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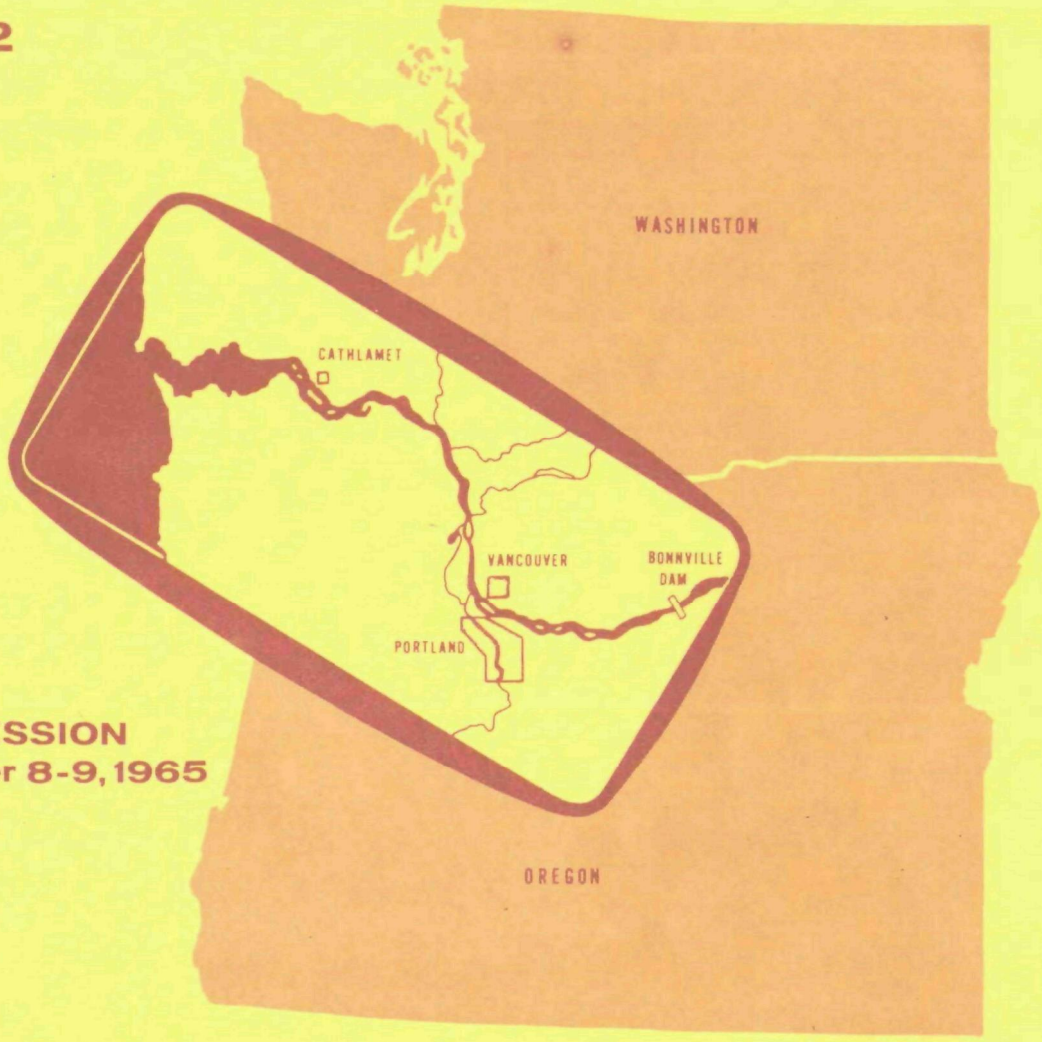

THIRD SESSION
September 8-9, 1965

Conference

In the matter of Pollution of the Interstate Waters of the Lower Columbia River and the Tributaries · Bonneville Dam to Cathlamet, Washington

U. S DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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(Thursday, September 9, 1965, the Conference reconvened at 9:40 o'clock, A.M., at which time the following further proceedings were had:)

CHAIRMAN STEIN: May we reconvene? At this time, we will start with the state of Washington's presentation, and I would like to call on Mr. Roy Harris of Washington.

Mr. Harris.

MR. HARRIS: Mr. Chairman, I think the mike seems to be a little better.

Chairman Stein, Mr. Poston, Mr. Spies, ladies and gentlemen:

I seem to sort of get in these situations where the second day I lose an audience, but that's all right. We still have the conferees.

The last time I testified before the Muskie Committee, I remember Mr. Stein was there on the second day. The first day I walked in, I was supposed to follow Governor Rockefeller. My goodness, there were TV cameras, reporters, and the place was crowded. The next day when Murray and I were there, we were just there as people to testify.

CHAIRMAN STEIN: Roy, if we can go off the record for a moment.

(Discussion off the record.)

MR. HARRIS: As a preface to our presentation of the Washington State Pollution Control Commission, I wish to specifically invite attention to the fact that this third session of the Lower Columbia River Conference has been convened by the Secretary of Health, Education, and Welfare under provisions of the Federal Water Pollution Control Act, and that the state of Washington did not request that this session be convened. We are participating in this session as we have in the past two conferences, and we are hopeful that some new and fruitful actions may be developed as a result of the presentations today. We wish to make it clear at this point, however, that regardless of this conference the stream improvement facilities mentioned later will basically evolve from Commission-Industry programs already initiated or under discussion.

The Report on Pollution of Interstate Waters of the Lower Columbia River, dated August 1965, and released by the U. S. Public Health Service, supplies the background information for the presentation made here yesterday by the Public Health Service conferee. This report, and the presentation, focused attention on the pulp mills as the source of waste materials which are producing objectionable conditions in the Lower Columbia River. It is concluded, therefore, that the U. S. Public Health Service considers

that the corrections as outlined in the 1958 Action Program for other industries and municipalities in Washington have been accomplished to their satisfaction. While it is true that the Washington communities have corrected the major municipal waste deficiencies listed by the 1959 session of this conference, there will always remain the necessity of constantly upgrading both treatment and operation.

When the basic law creating the Pollution Control Commission was passed by the Washington State Legislature in 1945, it was not envisioned that its mere passage would automatically end all the water pollution problems of the state. It was, however, a statement of policy and a specific charge to the state government to work more intensively toward alleviating the ill effects of one by-product of an ever-expanding civilization.

In dealing with the matters under discussion today, we wish to invite attention to the fact that in the preamble of our 1945 act, and I quote: "It is declared to be public policy of the State of Washington...to...require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington..."

Policies of the Pollution Control Commission during the years since passage of that law have reflected this basic obligation. It has not been easy in the past, and

it is not expected to be easy in the future, to keep attention in focus with the specific language of that stated legislative policy because there are those who would change the words "known available and reasonable" to the word "economical."

While it is incumbent upon a regulatory agency to give consideration to those methods which would be both economical and effective in controlling pollution, there inevitably comes a time when effectiveness must be used as the basic criteria.

Washington State's pollution control law has much in common with the suggested State Water Pollution Control Act developed and distributed by the United States Public Health Service. Specific language differences between the two do not erase the similarity.

The first Federal Water Pollution Control Act was passed in Congress three years after the Washington State law was enacted. In subsequent years we have made a considerable amount of progress, and it is heartening to note that when the Public Health Service recommends a model law to the states that it bears considerable similarity to our own.

The 1958 conference on the same subject we are addressing today documented numerous prior studies, and stressed the need for more definitive answers on actual

river conditions, and the effects of nutrient materials on slime growth. This need was translated into an active, but frequently disappointing search for better scientific answers to this complex problem.

In cooperation with the Oregon State Sanitary Authority and the pulp mills along the river, comprehensive field investigations were started in mid 1959. These studies spanned 109 miles of river from Bonneville Dam to Skamokawa. The purpose and objective was to obtain broad based data from which the water quality characteristics of the river could be discerned and their interacting relationships defined.

In contrast to other studies which were limited in purpose and scope, this joint study established 45 sampling stations in 11 river cross sections, and included the measurements of 27 parameters which resulted in the analysis of 20,500 items of data for one year's effort. I bring this in to indicate that subsequent to the 1958 session, which had certain directives regarding investigations, that we as a pollution control agency, together with our cooperating neighbors from Oregon and the mills, have not been inactive insofar as trying to ascertain the true conditions, causes and effects of this very baffling problem. This investigation was maintained at the same level until September of 1961, at which time the sample collection was

halted in order to evaluate the data which had been collected. During this time a contract was let with the University of Washington for the computer analysis of the 1960 data.

In addition to a complete analysis of these data, a subsequent report made technical recommendations for the conduct of a continued study. Sampling station adjustments were made to more closely coincide with the slime measurement locations, and the 1962 and 1963 surveys were conducted to the limit of available funds. These surveys coincided with the periods of major interest to the fishery and data summaries of the results were periodically reviewed by the survey cooperators.

On evaluation of the 1962 and 1963 data, it became apparent that the slime growths were still relatively high, even with corrective measures which had been incorporated by the pulp mills. It was also noted that slime growth occurred when nutrient levels were below the amounts which prior research had indicated as being limiting. The cooperators then determined that a closer look into the nutrient regime should be undertaken.

It became apparent that the required precision for the nutrient analyses would be difficult to obtain through the coordination of five different laboratories for these exacting tests, and it was decided to contract the nutrient

analyses to the U. S. Geological Survey laboratory. The organic analyses were assigned to the Pollution Control Commission laboratory, and the sample collection and slime box observations to the individual pulp mills.

Concurrently with these monitoring programs, a series of special studies were conducted by the Technical Coordinating Committee formed as part of the Action Program developed in connection with the 1959 conference.

Yearly surveys during the fall have been conducted to monitor the bacteriological quality of the river in the Portland-Vancouver area. Other studies by this group have been made to evaluate the effectiveness of the intermittent discharge prior to the acceptance of a proposal for a similar operation by a second mill.

Currently in progress by the Technical Coordinating Committee are studies designed to document objectively the locations and severity of the slime problem as it relates to fishermen's nets; to test the thesis of suspended slime growth as a dominant mechanism in contrast to the concept of slime sloughing from areas of attached growth; and to evaluate the implication of pulped fibers as a factor in the growth of slimes and problem severity.

There seems to be little disagreement that the carbohydrates discharged in pulp mill effluents are a prime source of nutrient material which sustain Sphaerotilus

growth. Also, there seems to be little, if any, disagreement that fibrillous materials in the water contribute nuclei for development of slime-like clumps. The reduction to a satisfactory level of both nutrients and fibers has been the subject of repeated study, research and discussion between our commission staff and the mills.

Had it not been for the fact that the Commission and the U. S. Public Health Service could not reach an agreement on conclusions and recommendations in a proposed joint report due for release early this year, our Washington program for nutrient removal might be in a more advanced stage. It was our conclusion then, as now, that fiber removal without nutrient removal would not solve the slime problem. As a result of this lack of agreement, the Public Health Service issued its own report in April of this year and recommended removal of volatile suspended solids as a first step, but made no definite recommendations for the nutrient reductions to be accomplished in sulphite liquor discharges, nor did it emphasize the importance of this requirement.

We are most pleased to note that the recommendations developed in the August report, although developed from the same basic data as the April report, are directed to the necessity for reductions in BOD loadings caused by sulphite liquor discharges, in addition to the recommendation for

removal of volatile suspended matter.

The prior emphasis placed upon removal of suspended solids by the Public Health Service report placed the Commission in a somewhat awkward position in our negotiations with the mills. As mentioned by Mr. McDevitt, the Commission has recently received from the Boise Cascade mill at Vancouver an assurance that planning is in progress to install facilities for elimination of 70 to 75 per cent of the nutrient materials from the effluent. This significant step might have been taken at an earlier date had it not been for effective recommendations. We think, however, that this is a significant step forward for industry and for the pollution control program in Washington. Not only will this industry remove its settleable solids, but it will also remove most of the dissolved solids from the stronger wastes, thereby relieving the river of the source of damaging nutrients.

A realistic date for completion of construction at Vancouver is presently under discussion. Also, it is the expectation of the Commission that the remaining sulphite mill on the Columbia River, not employing a recovery process, will proceed with construction of facilities to effect a similar reduction in nutrient materials. We have recently received a commitment from that mill which is now under study. Also, in meetings with the mill managers last

June, it was agreed that they would all proceed with plans for removal of volatile suspended matter, and at that time we indicated that our acceptance of these proposals would not compromise our position regarding the importance of nutrient removal.

We regret that this August report by the Public Health Service does not include recognition of the commitments made by the mills to install primary treatment, as this information was given to the Public Health Service in June. This apparently was an oversight.

We may not agree completely with the Public Health Service on desirable percentages nor on realistic completion dates, but we are most gratified that there is a reasonable agreement on the basic technical considerations involved in this problem. The fact remains, however, that we need to broaden our scientific horizons in this area.

Our state law requires that the Commission define the qualities and properties of water which are deleterious. This concept is also in the "Model Law," and we certainly agree that such information is necessary for long-range planning in water quality management. For example, basic research and investigation is needed of naturally occurring nutrient levels above Camas, together with a more adequate description of the deleterious changes in these levels in the Camas-Vancouver area and the Longview area of the

Columbia River. We were, and are, hopeful that the U. S. Public Health Service, with its vast scientific and research resources, can materially contribute to this area of knowledge so that we can better understand both cause and effect. We believe that this type of scientific contribution will serve a more useful purpose in the long-range solution of this complex problem than actions taken under enforcement provisions of the Federal law.

We are not in any fashion attempting to divert attention from the problems on the Washington side of the Columbia River, but we do believe that regardless of positive or negative conclusions, the effects of the Willamette River on the Columbia should have been more completely studied and documented in the Public Health Service Report. This conference is concerned with the Lower Columbia River and its tributaries. In this respect, I am in no way taking issue with Oregon's comments on this river. I merely want to call attention to the fact that the conference does involve the Columbia River and its tributaries.

We are in accord with the recommended time schedule for the removal of volatile suspended matter, but question somewhat the date of December 31, 1967 for completion of facilities to effect a 70 per cent reduction in BOD loadings derived from sulphite waste liquor discharges. We do have some question on the meaning and interpretation or

recommendation 3-a on page 11 of the report insofar as the ability of the various pulp mills might be to carry this recommendation into effect.

As conferee for the state of Washington I have invited each of the four Washington pulp and paper mills to make a presentation which will bring up-to-date their respective pollution abatement efforts subsequent to the 1959 session. At that time some of them may wish to comment on these recommendations. They will be heard later in this third session except for the Boise Cascade statement which was presented yesterday by Mr. McDevitt. However, if Boise Cascade has additional comments to make today, they are again invited to present them.

In concluding my remarks, I can say that we recognize quite completely that the installation of facilities for the adequate treatment of these industrial wastes under discussion will be costly to the industries. This is unfortunate, but the cost to others of waste discharges has also been great. Many of the costs involved can be measured quite precisely, but others are difficult to qualify, such as the impact of the state's morale and the economy of a stream which is damaged as a source of economic livelihood for another segment of the population.

It is obvious to us, however, that in view of the commitments we have already received, we can now see before

us the end point of a complex, long-standing pollution problem in the Columbia River.

It is also my conviction that the necessary corrective action in our state will be taken regardless of this session of the conference. However, the session today has afforded the opportunity for many old friends and acquaintances to get together again and talk about stream pollution.

Thank you, Mr. Chairman.

CHAIRMAN STEIN: Thank you, Mr. Harris. Are there any comments or questions?

MR. POSTON: I compliment Mr. Harris on a very fine presentation.

CHAIRMAN STEIN: Do you want to proceed to call people, Mr. Harris?

MR. HARRIS: Yes. Prior to calling representatives of the industry, I might mention that the State Department of Health and the State Department of Game and the State Department of Fisheries were invited to present comments. The State Department of Fisheries representative was here yesterday. I do not see him in the audience this morning. Is Mr. LeMier here? If he comes in later, Mr. Chairman, I should like to call on him.

CHAIRMAN STEIN: That will be perfectly all right.

MR. HARRIS: As lead-off for the pulp and paper industry, I guess we will take the upriver mill and work

down; and, therefore, we will call on Mr. Rex Morris of the Crown Zellerbach mill at Camas.

Mr. Morris.

MR. MORRIS: Mr. Chairman, conferees, ladies and gentlemen: My name is Rex Morris. I live in Camas, Washington, where I am resident manager of the Crown Zellerbach Corporation pulp and paper mill.

The pulp and paper mill at Camas has been in operation for about 80 years. From a rather modest beginning, the operation has grown to where its products are shipped all over the United States and into world markets. We presently employ approximately 2800 employees who receive an annual payroll of $20 million. Purchases of raw material, equipment, and supplies for our operation last year totaled about $37.5 million of which $11.6 million represented expenditures for wood and sawmill residues. The Camas mill pays over $900,000 annually in state and local taxes for the support of schools, roads and so forth. In addition, the mill's Federal taxes during 1964 were approximately $1.8 million.

Mr. Harris, director of the Washington State Pollution Control Commission, invited me to attend this conference to report on the progress of the water quality control program at our mill since the adjournment of the 1959 Columbia River Conference. I would like to briefly summarize the

progress we have made since 1959 and present plans for additional improvements.

Based upon an extensive research and development program we constructed an installation for collecting and impounding our spent sulfite liquor to help control the growth of Sphaerotilus. This project was outlined at the 1959 conference and undertaken with the agreement of the Washington State Pollution Control Commission. This installation, which was completed in 1960 at a cost of $750,000, permits collection of the cooking liquor and wash waters from the sulfite pulping process and impoundment of these for six days followed by discharge on the seventh day. An alternate method of operation used successfully in the spring of 1965 involves the collection and impoundment of the concentrated spent sulfite liquor for extended periods during critical river conditions.

Since the completion of the installation, comprehensive studies have been conducted to measure the effectiveness of this program. The results of these studies were submitted in a progress report to the Washington State Pollution Control Commission in November 1963. I have here a copy of that progress report. I believe the conferees and chairman have that copy. I would like it entered into the record if I might.

CHAIRMAN STEIN: Yes. Without objection, that will be

so done. How big is the report?

MR. MORRIS: (Indicating)

CHAIRMAN STEIN: How many pages? I want to see if we could use some of that taxpayers' money you spent to print it in the record.

MR. MORRIS: 47 pages.

CHAIRMAN STEIN: All right. That will be included in the record without objection.

(The document referred to, entitled "Columbia River Study -- A Progress Report, 1958-1963," consisting of 47 pages, is marked as Appendix C, and is attached hereto and made a part hereof.)

MR. MORRIS: The studies show that the water quality below our outfalls has been improved and controlled. Data collected to date indicates that intermittent discharge or impounding have been effective in controlling water quality. Both systems have been successfully used during the past five years.

Recent research and field studies in the Lower Columbia have shown that drifting slimes originate on suspended organic substrates. It appears that these attachment surfaces are essential for the development of slime growths in the lower river. In a letter to Mr. Harris of the

Washington State Pollution Control Commission dated June 24, 1965, we outlined a plan to construct a plant to collect and treat the fiber bearing effluents from the mill for the removal of wood fibers. The estimated cost of this treatment plant is about $2.0 million and will be completed in 1967. We believe this step will result in further improvements in water quality.

We have also reported to Mr. Harris that the Camas mill is now equipped to impound and reduce spent sulfite liquor by 70 per cent during periods when flow is less than 220,000 cubic feet per second at Mayger and water temperature is 10 to 15° C. In other words, we will be in a position upon completion of our treatment plant to comply with the intent of the recommendations presented in the U. S. Public Health Service report of August 1965.

We have had a positive water quality control program underway as reflected by our capital expenditures. With the proposed treatment plant our total capital investment in equipment designed specifically to improve water quality will be $3.4 million.

Thank you.

CHAIRMAN STEIN: Thank you. Are there any comments or questions?

MR. POSTON: I might ask a question: You have stated that your studies have shown that water quality below your

outfalls has been improved and controlled.

Would you care to speak to how far downstream this control has extended?

MR. MORRIS: We have checked the Columbia extensively down to the Interstate Bridge and beyond that during times of intermittent discharge. I note in the April report by the U. S. Public Health Service a comment was made on the improvement in the river condition in that stretch.

In the August report, however, it was mentioned that the fishermen stopped fishing during the time we were discharging our intermittent discharge.

We have done a lot of checking in that area. We would not agree with that statement of net lifting -- at least our investigations have not shown that to be the case.

MR. POSTON: Well, I also, as one of the original conferees, want to compliment Crown Zellerbach, and you have made mention here of your plans in 1959 to put in treatment. You were the only mill at that time that came up with plans, and I want to compliment you today on having plans in the works to comply with our recommendations. I compliment you on that.

CHAIRMAN STEIN: As far as I understand your situation, you would be in a position to comply with the recommendation of the Federal Report as far as the 70 per cent reduction of sulfite liquor within the time schedules indicated in

the report. However, you indicate that you would prefer not to run that all year, just during the time when there is a certain flow in the river and temperature. Is that a fair interpretation of what you say?

MR. MORRIS: Yes, sir. Our intent would be to pond the 70 per cent and discharge under conditions of high river flow and/or low temperature, at the time when Sphaerotilus growth did not appear to be a problem.

CHAIRMAN STEIN: You would have the equipment in to be able to do that when appropriate?

MR. MORRIS: Yes, that's correct.

CHAIRMAN STEIN: Within the time specified?

MR. MORRIS: In fact, most of that we have at present.

CHAIRMAN STEIN: Thank you.

MR. MORRIS: May I ask a question?

CHAIRMAN STEIN: Yes.

MR. MORRIS: Mr. Harris mentioned in his presentation the table in the Public Health Service Report, and also raised the question on 11, 3(a) and (b), the recommendations that appear in the report. As I interpret Recommendation 3(a), "Waste loadings, as shown in the last column of Table I... should not be exceeded." Is that correct? In Table I, there is a 15 per cent reduction claim for primary treatment. The information I have from our technical people -- this 15 per cent reduction would be

questionable, and this means, then, if we use the last column of Table I, we would be including in a figure of 15 per cent BOD reduction with primary treatment that may not happen.

CHAIRMAN STEIN: Is there any comment on that? I think this is a good point. Let's see if we can get this clarified. Can you comment on that?

MR. POSTON: I would prefer to call on Mr. Ralph Scott, the industrial waste consultant. Would you grant us time, Roy, for him to come up?

MR. HARRIS: Yes.

MR. POSTON: Come and discuss this.

CHAIRMAN STEIN: Yes, I think the best way to get these things resolved, settle an issue, is to get the experts up and have a colloquy and see what the point is.

MR. MORRIS: May I ask, raise one more point? It isn't in my prepared statement.

CHAIRMAN STEIN: Yes.

MR. MORRIS: The (b) section on page 11.

CHAIRMAN STEIN: Pardon me. I think the purpose of this is to try to have a coherent record when we are through, and if it's appropriate, we try to hit one at a time, because I find sometimes we get confused when we try to do too much, particularly when someone reads the written record.

Mr. Scott.

MR. SCOTT: Our position in developing the use of a 15 per cent reduction, 15 per cent reduction credited to primary treatment, was based upon considerable literature review which indicates that other pulp and paper mills who have employed primary treatment do obtain the added advantage of a reduction in the BOD load contained in the effluent discharge facilities.

There is no lack of information of this type in the literature, in Tappi publication, in Pulp And Paper, in Purdue Industrial Waste Conference Proceedings, and Sewage Works Journal. Perhaps the best source of information is Bulletin No. 178 by the National Council which both gives efficiencies in solid separation and BOD reductions for 55 mills in the southeast section of the country; and I think if that information is used, we might conclude that our 15 per cent is lower than might be expected and, therefore, the mills will actually enjoy an advantage in BOD reduction that will accrue due to primary treatment. I would look at it the other way rather than that you are not going to obtain 15 per cent, if we are to believe this information in the National Council Bulletin.

CHAIRMAN STEIN: Do you want to have one of your technical people respond to this?

MR. MORRIS: I would like to respond.

CHAIRMAN STEIN: I think, as I look at this, and we check -- this is a new point for me -- but I think this is something that we may be able to resolve. I think you are agreed on the 70 per cent BOD removal, and I think there is no disagreement on that.

There may be some disagreement whether a properly operated reduction by primary treatment will reduce the 15 per cent.

Now, if there is a problem on that and there is conflict in judgment on what may be attained, can we leave that to see if the primary treatment of the reduction is going to be accomplished anyway, to see which one proves out?

Now, in looking at these figures, either it does or it doesn't, and I think what we are talking about is settling on a 70 per cent reduction in BOD. Once we do that, if Mr. Scott's contention is correct, we are going to have a 15 per cent reduction. If there is some doubt about it and this doesn't work, then we will have 15 per cent more. I don't know that this is going to necessarily, as I look at it for the conferees and for the mills, that this should be a sticking point, because from an operation point of view, you are going to put in certain facilities, hopefully we will get the lower results, but if you don't, I think the problem will not be due to the fact that the mills didn't put in the work but that some of the assumptions or

calculations may have been a little awry, and I don't know that the mills have to necessarily be held responsible for that.

I don't look at this as a sticking point. Do the conferees see any problem with that?

MR. HARRIS: I, frankly, do not at the moment on this.

CHAIRMAN STEIN: But I think your point is well taken that there is -- I think we recognize that there is a difference in opinion on the reduction in BOD which will be effectuated by primary treatment, and I think here, again, only time will tell; but it seems to me in looking again at these figures, that if we get the 15 per cent reduction, well and good; and if we don't, I don't think there are going to be earth-shaking consequences.

Do you want to say anything more, Mr. Scott?

MR. SCOTT: Well, I would emphasize again, I will stand by the 15 per cent, and I assume we will get 15 per cent.

CHAIRMAN STEIN: Mr. Scott, no one is disputing you. If what you say is so, and we do get the 15 per cent, the program that is going to be considered will produce it. But I certainly hope, for the industry and for the river's sake, that we do get the optimistic figure on reduction, because that will give us that much more of a margin to play with in development for the river and development to

the industry. I hope we get it. But I don't think, in view of this controversy and about this, that that last column or meeting the last column should be a rigid requirement.

I think the requirement was met with the primary treatment and the 70 per cent BOD removal, and hopefully we will get the added 15 per cent, both.

Do you have another question, Mr. Morris?

MR. MORRIS: Well, I'm sure Mr. Scott has given this a great deal of study. I raised the question, because the tables are shown as a goal, and they assume the 15 per cent. Certainly, we are very much aware of our responsibility in maintaining water quality as we install a primary treatment plant which we have committed ourselves to do. We will operate it to the best of our ability and get everything we can out of it.

May I ask and comment on one additional item, the item on page 11, paragraph 3, subtitle (b)? This again refers to the last column in Table I, as I interpret it: "Additional wastes due to industrial expansion should be accompanied by provision for solids reduction, and a compensating degree of biological treatment, or other disposal means, to prevent exceeding the above recommended waste loadings." Again, a reference to the last column of the table.

One of the things that makes possible a competition of pulp and paper industry with other parts of the country is our ability to expand production, our need to maintain an expanding mill, increase our customers.

As I interpret this, this means, then, that we have committed ourselves to install primary treatment. After this is done and we expand mill production 20 per cent, then it's not enough to install primary treatment capacity for that addition, because we are pegged to this column in Table I, and once we have removed the solids in primary sedimentation -- not being a technical expert in this field -- it seems to me that further solids reduction is going to be a rather difficult thing.

