Environment Canada | Environnement Canada

Environmental Protection | Protection de l'environnement

Mill Characterization:

MacMillan Bloedel Ltd. Alberni Division October 1973

Manuscript Report 74-8

Pacific Region

ENVIRONMENTAL PROTECTION SERVICE REPORT SERIES

Manuscript Reports are of local interest only. They describe a part of a larger program or list results only without discussion or conclusions, or in some way do not qualify for national E.P.S. publications categories.

Other categories in the E.P.S. series include such groups as Regulations, Codes and Protocols, Policy and Planning, Technical Appraisal, Technology Development, Surveillance, and Reprints of Published Papers.

Inquiries pertaining to Environmental Protection Service Reports should be directed to the Environmental Protection Service, Department of the Environment, Kapilano 100, Park Royal, West Vancouver, B.C. V7T 1A2.

MILL CHARACTERIZATION:

MacMILLAN BLOEDEL LIMITED

ALBERNI PULP AND PAPER DIVISION

October, 1973

by

William E. McLean

and

Gerald C. Tanner

Environment Canada
Environmental Protection Service
Pollution Abatement Branch
Pacific Region

Manuscript Report - 74-8
October 1974

ABSTRACT

This report was prepared from technical data provided by MacMillan and Bloedel Limited, Alberni Pulp and Paper Division. The report provides supplemental information for establishing a water pollution abatement program to meet the requirements of the Federal Pulp and Paper Effluent Regulations. The report will be used as guide when determining the progress and changes made by the mill to achieve the requirements of the Federal Pulp and Paper Effluent Regulations.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The following assessment of MacMillan Bloedel Ltd.'s Alberni Division Mill was carried out in September, 1973. This project was initiated with a number of purposes in mind. Firstly, an attempt was made to become familiar with individual mill processes in order to gain insight into sources of particular effluent streams. Also, an up-to-date inventory of sampling methods, testing techniques and abatement facilities was compiled. During this period a good working relationship was established with the mill personnel involved in water pollution abatement programs.

2. MILL DESCRIPTION

2.1 Location

Alberni Division Pulp and Paper Mill is located in Port Alberni at the mouth of the Somass River. Effluent is discharged into the head of Alberni Inlet.

2.2 Organizational Structure

Mill Manager: Mr. W.E. Hawkings
Technical Superintendent: Mr. J.A. Cochrane

The Technical Department is responsible for assessing pollution problems. Within this department, the Kraft, Wood Room Pollution Group is in charge of environmental programs. D.A. Kelly as group leader is backed up by two process engineers, one process chemist, two kraft and pollution technicians and one routine pollution tester.

2.3 Operation Information

2.3.1 Production. Alberni Division Mill began operation in 1947 as a 200 ADT/D kraft mill. Present production data is shown in Table 1.

TABLE 1: PRODUCTION

	Maximum Rating	1972 Average
Unbleached Market Pulp	309	245 ADT
Liner Board	431.9	337 (5% moisture)
Newsprint	1,354.4	1,106 (7% moisture)

2.3.2 Water Supply. Process water is piped from Sproat Lake. The intake is protected by a link belt travelling screen with 3/8 inch square openings. Water usage over 1972 averaged 67.6×10^6 USGPD or 40,000 USG per ton of product. There is no general primary treatment before use in the process. Boiler feed water, however, is prepared by passing raw water through organic traps and ion exchange resins. The resin caustic rinse and acid regeneration chemical can be reused in the system; however, it is generally flushed directly to sewer.

2.3.3 Mill Processes. A complete description of mill processes (flow diagrams and equipment list) is shown in Appendix I. The following is a brief description of major processes.

2.3.3.1 Wood mill.

(a) No. 2 Woodroom:

Average chip production = 425 cunits/day

Average groundwood production = 252 cunits/day

The No. 2 woodroom is equipped with a Bellingham barker and a Sumner 153 inch chipper. Bark dewatering is carried out by 4 Sweco vibrating screens and 2 Kason vibrating screens.

(b) No. 3 Woodroom:

Average chip production = 140 cunits/day

Average groundwood production = 351 cunits/day

The No. 3 woodroom is equipped with a Hansel 30 inch Ring Barker.

Bark dewatering is accomplished by 5 Kason vibrating screens and 2 Tyrock F600 vibrating screens. A Hog Bark press produces an average of 137 cunits of hog per day from both woodrooms.

2.3.3.2 Groundwood.

(a) Stone groundwood production was 884 ADT/day during 1972.

22 48" Koehring waterous grinders
4 Dorr Oliver washers
3 Zn hydro reactors; capacity 28,600 dry Zn hydro/day
2 Kamyr groundwood bleach towers for Zn hydro bleaching
3 groundwood storage tanks 100 tons each
2 groundwood blending tanks 100 tons each

(b) Refiner groundwood production was 85 BDT/day during 1972.

