below one or two milligrams per liter (mg/l) of phosphorus, it becomes very expensive to remove the remainder.

As stated in the DEIS, if reductions are needed in wastewater contaminants, another option is the reduction of wastewater leaving the mill. This will reduce the BOD, total suspended solids, foaming tendency and color in the treated wastewater. The amount of nutrients added to the treatment system could probably also be reduced if losses from the mill were better controlled.

NONDEGRADATION

The Montana Water Quality Act requires that state waters in which the existing quality is higher than the established water quality standards be maintained "at that high quality" (75-5-303(1) MCA). The first permit issued to Champion (then Hoerner Waldorf) under the MPDES system in 1974 contained limits for TSS and BOD of 2,000,000 and 2,250,000 pounds/year, respectively. These limits were based on the nondegradation provisions of the Water Quality Act.

The state's rules on nondegradation of water quality (ARM 16.20.701 et. seq.), which were adopted by the Board of Health and Environmental Sciences (BHES) in 1982, include definitions, statements of applicability, and a discussion of limitations and permit conditions to ensure nondegradation. These rules were adopted to provide guidance to the public and the department as to the meaning of degradation, and to set forth procedures to be followed by the DHES. Degradation is defined in these rules as a deterioration of those parameters for which the surface water quality standards list absolute numbers, and of parameters which are toxic or deleterious; or as a violation of the surface water quality standards for those parameters for which an increase above naturally occurring levels is allowed in the standards.

The application of the nondegradation rules follows a uniform procedure. This procedure begins when the DHES receives an application to modify an existing MPDES permit or to issue a new permit. If issuance of the new or modified permit would result in a "new or enlarged point source" then the nondegradation rules apply. A new or enlarged point source means:

> "...a point source on which construction or major modification commenced or from which discharges increased on or after December 17, 1982. It does not include sources from which discharges have increased if the increase does not exceed the limits established in an existing MPDES permit for that source which was issued prior to December 17, 1982." (ARM 16.20.701(6))

According to this definition, Champion may be an enlarged point source only if its discharge of pollutants will increase. In this case, the loading for most parameters will not increase. However, taking a conservative view, the DHES considers an increase to include a case where the annual load is constant, but some periods of the year experience an increase over previous years. Because the proposed permit apparently allows "discharges" to occur during periods of the year that were not possible under the permits issued prior to 1982 (which allowed "discharges" only during periods when the flow was greater than 4000 cubic feet per second (cfs)), it is appropriate to consider Champion an enlarged point source and therefore the DHES provides the following analyses of nondegradation for all parameters of the proposed discharge.

Under ARM 16.20.701(6) the meaning of "discharge" must first be considered.

In 1982 approximately 40 percent of the effluent leaving the plant was directly discharged to the Clark Fork River, the remainder evaporated, seeped from the holding ponds or was deliberately infiltrated into the ground in the rapid infiltration basins. This seepage and infiltration amounted to about 50 percent of the total effluent leaving the plant. The previous permits had no limitations on the timing of these discharges. Knowledge of the actual time of year that these discharges reached the river is very limited, however, it is reasonable to believe that such seepage occurred year-round. In fact, because the flow of groundwater is controlled in part by the differences in head (or elevation) between the river and the ponds, it is probable that seepage "flows" into the river were greatest during periods of the year when the water levels in the river were lowest. The proposed permit allows direct discharge during this same time period with one exception: when the flow is less than 1900 cfs, the seepage uses up all of the "allowable color increase" in the river and direct discharges are not allowed. Thus, nondegradation is not a factor when river flows are greater than 4000 cfs and when discharge will not change from previous levels, nor does it apply when river flows are less than 1900 cfs and when there cannot be any new discharge.

During times when the river flow is between 1900 and 4000 cfs, there could be a change in the discharge of pollutants to the river under the proposed permit. However, it is not possible to document if there will be a change because the DHES doesn't have data to determine when the seeped and infiltrated water reached the river nor does the DHES know how much "treatment" was achieved by passage of seeped and infiltrated water through the ground. The DHES does know that some reduction of pollutants occurs during passage through the ground. For example, the amount of BOD reduction that occurs with rapid infiltration has been calculated to be over 80 percent, while the general scientific literature indicates that virtually no reduction occurs in the concentration of nitrate and some organic compounds.

Thus, in applying the nondegradation rules to BOD, the timing of the seepage and infiltration discharges were not controlled by the previous permits, so in fact, Champion could have--and may have--discharged to the Clark Fork the same amount of BOD during the same time as indicated under the proposed permit. Furthermore, the total amount of BOD that it will discharge to the river is decreased by the limits in the proposed permit. The conclusion must be that the proposed permit will not result in degradation with respect to BOD.

The same considerations given above lead to the conclusion that there will be no degradation with respect to toxicants such as metals and organics. In addition, under the definitions of the nondegradation rule, increases in TSS are not considered degradation unless the surface water quality standards are violated or increases in TSS cause a secondary impact instream (ARM 16.20.701(1)(a)(ii)). The increase in TSS will not violate the surface water quality standards, and the available data indicate that there will not be secondary impacts to the river. Thus, increases in TSS resulting from the proposed permit will not result in degradation.

The remaining group of parameters considered under nondegradation are the nutrients, that is compounds of nitrogen and phosphorus. Under the definitions of the nondegradation rule, these compounds must be considered if they are "deleterious substances" (ARM 16.20.701(1)(a)(i)), and there will be any "worsening" of their levels "in surface water where quality is higher than the established water quality standards" (ARM 16.20.701(1)(a)(i)). However, in the case of nutrients, "worsening" cannot be considered as equivalent to an increase. Nutrients are required for a healthy aquatic community and, at relatively low levels, an increase in nutrients is not necessarily deleterious. It is only when these substances are present at relatively high levels--such as when there are changes in the aquatic community--that these substances can be considered deleterious. Presently, there are no data to indicate that increased levels of nutrients have caused changes in the aquatic communities of the Clark Fork River or in Lake Pend Oreille. Thus, it cannot be concluded that the present levels of nutrients have degraded either the river or the lake. If future monitoring shows that there are undesirable changes in either the river or the lake, this permit and all other permits in the Clark Fork Basin will be revised to limit nutrient impacts.

EXTENT OF THE MIXING ZONE

The surface water quality standards state:

"Discharges to surface waters may be entitled to a mixing zone which will have a minimum impact on surface water quality, as determined by the department." (ARM 16.20.634)

In the case of Champion's proposed permit, a mixing zone is allowed. It varies in length depending on the river flow and the total amount of wastewater discharged, seeped and infiltrated.

There is no set length to the mixing zone. The DHES established a point 8.5 miles downstream from the Champion discharge to monitor for instream compliance with permit limits. This point is referred to as the Huson or Six Mile site in the DEIS. Depending on the volume of river water flowing downstream and the amount of wastewater reaching the river, the zone could extend beyond the Huson monitoring station, but past studies indicate mixing generally occurs above this point.

Since the mixing zone fluctuates, it is difficult to pinpoint where mixing occurs on any given day. The principal limiting factors are river flow and seepage which enters the river along the north bank at a number of locations downstream from Champion's direct discharge. However, the variable extent of the mixing zone can be measured.

Permit monitoring at Huson is used principally to determine compliance with color and DO limitations. In the case of DO, the direct discharge must cease if either the upstream or downstream levels drop below 7.1 mg/l. For color, there is an allowable increase of five units above that which is measured upstream at Harper Bridge.

Ideally, sampling to ensure compliance with a permit and to determine the impact on a receiving stream should be done at the point where the discharge has completely mixed with the stream (just below the mixing zone) for two reasons. First, due to the definition of mixing zone the "...Water quality standards do not apply in the mixing zone for the parameters regulated by a MPDES or National Pollutant Discharge Elimination System (NPDES) permit..." (ARM 16.20.602(8)). Second, it is at this point that the highest concentration of pollutants outside of the mixing zone would be expected.

Data gathered for the DEIS indicate that color values instream are generally the same from near Frenchtown to above Alberton. (Huson is about 4.5 river miles below Frenchtown and about 10 miles above Alberton.) Although the data are not conclusive, they are in agreement with the expectations based on scientific literature that color in kraft mill effluents is very persistent in water. Thus, the location of the sampling site to ensure compliance with the color limitations is not critical as long as the site is below the mixing zone. This condition is satisfied by the present site.

Unfortunately the point of greatest instream impact is not the same for all pollutants. In the case of DO, the expected maximum effect (minimum instream DO) should be at or below the present sampling point near Huson and would be at some point beyond the mixing zone. (DHES calculations, 1983; CH_2M Hill, 1983). The data gathered for the DEIS are not sufficient to define the point of maximum decrease, primarily because the theoretical (not measured) DO decrease instream is so low that it is near the precision of the analytical method used. In addition the natural variation from site to site is rather large, judging from the sampling performed for the DEIS. It does not seem feasible or reasonable to attempt to measure the decrease based on the very low theoretical maximum decrease of about 0.1 mg/l that would result from the discharge to protect instream uses. Thus, for DO the use of the present upstream and downstream sites appears to be reasonable.

The limits for TSS, BOD, pH, floating solids, visible foam, polychlorinated biphenyl and chlorophenolic-containing biocides must be met in the direct discharge to protect instream uses. Thus, for these parameters there is no mixing zone for the direct discharge, but there is a mixing zone for seepage of these parameters. However, for these parameters neither the extent of the mixing zone nor their concentrations in the mixing zone are critical, because if the limits are met in the direct discharge, the DHES can be certain that they will be met in the seeped or infiltrated wastewater because of the additional treatment afforded by these means of discharging. The DHES' primary concern with mixing zones is that such zones "have a minimum impact on surface water quality." Because of this concern, the proposed permit requires that direct discharges during river flows between 1900 and 4000 cfs must be made using a diffuser outfall. This results in the smallest possible mixing zone under the provisions of Champion's current discharge permit.