CHAIRMAN STEIN: Do you want to comment on that?

MR. POSTON: Well, as I explained yesterday, our purpose of putting in this recommendation is that we feel that someplace we have got to start drawing a line beyond which pollution must stop.

We think that the place to stop it is now, and we do not feel that we can continue, just because industry expands, to permit them to discharge wastes at the old rate. Already we see many of our rivers loaded to the point where they're all going septic, and the purpose in putting in this was to establish that floor.

Now, we feel and we know that in other parts of the

country they do go to a higher degree of treatment; and we would like to recommend that as you increase your production you increase the degree of treatment so that your total load is not increased; otherwise, we are fighting a losing game here in controlling pollution. This is the philosophy back of this.

We think that our technical people working with yours could work out something.

These pounds, as Mr. Stein has indicated, are not sacred. If we get a 15 per cent reduction -- we hope to get that; you may get more. So I think that these things can be worked out, but this is the establishment of a policy that we are going to reduce pollution and not let it grow. This is what we are trying to do.

MR. MORRIS: We are certainly in accord with that philosophy, but we have to be realistic.

CHAIRMAN STEIN: I do think so, but let's see if we can, and I hope we are not far apart on that. As I look at the total pounds here of BOD removal -- and I don't know that this table relates to solids, because I do think you can remove substantially your settleable solids even with expansion -- I really am not sure that with your present program that your solid discharge is going to really present a material problem unless the expansion is tremendous, because I think you can, as far as I have ever been

led to believe, remove substantially all your settleable solids, but the BOD removal will be 39 per cent below what it is now with that 70 per cent.

For example, at 778,000 pounds now, it will remove down to 478,000 pounds -- that's page 6, the total amount. Well, I think if we are down around 475,000 pounds or with that extra 15 per cent, from 406,000, but if, hopefully, we are down about 475 or 450,000 pounds, we have to think in terms of what the river will take, because conceivably if your industry expands and you keep on removing just 70 per cent, we can crawl up, creep up to the 778,000 pounds, and if that is causing the slime growths, we will be back where we are.

Now, that's why I say I hope we will get the extra 15 per cent, because we will have more leeway.

I think the intent here is to keep the liquid wastes out, coming from the paper mills, so reduced, so treated, that it will not cause the objectionable slime growth.

I do think, too, that you do have a lot of leeway, as far as I see it, for expansion, and given the existing treatment facilities; and I don't know how industry will take this, but what you're dealing with here is primary treatment. And other places -- I don't want to push this too hard, and I'm not posing this for the Columbia -- you have the industries that have demonstrated that they can go

way beyond that as the new Kimberly-Clark mill in California demonstrated with salmon coming right up. You have secondary treatment to go into; you have evaporation, burning, and you have other methods; but I think the Report is suggesting that we strike some balance on BOD loading removal. We hope that that balance will prevent slimes to come in. If this works, we will know we have the slime problem licked. I hope it does work and we don't have to come back. Once we have this licked, any future expansion of the pulp and paper industry -- goodness knows, we are all for expansion -- I think the expansion is inevitable. And I say to the fishermen in the audience, too, that we have to learn to live with an expanded pulp and paper industry here, and, hopefully, good fishing. But any expansion of that industry should not create conditions where we are going to have slime growths again.

I think the states in issuing permits for the new mills will certainly have that in mind.

Again, what I'm saying, Mr. Morris, is that I think we are trying to strike a very, very fair balance, and not asking you at this time to spend any more money or do anything which will be a futile gesture and something just for the motion, putting up a monument to treat the facilities. We are not looking for that. We are trying to get something lined up which will prevent slime growth, and

this is our sole point.

I would like to just take one second, because this deals with your Crown Zellerbach problem in your intermittent discharge, and that system developed by Dr. Amberg. At the time, I remember when Dr. Amberg came up with that suggestion; a lot of people told us that our job was to keep it out of the river and not let that waste go out, and I think the notion that I put forth then, at least the theory -- I haven't changed my mind -- keep it out of the river for what? The only reason we keep something out of the river is that it causes some damage to a water use, and if there was a way of discharging it as we thought at the time, then this wouldn't interfere with the water use.

We don't have any hard and fast rule; that is, our notion here is to devise some type of program which will prevent slime growth.

I am completely confident that once we have the slime growths licked, that we are going to be able to develop a program -- and I hope you and the states will, because I am not sure, once we have this licked, that there is any need for a Federal role; that you and the states will be able to develop the program which will permit expansion of the industry and yet the production of a waste which will not create the slime problem again.

Are there any further comments or questions? If not,

thank you very much, Mr. Morris.

MR. MORRIS: Thank you.

CHAIRMAN STEIN: Mr. Harris.

MR. HARRIS: Proceeding down the river, I would like to again ask if Boise Cascade would have any further comments other than those yesterday.

MR. McDEVITT: Not at this time.

MR. HARRIS: Next, we would like to call on Mr. Clarke of Longview Fibre.

MR. CLARKE: Mr. Chairman, conferees, ladies and gentlemen: My name is W. W. Clarke. I am Vice President-Production and Mill Manager of the Longview Fibre Company, Longview, Washington, testifying at the invitation of Mr. Roy M. Harris, official conferee for the Washington State Pollution Control Commission.

As noted in the USPHS report of August, 1965, Longview Fibre Company is operating under a valid waste discharge permit expiring February 14, 1969, which does not require sedimentation facilities but which is subject to upgrading of requirements. Recently, in cooperation with the Washington Commission, we have agreed to develop a program for installing sedimentation equipment and have filed a timetable and begun the necessary technical work to permit design and installation. We have done this in spite of the fact that wood fibre is not the primary cause of slime

and that the wood fibre which has recently been shown to make Sphaerotilus more tenacious is in all probability only in a small part coming out of paper mill outfalls. While the economic wisdom of installing sedimentation facilities is doubtful and it is not even clear that we could be lawfully compelled to do this, we are willing to undertake this very substantial expenditure so that as far as we are concerned, we can feel that no stone has been left unturned in the effort to safeguard the quality of the receiving waters for beneficial multiple use.

We believe that with the exception of a sedimentation system to reduce Total Suspended Matter that we have done everything that is expected or necessary to minimize the deleterious effects of our effluent including, of course, the recovery of kraft mill spent cooking liquor. Since the details have been covered on pages 33 and 34 of the USPHS report, it would not be useful to repeat them. However, I would like to point out that since 1959 we have spent over $300,000 on approximately 25 separate projects to remove various materials from the mill effluent streams before discharging into the river. Of this amount, over half was expended to improve existing conditions and was not part of any new production system. Among these projects were several for the purpose of removing fibres and small wood particles from various streams throughout the mill and

dewatering for land disposal or burning. Other projects were for changes in process to increase reuse of water and thus reduce the amount of material discharged to the river. In most cases, the disposal of the material removed was done at a cost for which there was no offsetting return.

We have been conscientious in using means and methods available to us to make reductions in fibre losses to the river from a mill which in 1959 already had relatively low losses.

We keep a full-time technical man working on our overall in-plant improvement program. His job is to determine whether existing equipment is being operated properly and to search for ways and means of improvement.

There is one more point that I wish to stress. Our mill, which has grown since 1959 and which is continuing to grow, operates almost 100 per cent on waste materials from sawmills, plywood plants and woods operations. These wastes, including wood logs, chips, sawdust and shavings, would be burned with an attendant air pollution problem if not utilized for pulp and paper. We and others in the industry have made recent dramatic progress in the utilization of sawdust and shavings for pulping. Extensive use of these smaller sized particles was not considered possible a few years ago. This development will make a major contribution to the elimination of the beehive waste burners, which

presently often create smog and will also make a major contribution towards conserving our forest resources.

Now, I have a few things I'd like to say that were not on my formal presentation, if you don't mind.

CHAIRMAN STEIN: Yes. Do you want to entertain questions first or do you want to say these first?

MR. CLARKE: Well, the comments that I had that are not on the record, Mr. Stein, relate to the subject that was brought up by Boise Cascade on the Recommendation No. 3 yesterday afternoon.

I have had a chance to do some thinking about this, and I have had like feelings, as Rex Morris expressed, that as far as we are concerned and the experience we have in our mill, we question very seriously the fairness and the validity of Table I when taken together with the Recommendation No. 3.

This puts a premium and a very severe penalty, let's say, on those of us who have tried to be good performers in the past and who already have done a good job short of sedimentation, and gives us a percentage reduction to live up to which can be very difficult.

And I think, from that standpoint, I know that this Table I -- some numbers had to go down -- I mean, there are things that have to be set forth, some goals, but it seems that it has put a terrible penalty on us, as we feel in our

mill we have been fairly well closed up and have done, with the available equipment, a good job.

Now, the case in point on this is the reduction of BOD. We have in our mill -- and I believe it shows in the August report -- that we are using contaminating condensates back in our process, and we have done this in an effort to reduce BOD loadings, because this is one of the streams that we could do something about.

Now, here, again, to get a 15 per cent reduction of our total BOD, we could be in trouble.

CHAIRMAN STEIN: You are talking in terms of the last table, and I thought -- I would agree with you there, Mr. Clarke, at least looking at your problem back in Washington and discussing it with the people here and reading the report -- I always thought the opposite and thought you fellows were practically home free because of your kraft mill process rather than an undue reduction, because if we talk in terms of the BOD reduction of 70 per cent removal, your reported discharge is 80,000 pounds and you would still have 80,000 pounds. In other words, because of your process and what you have done -- you have done this -- you are just faced with your sedimentation problem.

As I understand the problem -- and perhaps I don't -- what the main thrust of this recommendation is, to put the

sulphite mills on an equal basis with the kraft mill and the mill such as yours, and a good deal of the requirements here that are faced by some of the sulphite mills, you are already accomplishing because of your process.

MR. CLARKE: Isn't there an implication that we are to reduce our BOD loadings by 15 per cent?

CHAIRMAN STEIN: Here's the point: Let me make this clear again. I think you have indicated that you are going to put in sedimentation.

MR. CLARKE: Yes, sir.

CHAIRMAN STEIN: The point is, I think we can all make a judgment -- your company, the state people and us -- and I don't think there is going to be any disagreement on this judgment, whether you have an adequately constructive and operative sedimentation facility.

There is a notion -- at least Mr. Scott puts forward as his opinion and his firm opinion -- that this will reduce your BOD loading 15 per cent. There are some doubts raised by some people whether this will actually happen.

I think the requirement is that, and I think you have agreed with this, as I read the statement, that you are going to put in the sedimentation facility.

MR. CLARKE: We are.

CHAIRMAN STEIN: Once that is in and is operating, I think we will look at that on the evaluation, and to my mind

-- and, of course, the conferees will have to see this in view of the doubt -- I would not think that that issue is going to be a critical one. The last -- the poundage on the last column of the table, now, hopefully, you will have a 15 per cent reduction. If you don't and you put that in, the fibres will be removed, and I think we will have accomplished the push.

While we are on this, I'd like to ask you a question.

MR. CLARKE: Yes, sir.

CHAIRMAN STEIN: Would you care to indicate the kind of timetable you have filed -- you said you filed -- what the timetable is?

MR. CLARKE: I believe that the timetable that we had called for completion in mid-1958.

MR. HARRIS: '68.

MR. CLARKE: '68. I'm sorry.

CHAIRMAN STEIN: '68.

MR. CLARKE: Thank you.

CHAIRMAN STEIN: Well, fine. Does that answer the question?

MR. CLARKE: Yes, sir. I'm glad to hear you say that.

CHAIRMAN STEIN: I think this will obtain. We will have to ask the conferees. I didn't hear anything from the other conferees. I assume we are in agreement on this, that this seems to be a crucial point, that I can understand

the views of the pulp and paper industry on this; and I think your point is very well taken, sir.

MR. CLARKE: If you read this literally, this is what you come up with.

CHAIRMAN STEIN: I think that's a very good point, and I think this is one of the advantages of the conference technique and the way we do business.

Mr. Harris.

MR. HARRIS: Mr. Chairman, I would like to make a comment with regard to the date of 1968 mentioned by Mr. Clarke, the completion of primary sedimentation, that this was their proposal and the Washington State Pollution Control Commission has asked them to restudy this proposal to see if this could be accomplished in 1967. I believe this is under study at the moment.

CHAIRMAN STEIN: Right. Thank you.

Are there any further comments or questions? If not, thank you very much.

MR. CLARKE: All right.

CHAIRMAN STEIN: Mr. Harris.

MR. HARRIS: Next, we would like to call on Mr. Callahan, representing Weyerhaeuser Timber Company at Longview.

MR. CALLAHAN: Mr. Chairman, conferees, and ladies and gentlemen: My name is J. R. Callahan. I am a branch

manager of Weyerhaeuser Company's pulp and paperboard mill located in Longview.

I want first to express our appreciation to the Washington Pollution Control Commission for the invitation to appear here and enter a statement into the record of these proceedings.

Weyerhaeuser Company shares with all interested persons a concern about the quality of our streams and rivers. Our employees share this concern as is shown by their interest in helping us to maintain a consistently progressive program of water quality improvement.

Our Company's support of corrective programs is evidenced by our extensive and productive efforts in both research and practical operational procedures. The most outstanding example is the long and costly research work which resulted in perfection of the magnesium base pulping and recovery system for sulphite pulping. The installation of this system at Longview was the world's first practical solution to the problem of effective recovery of spent sulphite liquors. In the Longview plant alone, we have expended over $5,000,000 in new facilities which include water quality improvement as one of the resultant benefits. In this mill we have installed facilities for the recovery of chemicals which are (1) used in pulp cooking, and (2) contained in spent liquor.

A prime example of the effects of our in-plant control program is shown in the reduction of suspended combustible solids discharged per ton of pulp produced. From 1962 to date, such reduction was 36 per cent, even though pulp production increased by 26 per cent during this period, indicating more efficient in-plant controls.

The staff of the Washington Pollution Control Commission has followed a program of regular and periodic review with us of our mill discharges. On June 25, 1965, we advised the Commission that Weyerhaeuser Company would proceed with the design and construction of sedimentation facilities. The installation of these facilities will be completed by mid-1967, at a cost of $1,500,000. Thereafter, the Company will incur substantial costs annually to operate the facilities.

Expenditures of substantial sums for these items inevitably have an adverse effect on profits and return on investment. To alleviate this economic burden, we strongly urge a special investment tax credit for such facilities.

Weyerhaeuser Company will continue its research program in order to add to its knowledge about the waters of the Columbia River. We expect to make use of all available and economically feasible means of preventing material impairment of the Columbia River for other uses normally made of its waters.

CHAIRMAN STEIN: Thank you, sir. Are there any comments or questions? Thank you very much, sir. Your proposal of tax credits, as you know, has been taken up in the Congress from time to time, but it doesn't seem to get very far.

MR. CALLAHAN: Yes, sir.

CHAIRMAN STEIN: Mr. Harris.

MR. HARRIS: Mr. Chairman, I have also issued an invitation to Mr. Don Benson, representing the Northwest Pulp & Paper Association.

Mr. Benson, would you like to make a statement?

MR. BENSON: Chairman Stein, conferees, and ladies and gentlemen: I am Donald J. Benson, Executive Secretary of the Northwest Pulp & Paper Association.

The Association is one of the technical and research arms of the pulp and paper industry in the states of Oregon and Washington. This statement was prepared in cooperation with the pulp mills involved in this Columbia River Conference and with the National Council for Stream Improvement, the pulp and paper industry's national technical and research organization, through their regional engineer, Mr. Russell Blosser.

As demonstrated by previous statements, the Columbia River presents a complex and unique problem to those charged with its management. This is true, not only for pollution

abatement but for power production, navigation, recreation, irrigation, fisheries and flood control.

All of these functions relate in some degree to the perplexing problem under discussion here today.

Before demonstrating this, let me briefly note that the water quality of the Columbia River -- even in its industrialized section here in the lower reaches, is of high quality by many standards. The dissolved oxygen content is excellent, in fact, super saturated much of the year, the dissolved solid content is low, the coliform content has been reduced substantially by the efforts of municipalities and trace elements such as phosphates and nitrate and its cool temperature compares favorably to other large rivers across the nation. Indeed this lower section is used for the high quality needs of both industrial and domestic water supply and anadromous fish passage. Let me emphasize here that the pulp mill wastes do not contain the bacteria or virus injurious to health.

May I also note that there is no question of fish passage on the Lower Columbia. Our problem may involve the fisherman, but not the fish.

We may ask then if the water quality is so good why is there a problem? The answer in part may be because of this high water quality. The culprit in this dilemma, Sphaerotilus natans the slime organism, sometimes forms in

reported nuisance proportions at certain combinations of flow, temperature, trace elements and nutrient carbohydrates from effluent discharges. Note that none of these water quality constituents alone are at high enough levels to normally be the subject of pollution abatement. Nor does the problem always occur when expected. For instance, this spring a usual time for severe conditions, there was no discernible problem of organism growths.

Now to relate how the many services to which the Columbia is put bear on our problem of today. Again, no single or simple combination of these constituent uses can be identified as paramount, but each of these legitimate water services adds a confounding element to an already complex picture.

The nearly complete impoundment of the river on its main stem and main tributaries for power production and flood control add to the temperature and cut down the beneficial flushing action of freshets which could remove both man-caused and natural detritus from the lower tidal reaches.

The return irrigation waters east of the Cascades add to any natural levels of phosphate and nitrate which are suspect trace elements necessary in the production of Sphaerotilus. They also can periodically trigger algal blooms on upper river tributaries which may eventually add

to the background carbohydrate content of the lower river. The great river is also used to cool the nuclear reactors at Hanford, again with a tax on its temperature resource.

These upstream uses each contribute in a small but discernible degree to the combination of ingredients thought necessary for slime growth and add to the difficulty of solution.

Attesting to this difficulty are the many years of field study and more than fourteen public reports submitted by both industry and agencies since 1943 in an effort to untangle the technical web.

Less than six months ago the first of two reports compiled by the U. S. Public Health Service from recent Federal and state data, developed a completely new theory on the mechanism and manifestation of the nuisance bacteria. The new theory, the third hypothesis since 1943, which has necessarily been subjected to only minimal field confirmation because of its recent origin and lack of discernible nuisance conditions in the river this spring, relates to the slime-fiber relationship adequately described earlier in this meeting.

This concept has been accepted as a possible contributory cause.

This is witnessed by the fact that the pulp manufacturers have responded with positive plans for removal of

settleable solids to the official state agencies. This is another in a series of positive steps taken by the industry whenever new and reasonable information regarding this problem has been developed.

These steps do not imply that the previous hypotheses have been invalidated, but perhaps the character of the problem has been changed due in point either to the steps taken by the mills heretofore, or perhaps yet unrecognized changes occurring on the river. It would appear that we have some aspects of a totally different problem than witnessed 20 years ago or perhaps even in 1958.

The earlier reports referred to the problem almost entirely in the upper river near the Camas-Vancouver area, and described the nuisance in terms of Sphaerotilus natans only. Now, the complaints center largely on the lower tidal reaches, and the composition of the material causing the complaints has changed significantly.

The August 1965 report emphasizes that substances collected on fishermens nets include many materials other than fiber or Sphaerotilus natans.

Particular reference is made to the section in the August 1965 report entitled "Effects of Wastes on Water Quality Uses and Appendix B." Here it can be noted that much of the material caught on nets is not of pulp mill origin and consists of plant debris, algae, diatoms and

slimes, principally other than S. natans.

The sedimentation facilities proposed will add an estimated 6 million dollars to the 2 million spent to date by the pulp industry in solving this problem. These capital costs are for liquid waste control facilities only. They add no new production nor do they increase the efficiency of operations. In addition operation and maintenance costs will run an estimated half million dollars annually.

No firm cost estimates are available for the 70 per cent BOD control of spent sulfite liquor solids, but this item alone will easily surpass the amounts spent and committed thus far.

The mills of the Columbia River who are here today employ over 7,000 people and pay annual wages of 52 million dollars. In addition they pay to state and local governments $5.3 million each year in taxes; seventy per cent of their raw wood source is in the form of chips which adds 25.7 million dollars annually to our related wood products industry revenues and efficiently utilizes a resource once wasted. The total dollar value purchased in the form of labor, wood and other goods and services in Northwest communities exceeded $187 million in 1964.

We commend the states of Oregon and Washington and the U. S. Public Health Service for their persistent efforts -- along with those of the pulp industry -- to untangle this

highly involved and complex technical problem.

Through the cooperation of the pulp industry and the agencies involved solutions are being approached, both to the knowledge of the nuisance mechanism along with the installation of such effluent treatment facilities and controls as are feasible and are found necessary by sound data and scientific interpretation.

CHAIRMAN STEIN: Thank you, Mr. Benson. Are there any comments or questions?

MR. POSTON: A good statement, Don.

MR. BENSON: Thank you.

CHAIRMAN STEIN: Mr. Benson is one of the best salesmen you have, and we deal with a lot of trade association executives in our business. I think he does very well for you people. As far as I can see, he is one of the most effective, certainly, in dealing with the Federal Government.

MR. BENSON: I assume this was on the record.

CHAIRMAN STEIN: Yes, it is on the record.

MR. BENSON: Thank you. (Laughter)

CHAIRMAN STEIN: I am not trying to -- don't run on. I am not trying to set you up here.

MR. SPIES: Still on the record, I'd like to point out that Don was well trained.

CHAIRMAN STEIN: One thing you dealt with -- I guess it's fair -- dealing with Hanford as a heat source.

Sometimes I think -- although we are charged, and I specifically am charged with abating pollution from Federal installations -- that those poor guys don't have a lobby speaking for them, and everyone clobbers them by fair shooting; but we did look into the Hanford heat situation. As far as we can see, the heat put in by Hanford dissipates within a few miles below -- at least from what I get from our scientists -- and that has no effect on the heat problem or contributes to the heat problem down in this area of the river.

Now, if we are incorrect on that, we will look at that, but with the new steam reactors and so forth, I think the Hanford heat problem is being reduced, and I do -- I really do think it's minimal.

I, again -- and the reason I say this is I think we are -- possibly you heard some question of thermal pollution on the Lower Columbia River, and it may be you are going to hear a lot of talk; you have your own industry. Anyone who puts the stuff in, including the pulp and paper industry, is going to be implicated in this.

I think we have to be very, very careful if we are dealing with a thermal pollution problem, because this very well may be the next issue in the river, and being careful to delineate where the heat comes from, and I would be the last to say that as far as I see it, I see no evidence

yet that the pulp and paper industry is contributing substantially to this problem, but I am not sure that Hanford is either.

MR. BENSON: I didn't intend to bring this up as another pollution problem but just as a complexity.

CHAIRMAN STEIN: Right.

Now, I have one point, and it may be you may not want to answer this question. I am not asking this as a question, but in your statement on the Sphaerotilus problem you say, "Nor does the problem always occur when expected." And if we go back to a statement given just a little bit ago by Mr. Morris of Crown Zellerbach, he talks about operating the plant to remove, reduce the BOD by 70 per cent during periods when flow is less than 220,000 cfs at Mayger, and water temperature is 10 to 15 degrees centigrade. Now, the question that occurs to me is the reconciliation of those points of view. If the problem doesn't always occur when it's expected, how can we, with particularity, talk about just operating the reduction of BOD when certain conditions occur at a particular point on the river?

MR. BENSON: Unfortunately, we have a positive aspect of this. The reference I mentioned was when the slime did not occur when we expected it, and I don't think it's ever occurred from the opposite ----

CHAIRMAN STEIN: In other words, you mean sometimes it

doesn't happen?

MR. BENSON: Sometimes it doesn't happen when we think it might, and this is -- this did not happen.

CHAIRMAN STEIN: Right. Well, thanks.

(Discussion off the record.)

CHAIRMAN STEIN: Are there any further comments or questions? Mr. Harris, do you want to continue?

MR. HARRIS: I have no further questions from Mr. Benson.

CHAIRMAN STEIN: Do you have anyone else to call?

MR. HARRIS: We have one other member of the Washington State Department of Fisheries I see is here at the moment, I called on previously -- probably had a flat tire on the way down. Mr. LeMier, would you like to present a statement on behalf of Director Tollefson of the Washington Department of Fisheries?

MR. LeMIER: Thank you, Mr. Harris, and I apologize for being late.

Mr. Chairman, conferees, ladies and gentlemen: First of all I would like to extend some greetings from Director Tollefson who could not attend because of some other matters, and want to thank the Chairman and the other Conferees, and especially Mr. Harris, for the invitation to participate in this third session.

The statement is fairly brief. We feel that a good

deal of this material has been reviewed in the earlier sessions; and some of it, to avoid being completely redundant, we have cut our statement quite short.

The magnitude of bacterial contamination from untreated or inadequately treated sewage and slime-forming industrial discharges in the Lower Columbia River was spelled out at joing state-Federal conferences held in September of 1958 and 1959. Following the first session, an action program was inaugurated by the states of Washington and Oregon through their respective pollution control agencies. The second session established specific dates for compliance to curb pollution and to ascertain progress of the program.

Despite the efforts of the action program the filamentous slime growth, Sphaerotilus species, has continued to plague commercial and sport fishing operations in the Columbia River. In almost all years subsequent to the second session of the Conference on Pollution, commercial and sport fishermen have complained of the effect of slime (Sphaerotilus) on their operations. During test fishing operations conducted by the Oregon Fish Commission to determine the timing and size of the spring chinook salmon run in 1964, the fouling of the test fishing gear by slime was so great as to make analysis of the data useless. Washington test fishing for spring chinook salmon occurred upstream from the major industrial discharge sites and was

not affected by this problem.

The obligation of the Washington Department of Fisheries to maintain an orderly fishery requires that the overall action program, instituted in 1958-1959, be expedited in order to eliminate slime-producing and toxic discharges into the lower Columbia or its tributaries at an early date.

That's all I have, Mr. Harris and Mr. Chairman.

CHAIRMAN STEIN: Thank you, Mr. LeMier. Are there any comments or questions? If not, thank you very much.

Mr. Harris.

MR. HARRIS: Mr. Chairman, an invitation was sent to the president of the Washington State Sportmen's Council to designate a representative to present a statement at this meeting.

At the time I left my office, I had not received a response, and I would like to ask if such a representative is present this morning.

(Discussion off the record.)

MR. HARRIS: To go back on the record, apparently there is no representative from the Washington State Sportmen's Council. And the Pollution Control Commission of Washington has now concluded its presentation.

CHAIRMAN STEIN: Are there any further comments or questions? If not ----

MR. POSTON: Mr. Chairman, yesterday the Weather

Bureau had indicated that they wished to make a presentation. They appeared in the afternoon. There was no time to put them on. I wonder if they are here this morning. They told me that if they were not, they would have a statement which they wish to include in the record, and I would like to request that when the statement is received that it be placed in the record.

CHAIRMAN STEIN: Well, I hope we will get the statement within the next day or so. We will keep the record open to the end of this week.

MR. POSTON: It was supposed to have been here this morning.

CHAIRMAN STEIN: But we do have to proceed with an orderly closing of the record, and the reporter has to get his payment. We can't keep it open. We have to go toward printing; so the record will be open if they get it in by the end of the week.

MR. POSTON: Will you hold it open until 4:00 o'clock? After that, it's a dead issue.