2 480 Bauer double disc refiners
1 upflow Zn hydro bleach tower

2.3.3.3 Sheet formation. Major equipment is summarized in Table 2.

TABLE 2. SHEET FORMATION

Machine #	Make	Width (inch)	Max. Speed (fpm)	Av. 1972 T/D
News				
#3	Beloit	264	2,500	349
#4	Beloit	252	3,000	340
#5	Dominion	302	3,000	417
Linerboard				
#2	Dominion	184	2,000	337
Unbleached kraft				
#1	Dominion	148		245

2.3.3.4 Kraft pulping. The maximum unbleached kraft production is 1095 ADT/D. Over 1972 an average of 521 BDT/D of chips were manufactured and 1082 BDT/D of chips were purchased. The distribution of wood species to the digesters is shown below:

Hembal	1,041 BDT/D
Fir	547 BDT/D
Cedar	261 BDT/D

(a) Digesters

- Batch; three brick lined 3,065 ft^3 each
  one unlined 4,785 ft^3 each
  four unlined 6,060 ft^3 each
- Continuous; One kamyr continuous digester with internal washing stage.

(b) Washers and knotters

- No. 1 Side; 3 Jonsson knotters
  1 knot tank 3,000 ft^3
  2 Sherbrooke 8 ft x 12 ft BSW
  1 DOL 11.5 ft x 16 ft BSW
  3 seal tanks
  1 foam tank
- No. 2 Side; 3 claflin refiners for hot stock refining
  3 Impco hot stock screens
  4 Dorr Oliver 9.5 ft x 16 ft BSW
  4 seal tanks
  1 hot stock rejects tank 3,540 ft^3
- No. 3 Side; 4 Jonsson knotters
  3 Sherbrooke 11.5 ft x 20 ft BSW
  3 seal tanks

(c) Kraft screening and refining; 5 MKA Cowan screens for primary
2 MKE Cowan screens for secondary
2 Sherbrooke deckers 48 inch x 132 inch
3 Sherbrooke deckers 48 inch x 150 inch
1 Sherbrooke 9 ft x 14 ft saveall

(d) Black liquor (B.L.) oxidation; one WBL mix tank
One Trobeck Ahlen 2 tower WBL oxidation unit with 1500 gpm BL capacity
Three WBL storage tanks at 38,151 ft^3 each
One Trobeck Ahlen oxidation sump at 12,661 ft^3. The BOD_5 of this liquor has been found to be 310 lb BOD_5 per 1000 USG.

2.3.3.5 Recovery, steam plant.

- Three sets of evaporators;
No. 1 John Inglis Sextuple 130,000 lb/hr
No. 2 Lundberg-Ahlen Sextuple 260,000 lb/hr
No. 3 Swenson Septuple 435,000 lb/hr

- Three recovery furnaces;
No. 1 Combustion Eng. BL unit capacity 561,000 lbs dry solids/24 hr
No. 2 Combustion Eng. BL unit capacity 1,020,000 lbs dry solids/24 hr
No. 3 Babcock and Wilcox BL unit capacity 1,400,000 lbs dry solids/24 hr

- Three power boilers;
No. 1 CE oil and/or hog fuel unit
capacity on oil: 300,000 lbs/hr
capacity on hog: 180,000 lbs/hr
multi-cones and doyle scrubbers
No. 2 CE oil and/or hog fuel unit
same as No. 1

No. 3 Babcock-Wilcox oil and/or hog fuel unit
capacity on oil: 350,000 lbs/hr
capacity on hog: 215,000 lbs/hr
multi-cones and doyle scrubbers

- Two marine boilers; capacity on oil 80,000 lbs/hr each
Oil storage; 1 50,000 BBL oil storage
1 10,000 BBL oil storage
1 1,500 BBL day oil tank

2.3.3.6 Recausticizing.

Four green liquor storage; No. 1, No. 2, No. 3 9,050 ft^3 each, No. 4 21,200 ft^3
2 GL clarifiers
3 WL clarifiers
4 slakers
8 causticizers
3 mud washers
4 mud storage tanks
2 WL storage tanks; No. 1 21,200 ft^3
No. 2 66,800 ft^3
3 mud filters
1 dregs filter; Eimco vacuum filter; dregs removal ∿ 5 ODT/day at 28% moisture
3 lime kilns; No. 1 - one Traylor kiln 7 ft dia x 200 ft long
No. 2 - one Canadian Allis Chalmers kiln, 8 ft dia x 200 ft long with peabody scrubber
No. 3 - one Canadian Allis Chalmers kiln, 11.5 ft dia x 200 ft long with peabody scrubber

2.3.3.7 Kraft bleach plant.

CEH sequence
av. production 250 T/day SBK (brightness ∿ 60 units)
4 8 ft x 14 ft Sherbrooke vacuum filters
3 Kamyr bleaching towers;
    1 upward flow chlorination
    1 downward flow high density caustic extraction
    1 downward hypochlorite
4 velocity leg type seal tanks
1 Kamyr chlorine premixer
2 Hooker in line chlorine mixers

2.3.4 Water Reuse.

(a) Evaporator consensate is reused in the recaust area; clean evaporator warm water is used on the bleach plant washers and in the groundwood area and for high density dilution. Evaporator foul condensate is sewered.