As for the future, the DHES plans to do instream studies to better define the mixing zone. This will enable the department of determine if water uses are being impaired beyond the mixing zone.

WATER QUALITY MONITORING

Beginning in March 1984, the DHES initiated the largest water quality monitoring project ever undertaken by the state on one river. The study was initiated following a groundswell of public concern over the general health of the river. Much of the concern stemmed from the proposed modification of Champion's wastewater discharge permit to allow a year-round discharge of treated wastewater. The DHES' Lower Clark Fork Study examined the river from Turah to Idaho and coincided with the two-year term of a waste discharge permit issued to the Champion facility.

The focus of the study was to examine the instream consequences of the Missoula WWTP and Champion discharges (the two largest dischargers to the lower Clark Fork) and the fates and effects of toxic metals downstream from the headwater sources in the historic Butte Mining District. As the first monitoring program of its kind on the lower Clark Fork, the DHES also hoped to further establish water quality trends and general conditions and identify any other significant sources of pollutants and their effects.

The monitoring network included 31 fixed water quality stations on the lower 225 miles of the river, in its four mainstem reservoirs and on three major tributaries--the Blackfoot, Bitterroot and Flathead Rivers. Conditions were also monitored in eleven deep pools and slow-water areas between the Champion mill and the Thompson Falls Reservoir. Sampling was done monthly and more frequently during the spring high water season. A total of 25 monitoring runs were conducted between March 1984 and August 1985.

A lengthy list of chemical, physical and biological water quality variables were measured in several thousand samples collected from both shallow waters and from the bottoms of the deep pools and reservoirs. Nutrients, metals and suspended solids, especially organic solids, were the pollutants of primary interest. Biological measurements centered on the river and reservoirs' periphyton (algae and other attached microscopic bottom life) and macroinvertebrate communities.

In addition to the river monitoring program outlined above, several other special investigations of the river were conducted by the DHES in 1984-1985. These included two diurnal dissolved oxygen studies during summer low flows at 12 river stations, a dye study to determine time of flow between monitoring stations and a diurnal chemical analysis of the Missoula WWTP discharge. Contracts were let to the University of Montana (UM) to measure phosphorus, organic matter and metals in bottom sediments from mainstem reservoirs and to conduct a river benthic metabolism study. The EPA assisted with the study effort by conducting a 30-day chronic toxicity bioassay of the river and Champion wastewater using juvenile rainbow trout and a water flea and by performing a series of algal bioassays on water from various reaches of the river.

Joining the DHES in studies of the lower Clark Fork over the past two years have been the DFWP, the State of Idaho Division of Environment, the United States Geological Survey (USGS), Champion International, UM researchers and citizen's river watcher groups.

In the last two years, the DHES has logged more than 30,000 miles on lower Clark Fork monitoring trips, collected more than 4,000 water quality samples, performed more than 15,000 lab and field tests, examined more than a half million biological specimens and compiled some 50,000 meaningful pieces of information about the river through the expenditure of 10,000 man hours of effort and more than $200,000.

The results of the study effort were presented in a two-volume water quality data report and were the basis for the water quality assessments made in the Champion DEIS. Some of the key findings of the DHES lower Clark Fork monitoring are summarized here:

Metals

-- Up to 150 miles of the 225 mile reach of the lower Clark Fork examined were periodically subjected to copper pollution. The criteria for protection of aquatic life were exceeded at least once at all mainstem sites from Turah to below the Flathead River confluence.

-- There was no indication that the discharge of organic solids from point sources lowered the dissolved oxygen and pH of the reservoirs and deep river pools which would increase the mobility of metals contained in bottom sediments. This had been mentioned as a possible consequence of the increased organic solids discharge from the Champion mill.

Nutrients

-- Nitrogen and phosphorus from the Missoula WWTP and Champion discharges represented on the average 16 and 34 percent and 12 and 19 percent, respectively, of the loads present in the river below each of those discharges.

-- Based upon 1984-1985 sampling, roughly an average 20 percent of the total nitrogen and 40 percent of the phosphorus load in the Clark Fork above Thompson Falls was removed by the Thompson Falls and Noxon Rapids

Reservoirs. Yet at the same time, inorganic nitrogen levels increased through the reservoirs.

-- The Clark Fork is primarily phosphorus-limited in terms of algae growth potential where it passes the Champion mill.

-- Nutrient concentration guidelines for avoiding nuisance attached algae growth in the river were not exceeded below the Missoula WWTP or Champion discharges.

-- Guidelines for avoiding blooms of suspended algae were exceeded in a third of the samples collected above Thompson Falls, where the series of reservoirs begins. However, measured reservoir phytoplankton concentrations were well below the eutrophication problem threshold.

Suspended Solids

-- Neither the Missoula WWTP or Champion discharges caused measurable instream increases in suspended solids concentrations or loads in the Clark Fork River.

Dissolved Oxygen

-- Dissolved oxygen concentrations slightly below the applicable B1 water quality standard of 7 mg/l were measured once each at the bottoms of Noxon Rapids and Cabinet Gorge Reservoirs, in the Clark Fork River below Noxon Rapids Dam and in the lower Flathead River.

Toxic Substances

-- The Champion wastewater discharge contains ammonia, hydrogen sulfide and organic resin acids. All of these compounds are potentially toxic. While it seems unlikely that acute or chronic toxicity problems would occur in the Clark Fork following the minimum river water to waste dilution ratio of 200:1, further investigation is warranted.

Aesthetics

-- The increased presence of river foam was determined to be a significant problem below the Champion mill.

-- Evaluations of game fish flavor and odor indicated that fish tainting problems due to the Champion wastewater discharge are unlikely.

Periphyton Community

-- Periphyton production on artificial substrates placed above and below the Champion mill was similar. Champion's wastewater discharge did not appear to stimulate or inhibit periphyton growth rates over those measured above the mill.

Macroinvertebrate Community

-- The lower Clark Fork throughout the study reach supported a rich, highly diverse macroinvertebrate community. More than 200 different species were identified and as many as 60 species were present at one time at individual sampling stations.

-- A subtle, localized impact was seen immediately below the Champion discharge, especially in the fall of 1984. No significant problems were indicated below the wastewater mixing zone.

Riffle Community Metabolism Study

-- The discharge of wastewater from the Champion mill had no apparent effect on the metabolic rates of the riffle communities downstream of the mixing zone.

Present Monitoring

Since August 1985, following the collection of the last set of data to be used in preparing the Champion DEIS, the DHES has combined its lower Clark Fork monitoring program with a long-term, ongoing study of the upper Clark Fork from its headwaters to Garrison. The objective of the new monitoring program is to monitor the long-term and cumulative effects of past, present and future impacts to the water quality of the entire Clark Fork River drainage. Twelve of the 31 lower river stations have been discontinued. Most of the stations dropped were located within the Missoula WWTP and Champion discharge waste mixing zones and in the mainstem reservoirs. They were stations which had been monitored only three times per year in the past.

The DHES now collects data approximately 16 times per year (monthly in August-March, twice monthly in April-July) at 30 stations in the Clark Fork River drainage including its three major tributaries (Blackfoot, Bitterroot and Flathead Rivers) and two major wastewater discharges (Missoula WWTP and Champion), from its headwaters to the Idaho border. Parameters measured are selected metals, nutrients, total and organic suspended solids and other parameters such as hardness and alkalinity which affect metals toxicity. Biological monitoring for macroinvertebrate organisms and periphyton is scheduled to be conducted once per year at each of the stations.

In addition, the Champion Frenchtown mill discharges are usually monitored a minimum of twice annually under the DHES' compliance monitoring program.

Future Monitoring

Funding for the DHES study now in effect is secure through June 1986. Application has been made through the Governor's Office to the Department of Natural Resources and Conservation to use Legacy Program funds for a one year continuation of the monitoring program through state fiscal year (FY) 1987. Tentative approval has been received, barring any unforeseen freezes in these funds. A request for continuing funding of this program in FY 1988 has also been made to the DHES director via the executive budget planning process.

Assuming the continuation of monitoring funds at least through FY 1987, the DHES proposes to continue monitoring chemical, physical and biological conditions in the Clark Fork at the stations now established. Additional special studies in the lower river will be conducted as resources allow in hopes of answering some of the remaining questions about the long term effects of the Champion discharge. Information needs which have been identified by the DHES or have been recommended by other parties, and which will require special studies, are listed below in descending order of the likelihood for completion in FY 1987:

1. Dissolved Oxygen: Additional studies of Clark Fork diurnal dissolved oxygen during the summer season are needed. The reach of river from Missoula to above Superior should be reexamined in July and August while Champion is direct discharging. Percent oxygen saturation should also be measured as an additional index of stress on the river's biotic community due to oxygen depletion.

2. Chronic Toxicity and Bioaccumulation Potential of Organic Compounds in the Champion Wastewater: At the present time uncertainties exist as to the potential for long-term chronic toxicity problems and bioaccumulation of certain organic components contained in the Champion wastewater. A 30-day chronic toxicity bioassay was done on the Champion wastewater in 1985 using young rainbow trout and a water flea. Although problems were not indicated, an operational upset in the rainbow trout test on day 12 casts some doubt on the test results. Secondly, questions remain about potential chronic toxicity problems to resident river life over periods of exposure greater than 30 days.

To further address these questions, the DHES has requested the assistance of EPA Region VIII to rerun the 30-day tests when its schedule allows. The DHES also has purchased access to several state-of-the-art computer programs, which will provide information on the subject. One program provides a computer search of all available literature on the toxicity of the compounds. Should the needed information be unavailable, a second program provides computer modeling of chronic toxicity and bioaccumulative tendencies based on the chemical structure of the compounds being examined. The DFWP will assist with the work in this area by analyzing for organic substances in the intergravel environment of the river below Champion.