(The U. S. Weather Bureau Report referred to, is as follows:)

"Statement of the U. S. Weather Bureau River Forecast Center

Presented to

The Third Session of the Conference on Pollution of Interstate Waters of the Lower Columbia River - Bonneville Dam to Cathlamet, Washington. September 8, 1965, Portland, Oregon.

"The purpose of this statement is to insure that all people concerned with the level of flow in the lower Columbia River are aware that forecasts are being routinely prepared and issued by the River Forecast Center.

"Two types of forecasts are available. The first is a short range, operational forecast issued each day, Monday through Friday, for 3 days in advance. It incorporates the anticipated effect of rainfall and scheduled regulation by the several power reservoirs in the basin. Flows are predicted at principal reservoirs including Bonneville.

"The second type of forecast is a longer range outlook or planning forecast issued twice weekly (Tuesday and Friday) for 30 days in advance. This is a cooperative effort with the Corps of Engineers, North Pacific Division, utilizing their computer facility. It might be termed a probability forecast since it is built up from the most probable flows in each of the major tributaries to the Columbia. These have been determined for all periods of the year by computer analysis of long period flow records. Until accurate long range weather forecasts become available, this method of extending flows is probably the most useful. Also incorporated are long range reservoir regulation schedules. Forecasts are available for most points in the Columbia Basin, down to the Willamette confluence.

"If you desire this forecast service, please contact

the River Forecast Center, 320 Custom House, phone 223-5273. Anthony J. Polos, Hydrologist in Charge."

CHAIRMAN STEIN: Are there any further comments or questions?

MR. SPIES: Yesterday afternoon before adjournment, I didn't get an opportunity to thank all those from the state of Oregon who made statements, and I may have set it off a little too quickly.

I wonder if Dr. Charlton wanted to make any statement on behalf of the Izaak Walton League.

DR. CHARLTON: I haven't prepared a statement, Ken, so I don't think I will attempt to make one. I have testified at previous hearings. The position of the Izaak Walton League is well known. If Mr. Stein thinks that a statement should be submitted, I can prepare one, but we are on record on previous conferences. I have been listening to the proceedings with a good deal of interest today.

MR. SPIES: Thank you, Dr. Charlton. Thanks again to all those who participated.

CHAIRMAN STEIN: Thank you, Mr. Charlton, too, because we do know that the Izaak Walton League through the country has been one of the most vigorous supporters of pollution control, one of the most vigorous supporters of our program and our legislation, and also, I might say, one of the most vigorous watchdogs to see that we are on the job and doing

it.

(At the conclusion of the hearing, a statement was submitted by Mr. Charlton in behalf of the Izaak Walton League of America, which appears as follows:)

"A Statement submitted by David B. Charlton, Member, Clean Waters Committee - Izaak Walton League of America

CONFERENCE IN THE MATTER OF POLLUTION OF THE INTERSTATE WATERS OF THE LOWER COLUMBIA RIVER AND ITS TRIBUTARIES FROM BONNEVILLE DAM TO CATHLAMET, WASHINGTON, SEPT. 8 AND 9, 1965.

"The abatement of water pollution in the Willamette River has been a concern of mine over the past 30 years. I have served continuously since 1935 on chapter, division and/or national committees of the Izaak Walton League having clean waters as our objective.

"The policies and action programs of the League are well known. Our members were active in supporting legislation that established the Oregon State Sanitary Authority in 1939 and Federal Waters Pollution Control law in 1948. The League is already on record at previous sessions of this Conference in support of the action program that has been initiated.

"The pollution problems in the lower Columbia and the Willamette Rivers are similar in that sewage contamination threatens recreational use of important sections of the

rivers and both have a serious bacterial slime problem due to Sphaerotilus. However, the low dissolved oxygen condition during the summer and early fall months exists in the Willamette River only. It has been destructive to summer and fall runs of salmon and steelhead (perhaps also to downstream migrants of other runs), at least since 1926. Improvement in this situation has been slight, - in the August-September period of 1934, the dissolved oxygen content ranged from 0 to 2.0 parts per million in the Portland harbor section of the River, while in recent years the range is roughly 1.8 to 3.5. This is still well below the desired minimum of 4 to 5.

"Why does the river continue to be in a critically polluted condition? The answer is simply that steps taken to reduce the industrial wasteload have been inadequate. A recent report states that the untreated organic wasteload amounts to 6 million population equivalents with over 90 per cent being contributed by industrial activity. It should be noted that there has been only one major pollution abatement measure affecting the wastes of the pulp and paper industry on the Willamette River. This came about only after much prodding by the Sanitary Authority. That was back in 1952 and it consisted of lagooning the strong sulfite digester liquors during the low water period for release to the stream during high water flows. One mill

found it more feasible to collect the liquors, barge them to the Columbia River and release them there.

"At last action is being taken by the Sanitary Authority that should result in a significant reduction of this huge industrial wasteload. The pulp mills on the Willamette River have received orders to achieve an overall reduction of not less than 85% in the biochemical oxygen demand loading of the effluents from the entire mill and to install primary treatment for the removal of settleable solids. It is hoped that the slime problem will be greatly reduced or eliminated through a reduction in the substances that stimulate the growth of the bacteria and in the wood fibers which provide attachment surfaces with resulting 'mass growths' which are so objectionable.

"Percentage goals may be inadequate. If pulp production continues to increase then the untreated 15% of the total waste becomes more significant. The quantity of water in the river and the dissolved oxygen content of it are limited and are known. Perhaps allocations should be made on a pounds of oxygen basis so that any increase in production would require increased efficiency in waste treatment. Utilization of the wood sugars present in sulfite waste liquors, with resulting reduction of the organic load going to the river, in the production of yeast and alcohol is made at some pulp mills on this continent and in Europe. There

is one such plant at Bellingham, Washington, in operation since about 1945. We wish there were more of them. The comment heard is that it is not yet economical to make such installations and if all the sulfite mills made these products the market would be glutted. However, as costs of waste treatment go up, utilization of wastes for the production of by-products may become more feasible.

"Progress in the abatement of sewage pollution in Oregon has been slow but significant. Recently orders have been issued by the Authority requiring cities situated on the Willamette River to install secondary sewage treatment facilities. This is an important step in getting a clean river and it will receive public approval and support.

"Water requirements of our expanding industry, of our increased population with greater per capita use and of agriculture along with a tremendous increase in water-based recreation, have made everyone aware of the water supply and water quality problem. Cooperative efforts in pollution abatement by State and Federal agencies such as are taking place in this Conference are most desirable. There is an evident determination to stop further pollution of the Columbia and Willamette Rivers and to enforce measures that will reduce existing pollution. Interstate action promotes uniformity and fairness with respect to waste treatment costs to be met by the many plants within a particular

industry. Cost of waste treatment is an essential cost of production. The dumping of untreated waste into streams must come to an end. It now appears that we are really on our way to that objective, not only in this area but throughout the country."

CHAIRMAN STEIN: Are there any other comments from the conferees at this time?

If not, I think that the conferees would like to have an executive session at this point, and we hope to have an announcement in about an hour, which will make it 12:15 to 12:30, and we will reconvene in this room to make the announcement.

With that, we will stand recessed until about 12:30. Thank you.

(Whereupon at 11:20 o'clock, A.M., of this day, Thursday, September 9, 1965, a recess was taken until 1:45 o'clock, P.M., of this day, at which time the following further proceedings were had:)

CHAIRMAN STEIN: May we reconvene?

I am happy to report that the conclusions and recommendations of the conferees are unanimous.

The conclusions and recommendations of the conferees

of the Third Session of the Lower Columbia River Conference are as follows:

1. Cognizance is taken of the successful programs of the Oregon and Washington State Water Pollution Control Agencies and municipalities and industries covered in the first two sessions of this conference to abate pollution and improve the quality of the waters of the Lower Columbia River. The conferees believe that as a result of this action, waste discharges no longer endanger health so as to be subject to abatement under the Federal Water Pollution Control Act.

2. Despite conscientious efforts by the Federal and State Water Pollution Control Agencies and the industries concerned, slime growths still remain a pollution problem in the Lower Columbia River. Wastes from the pulp and paper industry are in large measure responsible for this problem.

3. The delays in dealing with the slime growth problem in the Lower Columbia River have been due to the technical complexities of evaluating the causes of the slime growth and of the appropriate measures to be taken for its correction.

4. All pulp and paper mills discharging wastes to the Lower Columbia River shall design and construct primary treatment facilities for removal of settleable solids. Such

facilities shall accomplish at least a 70 per cent reduction in volatile suspended matter discharged to receiving waters. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than December 31, 1967.

5. The Crown Zellerbach Corporation mill at Camas and the Boise Cascade Corporation mill at Vancouver shall accomplish a 70 per cent reduction in BOD loadings derived from sulphite liquor discharged into receiving waters. These facilities shall be placed in operation no later than December 31, 1969. The Publishers' Paper Company mill at Oregon City shall by December 31, 1969, discontinue barging and discharging liquor solids in the Columbia River.

6. Following the installation of the above-recommended facilities, an evaluation of their effectiveness in controlling objectionable slime growths in the Lower Columbia River will be made. If this waste reduction program is not successful, further recommendations will be necessary.

7. All discharges into the Lower Columbia River resulting from new or expanded pulp and paper mill operations shall conform to the foregoing requirements. Additional measures may be required for existing as well as new or expanded installations as may be necessary to prevent the recurrence or intensification of the slime growth

problem.

8. The technical coordinating committee established by the second session of this conference shall advise the conferees on matters concerning compliance with these conclusions and recommendations.

This concludes the conclusions and recommendations, but the conferees could not resist the following, and that is, recognition by the conferees is given to the willingness expressed by the several mills at this conference substantially to comply with the above recommendations.

Are there any comments or qualifications by the conferees? If not, I really do think that we have achieved a substantial breakthrough in the program to control pollution of the Lower Columbia River.

I think the attitude expressed by the mills, the state agencies, and the Federal Government represent a consensus and represents years of wrestling with a very difficult problem indeed.

I do think that we are going to be able to look forward to a cleaner Columbia River.

I do think, too, that we have experienced the equitable handling of one of the most complicated problems we have had on a major river.

I think that all parties are to be commended, and I am sure if we will work forward with this program, we can

restore the Columbia River to a water quality which will be suitable for the maximum number of water uses, and we can preserve that quality.

I want to thank all of you for the opportunity of working with you, and I want to assure you that the Federal Government will continue to cooperate with the state agencies in seeing that the Columbia River is kept clean and can be used for the growth and development of this area.

I would like to thank all of you for participating in the conference and staying with us through the technical reports to the bitter end.

Thank you very much, indeed; and with that, if the conferees do not have anything more, the Conference is adjourned.

(Whereupon at 1:50 o'clock, P.M., of this day, Thursday, September 9, 1965, the Conference on Pollution of Inter-State Waters of the Lower Columbia River was adjourned.)

This is to certify that the attached proceedings in the matter of Conference on Pollution of Interstate Waters of the Lower Columbia River held at the auditorium of the Interior Building, Portland, Oregon, on September 8-9, 1965, was held as therein appears, and that this is the original transcript thereof.

Douglas G. Alex

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Official Reporter.

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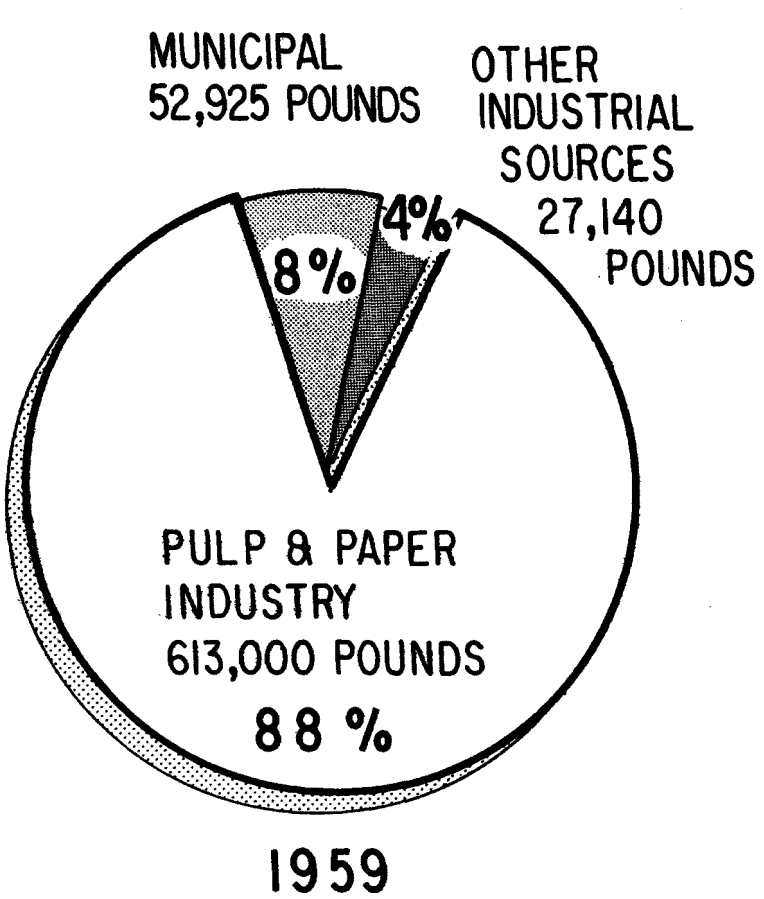
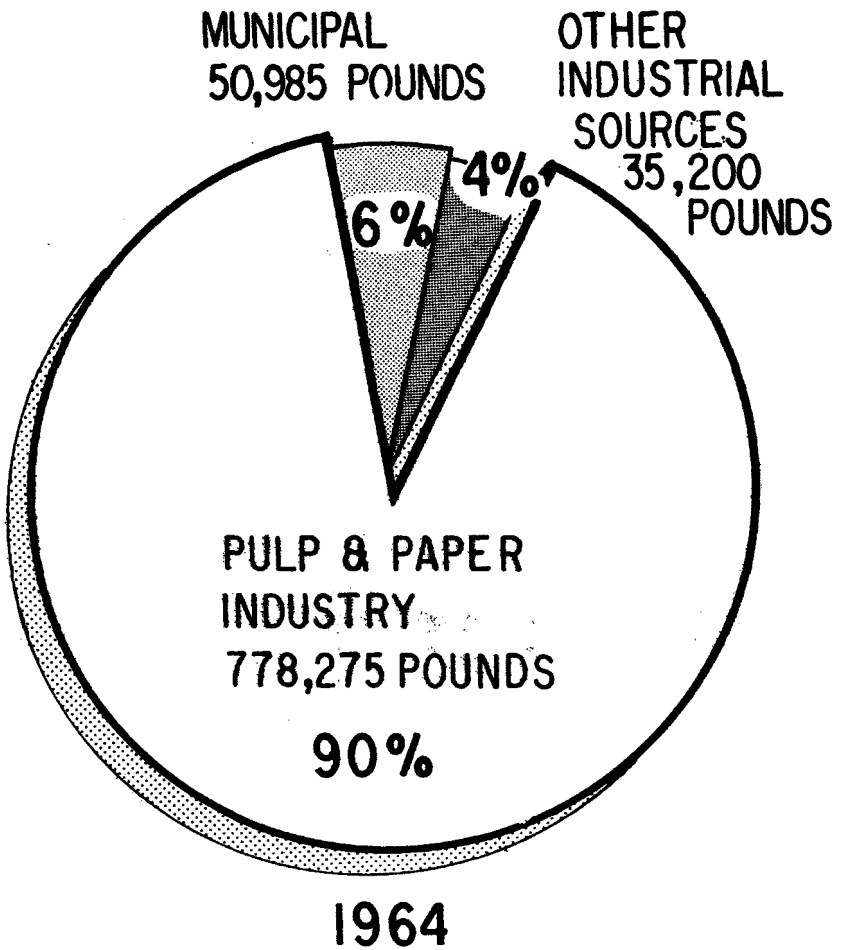
A P P E N D I X B

LOWER COLUMBIA RIVER- Bonneville Dam to Cathlamet Wash.

ESTIMATED POUNDS BOD PER DAY



TOTAL: 693,065 POUNDS
Population Equivalent 4,077,000



TOTAL 864,460 POUNDS
Population Equivalent 5,085,000

Illustration I

LOWER COLUMBIA RIVER- Bonneville Dam to Cathlamet Wash.