(b) Digester condensate is reused on the brown stock washers.

(c) Kraft screen room white water can be reused on the hydraulic debarkers. Since debarker effluent goes to the treatment system, this reuse scheme gets a portion of the bypassed kraft mill effluent to the secondary treatment system. Operators claim that reuse of screen room water for hydraulic debarking results in excess foaming. Generally, therefore, this reuse route is not utilized to the maximum.

3. SEWER SYSTEM AND EFFLUENT CHARACTERISTICS

3.1 Sewer Layout

A layout of the sewer system is shown in Figure 1. Briefly, the groundwood, wood mill, news and caustic extraction stage effluent receive primary and secondary treatment while kraft effluent goes directly to sewer. Treated effluent is

mixed with the kraft mill sewer before being discharged at one outfall.

3.2 Spill Detection

pH probes and conductivity alarms are located in the following areas and on the following Parshall flumes (PF):

(a) pH probe on main outfall, recorded in clarifier building.

(b) pH probe on treated "Clarifier In" stream, recorded in clarifier building.

(c) pH probe on bypass stream #13 PF recorded in recaust.

(d) Conductivity probe on #13 PF recorded in recaust.

(e) Conductivity probe #7 PF recorded in recaust.

(f) Conductivity probe #5 PF recorded in recovery.

(g) Conductivity probes on kiln sewers.

3.3 Sewer Sampling

Automatic sampler locations are noted in Figure 1. Samplers "S" are either chain samplers or Dezurik vacuum samplers. Dezurik samplers are flow regulated, whereas chain samplers are constant. At present there is no automatic sampler at the main outfall. A description of the sewer sampler designations is shown in Table 3.

TABLE 3. SEWER DESCRIPTIONS

Sewer	Description
No. 1 Parshall Flume (PF)	Stone groundwood mill
No. 2 PF	Bleach plant (W5, 15, 35)
No. 3 PF	Treated stream
No. 4 PF	No. 2 PM and steam
No. 5 PF	Recovery