3. Intergravel Oxygen Depletion Due to Secondary BOD: The DFWP Fisheries Study found reduced survival of brown trout eggs in artificial redds (spawning areas for fish) located downstream of the Champion discharge. The only water quality parameter which could be correlated positively with the test results was intergravel dissolved oxygen concentrations, which averaged less than those measured at control sites above the Champion discharge. Since each of the artificial redds was located in areas of upwelling (recharging) flow into the intergravel (from deeper areas of the river substrate), it is possible that the lower downstream oxygen concentrations were due to the presence of upwelling groundwater that was naturally low in dissolved oxygen. If the Champion discharge was responsible for a reduced intergravel oxygen content, it would have to be due to: 1) the oxygen demand of the wastewater in the river which infiltrated into the river bed and resurfaced at the artificial redd test sites, 2) oxygen-demanding contaminated groundwater moving in a plume from the Champion mill site and resurfacing at the test

sites or 3) a secondary oxygen demand exerted by the wastewater/river water mixture at the test site through the growth stimulation and subsequent oxygen-demanding respiration and decomposition of periphyton on or within the river gravels. In view of the DHES study results which indicated no measurable water column metabolism or appreciable oxygen demand in the river below Champion, the first possibility seems unlikely. Also, the probability of contaminated groundwater originating at the Champion mill influencing the intergravel water quality of the lower of two downstream artificial redds some 25 miles distant is very low, according to the USGS. The third possibility, that of a secondary oxygen demand seems to be the most reasonable if the wastewater is responsible for the observed test results.

To address this question, the DHES proposes to measure quantitatively the standing crop of periphyton biomass and chlorophyll and the ratio of producer organisms (autotrophs) to consumer organisms (heterotrophs) on natural river bottom substrates (rocks) at several sites above and below the Champion mill. The sites monitored would correspond with the DFWP artificial redds and would provide an indication of periphyton stimulation, if it exists, in the river downstream from the Champion mill. Although similar tests were performed by the DHES in the fall of 1983 and summer of 1984 and did not indicate growth stimulation, artificial substrates (glass microscope slides) were used instead of natural substrates. The standing crop occurring on natural substrates reflects growth over a much longer period of time than artificial substrates which are exposed for only three or four weeks. Thus natural substrate data will be more meaningful. This work would be done in summer or early fall of 1986.

4. Additional Foam Monitoring: The DHES would conduct further investigations into the link between the Champion wastewater discharge and the observed increased occurrence of river foam downstream of the discharge. The Pearl-Benson Index or lignin sulfonate test has been identified as a potentially useful tool to measure the relative concentration of spent Kraft pulping liquor in downstream accumulations of river foam. The occurrence of Champion wastewater materials in river foam at concentrations significantly higher than those expected to occur in the river after mixing of the waste, would tend to indicate that there is a relationship between the wastewater and foam production in the river.

5. Mixing Zone: As discussed in the mixing zone section, the actual downstream extents of the variable mixing zone would be determined in the field.

6. Chlorinated Hydrocarbons: The DHES has the results of at least five organic chemical analyses of the Champion wastewater which included testing for a lengthy list of potentially toxic chlorinated hydrocarbons. None of those data have indicated the presence in measurable quantities of such compounds in the Champion discharge. However, in view of the considerable quantity of chlorine derivatives that are used in the production of bleached pulp at the mill each month and which are ultimately disposed of via the mill's wastewater treatment system, further investigation into this area may be warranted. This work would

attempt to quantify the amount of chlorinated compounds reaching the waste treatment system and their ultimate fates whether it be volatilization in the aeration basins, deposition in storage ponds, biodegradation or dilution below detectable levels. The potential for groundwater and/or surface water pollution problems could thereby be determined.

FISHERIES

Following the issuance in April 1984 of a two-year discharge permit to the Champion International Frenchtown Mill to allow the conditional year-round discharge of treated wastewater, negotiations between Trout Unlimited, other environmental groups and Champion resulted in an agreement which called for, among other things, a two-year $100,000 Clark Fork River fisheries study to be conducted by the Montana DFWP and financed by Champion. The objective of the study was to evaluate the effects of the Champion wastewater discharge on the river's fishery.

The complete status report and summary results, as provided by the DFWP, was printed in its entirety in Volume II of the DHES' data report and was made available for public review.

This section of the addendum discusses the implications of the Champion wastewater discharge to the Clark Fork fishery. The first section discusses the results of the DFWP fishery study. Additional material has been included on the results of a 30-day chronic toxicity bioassay of juvenile rainbow trout conducted by EPA, the effects of hydroelectric facilities on the fishery in the Clark Fork below the Flathead River, the results of recent fisheries' studies by the National Council of the Paper Industry for Air and Stream Improvement and a review of other recent literature.

DFWP Fisheries Study

The first part of this discussion is drawn from the project status report which appears in the Data Report, Volume II. Tables of raw data have been omitted; only an outline of the study design, preliminary findings and a summary are included. The second part is a commentary by the DHES on the fishery study results. While the DHES is supportive of the DFWP efforts, the DHES believes some information is lacking which may influence the applicability of the study findings to the current wastewater discharge situation.

1. DFWP Middle Clark Fork Fishery Study Status Report

Scope of the Middle Clark Fork Fishery Study

The study area extends for about 120 miles from Milltown Dam to the confluence of the Flathead River. To evaluate the river's ability to safely assimilate additional quantities of pulp mill wastes, the current status of sport fish populations must be determined. Although fifteen species of fish are known to occur in the middle Clark Fork River, the bulk of the sport fishery is provided by rainbow trout along with a few cutthroat, brown and bull trout. The study is attempting to evaluate effects of pulp mill effluents on trout populations by assessing trout population characteristics in the river in areas upstream and downstream from the pulp mill effluent and by monitoring trout reproductive success in areas upstream and downstream from the effluent.

Trout population characteristics are being assessed by making population estimates. Factors which are being estimated include the number and biomass of trout per mile, species composition, condition factors, growth rates, age structure and mortality rates. Fish are being collected to make trout population estimates using boom suspended electrofishing apparatus. Much of the field work for this phase of the study is being accomplished at night because efficiency of the electrofishing system is significantly better at night than during day time. Trout population characteristics are being compared in study areas upstream and downstream from the pulp mill effluent to evaluate influences of the mill on the sport fishery.

Trout reproductive success is being monitored through a bioassay of trout egg and fry survival in the intergravel environment in study sites upstream and downstream from the pulp mill effluent. Egg and fry survival are being monitored for brown trout, a fall spawner. Egg and fry survival are being evaluated because the egg through emergency fry stage in the life cycle of trout may be relatively more vulnerable to possible influences of pulp mill pollutants than life stages after the trout fry have merged from the spawning gravels.

Trout spawn in relatively shallow gravelly areas of the river with moderate current velocity. After a depression is dug in the spawning gravel by a female, eggs deposited in the depression by the female are fertilized by an accompanying male and covered over with four to eight inches of spawning gravel. Water quality by pulp mill effluents include dissolved oxygen, pH, ammonia and fine sediments. Additional water quality parameters of concern may be identified during the course of investigation.

<u>Study Design Problems</u>

There were several problems in designing this study to evaluate effects of pulp mill effluents on the sport fishery. First, the study was intended to document an impact from year-round discharge of effluent from Champion's mill after the discharges had already begun. Second, there was very little baseline information on the condition of fish populations in areas downstream from the Champion discharge prior to the year-round discharge situation which now occurs. Third, the time frame for the study to assess impacts of the pulp mill was limited to two summer and one winter field seasons. This time frame was too short to provide an adequate assessment. Fourth, there are many other water quality problems in addition to pulp mill effluents which may affect the Clark Fork River fishery. Additional water quality factors which may be influencing the fishery include Missoula sewage treatment plant effluents, potentially toxic heavy metals originating from mine tailings in the upper Clark Fork drainage and fine sediments originating from various human related activities which could impair trout food production or trout reproductive success.

For these reasons, the scope of the study was broadened with additional funding and assistance being provided by the Department of Fish, Wildlife and Parks. A study was funded by the department to determine the relative importance of various tributaries as sources of recruitment for Clark Fork River trout populations. In addition, resident sport fishery values of the tributaries are being assessed and appropriate management recommendations will be made to maintain or improve fishery values of important tributaries.

To assist in identifying the potential influence of toxic metals on aquatic biota, DFWP is analyzing crayfish tissue samples. Potentially toxic heavy metals originating from mine tailings in the upper Clark Fork drainage are gradually diluted as the Clark Fork receives more good quality dilution water from downstream tributaries. However, monitoring has not been intensive enough, particularly from Milltown Dam downstream, to determine how often, if at all, metals criteria are exceeded. Crayfish were chosen as an indicator organism because their movements are confined to a relatively small area. Metals concentrations in crayfish exoskeletons may prove to be a good integrator of past history of exposure to metals.

The Department of Fish, Wildlife and Parks is also assessing the potential influence of pulp mill effluents on the taste of sport fish in the Clark Fork River. Taste tests will be conducted at an Oregon State University lab to evaluate the concentration at which pulp mill effluents adversely taint the taste of desirable sport fish.

The Department of Fish, Wildlife and Parks also believes that there is a need for a comprehensive evaluation of the Clark Fork River system which cannot be accomplished within the scope of ongoing studies. The comprehensive study should include quantification of instream flow requirements for sport fish in the main river as well as major tributaries, expand sampling to below the confluence of the Flathead River, assess seasonal and temporal distribution and movements of sport fish during both juvenile and adult life stages and identify interactions between fish populations and water quality relative to the influence of tributary streams.

Some of the above mentioned activities will be studied under continued redirection of department effort to the Clark Fork River. New funding will probably be required to complete portions of the comprehensive evaluation. Although the comprehensive evaluation cannot be completed in the short time frame required for the Champion Environmental Impact Statement, the data collected to that date will be made available and used.