ESTIMATED POUNDS V S M PER DAY

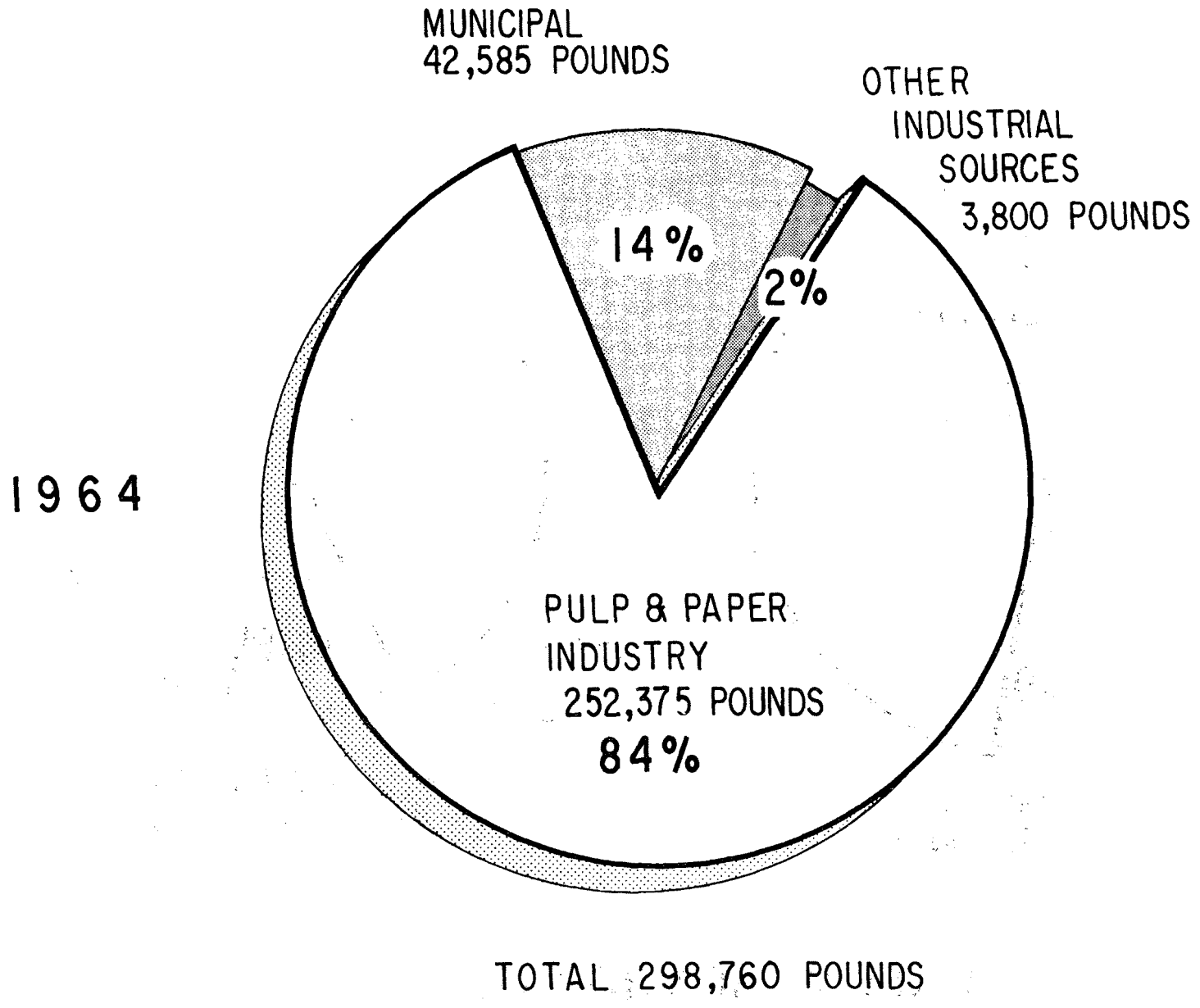


Illustration 2

LOWER COLUMBIA RIVER

PULP MILL PRODUCTION

1959 and 1964

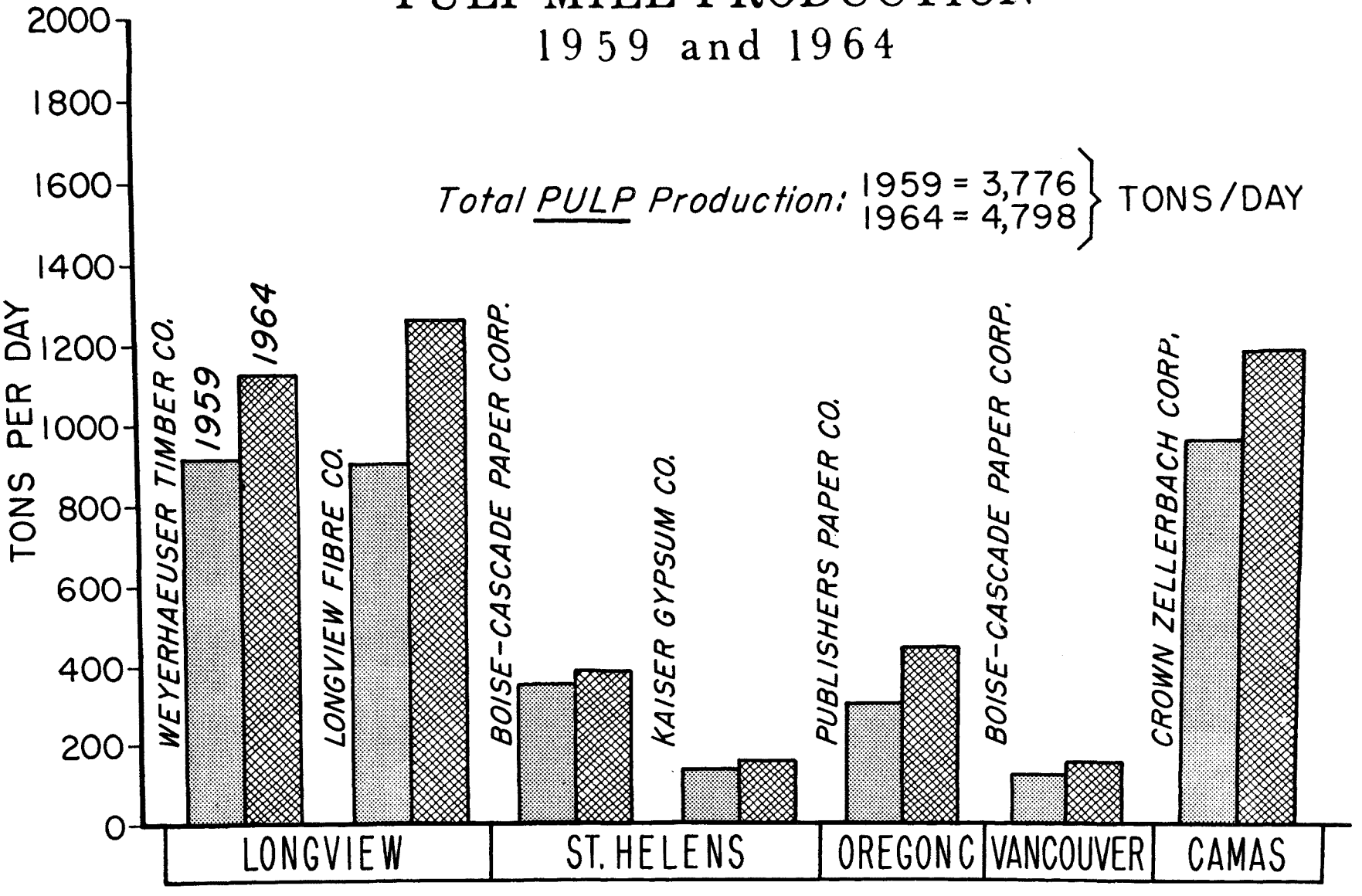


Illustration 3

LOWER COLUMBIA RIVER

PAPER MILL PRODUCTION
1959 and 1964

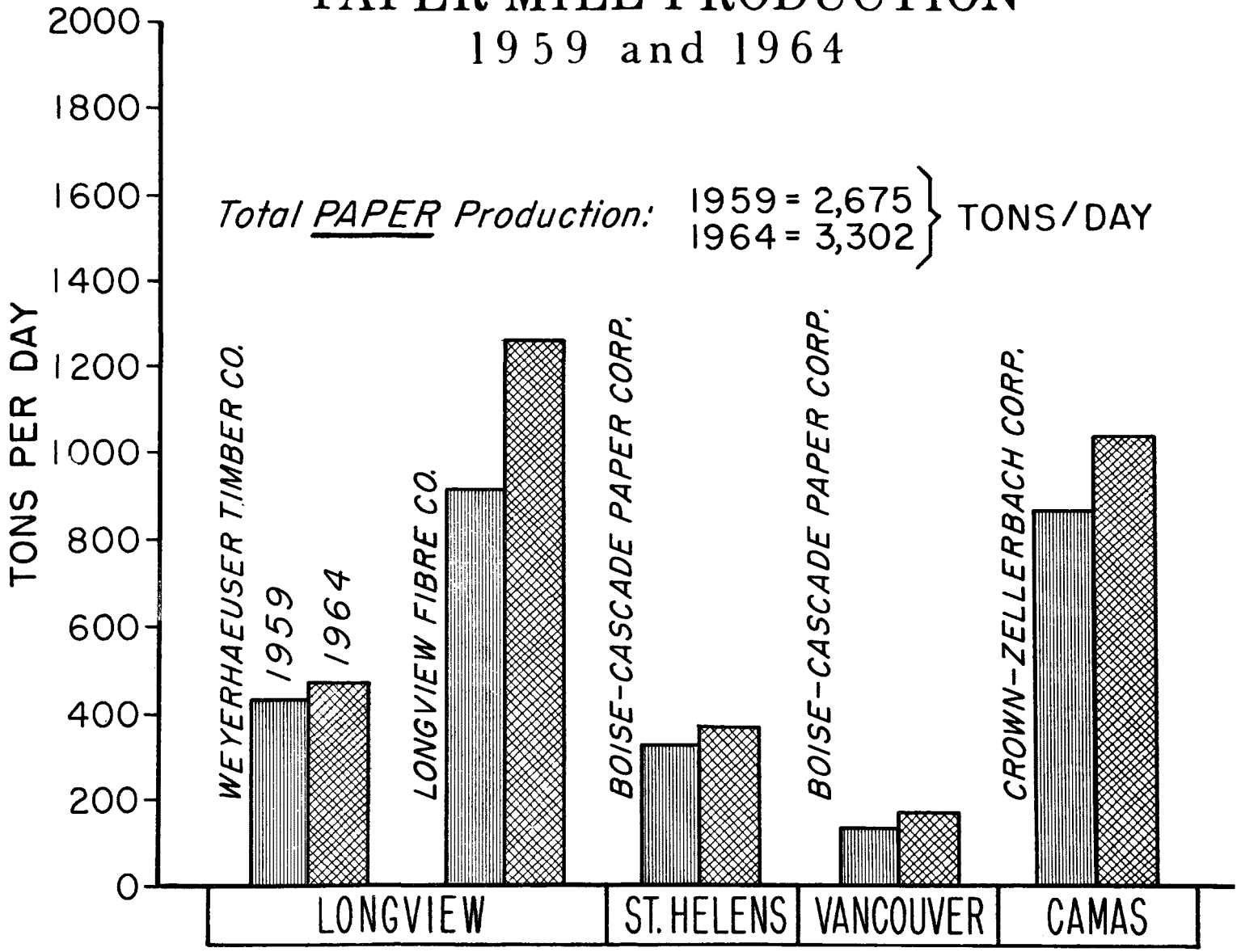


Illustration4

LOWER COLUMBIA RIVER • PULP & PAPER INDUSTRY

BIOCHEMICAL OXYGEN DEMAND LOADINGS

1959 and 1964

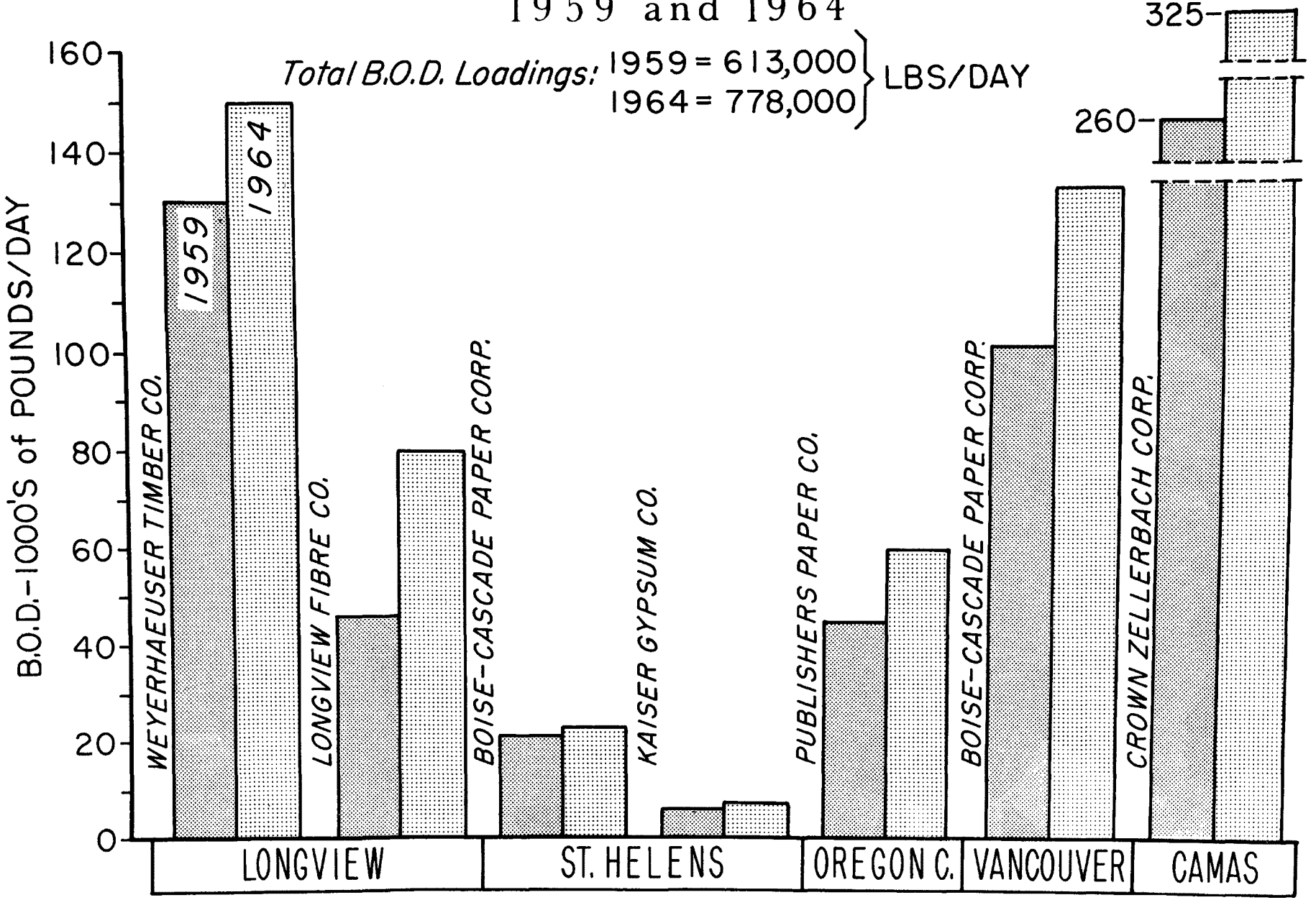


Illustration 5

LOWER COLUMBIA RIVER • PULP & PAPER INDUSTRY

VOLATILE SUSPENDED MATTER LOADINGS

1959 and 1964

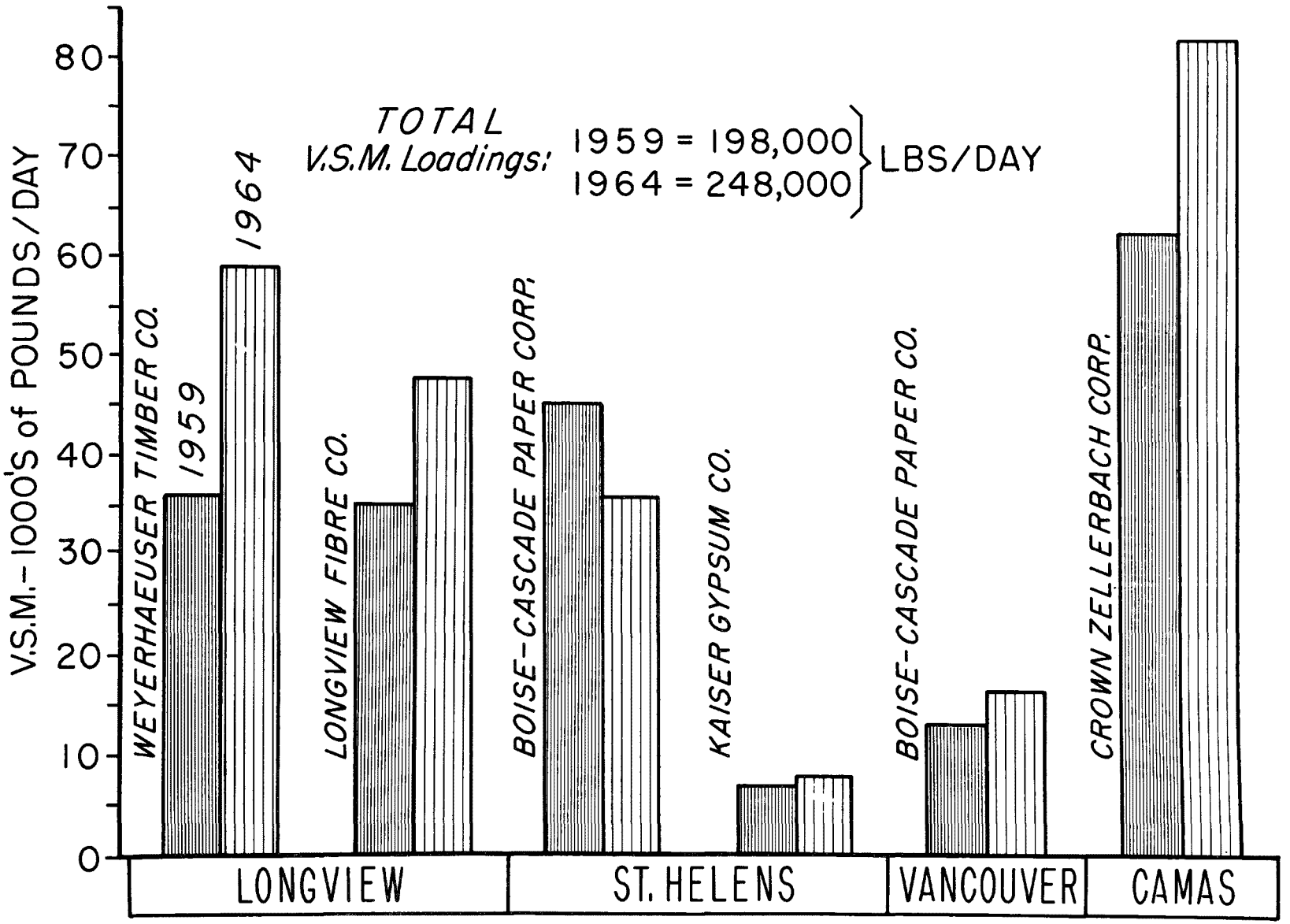


Illustration 6

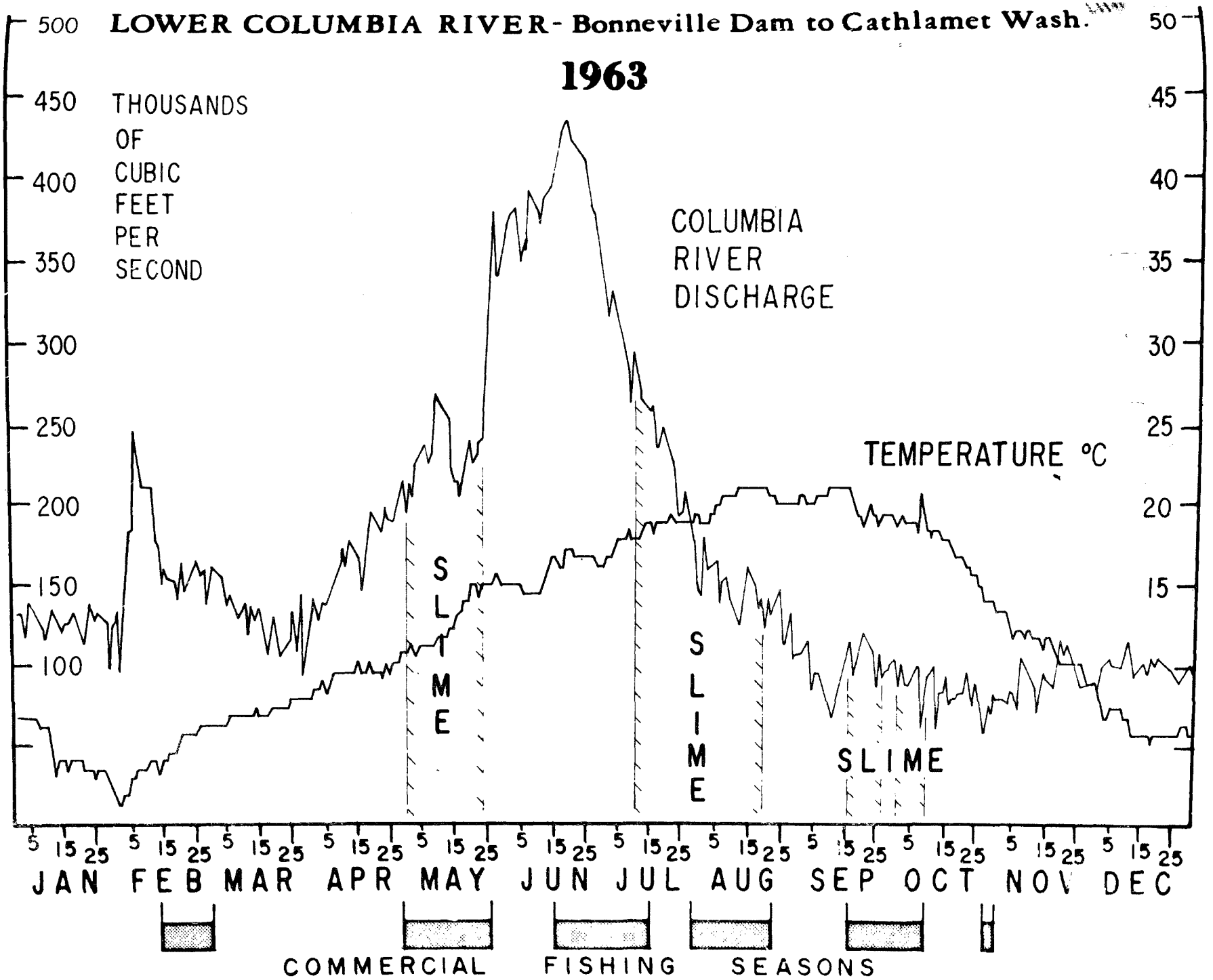


Illustration 7

LOWER COLUMBIA RIVER- Bonneville Dam to Cathlamet Wash.

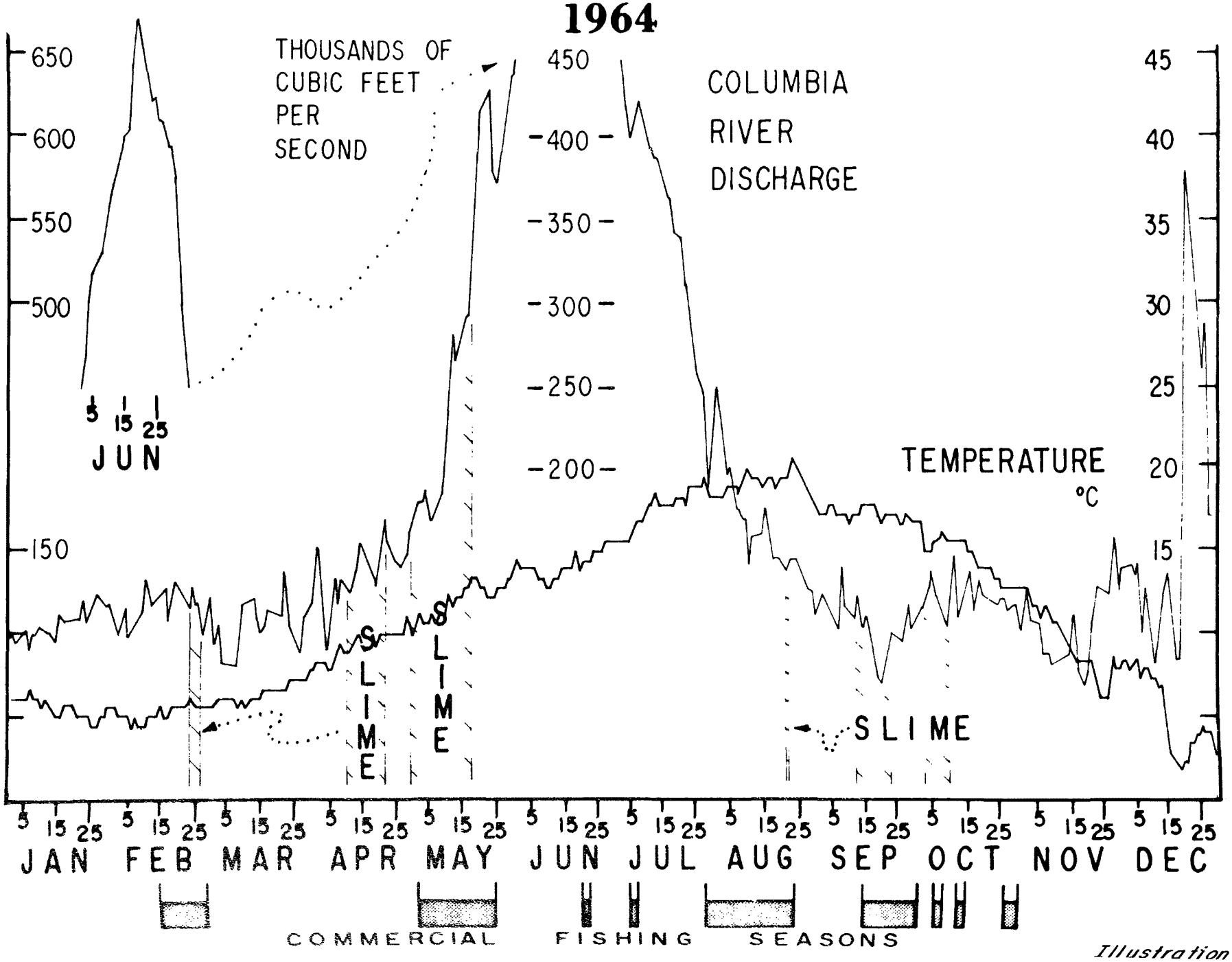


Illustration 8.

LOWER COLUMBIA RIVER- Bonneville Dam to Cathlamet Wash.

1965

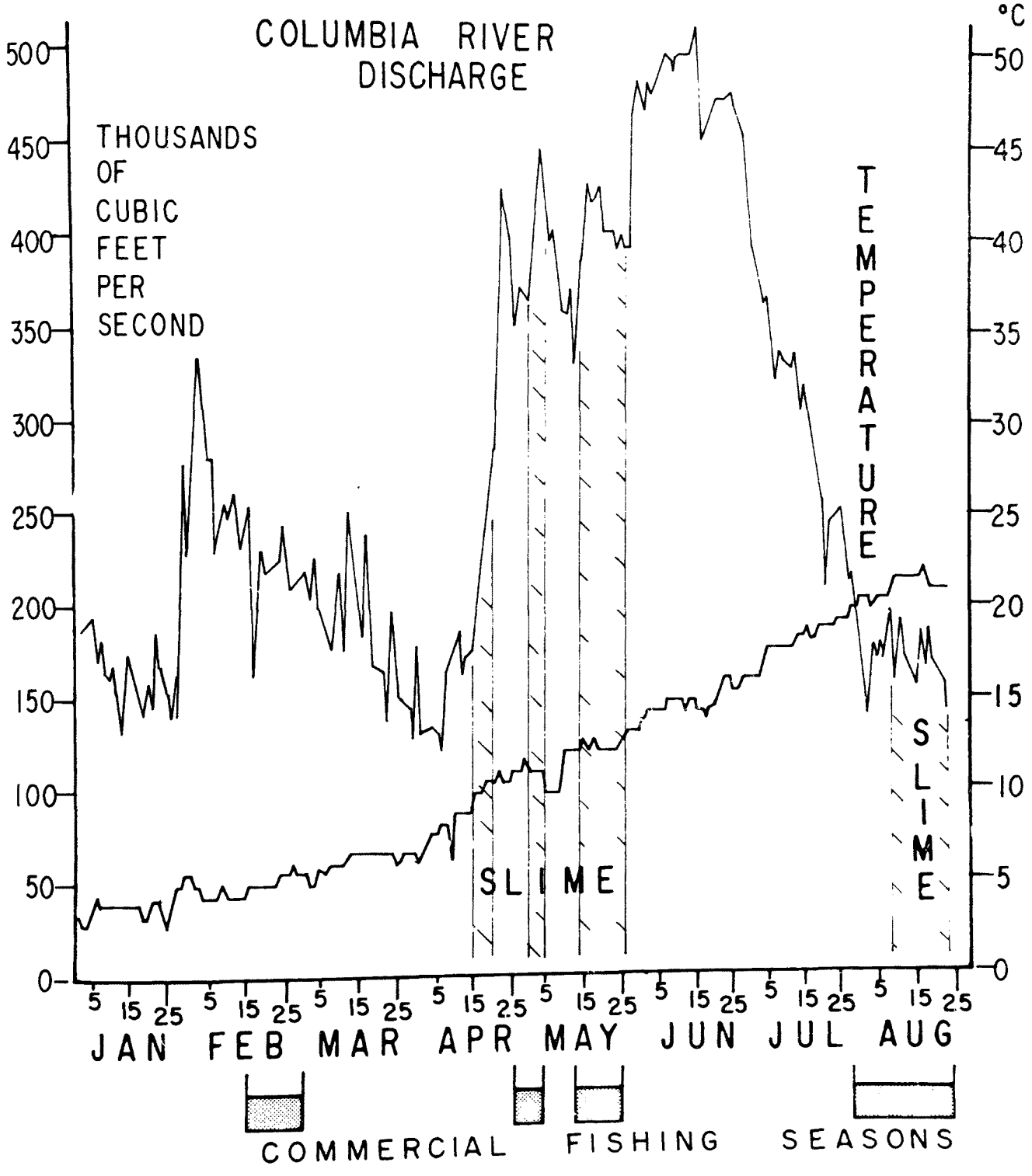


Illustration 9

LOWER COLUMBIA RIVER • PULP & PAPER INDUSTRY

VOLATILE SUSPENDED MATTER LOADINGS

Reported & Recommended

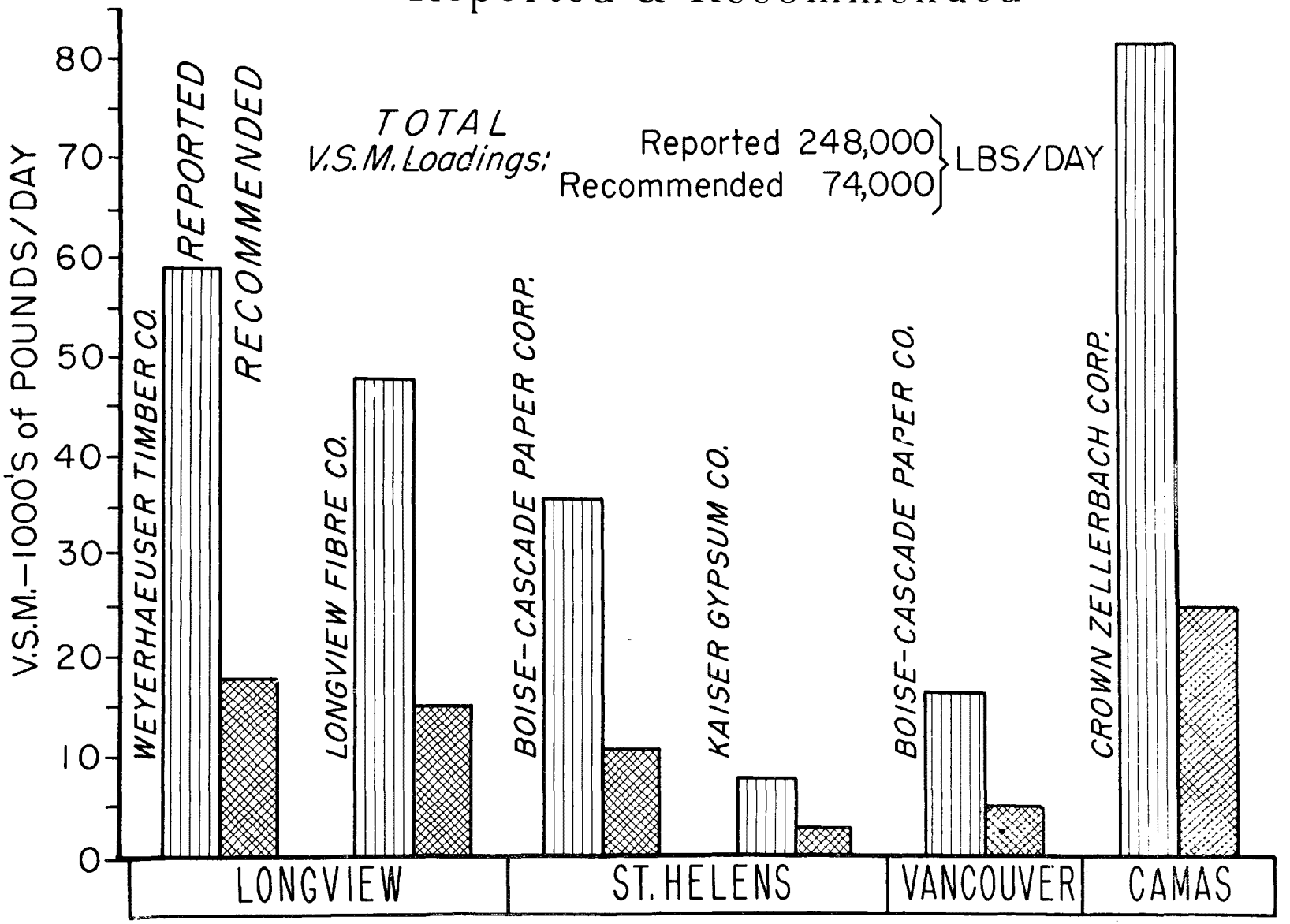


Illustration 10

LOWER COLUMBIA RIVER · PULP & PAPER INDUSTRY
BIOCHEMICAL OXYGEN DEMAND LOADINGS
Reported & Recommended