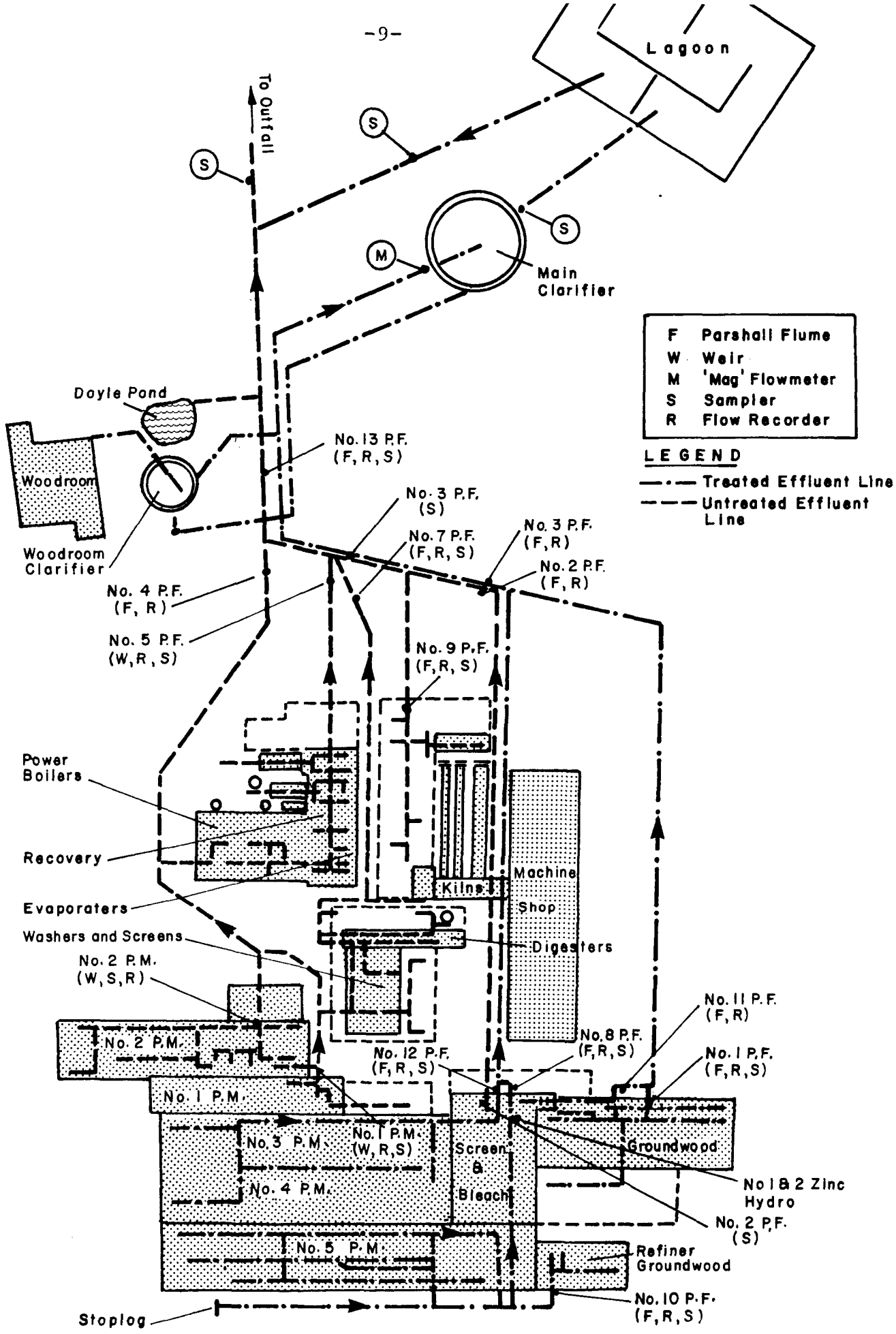


FIGURE 1 SEWER LAYOUT

No. 6 PF	Wood mill
No. 7 PF	Kraft pulping area
No. 8 PF	No. 5 PM, Refiner groundwood
No. 9 PF	Recaust
No. 10 PF	Refiner groundwood
No. 11	Refiner and stone groundwood washers
No. 12	No. 3, No. 4 PM
No. 13 PF	Bypass stream

Samples are taken by the Fiber Loss Technician according to the following schedule:

(a) Samples are collected daily (except weekends).

(b) Daily fiber loss analyses are carried out on:

- No. 1 PF
- No. 3 PF
- No. 7 PF
- No. 8 PF
- No. 10 PF
- No. 1 Machine
- No. 12 PF
- No. 13 PF
- Main Clarifier Out
- Lagoon In
- Lagoon Out
- Combined Effluent
- Woodroom In.

(c) Daily sodium loss is carried out on:

- No. 5 PF
- No. 7 PF
- No. 9 PF
- No. 1 Machine
- No. 2 Machine

(d) Weekly BOD_5 determinations are carried out on composites from No. 13 PF, No. 3 PF, Lagoon Out and Woodroom Clarifier Out. Daily composite samples are stored in a refrigerator until the end of the week. The daily samples are then mixed and the BOD_5 is carried out on the mixed sample.

3.4 Final Effluent Discharge

3.4.1 Provincial and Federal Effluent Quality Requirements. Alberni Division Ltd. was issued a Pollution Control Board effluent discharge permit on December 6, 1973. The effluent characteristics stipulated are shown in Table 4.

As an existing mill, the Federal Pulp and Paper Effluent Regulations require that Alberni Division meet more stringent effluent standards for toxicity than provincial requirements. The federal requirements are shown in Table 5.

TABLE 4: PROVINCIAL OBJECTIVES

Characteristic	Value
Total Suspended Solids	20 lb/ADT
BOD_5	35 lb/ADT
Settlable Solids	2.5 ml/ℓ
Floatable Solids	Negligible
pH Range	6.5-8.5 (15 ft off outfall)
Temperature	$95^{\circ}F$
Residual Chlorine	< .1 ppm
Sulphides	< 1 ppm
Mercaptans	< 2 ppm

Toxicity (TL_{m96}) - 50% survival at 25% effluent concentration over a 96 hour exposure time

TABLE 5: FEDERAL REQUIREMENTS

Process	Allowable Discharge S.S.	Allowable Discharge BOD_5
Hydraulic Debarking	5 lb/ODT of wood	
Kraft Pulping	7 lb/ADT	64 lb/ADT
Kraft Bleaching	6 lb/ADT	27 lb/ADT
Kraft Sheet Formation	2 lb/ADT	
Specialty Single Product Papermaking (Kraft Liner)	6 lb/product ton	
Mechanical Pulping	13 lb/ADT	
Mechanical Pulp Brightening	2 lb/ADT	
Integrated Single Product (Kraft)	3 lb/product ton	
Papermaking (Newsprint) (Groundwood)	5 lb/product ton	

Toxicity - 80% survival at 65% v/v concentration over 96 hours.