Outline
Middle Clark Fork River Fishery Monitoring Study

I. Assessment of Influences of Pulp Mill Effluents on Trout Population Characteristics Including:

1. Number and Biomass (pounds) of Trout/Mile
2. Trout Species Compositions

3. Condition Factors
4. Growth Rates
5. Age Structure
6. Mortality Rates

Method: Fish are being sampled with boom suspended electrofishing apparatus and estimates are being made using a mark/recapture technique.

II. Assessment of Influences of Pulp Mill Effluents on Trout Reproduction. Bioassay of brown trout egg and sac fry survival in the intergravel environment. Intergravel water quality parameters of possible concern which could be influenced by pulp mill waste products include dissolved oxygen, pH, ammonia and fine sediments. Bioassay sites include:

1. Council Grove Site - just upstream from Champion effluent
2. Champion site - immediately downstream from Champion effluent
3. Cyr site - downstream from the end of the pulp mill effluent mixing zone (about 25 miles downstream from the mill)

Method: Trout egg and fry survival are being monitored with fiberglass screen egg bags placed in the intergravel environment and with fry emergency traps placed over redds. Intergravel water quality samples are being collected using standpipes. Stream substrate samples are being collected using a McNeil core sampler.

III. Assessment of the Potential Influence of Toxic Heavy Metals on Aquatic Biota. Crayfish were chosen as an indicator organism because their movements are confined to a relatively small area. Toxic metals concentrations in crayfish exoskeletons may prove to be a good integrator of past history of exposure of an indicator organism to metals. Sampling locations for crayfish include below Milltown Dam, below the Missoula sewage outfall, below the Champion outfall, in the Bitterroot River (control), near Superior, below the Flathead River, below Thompson Falls Reservoir and below Noxon Reservoir.

IV. A more comprehensive evaluation of the Clark Fork River system which cannot be accomplished within the scope of ongoing studies is needed. The comprehensive study should include quantification of upstream flow requirement for sport fish in the river as well as major tributaries, expand sampling to below the confluence of the Flathead River, assess seasonal and temporal distribution and movements of sport fish during both juvenile and adult life stages and identify interactions between fish populations and water quality relative to the influence of tributary streams.

Preliminary Findings

1. Fifteen species representing six families of fish are found in the middle Clark Fork River between Milltown Dam and the confluence of the Flathead River (Table 1). Rainbow trout provide the bulk of the sport fishery along with a few brown, westslope cutthroat and bull trout.

2. Brown trout egg survival rates were lower at sites 2 and 3, Champion and Cyr, downstream from the pulp mill effluent than at site 1, Council Grove, and upstream control (Tables 2 and 10).

3. Lower egg survival rates occurred at Champion and Cyr even though measured gravel permeabilities were consistently higher at these sites compared to the control (Table 5). If other factors remain constant, higher permeability should enhance egg survival by increasing the rate of oxygen supply to incubating eggs.

4. Measurements of apparent velocity in the intergravel environment were very limited. However apparent velocities monitored at each bioassay site from late February through early March indicated intergravel apparent velocity as highest at Cyr, lowest at Champion and intermediate at Council Grove (Table 4). Considerable difficulty was encountered in developing reliable techniques for measuring apparent velocity in the intergravel environment of the middle Clark Fork River. This accounts for the limited number of measurements made during the brown trout incubation period in 1984-85. Field experiments indicated standard standpipe methods for measuring apparent velocity were unsuitable for use in the Clark Fork because groundwater does not flow parallel to surface water. This violates a basic assumption for standpipe methods that groundwater does flow parallel to surface water. To replace standpipes, a variety of sizes and types of seepage meters were constructed and tested to measure apparent velocity. The limited findings in Table 4 are based on measurements of apparent velocity from these seepage meters.

5. If other factors remain constant, higher apparent velocity should enhance egg survival by increasing the rate of oxygen supply to incubating eggs.

6. Dissolved oxygen concentrations in the intergravel environment ranged to considerably lower levels at Champion and Cyr than at Council Grove (Table 7). Low dissolved oxygen concentrations in the intergravel environment can reduce trout egg survival rates during the incubation period.

7. Substrate composition was most favorable for egg survival at the Champion bioassay site (Table 14).

8. Dissolved oxygen concentration, permeability, apparent velocity and substrate composition interact to influence trout egg survival in the intergravel environment.

9. Preliminary observations suggest concentrations of cadmium and zinc in the intergravel environment are not high enough to adversely affect trout egg survival rates (Table 8). Additional monitoring of copper and iron concentrations in the intergravel environment is needed to determine whether levels are high enough to influence trout egg survival rates (Glenn Phillips, Montana Department of Fish, Wildlife and Parks and Gary Ingman, Montana Department of Health and Environmental Sciences, personal communication).

10. Preliminary observations indicate concentrations of ammonia in the intergravel environment are not high enough to adversely affect trout egg survival rates (Table 8) (Glenn Phillips, Montana Department of Fish, Wildlife and Parks, personal communication).

11. Water depth and velocity remained within acceptable criteria for brown trout egg survival during the incubation period (Table 3 and Figure 1).

12. Embryo development was slower at the Champion and Cyr sites than at Council Grove (Table 10). By mid-March, 1985, the eyed egg bioassay was developed to 97.8 percent sac fry at Council Grove compared to 53.7 and 49.1 percent sac fry at Champion and Cyr, respectively.

13. Elevated concentrations of sodium and chloride ions in water samples collected from the intergravel environment at Champion and Cyr suggest Champion effluent affects intergravel water quality for a distance of at least 25.6 miles downstream from the effluent discharge (Table 9).

14. Limited electrofishing surveys indicated young-of-the-year trout were relatively more abundant in the Milltown and Superior study sections than in the Missoula and Huson sections during late summer of 1985 (Table 11).

15. Preliminary estimates of catchable rainbow trout in four study sections of the Clark Fork River are shown in Table 12. Rainbow trout provide the bulk of the sport fishery in the middle Clark Fork River. While the Clark Fork roughly doubles in size between the Milltown and Superior study sections, preliminary estimates indicate trout populations do not increase at this same magnitude. Locations of the trout population estimate study sections are shown in Table 13.

<u>Summary</u>

Fishery studies conducted to date on the middle Clark Fork River suggest Champion effluent affects intergravel water quality for a distance of at least 25.6 miles downstream from the discharge. Findings from a field bioassay indicated brown trout egg survival rates were lower at sites immediately downstream and 25.6 miles downstream from the pulp mill effluent than at an upstream control. Brown trout embryo development was also significantly slower at sites downstream from the pulp mill effluent than at the upstream control.

Intergravel water quality will be monitored by the Department of Fish, Wildlife and Parks (DFWP) at eight study sites on the Clark Fork River during the brown/rainbow trout incubation period in 1985-86. In addition to the Council Grove, Champion and Cyr bioassay sites established in the fall of 1984, intergravel water quality will be monitored at sites near Milltown Dam, in the main channel of the Clark Fork River near Council Grove, near the Erskine Fishing Access (several miles downstream of the Champion effluent discharge and within the mixing zone), near Huson (below the Champion mixing zone) and near Superior (also below the Champion mixing zone). This will provide a total of three monitoring

sites upstream from the pulp mill effluent discharge and five downstream from the discharge.

Intergravel water quality parameters which will be monitored during the brown/rainbow trout incubation period in 1985-86 include total recoverable concentrations of iron and copper, total hardness, total alkalinity, pH, water temperature, dissolved oxygen, conductivity, total suspended solids, volatile suspended solids and concentrations of chloride, sodium, calcium and magnesium. The intergravel studies are being conducted to continue to evaluate environmental factors potentially affecting trout egg survival rates in the Clark Fork River and to more accurately assess potential direct to indirect effects of Champion effluent discharge on trout reproductive success.

Even though the Clark Fork River approximately doubles in size between the Milltown and Superior study sections, preliminary estimates made during 1984-85 indicate trout populations do not increase at the same magnitude. DFWP will estimate trout populations in the Milltown, Missoula, Huson and Superior sections in 1986 to monitor population changes compared to earlier baseline estimates. Environmental factors potentially influencing trout population characteristics in the four study sections will also be assessed. Factors such as stream gradient, channel development, water temperature and water chemistry will be measured to aid in evaluating differences in population characteristics between study sections and to continue to more accurately evaluate whether trout population characteristics are affected by Champion effluent discharge. The Milltown and Missoula sections are located upstream from the Champion effluent while the Huson and Superior sections are located downstream from the Champion effluent and downstream from the effluent mixing zone.

DFWP will conduct electrofishing surveys in 1985-86 to document species of nongame and forage fish present and their relative abundance in the Milltown, Missoula, Huson and Superior study sections. Forage fish are important constituents in the diet of trout, particularly brown and bull trout. The surveys will aid in beginning to identify potential differences in trout food supply between the sections and in evaluating whether the trout food supply is affected by Champion effluent discharge.

Potential impacts of year round discharge of pulp mill effluents on trout populations and the sport fishery of the middle Clark Fork River represent a legitimate public concern. Additional time is needed to adequately assess potential impacts of year round discharge on trout reproductive success, trout population characteristics, trout food supply and sport fishing success rates. A minimum of five years will be required for a reliable assessment of these impacts.