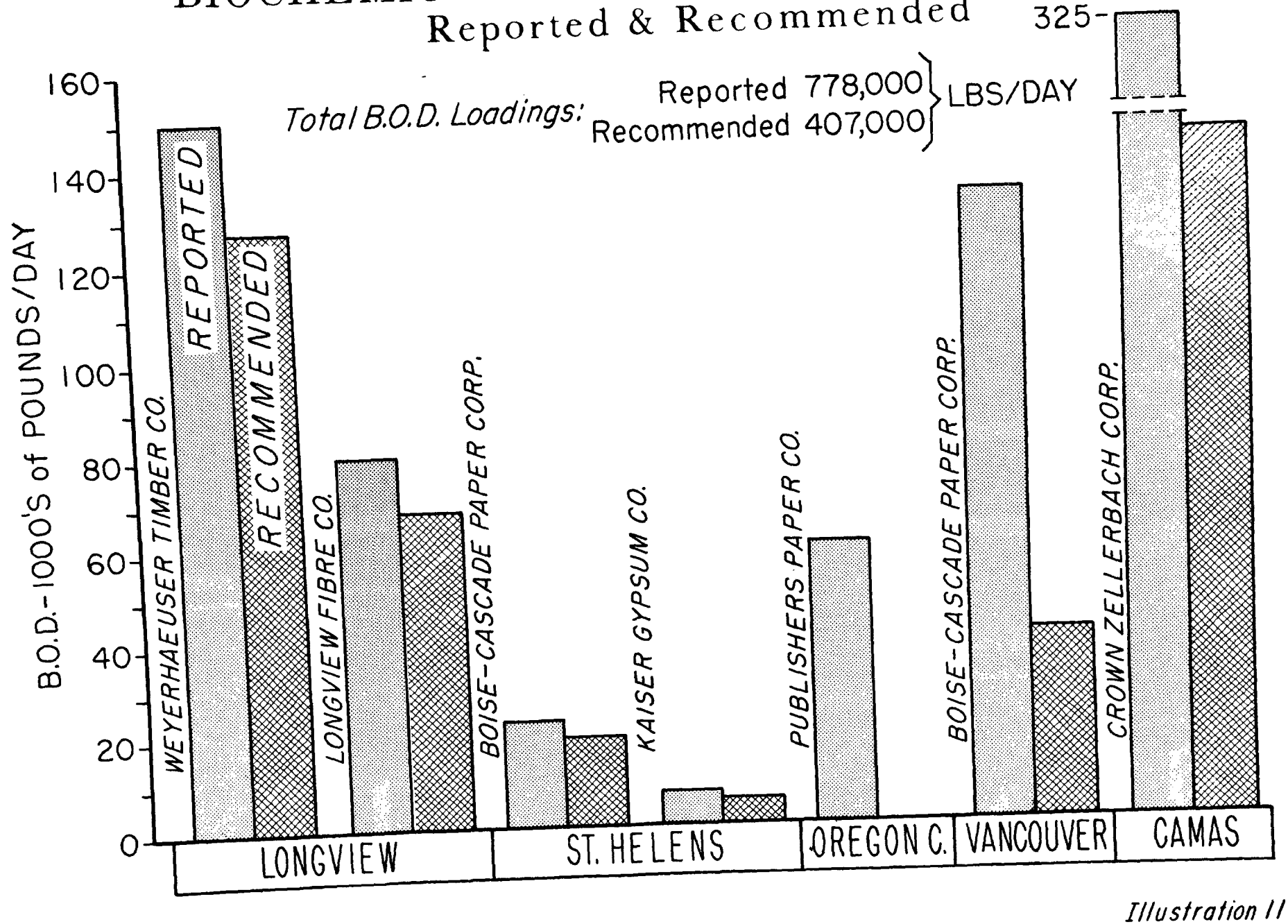
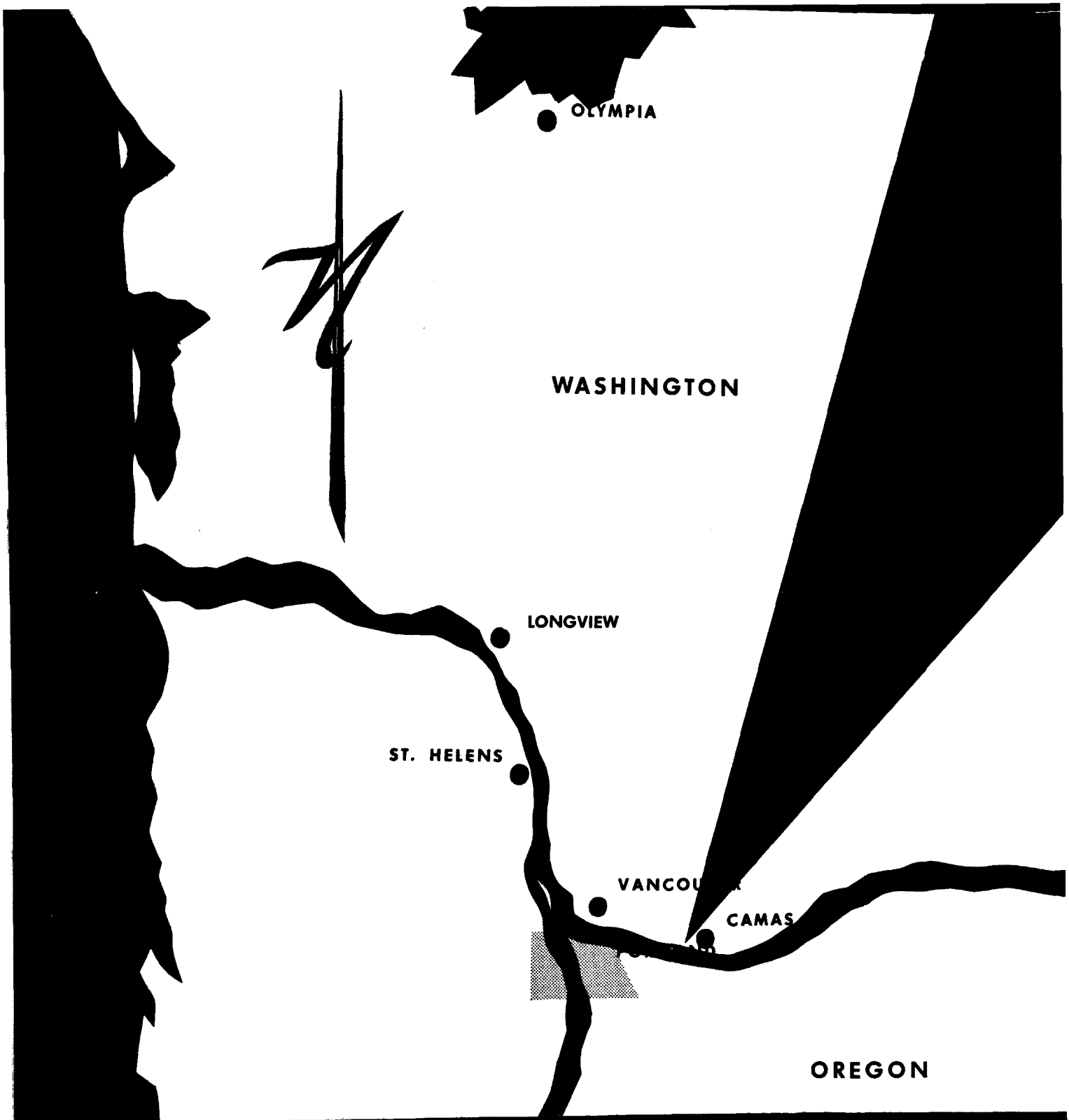


Illustration 11

APPENDIX C



COLUMBIA RIVER STUDY

A progress report

1958 - 1963

C O L U M B I A R I V E R S T U D Y

1958 - 1963

A Progress Report

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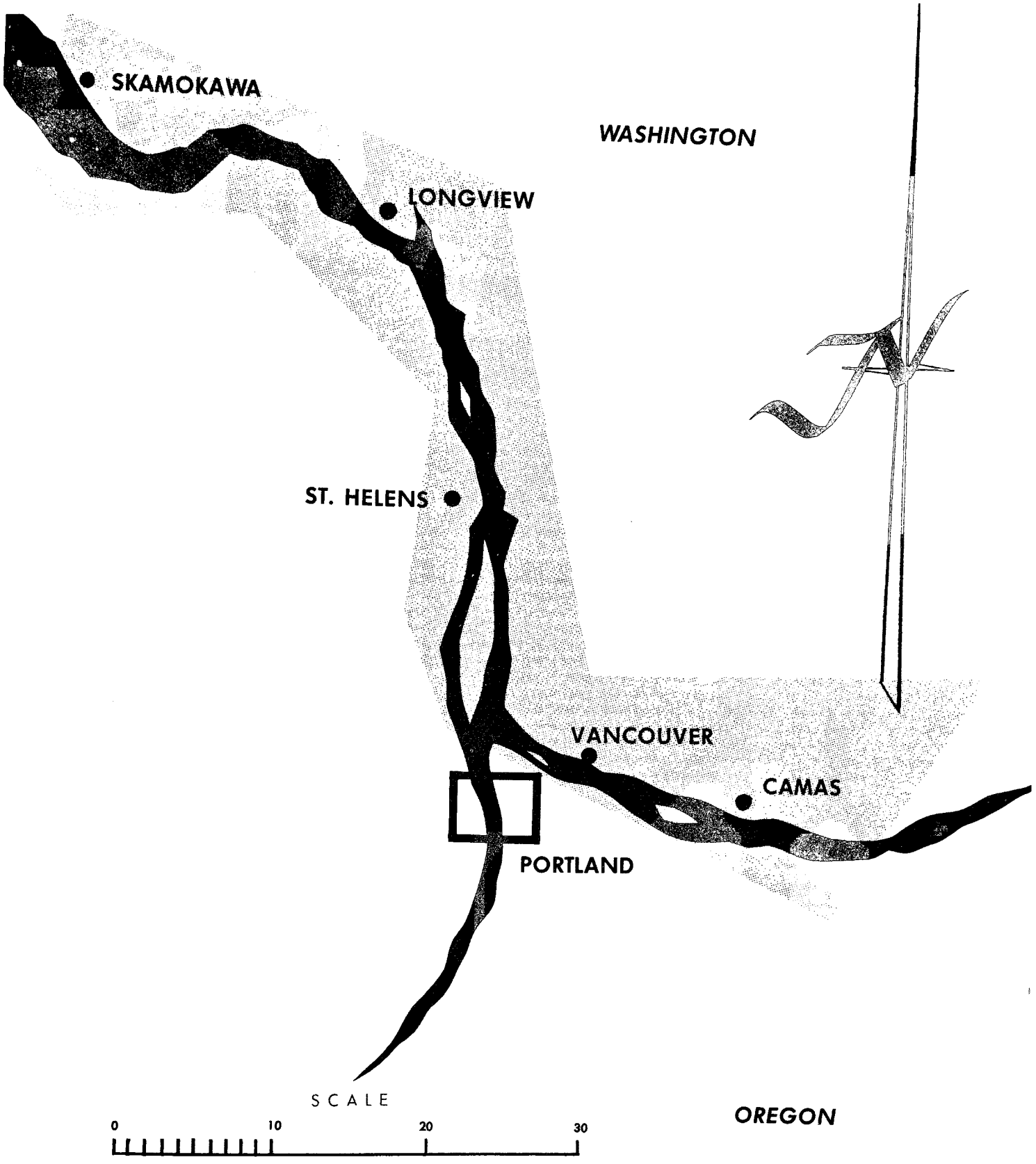

FIGURE 1. Map of Lower Columbia River shows area of study.

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INTRODUCTION

In 1955 the Washington State Pollution Control Commission asked Crown Zellerbach Corporation to propose possible solutions to the long-standing problem of growth of a slime bacterium called Sphaerotilus in the lower Columbia River.

Sphaerotilus is one of a group of water bacteria common to most streams and which are responsible for the destruction of foreign organic materials in the watercourses. They are not harmful to health and do not cause diseases.

However, the Sphaerotilus growth sometimes presented a problem by becoming enmeshed in the gill nets commercial fishermen set for salmon and steelhead.

The late J. D. Zellerbach, then president of the Corporation, noting company officials were "ever mindful of their responsibilities to the public interest," suggested on behalf of the Board of Directors that the Pollution Commission retain an outstanding biologist of its own choosing to conduct studies to determine the precise causes of the slime. The Corporation volunteered to pay the costs of the survey which would be under the sole and complete direction of the Commission.

"We are of the opinion," Mr. Zellerbach stated in his letter, "that there is urgent need for more intensive research, to guarantee that the substantial expenditures called for will achieve the desired results. It would be a mistake to proceed with a project only to discover that elements not now known or understood continue to generate slime growth downriver."

The Commission accepted the Crown Zellerbach proposal. Later that year it named Dr. E. J. Ordal, microbiologist on the faculty of the University of Washington School of Medicine, to serve as senior scientific advisor for the study. The company assigned two men to the project and made the facilities of its Central Research Laboratory at Camas available. A biologist and other personnel from the State Pollution Control Commission were assigned to the project.

The cooperative study began early in 1956 with the commencement of limnological and laboratory studies. In the succeeding two years the project team gathered and analyzed large amounts of data on the 14-mile section of the Columbia River between Washougal and Vancouver. The team's work produced information on the characteristics of the river which will continue to be of value to all other agencies concerned with the river.

This study also produced valuable data on the characteristics and growth patterns of Sphaerotilus, information vital to any program for controlling the slime. During this period laboratory experiments were made on various methods which might produce a satisfactory solution to the problem.

Results of this work were reported in the COLUMBIA RIVER STUDY, 1956-1958, Progress Report, which was published in May of 1958. This second progress report covers the period from 1958 to the present, with emphasis on development of the intermittent discharge system at the Camas mill (see Figure 2) and the outlook for use of waste sulfite liquor by converting it to saleable by-products.

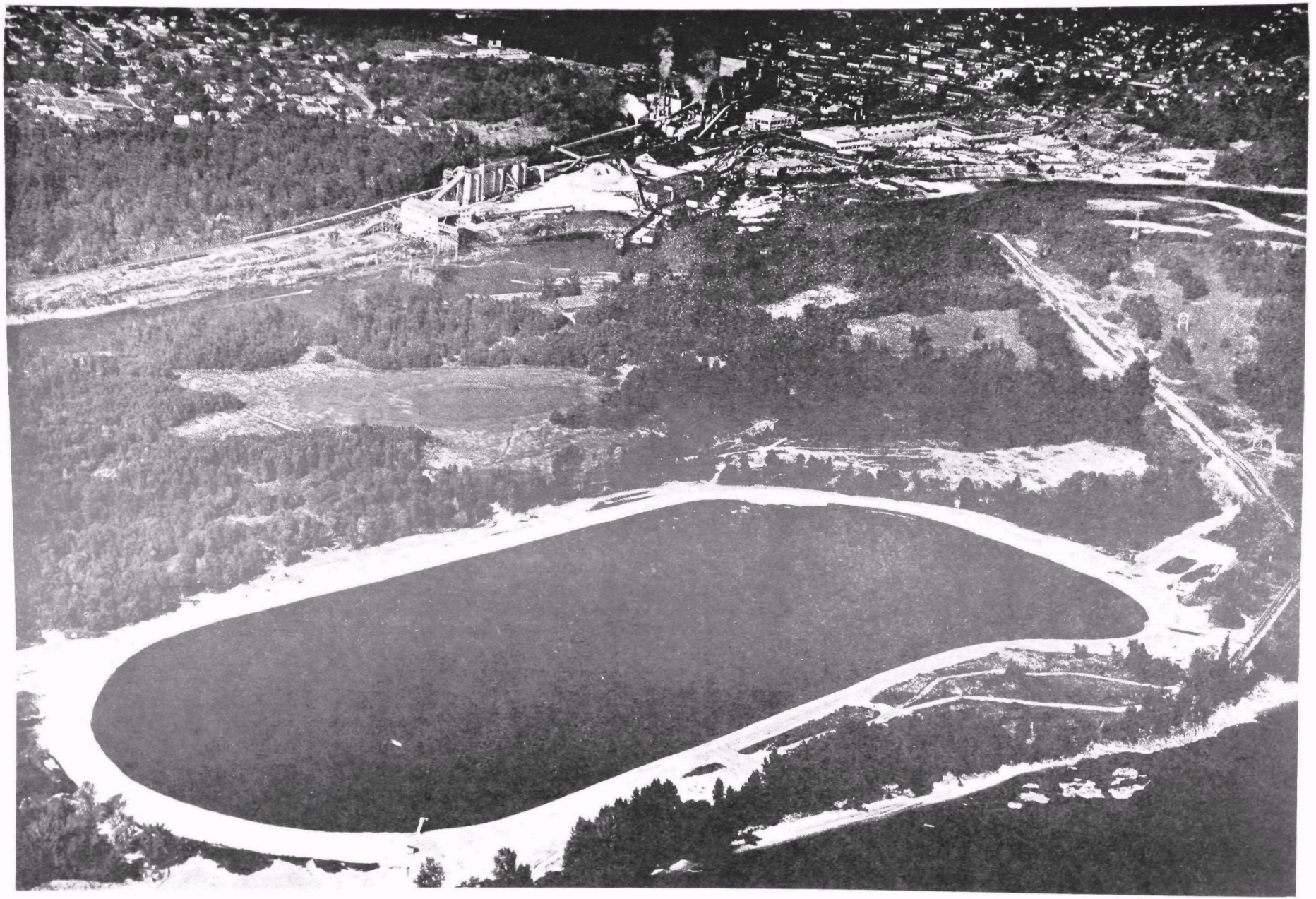


FIGURE 2. Key to Crown Zellerbach's Camas mill disposal system is 46-acre pond for spent sulfite liquor storage.

NATURE OF SPHAEROTILUS

Scientists determined that the organism primarily responsible for slime growth in the Columbia River is Sphaerotilus natans. It is a filamentous bacterium which consists of chains of single cells encased in a sheath, and it is believed that the organism may exist in either the single cell form or the filamentous form (Figures 3 and 4). It is generally agreed that reproduction may occur by fragmentation of the filaments or by formation of motile conidia.

Sphaerotilus is widespread, with growths having been reported throughout Europe and the United States in streams receiving pulping wastes, food processing wastes, distillery and brewery wastes, beet sugar wastes, milk wastes, domestic sewage, packing plant wastes, and other organic wastes.

Complicating the problem is the fact that growths often occur in streams and rivers, such as the Columbia, which receive low concentrations of organic matter and are considered in excellent condition with respect to ordinary sanitary standards. Sphaerotilus growth also may occur during periods of low water temperature.

In its natural environment, the organism usually grows attached to stones, logs, branches, gravel and even sand in the flowing stream. The slime flocs periodically "slough" and flow downstream. While not constituting a public health problem, the slime poses an occasional difficulty when a freshet occurs during the spring fishing season and the flushing velocity of the water tears the slime loose, permitting it to drift free downstream.

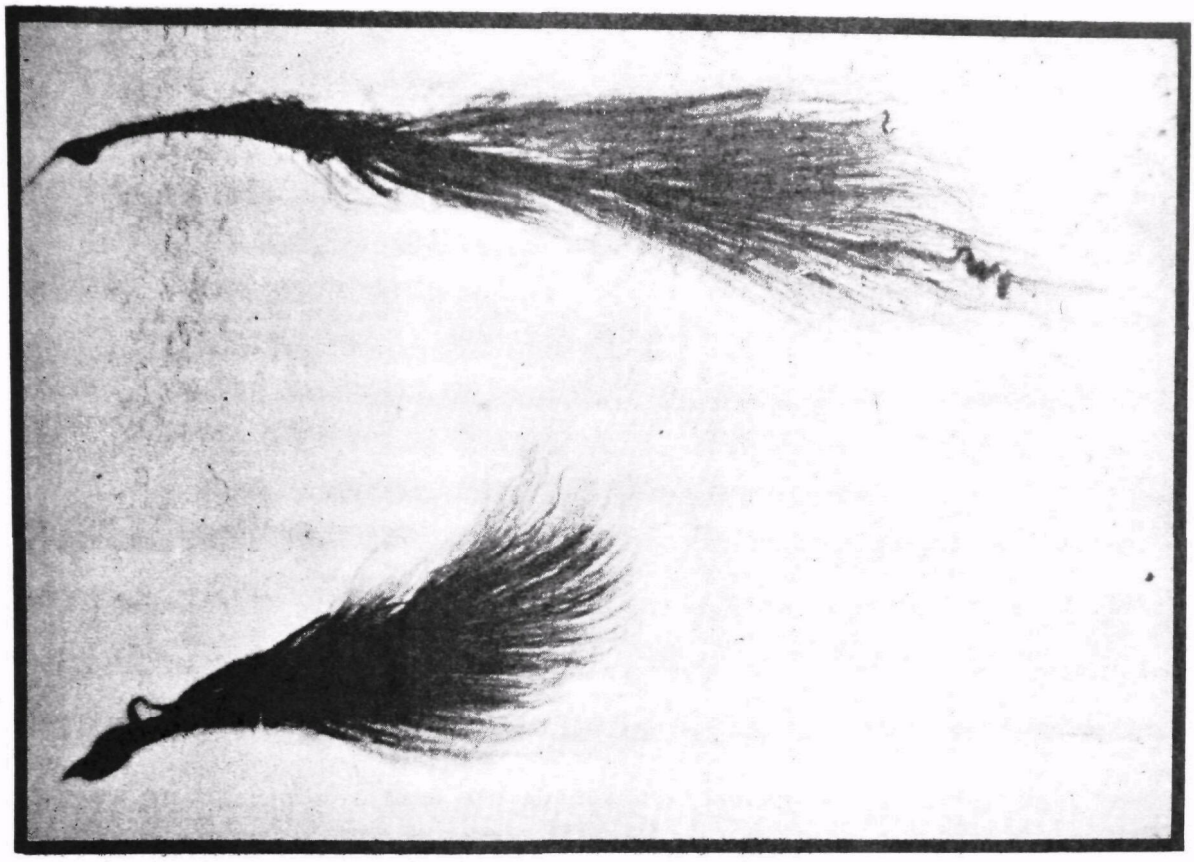


FIGURE 3. Typical *SLIME FLOCK* obtained from the Columbia River.

FIGURE 4. Photo micrograph of *SPHAEROTILUS NATANS* shows the sausage-like individual cells.

RESULTS OF EXPERIMENTAL PHASE

The cooperative study begun in 1956 was divided into two major categories: (1) a limnological study of the Columbia River from Washougal to Vancouver; (2) laboratory studies for evaluation and abatement measures. Briefly, the major findings of these studies were:

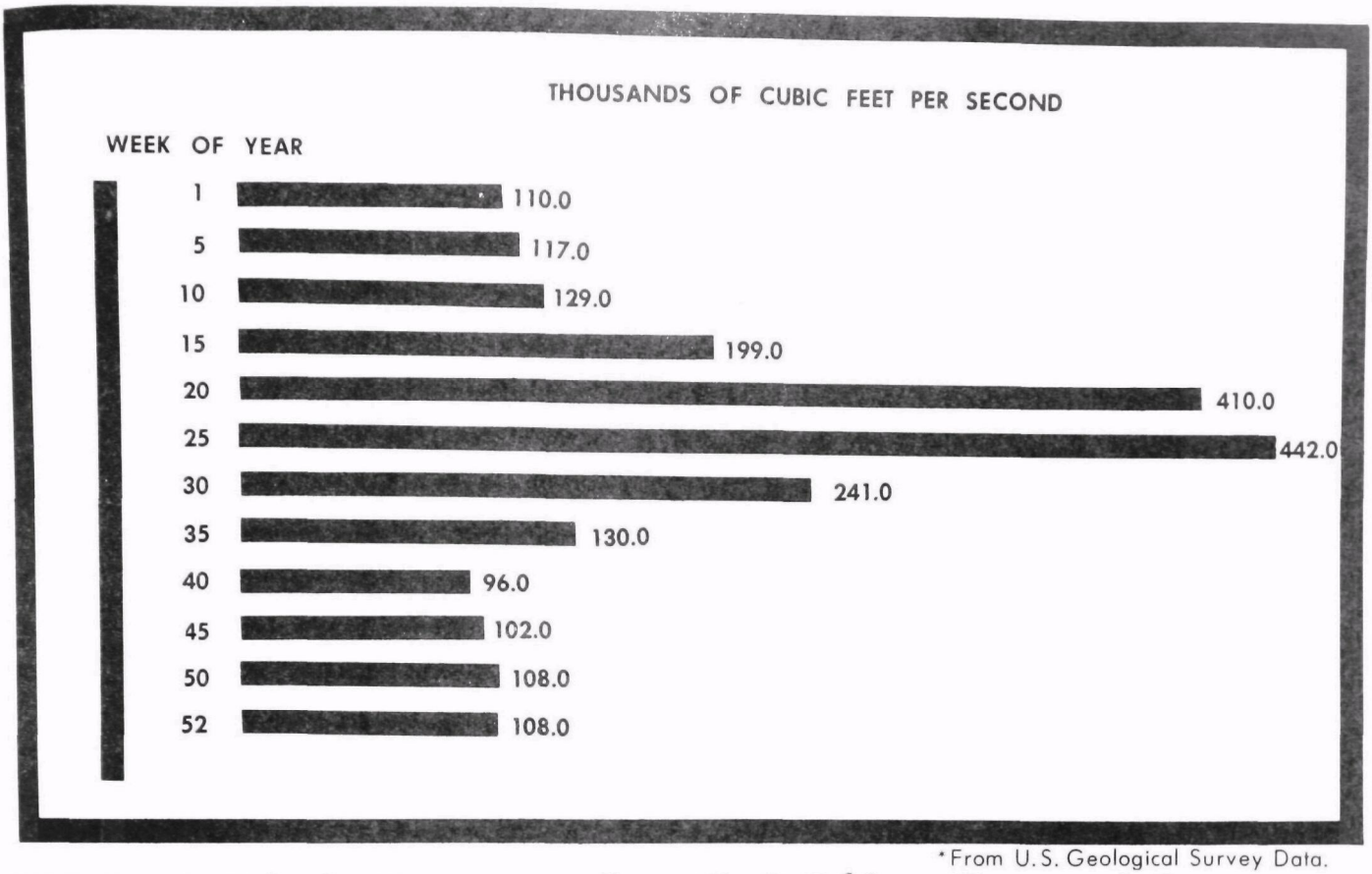
STREAM SURVEY

The flow of the Columbia River varies considerably during the year with the volume increasing gradually during March and April, increasing abruptly during May and June, and decreasing again in July (see Figure 4-A). The flow normally remains low during the fall and winter months, although high water can occur in the lower river during the winter months.

Velocity, closely related to flow, also varies seasonally and there may be variations in any traverse across the river or in traverses between surface and bottom velocities.

Before 1960, when the Camas mill was discharging wastes continuously, flow was one of the major factors which had a decided effect upon slime conditions in the lower river. In general, excessive velocities encountered during flood stage caused "sloughing" of attached growth and prevented new growth from becoming established until the velocity again dropped below the critical value.

The Columbia River studies showed the temperature of the river increases gradually in March and reaches a maximum in July and August before beginning to drop off again in September (see Figure 4-B). Optimum slime growth occurs at a temperature range of about 10° to 15° C. However, Sphaerotilus growth may occur at temperatures below 10° C., providing that the growing period is sufficiently long. When the temperature drops below 4° C., growth ceases but does not die, and growth again occurs as the



*From U.S. Geological Survey Data.

FIGURE 4-A Columbia River average flow at The Dalles for a 15-year period.

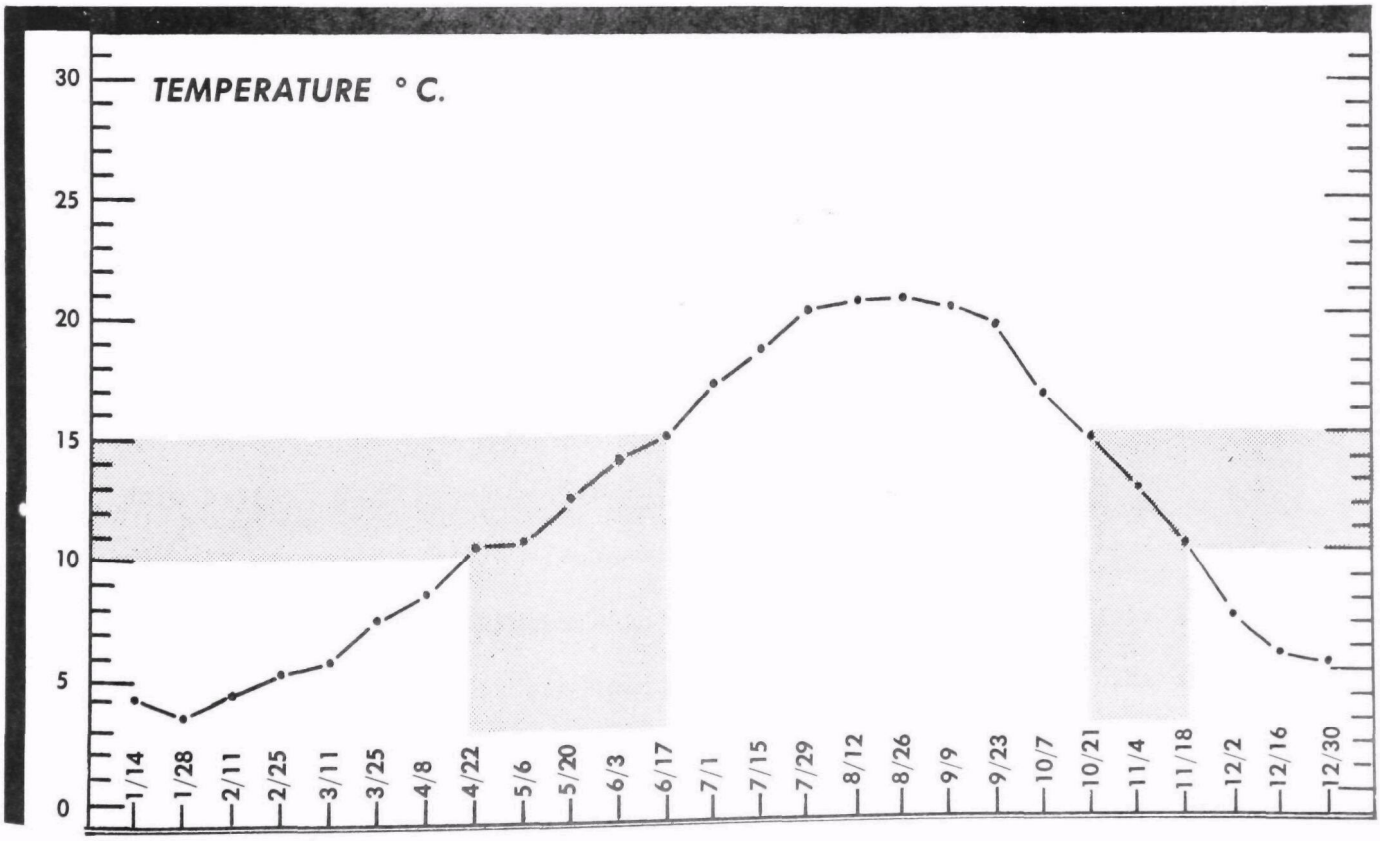


FIGURE 4-B Columbia River water temperature average in vicinity of Camas, 1956-1963, showing temperature range conducive to Sphaerotilus growth.

temperature increases above 4° C.