3.4.2 Current Alberni Final Effluent Discharge.

(a) BOD_5 and S.S. BOD_5 and S.S. discharge over 1972 have been shown in Table 6. These values have been contrasted with federal and provincial requirements. It should be realized that the BOD_5 output value is actually the mathematical sum of the bypass stream BOD_5 and the lagoon out stream BOD_5. Repeated trials have shown that the mathematical sum gives a lower result than the BOD_5 of the combined effluent.

TABLE 6. 1972 AVERAGE BOD_5 AND S.S. DISCHARGE

Alberni Mill including Wood Mill

	Alberni	Federal Allowable	P.C.B. Allowable
S.S.	36.7	21 lb/ADT	20 lb/ADT
BOD_5	33.4	None established	35 lb/ADT

(b) Toxicity. Six toxicity determinations carried out on daily composites of the whole mill effluent have shown that the TL_{m96} of the effluent ranges from 24% to 100% (mean 59%). These tests were carried out between 1971 and 1973.

3.4.3 Solid Waste.

(a) Dredgate is being dumped on Johnson Island at the mouth of the Somass River at the rate of 100,000 yd^3 per year. The mill considers this a critical problem and is awaiting a decision on ocean dumping or land reclaim.

(b) Mill waste consisting of:

Clarifier Sludge	- 30 T/D
Dregs	- 5 T/D
Doyle Pond Dredgate	- 107 yd^3/year
Zn Hydro Sludge	- 1,000 lb/wk
Slaker Grits	- 7,000 lb/day

is going to the solid waste dump site. Previous to August, 1973 this waste was going to the Shoemaker Bay site. At present this waste is going to the newly developed Mountain Dump site.

(c) Excess hog fuel (from the pulp mill and sawmills in the area) is being trucked to the China Creek site at the rate of 207 yd^3/day. The large quantity of hog which has accumulated has resulted in a severe leaching problem. Leachate runs directly to Bad Creek, which is a tributary to China Creek. At the present time plans are underway for installation of an incinerator.

3.4.4 Process Losses.

(a) Brown stock washer soda losses over 1972 averaged 25 lb Na_2SO_4/BDT. Changes in washing in August, 1973 resulted in a 40% decrease in sodium lost at the brown stock washers. The loss over September, 1973 averaged only 14.5 lb/BDT. This was mainly the result of shower maintenance and alignment.

(b) Zn hydrosulfite usage averaged 18.7 lb/BDT over 1972. This usage represents 4,900 lb/day zinc and results in a sewer concentration of 5.5 mg/l.

(c) Slimicide usage on the machines averaged 151 lb/day over 1972. Usage during the summer months, however, increased dramatically; for example, usage during May, 1973 averaged 405 lb/day.

(d) Inplant loss measurements have resulted in balances for a number of parameters. BOD_5, S.S., V.S.S. and flow balances are shown in Figure 2. Sodium and sewer balances based on 1972 data are shown in Figure 3. Available toxicity data is shown in Figure 4.

Measurements of sources of effluent colour have resulted in the following distribution: (Chlorination and caustic extraction stages).

Bleach Plant	60%
Wood Room	20%
Unbleached W.W.	15%
Other	5%

(e) $CaCO_3$ lost to sewer over 1972 averaged 10.6 T/D.

3.5 Effluent Testing Procedures

Detailed test procedures for S.S., V.S.S., settlable solids, colour and BOD_5 have been shown in Appendix II. The essential featues of the methods have been outlined below.

(a) Suspended Solids. Reeve Angel 934AH 9 cm disks are used with a 1000 ml sample for routine analysis. When V.S.S. analysis is carried out, Whatman 40 disks are used. Alberni Division has found glass paper to be unsuitable for V.S.S. determinations.

(b) Colour. The sample is adjusted to pH 7.6 with NaOH or HCl and filtered through a millipore 0.45 mμ filter.