2. DHES Commentary

The following comments are directed at the trout egg bioassay, its general design, the conditions under which it was carried out and the study findings.

a. There is no evidence to date of widespread trout spawning activity in the mainstem of the section of Clark Fork examined, either upstream or downstream of the Champion mill, with the exception of a side channel located at the Council Grove control site (Rod Berg, personal communication; Greg Munther, personal communication and statements to the Champion Technical Advisory Committee, January 8, 1986). It may be that the vast majority of mature trout seek tributaries for spawning, due to a predominantly large-sized stream bed material in the main river which is not conducive to successful redd construction. If that is the case, the experimental results might have little bearing on trout recruitment and trout populations in the Clark Fork.

b. The Council Grove site may not be a representative control in which to compare conditions at the two downstream sites. Because the Council Grove area is the only known heavily used mainstem trout spawning site in the study reach, conditions there may be unique and for some reason highly supportive of successful spawning. The site has been shown to be an area of active, high volume groundwater recharge (spring activity) to the river. The recharge water also appears to be naturally high in dissolved oxygen, a factor which would favor egg survival and development. Although the two downstream sites also appear to be recharge areas (Rod Berg, personal communication), dissolved oxygen concentrations may be naturally lower due to a predominance of deeper groundwater containing little or no dissolved oxygen. Also, water temperatures in the intergravel environment at each experimental redd location were not given in the status report. If the considerable spring activity at the Council Grove site resulted in a more stable or higher mean water temperature, egg development could have been enhanced. Brown trout embryo development rates were highest at the Council Grove site.

c. Freeze up problems occurred at experimental sites 2 and 3 downstream of Champion during sustained subzero weather in winter 1984-1985. Water depths and current velocities in the river at the experimental redds were severely reduced as ice choked off the river flow. The side-channel at site 2 was completely blocked off on one occasion. Although it was not mentioned in the status report narrative, the survival of eggs in the green egg experiment was strongly influenced by ice problems at the sites downstream of Champion.

d. The fishery study status report indicates that intergravel water quality is affected by the Champion wastewater discharge at least 25.6 miles downstream. Further, a correlation is implied between wastewater discharge-induced changes in water quality and the observed reduced survival and development rate of brown trout eggs.

The first conclusion is based on measured increases in the concentrations of sulfate, chloride and sodium ions in intergravel water from above to below Champion. These constituents are not of concern from a toxic or deleterious standpoint. They are merely used as tracers or indicators of the relative dilution of the Champion wastewater, since the wastewater is relatively high and the river relatively low in the concentrations of these constituents. Data for the side-channel experimental redd location at site 2 (Marcure Slough) are conclusive. Sulfate, chloride and sodium concentrations were well above those measured at all other sites, including a location less than 50 feet away in the main river channel. This is not surprising since the side channel at site 2 is in the direct zone of influence of active seepage from Champion storage ponds located immediately adjacent to the site. Data for site 3, 25.6 miles below Champion, are inconclusive. While there appears to be a slight increase in the concentrations of the three ions in the intergravel water at site 3, it cannot be directly tied to the influence of the Champion wastewater. On the two occasions that common ions were measured (March 5 and April 2, 1985), the dilution of Champion wastewater to river water was 2829:1 and 2208:1, respectively. At these high dilution rates, increases in the concentrations of the three ions as a result of the discharge would not have been measurable. Many factors could be responsible for the slight changes which were seen, including the influence of local groundwater upwelling and the possibility of some indirect effect of the Champion wastewater. However, there is no direct evidence that the Champion discharge or the zone of groundwater contamination has affected intergravel water quality or egg survival 25 miles downstream. Also, DHES study results to date do not indicate any parameter or condition associated with the Champion wastewater discharge which would appear to be responsible for a reduced intergravel dissolved oxygen concentration. As has been mentioned earlier in this addendum, both the DFWP and DHES are pursuing further experimentation which will shed more light on questions raised by the egg bioassay results.

Rainbow Trout Chronic Toxicity Bioassay

From May 13 to June 12, 1985, personnel from EPA Region VIII, the National Enforcement Investigations Center, EPA Montana Operations Office and the DHES conducted a 30-day chronic bioassay of juvenile (button-up stage) rainbow trout exposed to dilutions of Champion wastewater.

The life stage of trout used was recommended as potentially the most sensitive to the effects of kraft mill effluents. The fish were at the stage where the larval egg sac has been completely absorbed and active feeding begins. Mortality, growth and condition of the test fish were determined following exposure to wastewater and river and well water dilutions ranging from 50:1 to 500:1. The minimum amount of dilution the wastewater receives in the Clark Fork is 200 parts river water to one part wastewater or 200:1. Control groups of fish were held in both 100 percent river water and well water. The complete report on these tests appears in Volume I of the Data Report and a summary of findings is given here.

An unfortunate event interrupted an otherwise problem-free study. On day 12, a drain system evacuating test water from each of the aquaria became clogged. As a result, volumes of test dilutions delivered to the aquaria were not drained. The aquaria finally filled and overflowed into the temperature control bath. As this was occurring, test fish from some aquaria escaped into the bath and finally mixed with fish in other aquaria. Consequently, some aquaria (where mixing of fish occurred) could not be used in the analyses and others had reduced numbers of fish.

Mortality of fish during the test was extremely low in both river water and well water dilutions. The percentage of deaths was 10 percent or less in the dilutions of river water, and 8.75 percent or less in the well water dilutions. No fish died in the well water dilutions during the last nine days of the test, and only one died in the river water dilutions in the last ten days. Approximately half of the fish that died during the first 20 days of the test were recorded as "pinheads" or non-feeding larvae. A condition factor (or condition coefficient) was determined by dividing the wet weights of test fish by the lengths. Significant differences occurred between several groups and the controls. However, there was no clear dose response relationship with wastewater dilution. In most cases, fish were larger in the groups exposed to river water dilutions than in groups exposed to the well water dilutions.

The study results do not indicate chronic or acute toxicity problems associated with the Champion wastewater, even at concentrations four times higher than those ever expected to occur in the river. The researchers concluded that "there are no data in this study that suggest the current permit limits or conditions should be changed for Champion International." However, some reviewers have suggested that the upset on day 12 invalidates the study and necessitates a rerun. Others have expressed concern over the possibility of effects on aquatic life in the river over exposure periods greater than 30 days. These are valid concerns and the DHES intends to do further work in this area as resources permit. The proposed activities have been outlined in the monitoring section of this addendum and include a repeat of the 30-day bioassay and investigations into long term toxicity and bioaccumulation.

<u>Hydroelectric Facilities and the Clark Fork Fishery Below the Flathead River</u>

The DHES has received several comments from individuals who perceive the abundance of northern squawfish and a paucity of game fish in the lower Clark Fork River and mainstem impoundments as the result of wastewater discharges and deteriorating water quality. However, a review of the available literature indicates that 1) squawfish have always been abundant in the system and 2) the presence and operation of hydroelectric dams on the lower Clark Fork and Flathead Rivers are the major factors preventing the establishment of a healthy sport fishery.

In a paper entitled "Past, Present and Future Fishery Management in Cabinet Gorge and Noxon Rapids Reservoirs", which was presented at the Clark Fork River Symposium held in Butte in April 1985, Scott Rumsey and Joe Huston compare fish population trends in the reservoirs from 1953 to 1983.

Prior to the construction of Cabinet Gorge Dam (and Champion International), the section of the Clark Fork between Lake Pend Oreille in Idaho and Thompson Falls Dam in Montana provided spawning, rearing and resident habitat for numerous fish species. Bull trout, cutthroat and kokanee salmon (during spawning runs) were common, while squawfish, suckers and mountain whitefish were abundant. Following the 1952 construction of Cabinet Gorge Dam, which blocked the movement of fish between Lake Pend Oreille and the river in Montana, gill net surveys conducted in 1955 on the newly formed Cabinet Gorge Reservoir indicated extremely low numbers of game fish. Suckers and squawfish dominated the catch. The Frenchtown Mill was still not in existence.

Prior to the completion of Noxon Rapids Dam, the Clark Fork was chemically treated from Thompson Falls Reservoir to Cabinet Gorge Dam in 1958 in order to eradicate undesirable rough fish species thought to compete with game fish. Although success of the treatment was considered to be limited, the attempted eradication was equally effective on the river's game fish population. In a three year period from 1959 to 1961 over three million rainbow trout were planted in Noxon Rapids and Cabinet Gorge Reservoirs. As a direct result, the rainbow fishery flourished briefly during those years. Subsequent heavy plantings failed to be effective and poor survival was suspected. Since that time, the establishment and maintenance of a satisfactory sport fishery has been largely unsuccessful. The lower river-reservoir fishery today consists of whitefish, brown trout, bass, bullheads, pumpkinseeds and shiners, which are common, while squawfish, suckers, peamouth and perch are abundant.

The absence of a healthy sport fishery in the lower Clark Fork River and mainstem reservoirs has been attributed to seasonal water level fluctuations, changing flow regimes through the dams, rapid reservoir exchange rates and limited productivity. John Fraley, in an article entitled "Fish, Wildlife and Hydropower: Researching a Balance in Western Montana" (Western Wildlands Winter 1986) describes the problems for fisheries associated with a multi-reservoir, multi-ownership power system, such as that on the Columbia River drainage. In the spring of 1985, "power demands at downstream projects called for drawdown of Noxon Reservoir under terms of a Northwest Power Pool agreement. The rapid water level drop stranded many fish, especially bass, which had begun to establish a viable population. Obviously, although the Fish and Wildlife Program specifies that steps be taken to improve the fishery in the lower Clark Fork reservoirs, planning is in the early stages." The Fish and Wildlife Program referred to is the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, a federal program designed to accomplish the restoration of natural resources damaged by hydropower development. The program includes an annual $1.5 million allocation to the Montana DFWP for fisheries and wildlife projects on the Flathead, Kootenai and Clark Fork River systems.