Heavy slime growth normally was not found during the maximum temperature period.

Tests on dissolved oxygen (D.O.) and biochemical oxygen demand (B.O.D.) made during the cooperative study showed these results: The B.O.D. added to a background level of 0.5 to 1.0 parts per million (ppm) above the mill is about 0.5 to 1.0 ppm with an absolute maximum of 1.5 to 2.0 ppm. Maximum B.O.D. values occur during the early fall months, but again the levels are very low. The dissolved oxygen content fluctuates from 9 to 14 ppm in the stretch of river from Washougal to Vancouver, and this fluctuation is caused by seasonal temperature changes. The D.O. drop directly attributable to effluent discharge at Camas does not exceed 0.5 ppm.

LABORATORY STUDIES

The second section of the study dealt with the factors affecting Sphaerotilus growth. To accomplish this, 12 simulated streams were constructed at Crown Zellerbach's Central Research division laboratories at Camas. Thus it was possible to study various factors under varying conditions. The findings included:

Phosphorus and nitrogen are essential for optimum growth and a deficiency of either of these elements will limit slime growth. Calcium-base spent sulfite liquor, such as that at Camas, is low in both of these elements and for optimum slime growth the water must be supplemented with these nutrients. The importance of phosphate is clearly shown in Figure 5. Very little growth was noted in the channels receiving 10 ppm of spent sulfite solids (2.5 ppm of B.O.D.) and phosphate deficient water. However, when the spent sulfite solids (S.S.S.) were supplemented with 1 ppm of

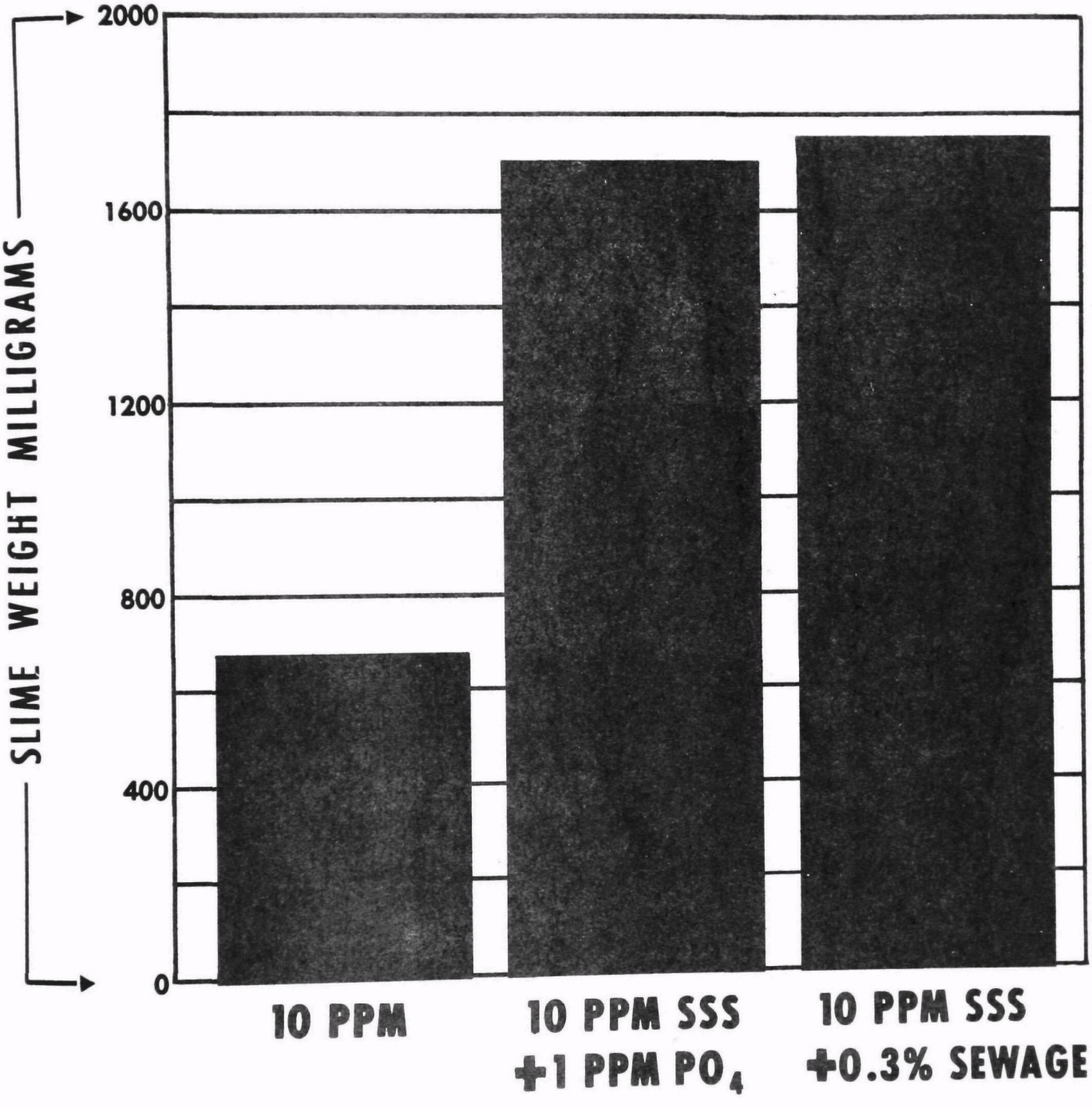


FIGURE 5. Effect of phosphate upon slime growth.

phosphate, slime growth was more than doubled.

The oxidation of domestic sewage leaves an excess of nitrogen and phosphorus on which Sphaerotilus feeds. In the Columbia Basin, both phosphorus and nitrogen, in ever-increasing quantities, are supplied by agricultural runoff and irrigation return water.

Minimum Waste Concentration. In 1941 and 1942 the states of Washington and Oregon conducted a limnological research study of the Columbia River between Bonneville Dam and Longview. Under the direction of two highly qualified scientists, J. H. Lincoln and R. F. Foster, the study developed much data about the river. This was contained in the "Report on Investigation of Pollution in the Lower Columbia River," Washington State Pollution Control Commission and the Oregon Sanitary Authority, 1943.

The study indicated that Sphaerotilus growth could be minimized by reducing the concentration of S.S.S. below 5 ppm.

Based in part on this early study, Crown Zellerbach installed a deep water diffuser line at the Camas mill in 1950. It discharged the sulfite pulp mill effluents in the main channel of the Columbia at a depth of about 45 feet. The initial cost of the installation was $270,000, with maintenance costs since then totaling more than $350,000.

Although this was the most accurate information available up to that time, subsequent experience showed that the deep water diffuser line had not solved the Sphaerotilus problem. While the underwater diffuser was effective in reducing waste concentrations, slime growth was not sufficiently reduced to eliminate the problem entirely. Surveys conducted after the diffuser outfall was installed showed slime growth in areas

where the S.S.S. concentration was well below 5 ppm.

Stream studies started in 1956 showed growth at concentrations as low as 1 to 2 ppm. Growth curves for Sphaerotilus at S.S.S. concentrations of 2 and 5 ppm are shown in Figure 6. For all practical purposes, it appears to be extremely difficult to reduce the waste concentration to levels which will not support some slime growth.

To insure an adequate and a continuously replenished food supply for the Sphaerotilus, the food must be brought past the growth by means of stream velocity. Figure 7 shows that at a feed concentration of 10 ppm, slime growth was increased from 1,000 mg. to 5,500 mg. by increasing the velocity from 0.001 to 0.58 feet per second (fps). These tests showed there is a minimum velocity below which Sphaerotilus will not grow and, of course, there must also be a maximum velocity at which Sphaerotilus cannot remain attached.

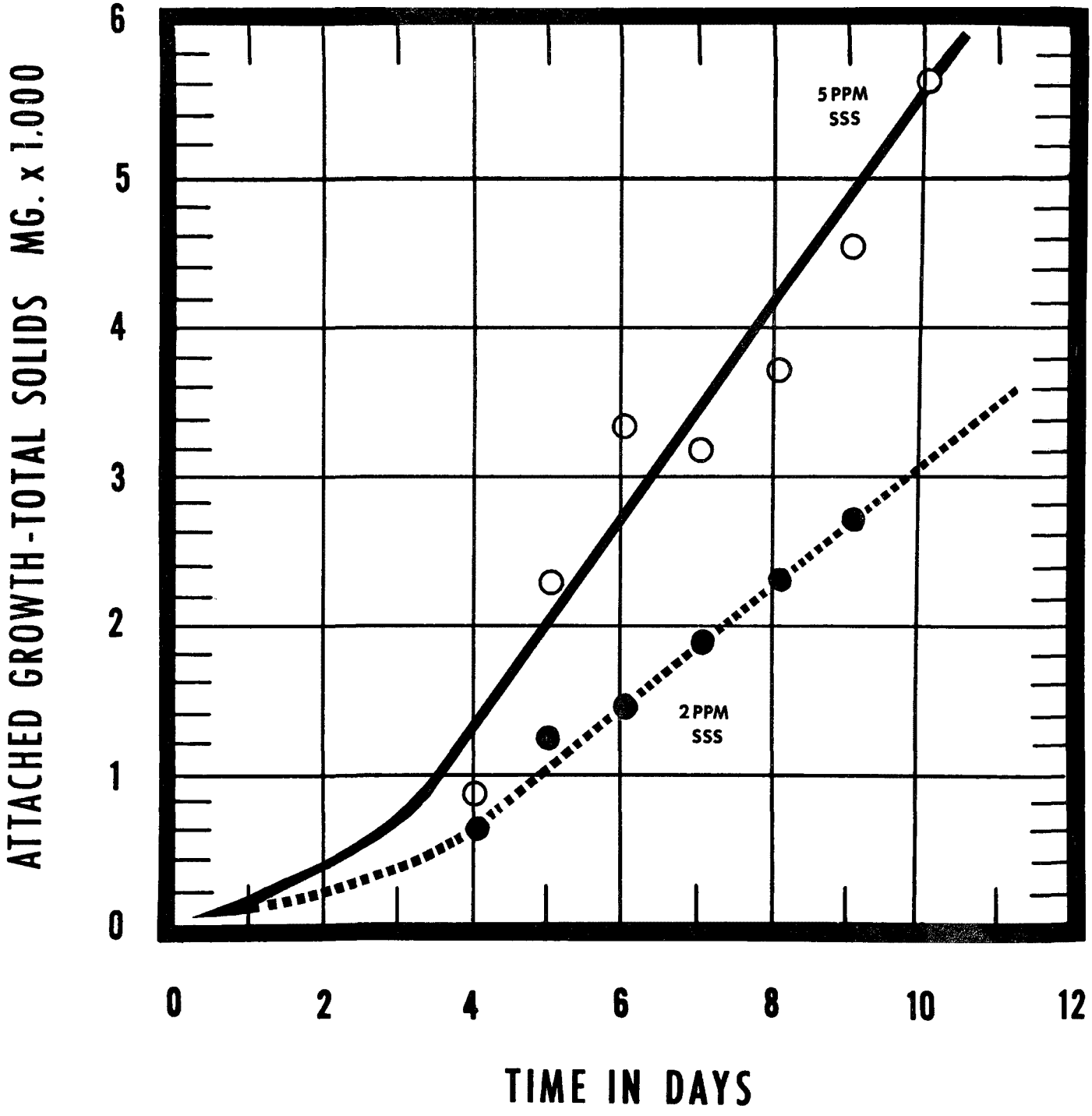


FIGURE 6. Rate of slime growth at low sulfite solids concentration.

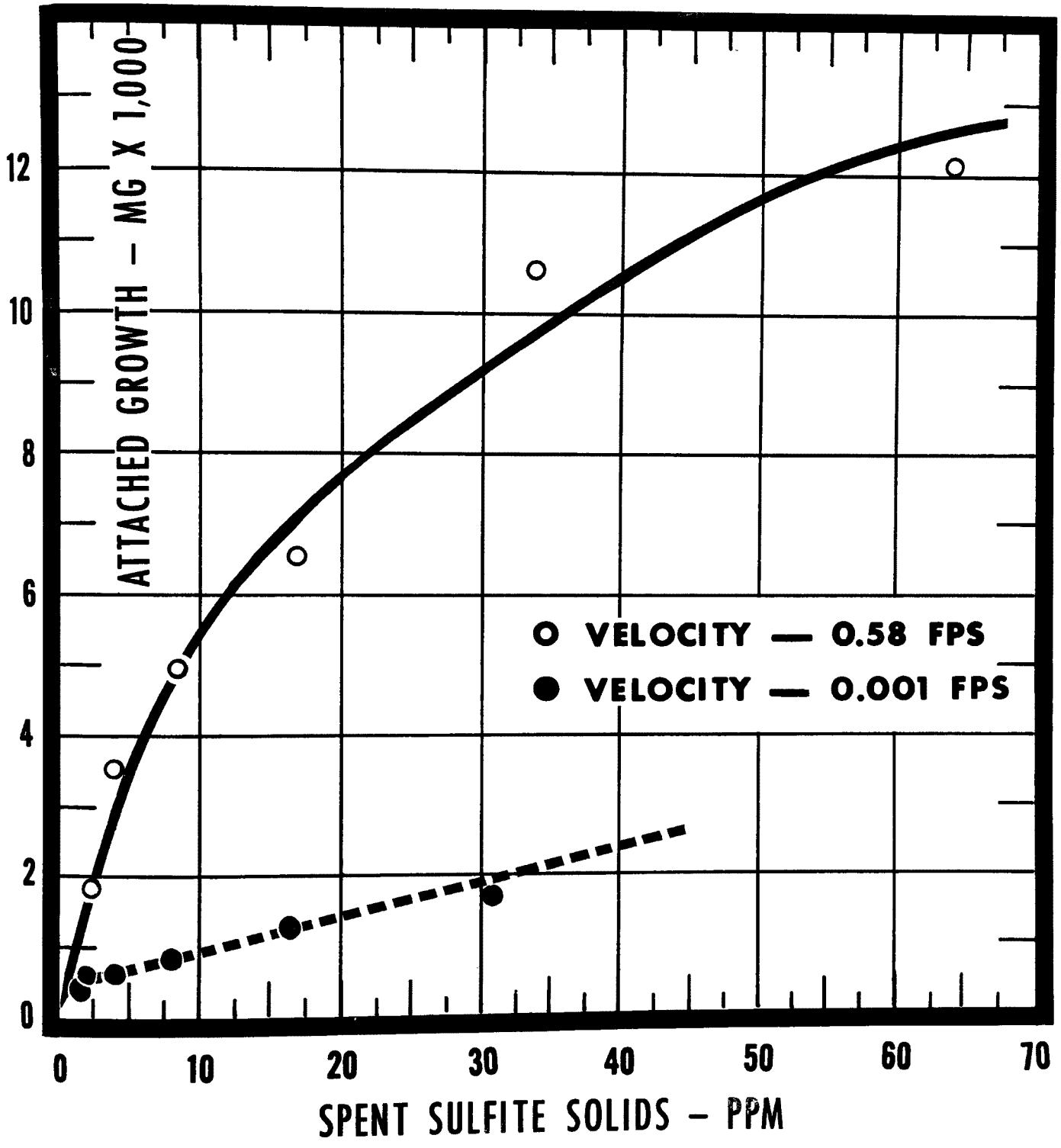


FIGURE 7. Effect of waste concentration upon slime growth at two different water velocities as shown by laboratory studies.

ABATEMENT MEASURES STUDIED

In Crown Zellerbach's Central Research division laboratory, evaluation was made of possible abatement measures which might be utilized.

Evaporation and Burning Processes. There are a number of pulping processes which permit the evaporation and burning of the waste liquor. Heat is recovered from the burning of the organic material, and chemicals are also recovered. Although the B.O.D. reductions accomplished by the recovery processes are relatively high, a substantial B.O.D. load is still discharged, and this load in conjunction with the other pulping effluents is of sufficient magnitude to support heavy slime growth.

Heat Hydrolysis. In this process the digester strength liquor is heated at temperatures of 250° C. and at high pressures. During the high temperature treatment the lignin is precipitated as a ligno-carbon and the sugars are converted to volatile acids or completely broken down to carbon dioxide and water. However, the results of bioassays showed that the slime reduction which might be expected by this method would only be about 50 per cent.

Biological Treatment Methods. The first process of this type studied was the Torula yeast fermentation, a process in which the steam stripped waste is aerated in the fermentor in the presence of yeast which utilize both the six and five carbon sugars. The yeast cells are separated by means of a centrifuge, and the desugared lignin solution is discharged to the stream. Conclusions on this method were that the maximum slime reduction which might be expected would be about 70 per cent.

Alcohol fermentation also was tried but was found to be not completely effective in controlling slime. B.O.D. reduction after fermentation was a

maximum of 50 per cent and slime reductions were about the same.

Conclusions on Abatement Measures. There would still be two sources of slime-supporting effluents from evaporation and burning of spent sulfite liquors, these being weak wash waters and the evaporator condensate.

The various conventional fermentation processes studied for the reduction of wood sugars were found to be effective in reducing slime growth but none of the methods tried would eliminate the problem entirely.

INTERMITTENT DISCHARGE SYSTEM

Among the solutions considered was intermittent or regulated discharge of the waste. In this system the waste would be stored a specified length of time and then discharged over another specified, but much shorter, span of time. It was based on the facts bacteria feed continuously and require a continuous source of food; consequently, elimination of food during the growth phase should substantially reduce the bacterial numbers.

This theory is best explained by the table presented in Figure 8. This table presents the theoretical multiplication of Sphaerotilus under continuous and intermittent feeding based upon the assumption that one Sphaerotilus divides every 12 hours. The intermittent schedule is based upon 24 hours discharge every five days. The tremendous difference between numbers can readily be seen at the end of 21 days under both feeding schedules, the reduction in numbers being in excess of 99 per cent.

LABORATORY EVALUATION

In the initial phase of the study of an intermittent discharge system, the investigators repeated a study by the National Council for Stream Improvement, but using different equipment. Their results coincided with those of the earlier study, namely that a two-hour discharge followed by a waste storage period of 22 hours was effective in eliminating slime growth. As the feeding interval was increased, the effectiveness of the method decreased, and at a discharge interval of 12 hours per day, very little benefit was accomplished by intermittent feeding. For optimum results, a feeding schedule of two hours followed by the 22-hour storage period was recommended.

However, there were two major objections to this method of slime control: (1) a discharge interval of 2 hours followed by 22 hours of

storage would result in a twelve-fold increase in waste concentration, and (2) the short interval between discharges (22 hours) would decrease upon downstream movement and ultimate merging of discharges would occur.

To overcome the two objections, both the discharge period and the storage period were increased. For example, a waste discharge period of one day followed by a six-day storage period would only increase waste concentration sevenfold, and the six-day storage period would prevent merging of discharges. The effectiveness of this modified program is shown in Figure 9.

The simulated stream receiving the continuous feed was harvested after 19 days because of excessive growth, whereas the intermittent streams were fed for a period of 40 days before being harvested. (It should also be noted that the growths obtained under the intermittent programs shown in Figure 9 were not corrected for pre-growth developed under continuous feeding prior to the start of intermittent discharge. It was found that slime growth could not be established unless the simulated streams had a visible pre-growth, which was established by feeding 5.0 ppm of spent sulfite solids continuously for four days before the start of the intermittent discharge program.)

A 24-hour discharge followed by 24 hours of storage was ineffective in controlling slime growth. A discharge period of 24 hours followed by a storage period of two to six days was very effective in controlling growth.

PILOT PLANT EVALUATION

With intermittent discharge having proved successful in the laboratory, a pilot plant study was undertaken. The experiment was started in December, 1958, and was terminated at the end of April, 1959.

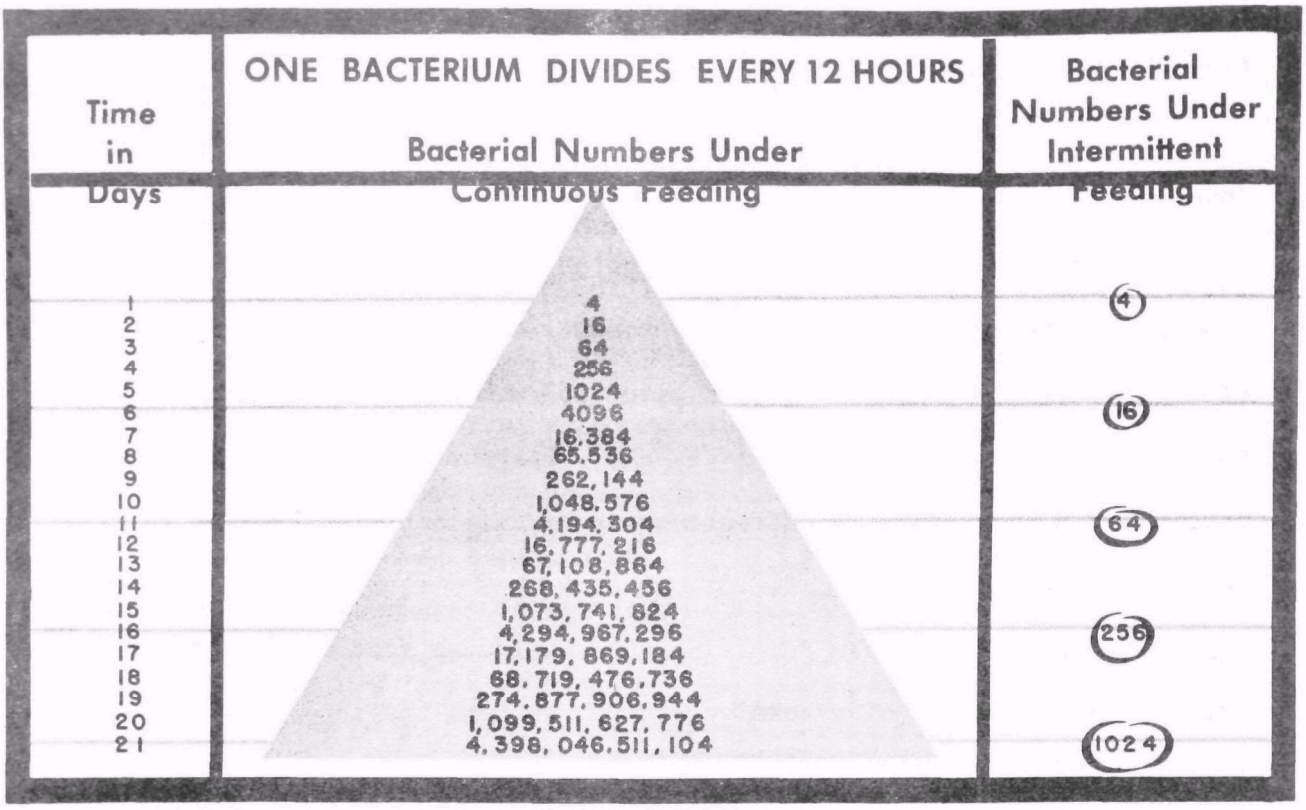


FIGURE 8. How different feedings affect bacterial growth.

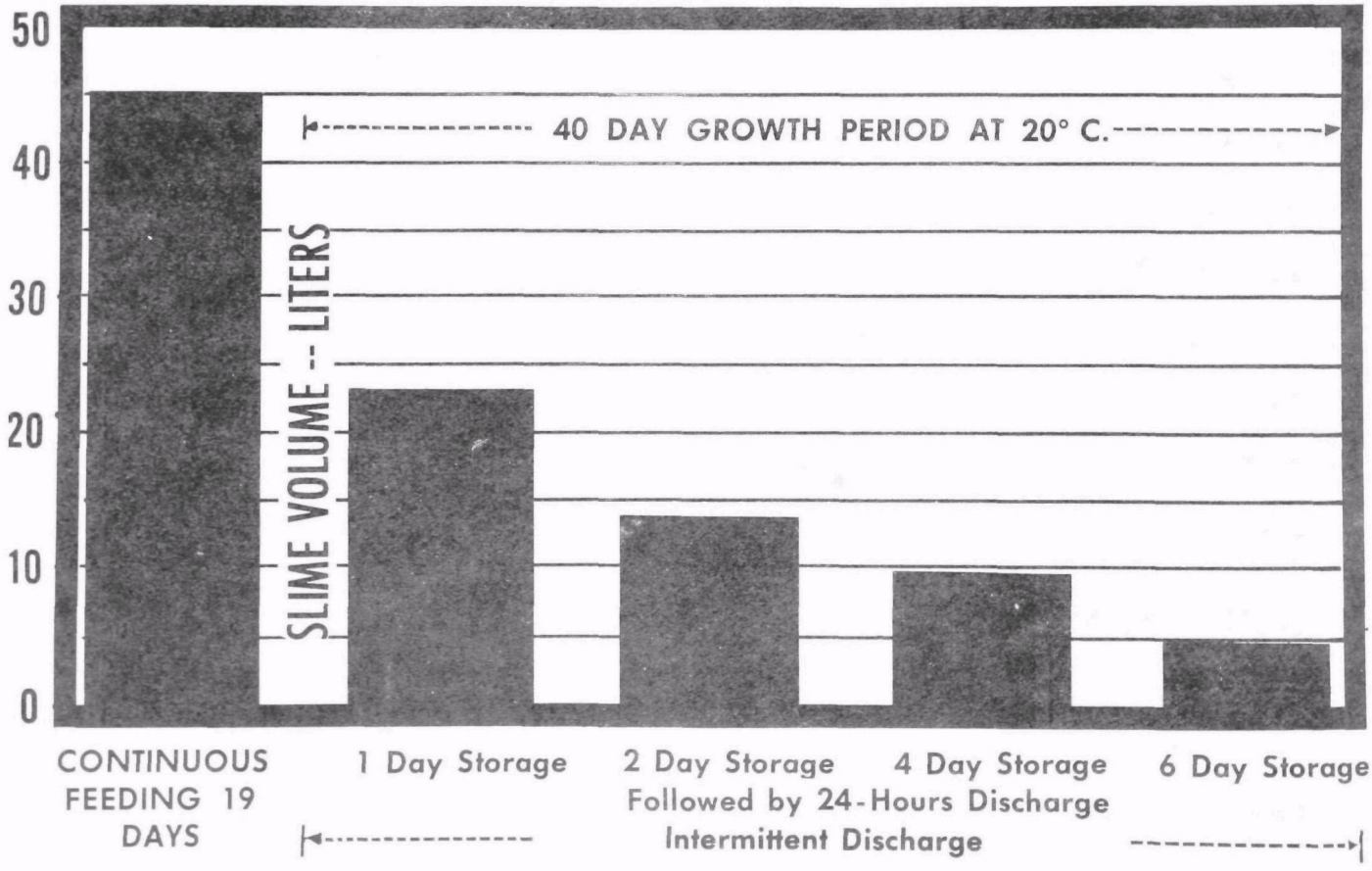


FIGURE 9. Effect of intermittent discharge upon Sphaerotilus growth at 20° C. and 40-day test period.