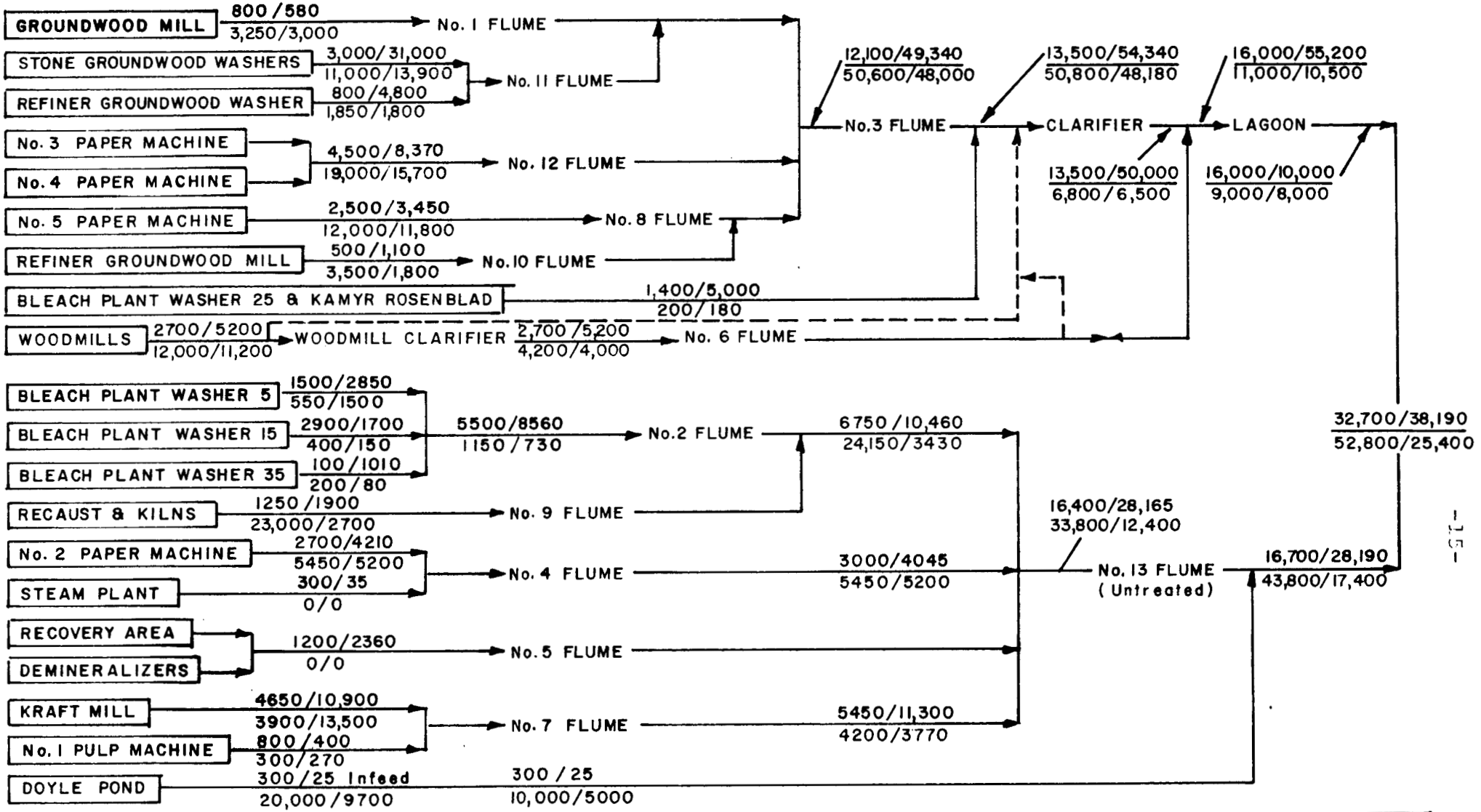


FIGURE 2 SEWER BALANCES