To summarize, the fishery of the Clark Fork River system below the Flathead is highly dependent on the operation of hydroelectric facilities in the basin. DHES studies have not identified any water quality parameter in the river-reservoir system below Thompson Falls which would preclude the successful development of a healthy sport fishery. Wastewater discharges in the Missoula area are not a likely cause. The future may be somewhat brighter with the recent announcement by the Washington Water Power Company (WWP) that they will keep Noxon Rapids Reservoir within 10 feet of full pool to help protect the area's fishery. The agreement between WWP and the DFWP is designed to avoid a repeat of the damage wrought by a 30-foot plus drawdown last spring that DFWP officials say devastated fish and insect populations and ruined years of fishery work. WWP also has agreed to limit drawdowns to four feet between May 15 and September 30, which is the critical time for spawning and young fish. However, the agreement is non-binding and the company will abide by it only as long as energy demands don't increase dramatically and severe droughts are not experienced. Joe Huston of the DFWP states that the reservoirs will never have an excellent fishery, but that Noxon Reservoir can support reasonable populations of bass, burbot, perch and some trout. He added that most improvements in the reservoirs fishery over the years would be erased by an occasional sharp drop in water level.

Recent Fisheries Studies of the National Council of the Paper Industry for Air and Stream Improvement (ncasi)

In 1980, the ncasi initiated a series of major aquatic biology field investigations. The objectives of these efforts are to provide a basis for estimating the concentration of kraft mill effluents that would not be expected to directly or indirectly decrease the production of fish. One of the studies, which may relate to the Champion situation, was a cold water fisheries research project conducted by Timothy J. Hall, who is a member of the Clark Fork Technical Advisory Committee. His work at Lewiston, Idaho involved artificial stream channels which were supplied with a mixture of Clearwater River water and biologically treated kraft effluent from the Potlatch Mill. The following summary of his findings covers study years 1983-1984 and was taken from ncasi technical bulletin no. 474, "Effects of Biologically Treated Bleached Kraft Mill Effluent on Cold Water Stream Productivity in Experimental Stream Channels - Fourth Progress Report", November 1985.

A comparison of the chemical and physical characteristics of the Champion and Potlatch effluents indicate some differences in quality (Champion effluent lower in color, higher in resin acids, BOD and TSS). Similarly, the Clark Fork system may be more or less sensitive to kraft mill wastes than the Clearwater River-fed test streams. However, the ncasi study results provide some guidance concerning potential problem areas which should be examined further in the Clark Fork system.

Two test stream channels were dosed with a sufficient quantity of the kraft effluent to add an increment of 2.0 mg/l BOD_5 to the streams representing 5.1 percent waste by volume. This also represented an incremental addition of 3.5 mg/l suspended solids, about 230 units of color, 10.0 micrograms per liter (ug/l) of organic resin acids and 16.4 ug/l chlorinated phenols. The physical and chemical characteristics, condition of the periphyton and macroinvertebrate communities, rainbow trout production and histopathology and the in-gravel incubation of coho, chum and chinook salmon eggs in the test stream channels were compared over the course of a year to control channels receiving only river water. Long-term early life stage bioassays of the three species of pacific salmon were also conducted during the investigation using kraft effluent dilutions ranging in strength from 5.6 to 100 percent.

The study conclusions are summarized by category:

1. Effluent additions to the streams resulted in the previously mentioned increases in concentrations of chemical constituents and suspended solids. Mean water temperatures in the treated streams were also slightly higher, dissolved oxygen concentrations slightly lower and there was a significant reduction in photosynthetically active radiation (or underwater light transmittance). Biologically significant increases in soluble reactive phosphorus concentrations were also noted.

2. Periphyton production on artificial substrates, when measured as chlorophyll _a_, was generally greater in control streams than in treated streams. Although nutrient concentrations in the treated streams were higher due to effluent additions, biostimulation was controlled by the

reduced light availability due to the influence of effluent color. Periphyton biomass production measurements indicated a tendency toward greater biomass in the treated streams due to the development of a heterotrophic (consumer-type, non-photosynthetic) community.

3. Macroinvertebrate biomass, abundance and number of taxa was only slightly lower in the treated streams than in the control. Species diversity was insignificantly higher in the treated streams.

4. Cumulative trout production in both treated streams exceeded that in either of the controls. However, there was no clear trend for difference in survival, average weight or growth rate between control and treatment. It was concluded that there was no indication of any deleterious effect on trout production at the effluent exposures tested.

5. Intergravel incubation of coho, chum and chinook salmon eggs indicated a lack of significant differences in survival rate to hatching or any differences in the weight of larvae between control and effluent treated streams.

6. The extended early life stage egg/larval bioassays of the three species of salmon indicated greater than 50 percent survival from the eyed egg stage to hatching at the 100 percent effluent test concentration. Longer term exposure from eyed egg through to hatch, button-up and to seven to eight weeks of feeding and growth indicated significant reduction in growth at effluent concentrations of 5.6 percent (the lowest tested) or greater.

7. Results of the rainbow trout histopathology study, following nearly a year's residence in the test streams, did not indicate any effluent related differences between control and treated fish. The investigation included evaluation of 20 different tissues from a large number of control and treated fish. Lesions and abnormalities, when they did occur, were predominantly parasite-induced and not related to effluent exposure.

The ncasi report mentions three similar studies which were conducted earlier, but which used lower effluent concentrations in the test streams (0.5, 1.0 and 1.5 mg/l BOD additions as opposed to 2.0 mg/l in this study). Results of those tests were similar in many respects and slightly different in some areas. These results represent the highest kraft mill concentrations comprehensively tested to date by the council. They are significant in view of the minimum of problems documented, even following continuous exposure of test organisms up to nearly one year at effluent concentrations much higher than those found in most receiving waters. The experimental conditions represent approximately 10 times the maximum effluent concentration expected to occur under any conditions in the Clark Fork downstream of the discharge from the Champion mill.

ECONOMICS

Economic benefits are derived from the recreational use of the lower Clark Fork River; however, there has not been a concerted effort to specifically relate the variety and quantity of these uses to actual economic gain from the Missoula area to Lake Pend Oreille.

The fact that there is little information relating to the economic benefits of recreation in the lower Clark Fork drainage doesn't mean it is not an important consideration. Like recreation in general throughout Montana, it is a contributing factor in local and regional economies.

In an effort to find substantive information concerning the importance of these pursuits in the lower part of the river basin, a number of sources were queried. They included: the Fisheries and Parks Divisions of the DFWP, Montana Promotion Division of the Department of Commerce, School of Forestry at the University of Montana, members of the Clark Fork Coalition, Mineral County government and the Bureau of Business and Economic Research, also at the University of Montana.

Although the investigation revealed there has not been a definitive study of the economic importance of recreational activities along the lower river, the investigation did reveal a variety of related information.

The DFWP has made attempts to determine the value of outdoor recreational activities throughout the state. In most studies, no dollar figures have been derived, however in an update of an earlier report, John Duffield, PhD, University of Montana, said that in constant 1984 dollars, the estimated annual value of recreation on the Upper Clark Fork River in 1978-1979 was $300,000 to $470,000. Duffield's report, entitled "Refinement of Recreation Value Estimates on the Upper Clark Fork River," included recreational use on the mainstem of the Clark Fork from Warm Springs Creek to Milltown. The study added that a more preliminary estimate of the annual value generated by use of Rock Creek, upstream from Milltown, was $945,000 to $1,590,000.

Duffield noted that the figures are "conservative" based on similar, more extensive studies done for recreational use on the Flathead River and Flathead Lake and Kootenai Falls and nearby China Rapids on the Kootenai River.

Although nothing like the Duffield study has been done for the lower Clark Fork River, DFWP has attempted to determine the amount of use by the public.

In a report released in January, 1986 titled The Montana Outdoor Recreation Needs Survey, done for the DFWP by Jeffrey Frost and Stephen McCool of the University of Montana's School of Forestry, information was gathered to help the department assess the recreational needs of the state's residents.

In terms of identifying recreational uses, the majority of the information relates to broad regional categories (DFWP divides the state into seven regional management areas). Most of the Clark Fork River is in Region 2, however, the reach of river from the mouth of the Flathead River to the Montana/Idaho border, is in Region 1.

The report presents the results of a randomly selected sample of 1,169 persons contacted throughout the state by telephone. The survey consisted of questions about the respondent's recreation behavior and preferences.

In the area of water sports, fishing proved the most popular in Regions 1 and 2, but there was no further delineation of which streams or lakes were the most popular.

One section in the report was devoted to river rafting. The report noted that this sport experienced rapid growth throughout the nation in the last 20 years, and was particularly suited to Montana due to the state's many miles of streams and rivers.

When asked which rivers respondents floated most often, the Clark Fork ranked fifth, behind the Yellowstone, Missouri, Madison and Bitterroot rivers. By far, the most important reason for floating a river was the availability of access, a distant second was fishing opportunities.

Most floaters said the river they floated the most often was their favorite (51 percent), however of those who liked other rivers better (32 percent), the popularity rankings changed, moving the Clark Fork to fourth place and dropping the Bitterroot into a tie with the Big Hole and North Fork of the Flathead rivers.

The DFWP's Fisheries Division is also involved with determining the use of various stream-segments throughout the state. The most recent figures for fishing in the lower Clark Fork are for 1984, and indicate the following:

Location along the Lower Clark Fork	Fisherman Days/Year
Bitterroot River to Superior	26,643
Superior to Siegel Creek	18,270
Siegel Creek to Flathead River	1,538
Flathead River to Thompson Falls Dam	9,898
Thompson Falls Dam to the old Highway 10A (Byrdland) Bridge	1,230

Although the information generated by the DFWP provides a perspective for the type and amount of use, the question of relating dollars to the recreational activities remains undetermined for the lower Clark Fork.

In discussing the economic assessment of tourism, the Bureau of Business and Economic Research points out that estimating labor income is difficult because the information is not available on a regular basis. The tourist and recreation industry is made up of portions of a number of trade and service activities, and is not an industry defined by the Standard Industrial Classification Code.

A report prepared by Richard Dailey, professor of management, University of Montana, in 1984 estimated that the total labor income generated by all expenditures of nonresident tourists in Montana in 1983 amounted to $127 million. The total labor income generated by resident tourists in Montana amounted to $98 million. Total labor income from travel was approximately $225 million.