To simulate natural conditions, the experiment was conducted in the Columbia River, using five groups of four 10-foot-long logs as attachment surfaces as shown in Figure 10. The rafts were secured about 200 feet from shore where the stream velocity during the run was about 0.5 fps.

To simulate downstream conditions, all the log rafts received low background concentrations of spent sulfite liquor continuously in addition to the intermittent load. Spent sulfite liquor was fed through diffusers to the logs, and slime growth was estimated by observation of the logs and measurement of growth on ceramic tile surfaces.

The log surfaces were subjected to the following feeding schedules: (1) control, with no spent sulfite solids; (2) intermittent feeding schedule started without the development of a primary slime film; (3) intermittent feeding started after slime growth was under way; (4) continuous feeding of spent sulfite solids, and (5) continuous feeding of extremely low concentrations of spent sulfite solids.

Examination of the logs at the end of the experiment showed some growth to be present on the control raft, slightly more on the intermittently fed logs, slightly more again on the low continuously fed logs, and very much more on the logs which were fed continuously at a higher rate. Intermittent discharge eliminated most of the growth and little effect due to pre-growth was observed. The field studies were in agreement with previous laboratory experiments.

LARGE-SCALE INSTALLATION

With the comprehensive and successful laboratory and pilot plant studies completed, Crown Zellerbach proceeded with designing an intermittent discharge program for the Camas mill (see Figure 11). The installation was

constructed at a cost of $750,000. In addition, some $600,000 has been spent in construction and upkeep on the original deepwater diffuser outfall constructed in 1950, making a total expenditure of $1.35 million for slime control at the Camas mill.

The stream improvement system developed was designed to handle either dilute or concentrated wastes from the Camas sulfite mill. During normal flow periods dilute waste has been collected for six days and discharged upon the seventh day. This schedule can be changed to give any sequence up to a storage period of seven days followed by one day of discharge. The strong digester liquor can be stored for 60 days and then released during high water. Calculations showed that a pond capacity of 150 million gallons would allow collection of at least eight days of total effluent or 60 days of concentrated waste. The only feasible location for a pond of this size was on the company-owned Lady Island in the Columbia River, offshore from the Camas mill.

The abatement system can be divided into three parts: (1) liquor collection, (2) ponding, and (3) deep water outfall. A schematic drawing of the combined system is shown in Figure 12.

Liquor Collection System. Although nearly 20,000 gallons of effluent are produced from each ton of sulfite pulp, the first 4,000 gallons contain about 80 per cent of the solids, and extensive studies have shown that the temperature of the draining liquor can be correlated to the solids content. The collection system is designed to collect the total wastes (20,000 gallons per ton) or the more concentrated liquor of about 4,000 gallons per ton.

For collection of the strong wastes with minimum dilution, care must be taken in the pulp washing cycle. At Camas, the bottom of the blow pit is "padded" (covered with about 3 feet of spent liquor) before the pulp is

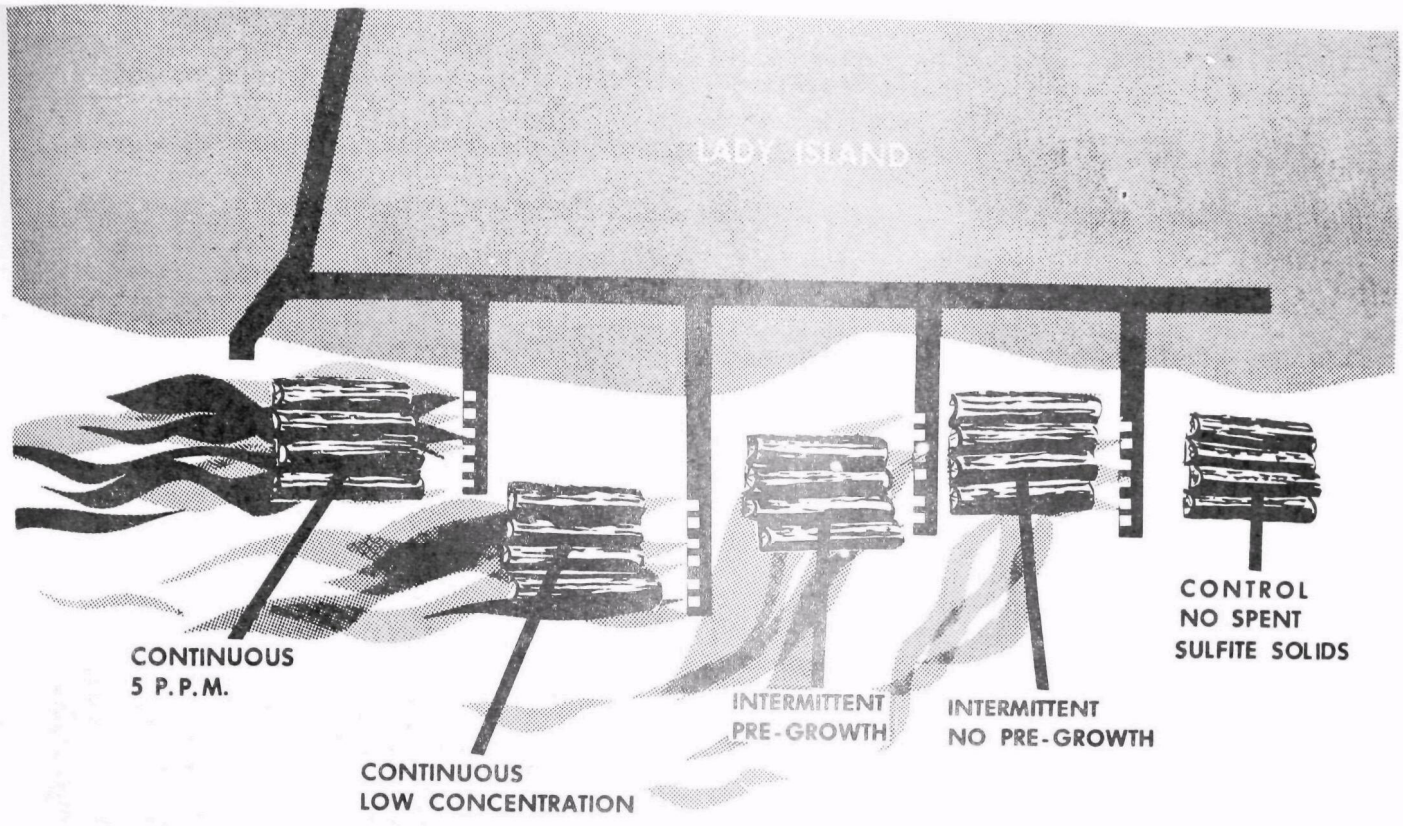


FIGURE 10. Log rafts were used as natural pilot plant installations.

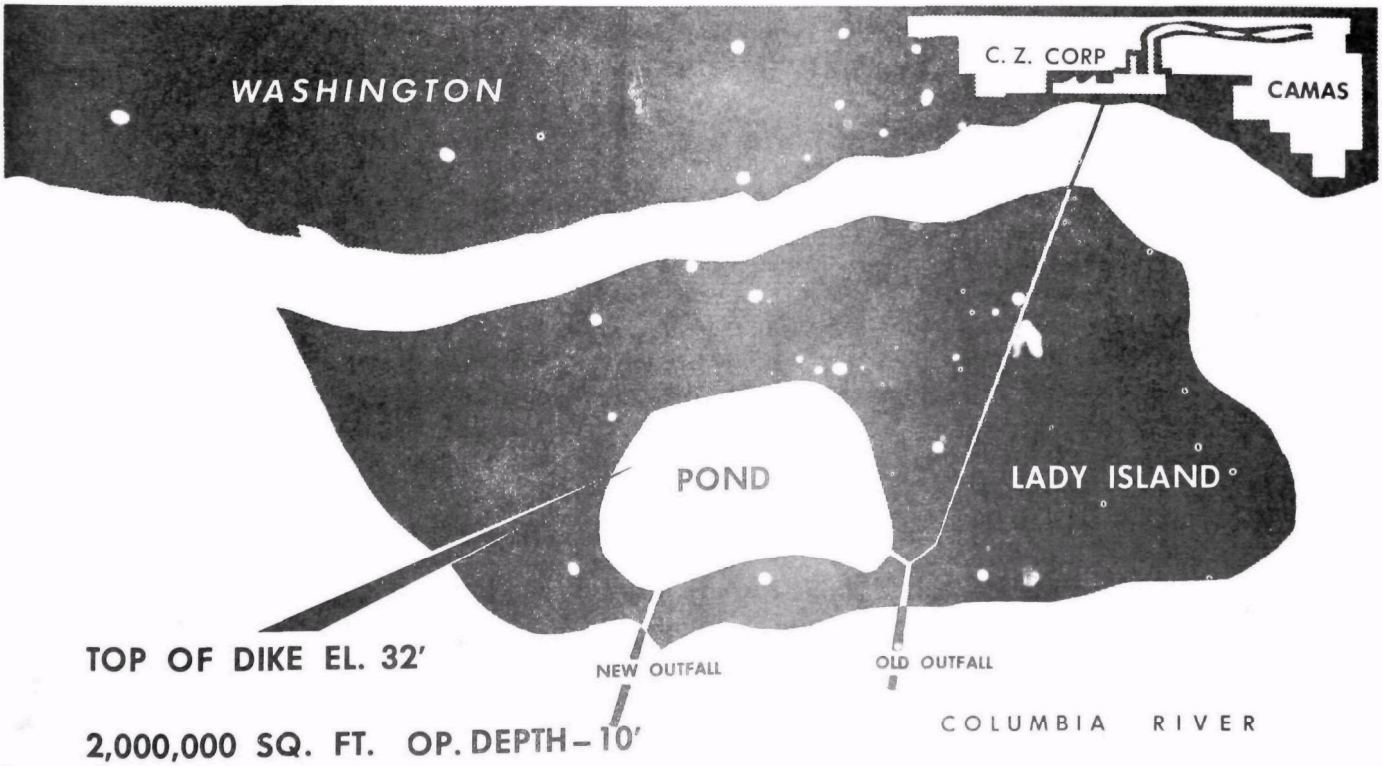


FIGURE 11. Columbia River in the vicinity of Camas showing the Crown Zellerbach mill, outfalls and storage pond.

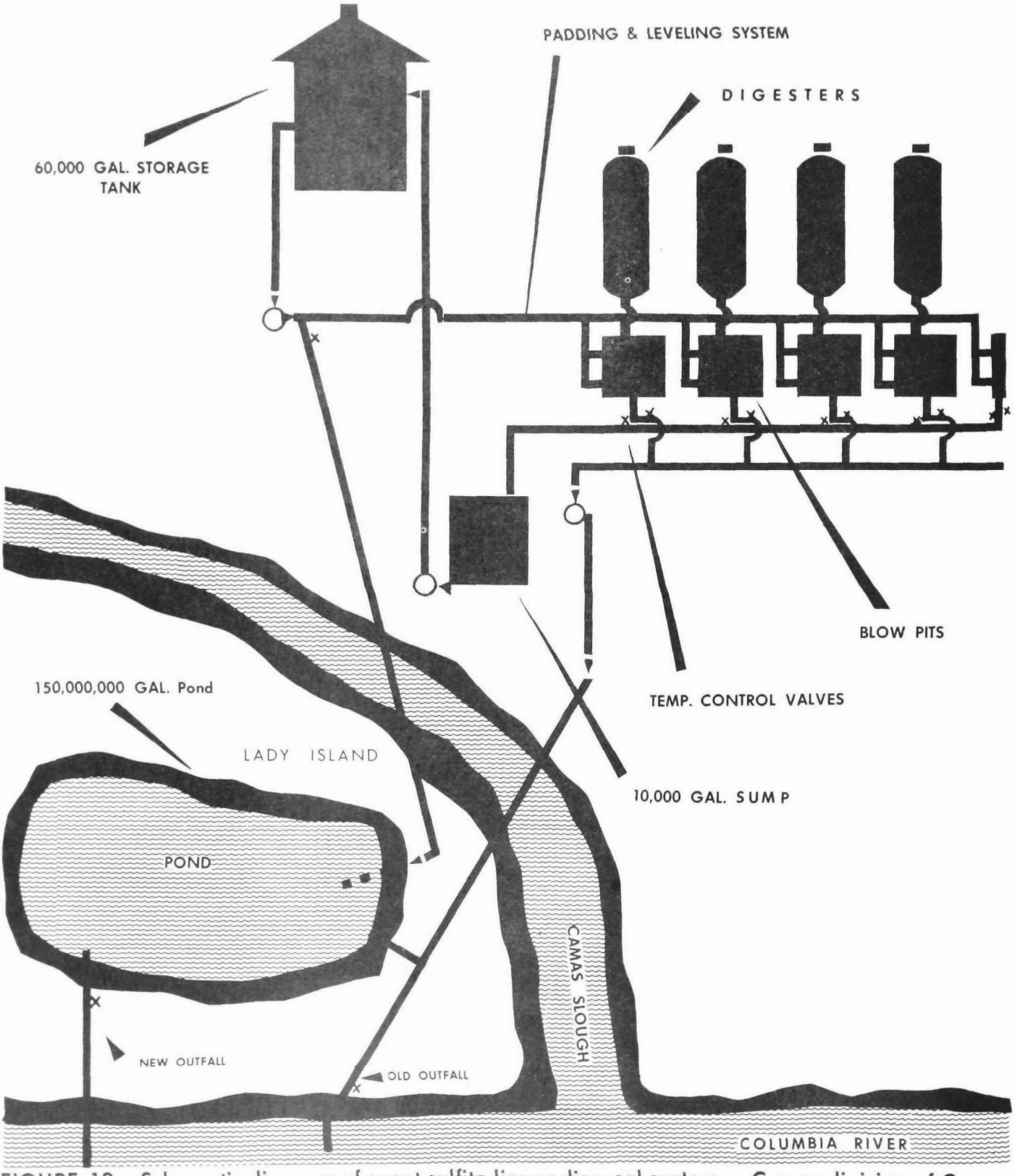


FIGURE 12. Schematic diagram of spent sulfite liquor disposal system, Camas division of Crown Zellerbach.

blown into it. As the pulp is blowing into the pit, spent liquor is injected at a high velocity across the stream of pulp to level the pile and allow even drainage. Padding and leveling is accomplished by automatic, time-controlled valves. At the completion of the blow the operator activates the drainage and wash water controls. The hot padding liquor plus the new hot spent liquor drains through a temperature-controlled valve to a 10,000-gallon, fiberglass-lined storage tank. Another pump takes the liquor from the tank and pumps it either to the pits for padding and leveling, or to the pond one mile away. All of the piping, pumps, and valves are of stainless steel, including the mile of 10-inch pipe to the pond. The drainage at the pit continues until the liquor temperature drops to about 120° F., indicating that 80 per cent of the solids have been collected.

The temperature-controlled valve to the sump then closes and a similar valve to the old system opens, sending the remaining 20 per cent of the solids through a 30-inch line under the Camas slough to the ditch across Lady Island, and from the ditch through a 30-inch outfall into the main channel of the river. When it is desired to collect the total effluent for six days, the "old system" ditch is diverted to the pond. The pond was constructed close to the ditch, thus permitting a valve-controlled, short diversion ditch.

Storage Pond. Land clearing was necessary before investigations were initiated for construction of the 46-acre pond on Lady Island. Following this, a complete topographic study of the island was made, followed by a complete soils study by soil consultants.

The pond was then designed and constructed, using a naturally occurring clay layer as the bottom membrane. The periphery of the pond is a dike with an 8 to 12 foot wide clay core keyed into the clay membrane. The core

extends from the membrane to the top of the dike completely around the pond. In certain locations the dike is 120 feet thick at the base and 18 feet high. The pond has an average working depth of 12 feet. Approximately 110,000 cubic yards of material were moved in construction of the dike and its core.

Grass was planted on the dike to prevent erosion and trees were planted outside the dike.

Underwater Outfall. Dye studies, including aerial photographs, and velocity studies were made to pinpoint the location of the single point discharge in the main flow of the Columbia River for maximum downriver dilution and optimum distribution for pond discharges (see Figure 13).

Test piling was driven along the south shore of Lady Island to find the best bottom for locating the outfall. River elevations for the past 10 years were plotted. Outfall pipe size was calculated using river and pond elevation data and anticipated flow from the pond.

After extensive testing, the line selected was a 54-inch diameter, 12-gauge corrugated pipe, asphalt-dipped, with the internal corrugations filled with asphalt to give smooth bore-flow characteristics. The 24-foot lengths are joined with two-foot-wide bands.

A 10-foot ditch was dug in the bottom of the river from the pond 1100 feet to the point of optimum dispersion. The pipe was joined in 96-foot lengths and lowered into the ditch and joined by divers. After joining, the line was covered with six feet of sand and topped with a blanket of 200 to 800-pound rocks to keep it from washing or being moved by the currents.

The line under the dike is a 1/2-inch wall fiberglass line containing a 48-inch Venturi section for metering, and terminates outside the

dike with a 54-inch stainless steel gate valve. The valve is housed in a 10-foot diameter, 24-foot high fiberglass-lined combination valve pit, vent, and junction box where the corrugated steel outfall starts. The valve pit is topped with a house for the valve operator and flow instruments.

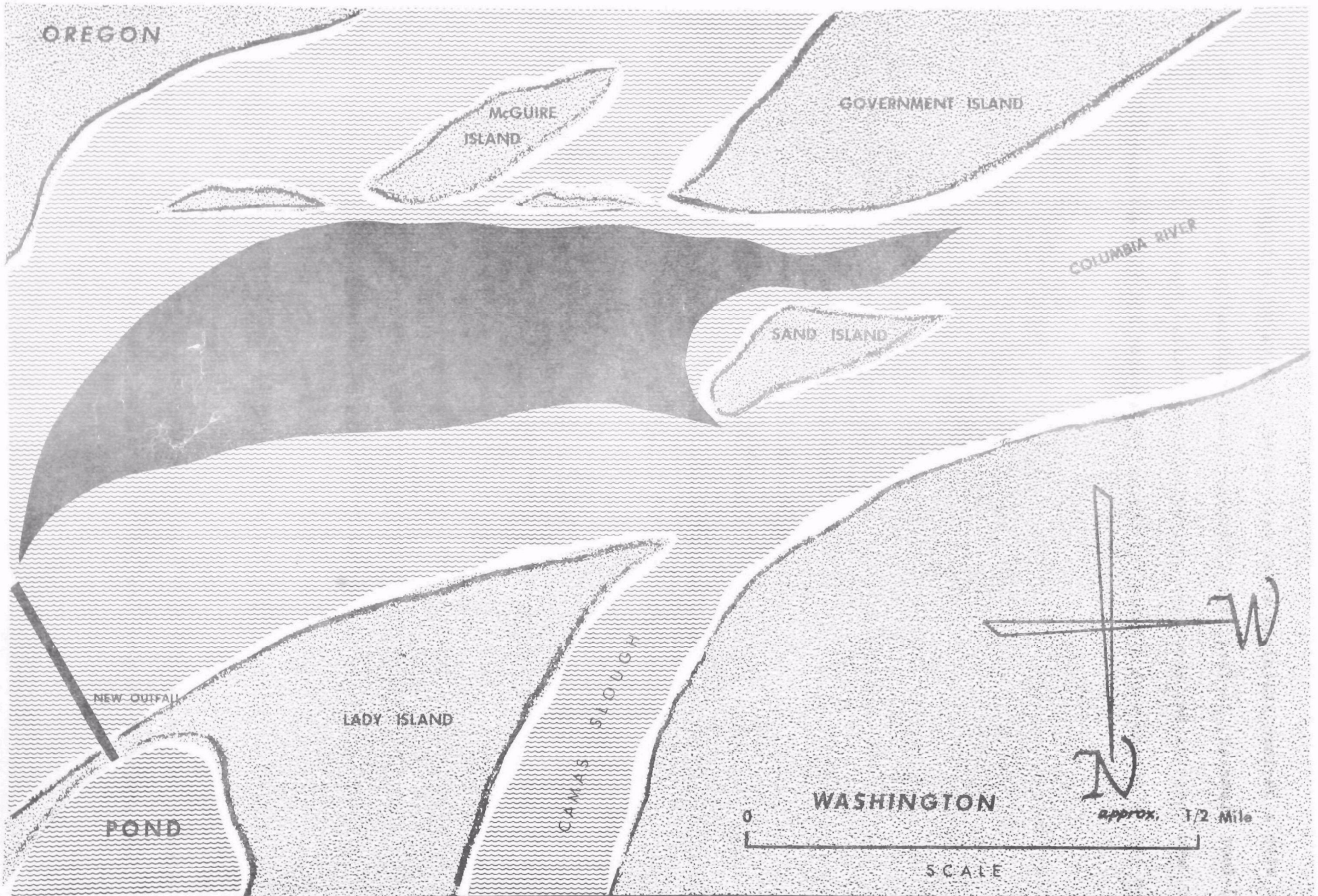


FIGURE 13. Distribution of dye marker discharge from outfall approximates the present pattern of spent sulfite discharged from the Camas mill.

RESULTS OF INTERMITTENT DISCHARGE SYSTEM

The intermittent discharge system at the Camas mill went into operation on a regular basis on February 1, 1961. On that date impounding of the total sulfite mill effluent (strong waste plus weak wash water) began. It was decided to use a 24-hour discharge period following a six-day storage period. The first intermittent discharge was conducted on February 8, 1961.

Tests begun with the start of the system showed the following results:

SLIME GROWTH

Following the start of the intermittent discharge system, a tile box sampler was placed in the main channel of the Columbia River 2.3 miles below the outfall and at a distance of 2,000 feet from the Washington shore. This tile box was located to receive maximum concentrations of spent sulfite liquor during discharge of the pond. A control station was located at Washougal, about 3 miles above the Camas mill outfall.

The test location below the outfall (at Hassalo Rock) had always shown slime growth during continuous discharge. The slime growth obtained at the Washougal control station and the Hassalo Rock station during intermittent discharge is shown in Figure 14. It can be seen that growth at the Hassalo Rock station was equivalent to the background growth obtained at Washougal. It is also of interest to note that the Hassalo Rock sampler was located about 2,000 feet from the Oregon shore and received the highest concentration of spent sulfite liquor during intermittent discharge.

This slime growth data showed that areas receiving only the intermittent discharges did not support slime growth. It also indicated that if an interval of five to six days is maintained between discharges in

downstream movement, slime will not become established at locations in the lower river.

Observations made on the commercial fishing drifts above the Interstate Bridge near Vancouver during the 1961 spring and fall fishing seasons showed the midchannel and Oregon shores to be free of slime growths. This area previously contained heavy growth during continuous discharge of spent sulfite liquor through the underwater outfall.

Previous laboratory experiments showed that kraft mill effluents also supported slime growth. Growth was obtained on evaporator condensate and the weak wash waters from the kraft mill. Although only a very narrow band of growth had been noted along the Washington shore, it was believed that removal of some of the kraft mill effluents from the Camas slough and inclusion of these effluents into the intermittent discharge program would accomplish an additional reduction of growth along the Washington shore.

Changes were made in the mill collection system to direct the following effluents to the main channel of the Columbia River: (1) blow gas condensates from the kraft mill, and (2) evaporator condensates from the kraft mill. This diversion involves a flow of 2.1 million gallons per day which were previously discharged into the Camas slough. These changes were completed in July of 1961.

TIME OF PASSAGE OF DISCHARGES

Time of passage data for the lower Columbia River were not available until installation of the intermittent discharge system, which, for the first time, made possible the accurate determination of time of passage over a wide range of river flows. A continuous automatic sampler was used for these studies which permitted the collection of a sample every half hour.

The time of passage of discharges at selected downstream testing stations varied with the amount of flow and the velocity of the river. At a low flow at Camas of about 90,000 to 100,000 cu. ft. per sec., the time of passage to the Interstate Bridge, 12.8 miles below the outfall, was 10 hours and approximately 29 hours were required to reach St. Helens, 32 miles below the mill outfall. Time of passage to Longview and Skamokawa during the low critical flow period was 49 and 100 hours respectively. The average velocity of the major flow from the Camas outfall to Skamokawa, a distance of 84 statute miles, was 1.23 fps during the low flow fall period.

Data collected during a spring flow of about 184,000 cu. ft. per sec. indicated that the time of passage to Longview was 29 hours. Extrapolation of this time of passage data showed that approximately 55 hours were required for the Camas discharge to reach Skamokawa. During this flow regime, the average velocity of the major flow throughout the lower 84 miles was 2.24 fps.

There was concern there could be some merging of discharges based on the theory that instead of maintaining a starvation interval of six days, the interval could decrease to five or even four days upon downstream movement. Continuous sampling during the spring of 1961 showed conclusively that no significant merging of discharges occurred. At a Camas flow of about 190,000 cu. ft. per sec., very little difficulty was encountered in merging of discharges and a starvation interval of six days was maintained between the discharges over the 52 miles between Camas and the Longview Bridge.

Behavior of intermittent discharges during the fall low flow period was found to be somewhat different than during the spring median flow in

a comprehensive survey conducted September 13-18, 1961. Dilute spent sulfite liquor was discharged during a 23-3/4-hour period beginning on September 13.

The discharge required 12.8 hours to reach the automatic sampler at the Interstate Bridge and arrived with very little "tailing" occurring. The discharge took 25 hours to traverse the section. The maximum concentration of 27.4 ppm was considered quite satisfactory since it represented the spent sulfite solids concentration resulting from a rate of liquor discharge close to 90 per cent of the maximum possible from the pond.

The situation at St. Helens, 32 miles below the outfall, was somewhat different (see Figure 15). As at the Interstate Bridge, the initial rise in spent sulfite liquor concentration was abrupt, but the initial values did not reflect the high initial rate of pond discharge observed at the Interstate Bridge. After 24 hours, a gradual decrease in spent sulfite liquor was observed and the time for the discharge to pass the sampling point completely was about 35 hours. However, Figure 15 shows that about 90 per cent of the total discharge passed this station in 24 hours. The maximum concentration of spent sulfite solids at this station was 8.2 ppm and the average concentration over the 35-hour period was about 5.2 ppm.

At the third sampling point, 52 miles below the outfall at the Longview Bridge, the general picture was similar to that observed at St. Helens. The initial rise in concentration was less steep and the tailing was greater. At this station some 43 hours were required for complete passage of the discharge, but again the major portion passed this station in about 28 hours. The background concentration of spent sulfite solids at this station before the arrival of the discharge was 1.5 ppm, and it was 2.0 ppm afterward.