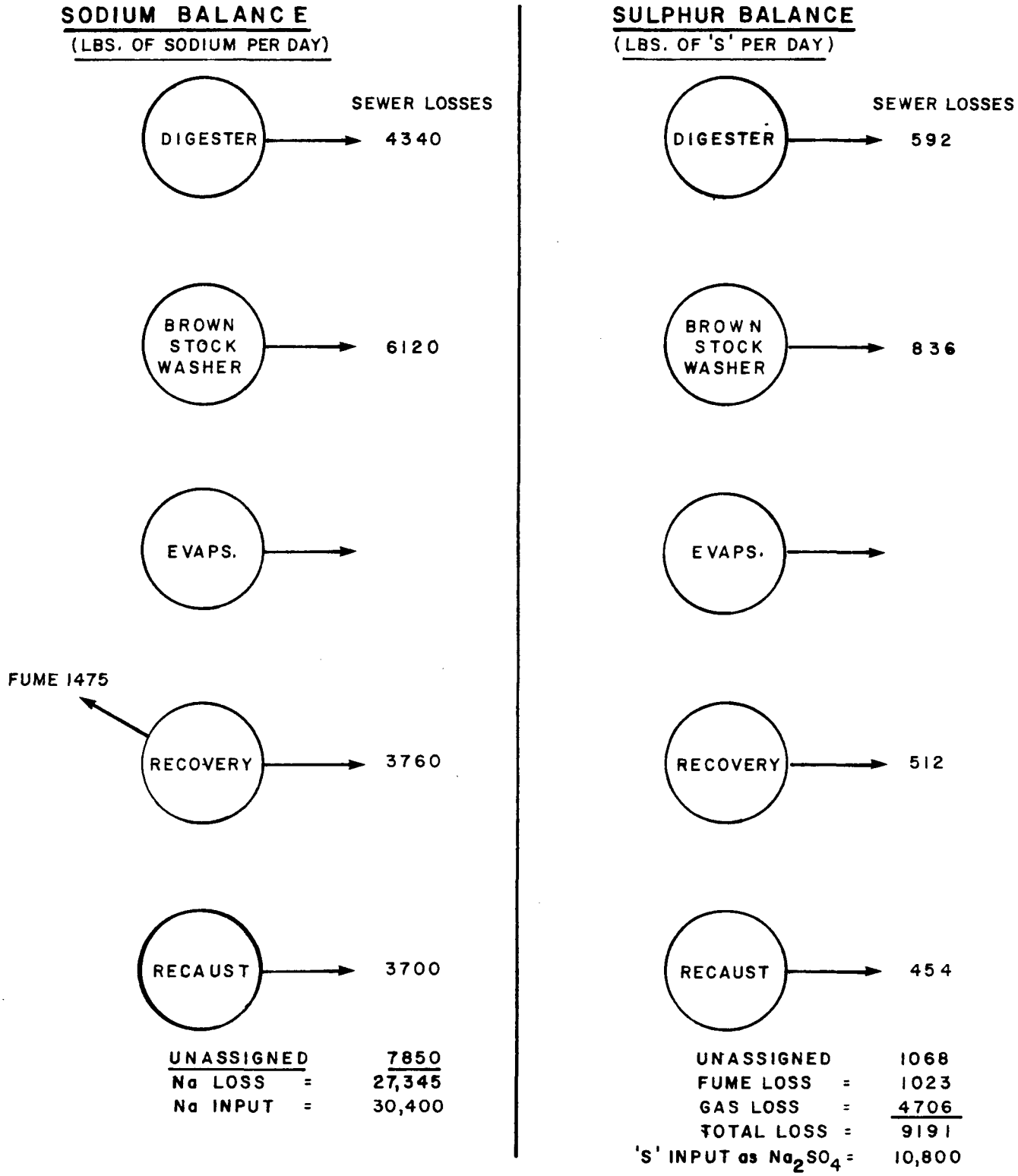
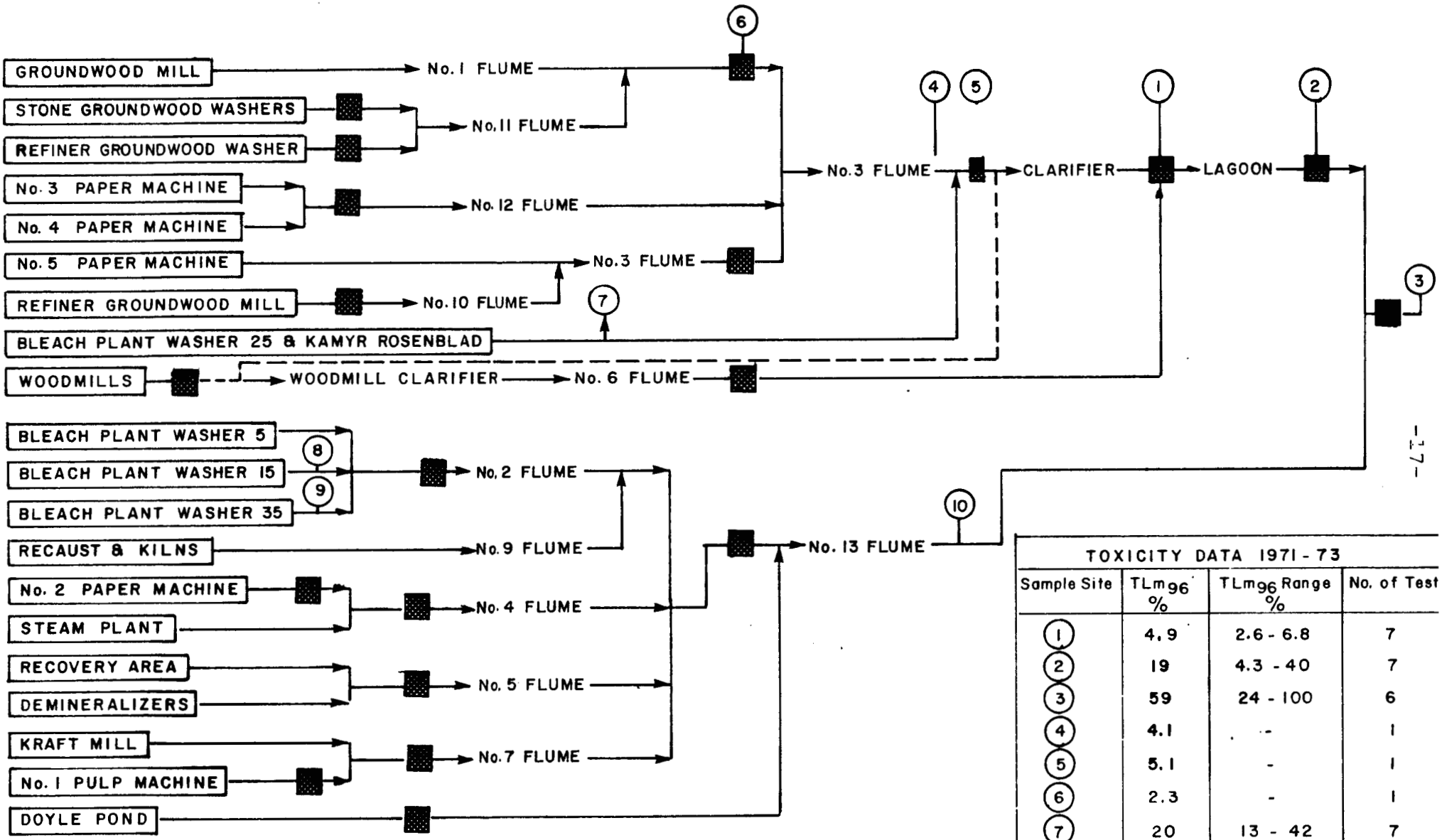