Resident travel is not part of the state's economic base. However, expenditures by residents from other parts of the state do contribute to western Montana's economic base.

Dailey estimated that 6.6 percent of all travel-related employment in Montana in 1983 was in Missoula County. Less than one percent was located in Mineral and Sanders counties.

Based on a liberal interpretation of labor income generated by all travel activities--resident and nonresident business and recreational travel--in 1983, travel income would be \$19.4 million (.066 + .01 + .01 = .086 x \$225 million). The residential and nonresidential recreational travel would be some portion of the \$19.4 million.

For a point of comparison, the percentage of the \$19.4 million estimate devoted to recreational travel for the three counties could be compared to the \$28.6 million in labor income generated by the Frenchtown mill in 1983.

In an attempt to broaden its economic base, Mineral County has been involved in several studies within the last ten years aimed at generally defining areas for potential growth. Recreation has been identified as one of the possible growth areas.

Although the studies identified outdoor recreation potentials, the scope of the studies remained general, and didn't narrow to surveys that defined most popular types of recreation, frequency, income generated, types of people participating, age groups and business directly and indirectly effected. However, the fact that the studies occurred indicates the county's interest, which in the future may lead to more detailed research.

An interesting aspect of the investigations that have been done to date on the economic benefits of tourism, outdoor recreation and real estate values as they all relate to the lower Clark Fork River is the question of the "quality of life."

University of Montana Professor Tom Power touched on this consideration in a 1983 article in Western Wildlands. He said:

> Money income alone is not an accurate measure of economic well-being, and economics is more than the study of dollar flows and relationships. Some of the real goods and services available to individuals cannot be bought and sold on the market, and it is difficult, if not impossible, to define their monetary value...The natural environment or the larger society still furnishes many important goods and services. These include clean air and water, unspoiled recreational opportunities, security from violence and crime, beautiful landscapes, a rich and varied culture and stable, attractive communities.

Certainly all the communities along the lower Clark Fork have a vested interest in maintaining a clean and healthful environment. Not only does it benefit fishing and floating guides and outfitters, it also serves as a means for attracting new businesses, as well as providing existing businesses with benefits to keep competent, conscientious employees. Meeting established standards for maintaining environmental health considerations and working for future improvement are means for communities and businesses to express support for this consideration.

The economic importance of recreation and tourist related activities in the lower Clark Fork is currently one of contribution rather than dominance. It does not rival, say, the timber industry or government employment. However, it is a part of local and regional economies, and is perceived by some to be a growing segment. The ingredient it needs most to exist and grow is to continue to maintain or improve the natural environment in the Clark Fork Basin by the persons, communities and businesses that use the region's natural resources.

ALTERNATIVES

The proposed agency action that initiated review under MEPA is the reconsideration of the existing MPDES permit for Champion International Corporation's Frenchtown Mill. Champion's present MPDES permit was last modified by the DHES on April 6, 1984 to allow for direct discharge of treated wastewater into the Clark Fork River at times other than during spring runoff. As a result of this modification, the length of the permit was shortened and an intensive study of Clark Fork River water quality was undertaken to try to determine any adverse effects of the discharge on the river.

While some DHES alternatives to the proposed action can be listed, it should be made clear that the DHES alternatives apply to permit decisions, not treatment alternatives. The DHES can only dictate the quality of the discharge to whatever level is necessary to fulfill nondegradation, water quality standards, and effluent guidelines requirements. The DHES cannot dictate treatment alternatives or methodology used in reaching the end result.

Presentation of Alternatives

Alternative 1) Deny issuance of any permit.

A) Summary of impacts--Champion would be required to develop a wastewater treatment system that did not include direct surface discharge or cease operations. The Clark Fork River would receive treated wastewater through seepage only.

B) Benefits--The discharge of wastewater to the Clark Fork would be reduced. The cessation of direct wastewater discharge would reduce the potential for any deleterious effects on aquatic life and reduce the potential for eutrophication of the lower river and Lake Pend Oreille. Recreational users of the river might perceive some aesthetic improvement from reduction in river color and foam, especially in the existing pollutant mixing zone, although impacts from seepage would continue.

C) Costs--Champion would be required to develop a new wastewater treatment system; however, physical, technological, and financial limitations would probably preclude the development of a no-discharge or seepage-only system so the mill would have to close. The adverse impacts to the dependent economy in western Montana are adequately documented in the DEIS.

D) Discussion--This alternative would only be selected if it was clear that any surface discharge would violate water quality standards. The water quality information currently available indicate that such measures are unwarranted.

Alternative 2) Renewal of the permit for five years with existing conditions and limitations.

A) Summary of impacts--This alternative would allow continued discharge of the effluent levels permitted since 1984, including direct discharge of effluent to the river whenever river flows exceed 1900 cfs and color and DO conditions can be met instream. No adverse impacts to the river were conclusively demonstrated in a two-year study, but some uncertainties remain relative to foam, nutrients and bioaccumulation of toxic compounds. Permitted levels of TSS discharged would equal four million pounds annually. Operational costs of the wastewater treatment system would remain at the current level. Recreational use of the river would be expected to continue as it has in recent years.

B) Benefits--Less DHES administrative time is required for reviewing and reissuing longer term permits than for permits of shorter duration. (MPDES permits are normally issued for a five-year period unless conditions warrant a shorter period of time.) Stability of permit conditions for five years allows Champion to make longer term commitments to facility improvements which might affect the quality of the discharge. More time would be available for continued collection and analysis of river data before the next official permit review; additional data will be available from Champion's self-monitoring, DHES compliance monitoring and instream water quality studies.

C) Costs--No requirements would be imposed to improve any components of Champion's discharge. Any impacts to the river that were not identified during the previous intensive water quality study would continue.

D) Discussion--Other than the required monitoring noted above, the conduct of additional studies and the acquisition of additional data would depend on availability of resources. Although under this alternative the permit would not be officially reopened for review until five years passed, it is important to note that a permit may be modified at any time studies reveal instream water quality problems.

Alternative 3) Renewal of the permit for five years with additional conditions to require a study of nutrients and foam sources within the plant followed by development of a contingency plan to reduce nutrients and foaming agents in the discharge if necessary.

3.1) Study the use of nutrients in the wastewater treatment system and determine minimum levels for effective wastewater treatment; evaluate methods to reduce nutrient use and nutrient discharge from the treatment system; and develop and implement a plan to achieve minimum nutrient discharge.

A) Summary of impacts--The summary of impacts presented under Alternative 2 generally applies to this alternative. When future study results are implemented, operational costs to Champion could either increase or decrease depending on the technology or process selected to achieve nutrient reduction.

B) Benefits--The findings of the study could lead to reduced nutrient loads in Champion's wastewater discharge and in the Clark Fork River. These loads were found in 1984-1985 to contribute approximately 12 percent of the nitrogen and 20 percent of the phosphorus found in the river below the Champion mill. A reduction of nutrients in the discharge would lower the of nutrients contributing to potential eutrophication of downstream lakes and reservoirs.

C) Costs--Champion would incur increased costs to study its nutrient management system and to develop and implement a plan to reduce nutrient loading.

D) Discussion--Nutrients reach the river from a variety of sources, both point and non-point. It is doubtful that a reduction of nutrients in the Champion discharge would, by itself, result in a major reduction in algal growth in the river. The water quality information currently available does not support the contention that nutrient contributions from Champion are responsible for nuisance algal growth or lowered DO levels, but given that algal mats do periodically appear in the river below the mill, a reduction in nutrients could help alleviate this condition. Reducing the amount of nutrients used within its water treatment system would also lower Champion's operating costs.

3.2) Study the origin and management of foam-generating compounds in mill processes; evaluate methods to reduce the amount of these compounds in Champion's wastewater discharge, and develop and implement a plan to reduce discharge of foam-generating compounds.

A) Summary of impacts--The summary of impacts presented under Alternative 2 generally applies to this alternative. In the future, when study results are implemented, operational costs to Champion could either increase or decrease depending on the technology or process selected to reduce the discharge of foam-generating compounds.

B) Benefits--The findings of the study could lead to a reduced discharge of foam-generating compounds from the Champion mill. This would reduce the quantity of foam in the river, although foam from other sources, both natural and man-caused, would still be present. The aesthetics of recreational use of the river would improve, though it is difficult to project whether actual recreational use of the river and related income will increase.

C) Costs--Champion would incur increased costs to study the origin and management of foam-generating compounds and develop and implement a plan to reduce the discharge of these compounds if necessary.

D) Discussion--Montana Water Quality Standards do not include specific limits for foam. While it is not practical to limit foam by numerical values, implementation of in-plant foam reduction measures may result in less visible foam on the river. Foam will never be totally eliminated on the lower Clark Fork or any other river since it occurs naturally.

3.3) Study the impacts of nutrients on the ecology of the Clark Fork River.

A) Summary of Impacts--The impacts identified in Alternative 2 would generally apply to this alternative.

B) Benefits--A detailed nutrient study could help resolve uncertainties about how nutrients affect the ecology of the Clark Fork River, instream reservoirs and Lake Pend Oreille. Findings from this research could provide a basin information base that could be considered in future decisions about discharge permits and land management activities.

C) Costs--Champion would incur high costs to fund a comprehensive nutrient study.

D) Discussion--As previously stated, Champion is a recognized source of nutrients to the Clark Fork River, but to date nothing has shown that contribution to be responsible for nuisance algal growth or lowered DO levels. Champion should not be required to totally fund instream ecological studies of the fate of nutrients because it is only one of many nutrient contributors to what may be a drainage-wide problem.

Alternative 4) Renewal of the permit for five years with tighter controls on specific components of the discharge.

4.1) Reduce allowable discharge of TSS.

A) Summary of impacts--The summary of impacts presented under Alternative 2 would generally apply to this alternative, except as related to permitted TSS levels. TSS levels could be reduced by 50 to 80 percent, based on information provided in the Weston report. Such a reduction could be expected with the implementation of treatment technologies ranging from polymer addition to microscreening or granular media filtration.