FIGURE 3 SODIUM AND SULPHUR BALANCES



TOXICITY DATA 1971 - 73

Sample Site	TLm_{96} %	TLm_{96} Range %	No. of Test
1	4.9	2.6 - 6.8	7
2	19	4.3 - 40	7
3	59	24 - 100	6
4	4.1	-	1
5	5.1	-	1
6	2.3	-	1
7	20	13 - 42	7
8	2.2	-	1
9	NT	-	1
10	59	42 - 75	2

FIGURE 4 TOXICITY BALANCE

The absorbance of the filtered sample is then measured at 425 mμ using a Hitachi Perkin Elmer 139 UV-VIS spectrophotometer.

(c) BOD_5. Alberni Division has had problems with its BOD_5 test. A separate report on this subject has been prepared (Appendix III).

4. POLLUTION ABATEMENT FACILITIES

4.1 Inplant Abatement

(a) Spills in the brown stock washer area flow to a catchall and are pumped to the NO_2 or NO_3 blow tank. This system has a pumping capacity of only 500 gpm and so cannot handle major spills. It is presently being replaced by a more flexible spill control system.

(b) Spills on the unbleached screen room operating floors go to the kraft spillage tank. Spillage tank effluent is pumped via a drainer and a refiner back into the No. 2 blow tank.

(c) The unbleached screen room No. 1 white water tank overflows to a saveall. Saveall effluent can be reused on the hydraulic debarkers.

(d) Unbleached screen room rejects are recycled to the bottom layer of the linerboard.

(e) An Eimco vacuum filter removes about 5 ODT/D of green liquor dregs from the recaust sewer.

(f) Slimicide in the news area is handled in 45 gallon drums to avoid large spills. Plans are underway to contain all slimicide storage facilities with curbs and spill collection tanks.

4.2 External Treatment

(a) Main Clarifier

Diameter = 200 ft
Volume = 3,556,000 USG
Inflow = 14,200 USGPM
Average S.S. removal efficiency = 85%

Sludge production averages about 30 BDT/D. The press is not capable of producing hog fuel from this material; it is therefore sent to landfill.

(b) Wood Mill Clarifier

Diameter = 80 ft
Inflow = 2,900 USGPD
Average S.S. removal efficiency = 65%

About 5 BDT of hog is produced per day from this facility.

(c) Biobasin

Area = 30 acres
Aeration = 14 aerators with a total H.P. rating of 1025 H.P.
Effluent flow = 20,000,000 USGPD
Depth = 14 ft
Lagoon capacity = 100×10^6 USG
Nutrient feed = 1,200 lb urea per day
Retention = 5 days.

The BOD_5 removal efficiency averages 80%. Removal is essentially complete after 3.5 days. Colour has been noted to increase slightly over the biobasin.

(d) Somass River Flow Control. Dilution of the effluent at the head of the inlet is guaranteed by controlling the minimum flow of the Somass River. Minimum flow is maintained at 1000 cfs.

Average Somass flow = 1,800 cfs
Maximum = 12,000 cfs
Minimum = 1,000 cfs

(e) Doyle Pond. Flyash is collected in the Doyle Pond. Dredging is required weekly. This system is very poor; plans are underway to install a belt filter in the pond effluent.

(f) Sewage. Domestic sewage is presently combined with mill effluent. By December, 1974, however, this stream should be separated and sent to municipal treatment.

APPENDIX I

A mill equipment list and set of flow diagrams can be found in the Alberni Division Pulp and Paper file.

APPENDIX II

A list of test methods is included in the Alberni Division Pulp and Paper file.

APPENDIX III

An evaluation of Alberni BOD_5 testing technique can be found on the Alberni Division Pulp and Paper file.