B) Benefits--The existing TSS load to the river would be reduced and Champion would be precluded from discharging at the currently permitted four million pound annual limit. However, the detection of any instream change in TSS levels (or aquatic ecosystem impact) attributable to a reduction in Champion's TSS discharge appears to be beyond the detection limits of the existing analytical tests.

C) Costs--The Weston report indicates the range of additional costs that Champion would incur to reduce TSS in the discharge. Capital costs would range from $1.8 to $3.7 million with additional operation and maintenance costs of $220,000 to $680,000 per year.

D) Discussion--To date, nothing has shown a link between TSS and attainment of water quality standards for the river. The TSS limits are "technology based," which under EPA terminology means achievable with currently available technology. Lower limits could be characterized as arbitrary because no rationale is available on which to set a specific lower limit. The river studies have shown no adverse impacts from Champion's TSS discharge, nor have projections indicated that the maximum allowable TSS discharge will cause a problem. Also, to date, studies have not demonstrated a relationship between Champion's TSS discharge and instream DO levels.

4.2) Reduce allowable levels of BOD in the discharge.

A) Summary of impacts--The Weston report indicates that installation of an activated sludge system would result in an average 48 percent reduction of effluent BOD. Given current dilution ratios, the improvement would result in a change in instream BOD concentration of less than 0.1 mg/l. The other impacts identified in the Alternative 2 summary of impacts generally apply to this alternative.

B) Benefits--Reduced BOD levels would be expected to lessen the frequency when the river is at or near the 7.0 mg/l dissolved oxygen limit; however, the magnitude of such a change might be too small to be detectable through instream measurements.

C) Costs--According to the Weston estimates, installation of the activated sludge system would cost Champion $1.9 million and increase annual operating costs by $150,000.

D) Discussion--Up to this time, nothing has shown a link between BOD and attainment of water quality standards for the river. The BOD limits, like those for TSS, are "technology based." Lower limits could be characterized as arbitrary because no rationale is available upon which to set a specific lower limit. Studies have not demonstrated a relationship between Champion's BOD discharge and instream DO levels.

Alternative 5) Clark Fork Coalition Citizens' Alternative.

The Clark Fork Coalition developed a "Citizen's Alternative" as a comment on the DEIS, and included proposed alternative conditions to be placed in the renewed Champion MPDES permit. The alternative calls for the issuance of a five-year temporary permit, with a complete review of certain parameters in two years by the public, a technical advisory committee and the DHES. The alternative also includes recommendations for specific permit conditions. Total suspended solids would be limited to two million pounds per year, but would be calculated as a three-year running average. Dissolved oxygen changes in the mixing zone would be limited to 1.0 mg/l, with surface discharge to cease if the level reaches 7.0 mg/l. Direct discharge would also cease when instream water temperature reached 65°F. Limitations for color and BOD would be the same as in the existing permit. The source of foam would be assessed and foam control measures implemented, if necessary. Nutrient loading would be reduced to pre-1984 levels. The present mixing zone should be reassessed and adjusted as necessary. Additional instream monitoring as recommended by the Technical Advisory Committee should be conducted at Champion's expense.

The concept of a five-year permit with a review in two years can be evaluated as follows:

A) Summary of impacts--The summary of impacts presented under Alternative 2 generally applies to this alternative. When the review is performed, the permit could be "re-opened" or modified to address specific water quality impacts if indicated necessary by the review or continuing monitoring and studies. This should result in a guarantee that adverse impacts, if any, are identified in the interim and will be addressed in a shorter time frame than five years.

B) Benefits--Findings from the review could result in earlier mitigation of any previously unrecognized river impacts discovered by the review. The public would be more involved with a guarantee of input after two years.

C) Costs--Champion would be less certain that present permit conditions would continue unchanged for a full five years. If the permit were modified with additional conditions, Champion would probably incur costs to meet new conditions. Some costs to DHES would result from holding informational and review meetings after two years.

D) Discussion--In order to implement this alternative, the present Technical Advisory Committee should continue in some form, probably in a twice-yearly review of monitoring results, study findings and permit compliance. At the end of two years, DHES could publicize and hold an informational meeting or meetings and at the same time receive any additional information from the public in the form of oral or written comments relative to the review. The Clark Fork Coalition could retain some responsibility for assisting in keeping citizens abreast of new developments or progress being made through the twice-yearly technical advisory committee reviews.

DHES agrees with the concept of a five-year permit with continued monitoring and review in the interim; this alternative would add an additional public involvement feature which might not always be included in such ongoing review. Timing of the actual informational meetings could be set anytime within two to three years of issuance.

Each of the specific permit conditions listed in this alternative is discussed below:

TSS - The DHES disagrees with the interpretation that the present permit's yearly limit of four million pounds violates the nondegradation rules (see nondegradation discussion in this DEIS addendum). The TSS limit of two million pounds enforced as a three-year running average may be more palatable to Champion than a strict yearly limit. However the DHES believes that a running average is not appropriate. Such an average would still be subject to criticism on nondegradation grounds as there would be large increases in the TSS discharged in individual years. Furthermore, the federal Effluent Guidelines prohibit Champion from discharging more than four million pounds of TSS in any one year.

DO - Continuing the 7.0 mg/l discharge cutoff while adding a 1.0 mg/l maximum decrease in DO between upstream and downstream sampling points may appear to be a way to limit degradation in terms of DO. The DHES believes this reasoning is flawed for a number of reasons. First, the DO "sag" produced by Champion's wastewater has never been calculated at more than about 0.1 mg/l. Second, this assumes the maximum DO depletion due to Champion's wastewater will occur at the downstream sampling site, which seems unlikely. Third, the combination of stream travel time and diurnal DO variation due to respiration/photosynthesis/re-aeration will make it nearly impossible to sample and measure any actual DO drop due solely to Champion's waste. Because of this, Champion would appear to have a right to complain if upstream-downstream measurements of 10 mg/l and 9 mg/l forced it to shutoff discharge for no demonstrated water quality benefit. Therefore, the DHES feels a 1.0 mg/l DO maximum decrease between upstream and downstream stations would be difficult to enforce. The DHES does feel that since there is a theoretical DO depletion of up to 0.1 mg/l from Champion's discharge, possibly the DO cutoff number should be changed to 7.1 mg/l. Even though the point of maximum DO depletion would vary up and down the river and would be extremely hard to measure, this would assure theoretical protection of the 7.0 mg/l DO standard.

Discharge cutoff at 65°F - The state Surface Water Quality Standards recognize a benefit to salmonids in B-1 streams by keeping the temperature below about 66°-67°F, if possible. Small incremental increases are allowed above those levels. Degradation, however, is defined only if the instream temperature standard is violated by the discharge. This will probably prevent the DHES from prohibiting Champion's discharge at a given instream temperature if instream temperature readings show little or no increase due to the discharge.

The DHES also suspects there is a fairly close relationship among low flows (less than 1900 cfs), low DO (less than 7.0 mg/l) and high temperatures. Therefore, the temperature-stress problem due to the process water discharge may be in large part avoided by the other two cutoffs. Some additional intensive study of instream temperatures in the vicinity of Champion's discharge may be warranted.

Color, BOD - These parameters are the same as in the present permit.

Nutrients, Foam - The DEIS recognizes potential problems with both foam and nutrients, although no significant water quality response has been linked to Champion's nutrient contribution. The DHES agrees that further assessment of these problems is necessary and intends to continue instream water quality monitoring. The DHES is also considering requiring Champion to continue efforts to reduce nutrients and foaming agents in its discharge to the maximum extent practicable.

Mixing Zone - Please refer to the mixing zone discussion in this DEIS addendum.

Monitoring - The DHES agrees with the concept of continued monitoring. Champion will be required to supply instream monitoring above and below its discharge, as well as monitoring of the discharge. The DHES and other agencies will continue to perform special studies to the best of its budgetary ability. Please refer to the monitoring discussion in this DEIS addendum and the discussion of Alternative 3.3.

RECOMMENDATION

The DHES recommends a combination of Alternatives 3 and 5 be selected. The permit should be renewed for five years, but on-going technical water quality review should continue. This will make the best use of administrative time which otherwise might be needlessly expended for permit reissuance in two or three years if river water quality studies do not indicate a need for permit changes at that time. On the other hand, periodic review by the already established Clark Fork Technical Advisory Committee and a mid-term review as called for in Alternative 5, will assure that the discharge will not adversely affect water quality standards for an extended period. If the review shows it is necessary, the permit can be reopened and changed at any time to address problems with water quality standards caused by the discharge.

The current major uncertainties in water quality effects are related to nutrients and foaming agents in the discharge. Therefore the DHES recommends that additional conditions be included in the permit to require Champion to evaluate nutrients and foaming agents in the plant processes and to prepare a contingency plan to reduce nutrients and foaming agents in the discharge if necessary. At the same time these suspected problems are being studied to determine their significance to water quality, Champion will be getting a head start on fine-tuning its processes to minimize these constituents in the discharge.

To preclude the theoretical violations of the DO instream standard, the DO cutoff will be set at 7.1 mg/l.

The combination of provisions from Alternatives 3 and 5 should enable Champion to continue to operate while DHES and other concerned parties including the Technical Advisory committee, continue to survey water quality relationships in the Clark Fork River and in Lake Pend Oreille. This approach should result in continued improvement of water quality in the basin.

After the EIS process is completed, the DHES will convert the recommendations into specific limitations and conditions in a tentative permit. According to the MPDES rules, a public notice shall be circulated by the department to inform interested persons of the proposed discharge and of the tentative permit. The public will be afforded a 30-day comment period and the opportunity to comment on the tentative permit at a public hearing held in the Missoula area. Substantive oral and written comments will be considered before a final permit is developed.

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