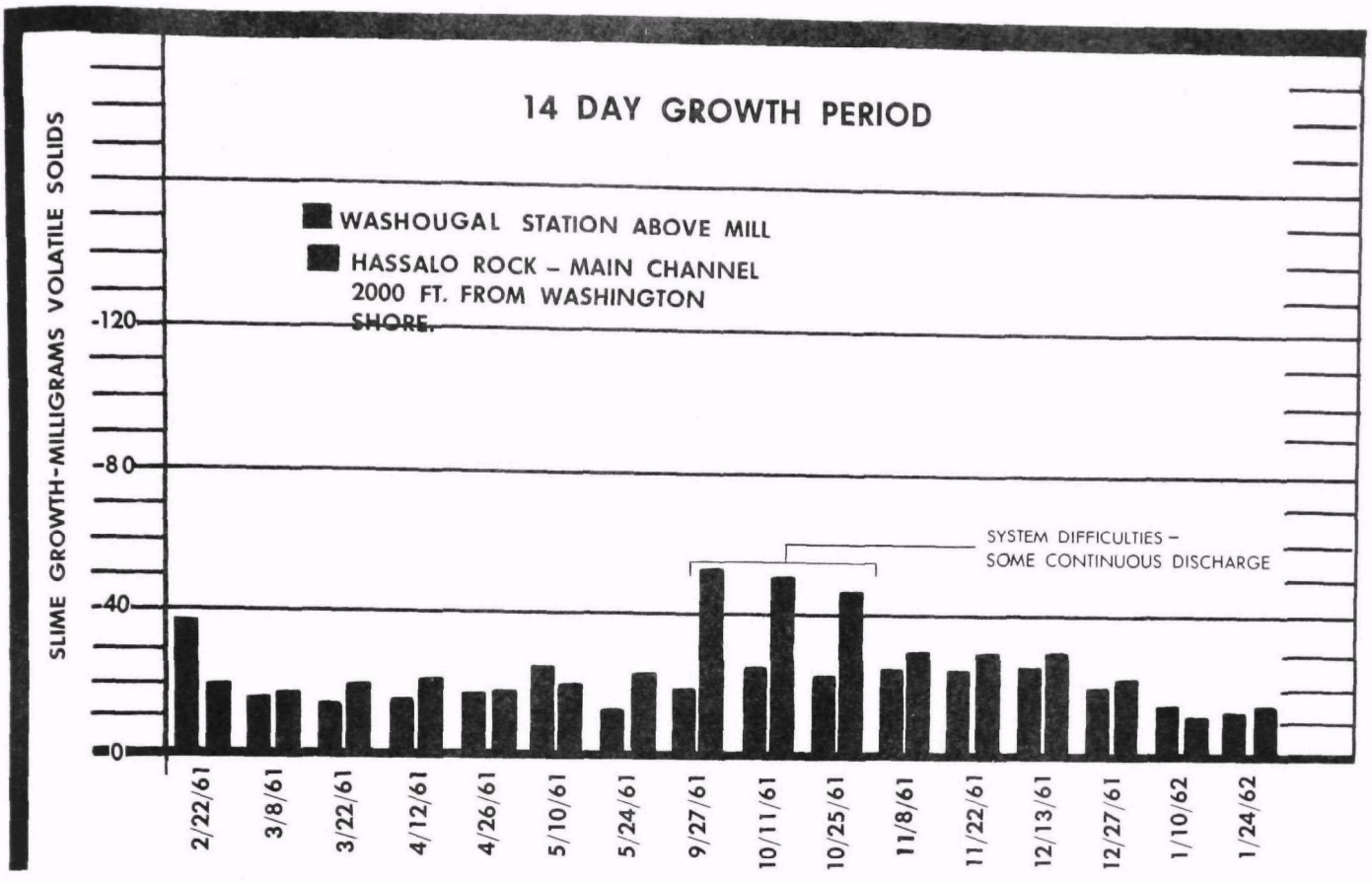


FIGURE 14. Comparison of slime growth at sampling stations above and below mill outfall after start of intermittent discharge system.

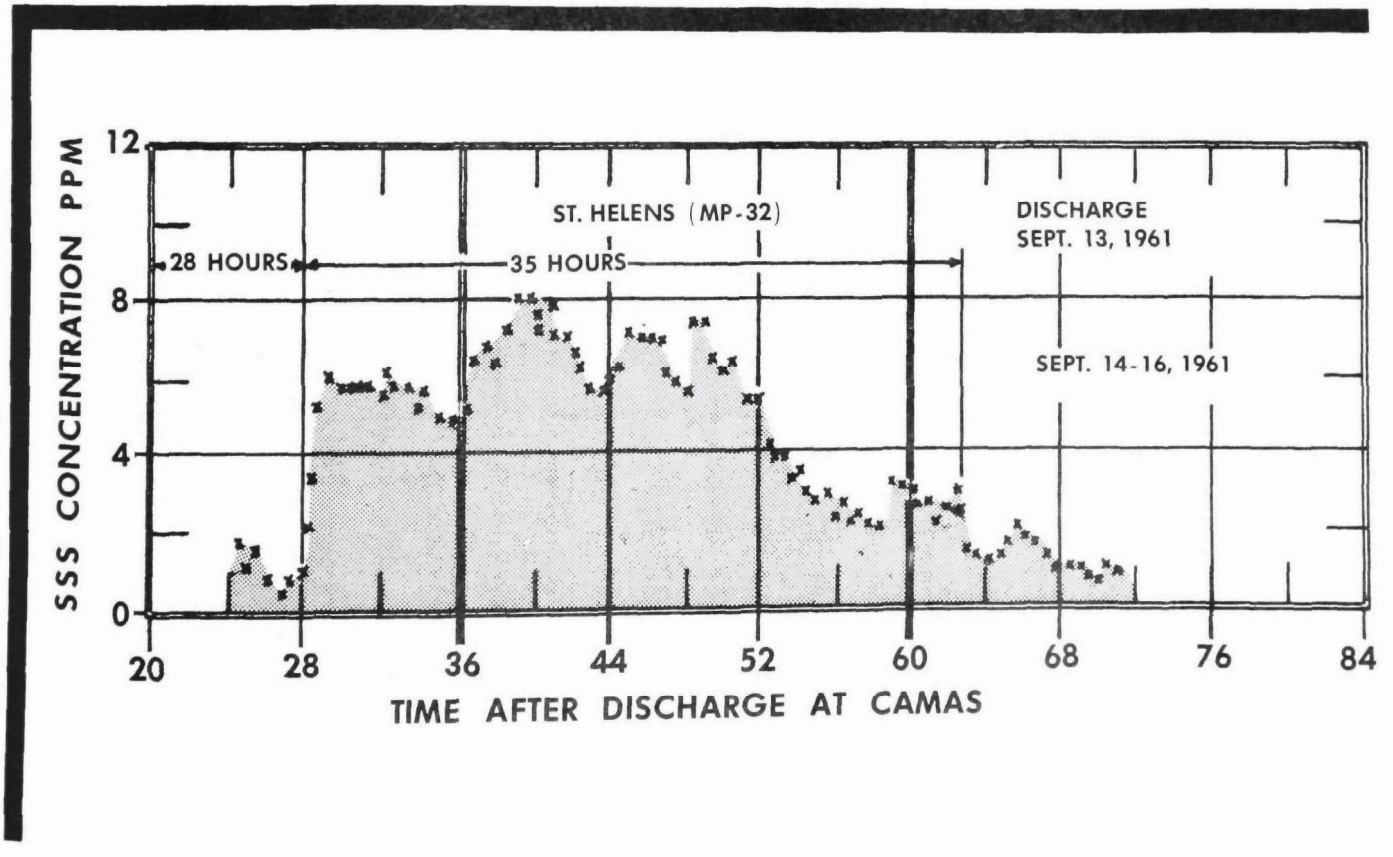


FIGURE 15. Continuous sampling profile during passage of an intermittent discharge at St. Helens on September 14, 15, 16, 1961.

This slight increase was not thought to be due to tailing, since once the 2.0 ppm level was reached, it remained at that value and did not fluctuate. The maximum concentration during the discharge was 6.2 ppm and the calculated average level of spent sulfite solids during the discharge was 4.6 ppm.

Laboratory studies have shown conclusively that even with the slight tailing which occurred at downstream points an interval of at least five days was maintained between the intermittent discharges.

WASTE CONCENTRATIONS DURING STORAGE AND DISCHARGE

Waste concentrations under an intermittent discharge program are extremely important since the stream utilized must have sufficient flow to handle the loadings. In planning the system for the Camas mill, close attention was paid to a report by the Washington State Department of Fisheries on the effects of spent sulfite liquor on salmon under experimental conditions. Long-term experiments on Chinook, pink, and silver salmon of varying ages showed that the most susceptible species of those concerned, Chinook salmon, has a threshold index of 56 ppm of spent sulfite solids.

This was considered the maximum concentration that could be tolerated in planning the intermittent discharge program. Intensive research work prior to the installation of the program indicated that these concentrations would not be reached.

Tests showed that during periods of storage the spent sulfite solids and B.O.D. concentrations in the major flow of the river are essentially the same as those found above the mill outfall. The normal background spent sulfite solids concentrations will range from 0.2 to 1.0 ppm, and B.O.D. values range from 0.2 to 1.0 ppm.

A number of cross-sectional samplings have been conducted below the mill during periods of intermittent discharge to determine the spent sulfite solids and B.O.D. concentrations. Average spent sulfite solids concentration at the Interstate Bridge was about 10.0 ppm during median flow conditions experienced during the winter and spring fishing season. During low flow encountered in September and October, the spent sulfite solids concentration at the Interstate Bridge will be about 14.0 to 16.0 ppm.

The maximum spent sulfite solids concentration at the Longview Bridge (see Figure 16) was 6.7 ppm at a Longview flow of about 200,000 cu. ft. per sec. At the St. Helens station, 32 miles below the outfall, the maximum spent sulfite solids concentration was 8.2 ppm during low flow.

From August 12 to 19, 1963, an extensive survey was made at Steamboat Slough near Skamokawa on spent sulfite wastes and B.O.D. in relation to the intermittent discharge system at the Camas mill. The location is 84 miles below the mill outfall and 36 miles from the jetties at the mouth of the Columbia. Average flow of the river during the testing period was 142,000 cu. ft. per sec. with the temperature varying from 20.8 to 21.8° C. Samples were collected by Crown Zellerbach personnel using an automatic sampling device constructed at Crown Zellerbach's Central Research division, and, in addition, traverses were run twice daily in order to determine the distribution of spent sulfite wastes throughout the river cross section.

The Lady Island lagoon was emptied beginning at 10 a.m. on August 12. The first increase in liquor concentration at the Skamokawa testing point was detected 77.5 hours later on August 15.

Examination of Figure 17 shows there was no increase in B.O.D. as the liquor passed Skamokawa, showing the B.O.D. of the liquor had been

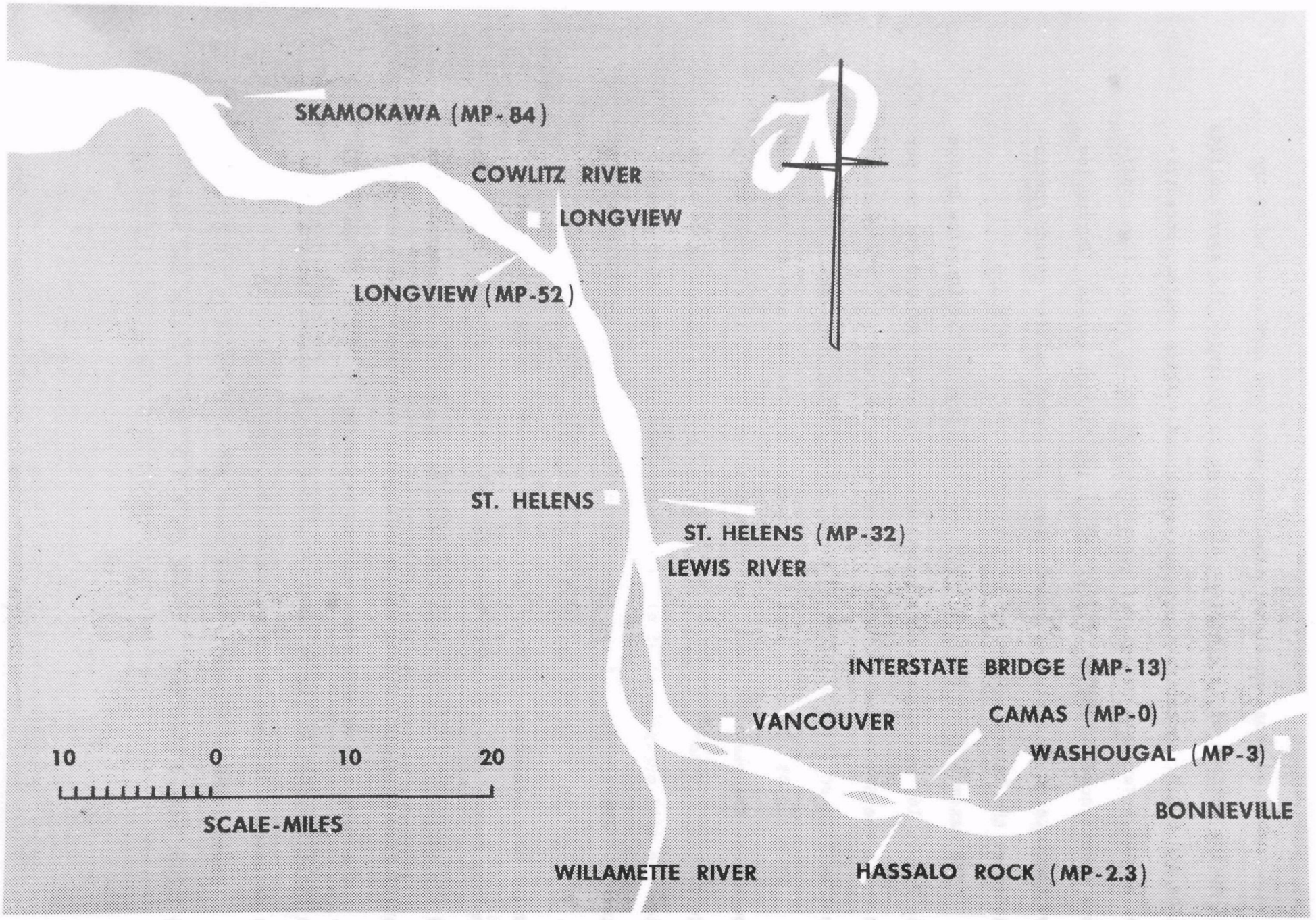


FIGURE 16. Lower Columbia River survey area showing sampling locations.

satisfied during the passage from Camas. The most likely explanation is that free floating bacteria in the water had utilized the sugars. B.O.D. tests in which test water is incubated at 20° C. in special bottles for a period of five days have shown that while there is no agitation such as occurs in a river, the free floating organisms are able to assimilate the food source quite completely. Additional evidence that the B.O.D. reduction was not due to the growth of Sphaerotilus was the absence of flocs of this organism in the river at the testing location.

For the most part the liquor was spread quite evenly throughout the entire cross-section tested and values were similar to those obtained at the sampler.

Although it took about 40 hours for the discharge to pass the Skamokawa testing point, this could not have produced Sphaerotilus growth as the B.O.D. tests showed all organic matter had been destroyed. Consequently, there were no wood sugars left which could be utilized as food by Sphaerotilus.

DISSOLVED OXYGEN

The dissolved oxygen (D.O.) concentrations in the lower Columbia River usually vary from 8 to 12 ppm depending upon the season. During the first spring trial of intermittent discharge, no significant drop in D.O. could be detected in the lower river. This was expected, since the flow was fairly high (about 180,000 cu. ft. per sec.) and water temperature was low.

The D.O. profiles for the lower river during the low flow period of September 13 through September 18, 1961, when the flow at Camas was about

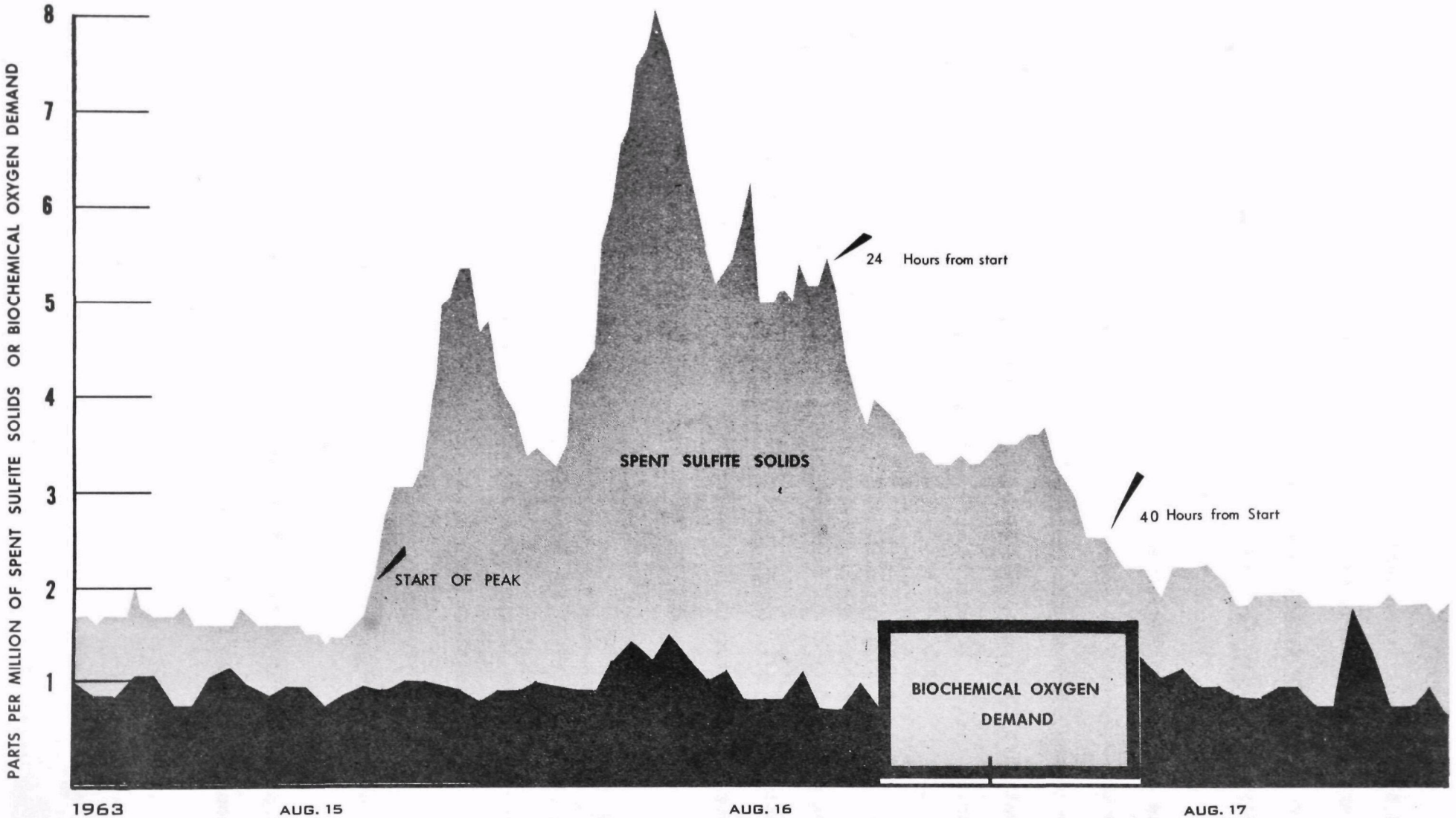


FIGURE 17. Continuous sampling profile showing biochemical oxygen demand during passage of an intermittent discharge near Skamokawa, August 1963.

80,000 cu. ft. per sec. are shown in Figure 18. The D.O. concentrations during periods of spent liquor storage dropped slightly in moving downstream, from 8.9 to 8.5 ppm. The average D.O. drop in the 84 miles of river under consideration was 0.4 ppm prior to intermittent discharge and 0.9 ppm during the passage of the intermittent discharge. The minimum D.O. recorded during this sampling period was 7.3 ppm some 84 miles below the outfall, which corresponds to a saturation value of 77.6 per cent.

The conditions during the fall survey represent the extremes of flow and water temperature under which intermittent discharge will be used. The water temperature during this period was 18° C. and the river flow at Camas was about 80,000 cu. ft. per sec. Figure 18 shows that the oxygen resources of the lower Columbia River will not be seriously affected by intermittent discharge of the Camas spent sulfite liquor during periods of low flow and relatively high water temperatures.

CONCLUSIONS

Full-scale operation of the intermittent discharge system at the Camas mill has produced the following conclusions:

1. A seven-day schedule consisting of six days' storage followed by a 24-hour discharge period has been effective in controlling Sphaerotilus growth.

2. Sphaerotilus growth has been virtually eliminated in the area between the Camas mill and the Interstate Bridge receiving spent sulfite liquor on an intermittent basis.

3. Spent sulfite solids concentrations during periods of discharge have been substantially below the concentration inimical to aquatic life and the dissolved oxygen assets of the lower river have not been adversely affected.

4. Merging of spent sulfite liquor discharge in the lower river has not been a problem and the interval between discharges has been sufficiently long to prevent Sphaerotilus growth development as the discharge moves downstream.

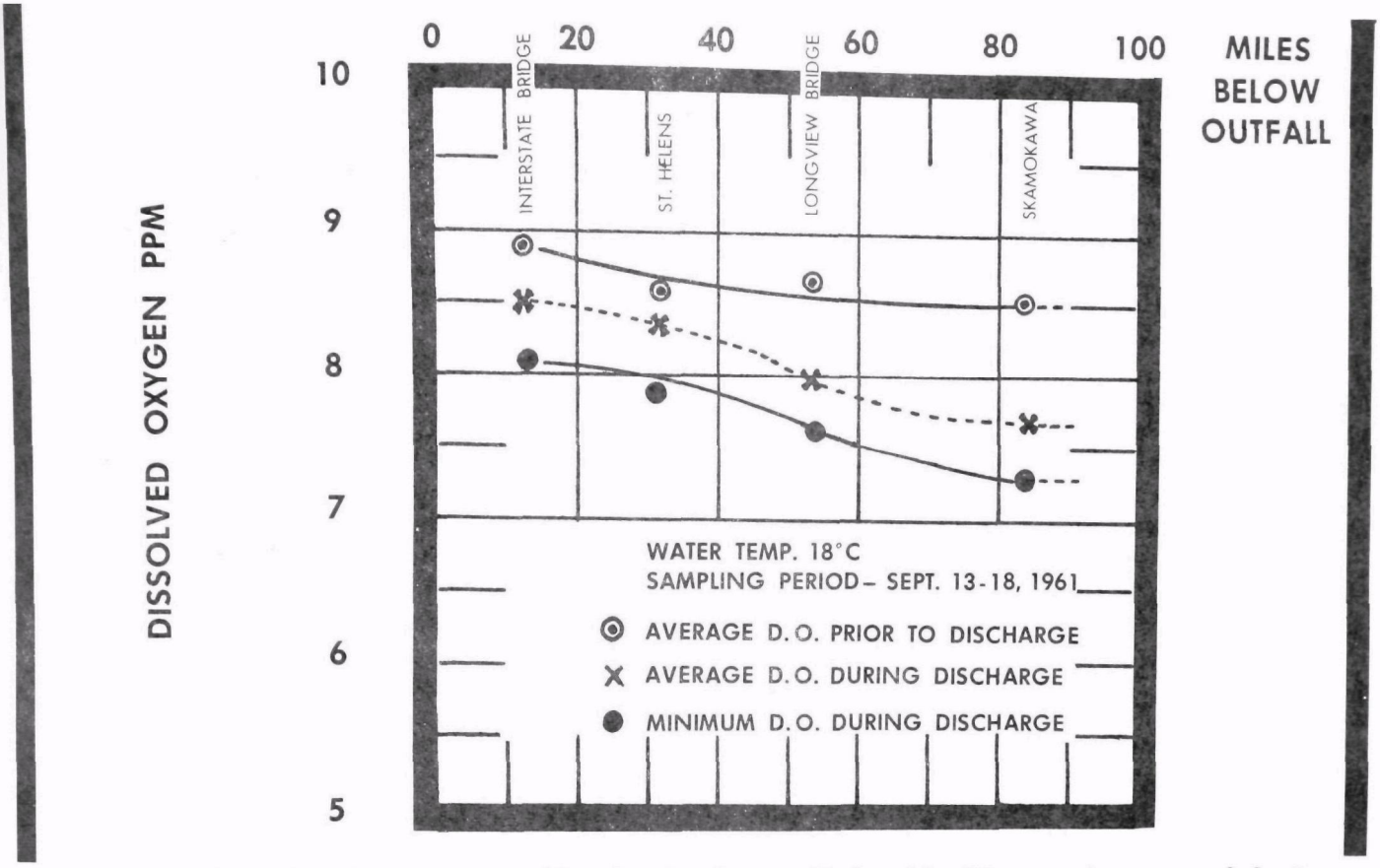


FIGURE 18. Dissolved oxygen profiles in the lower Columbia River prior to and during passage of an intermittent discharge for September 13 through 18, 1961.

FIGURE 19. Tile sampler boxes are checked for slime growth every two weeks.

PRESENT TESTING PROCEDURES

Crown Zellerbach scientists carry on a continual testing program in the Columbia River between Washougal and the Interstate Bridge at Vancouver to maintain a close check on possible slime growth and water conditions in the river. Special studies are made as far down river as Skamokawa, 84 miles below the mill outfalls.

The company's Central Research division maintains a regularly scheduled testing program which provides data for its own research projects, the Washington State Pollution Control Commission, and the Camas mill division. Some of this work is part of the program of the Lower Columbia River Cooperators, an organization of firms and public agencies concerned with water quality control from Bonneville Dam to the mouth of the Columbia.

To keep a constant check on possible slime growth, the company maintains five tile sampler boxes in the river between Washougal and the Interstate Bridge at Vancouver. The tile plates in the sampling boxes are checked every two weeks for slime growth (see Figure 19). Reports are filed with the Washington State Pollution Control Commission.

In conjunction with the sampling boxes, water tests also are made every two weeks. This phase of water testing is carried out at four locations: Washougal, west end of Sand Island, Ellsworth, and the Interstate Bridge.

A total of 24 samples are taken. Three are taken in a traverse at the Washougal station. At the Sand Island site three samples are taken from the main channel of the river between Sand and Government Islands, and seven in a traverse between Sand Island and the Washington shore. Five samples are obtained between Ellsworth on the Washington shore and

Government Island. At the fourth testing location, the Interstate Bridge, six samples are taken between the Washington shore and Hayden Island, again spanning the main channel.

All samples are taken at a uniform depth of three feet, with the water being tested for D.O., B.O.D., S.S.S., phosphate, nitrate, ammonia, pH, temperature, alkalinity and turbidity (see Figures 20 and 21). Results of these tests are sent to the Washington State Pollution Control Commission.

Water tests required by the Washington State Pollution Control Commission for the Camas mill are obtained from six locations starting with a control location at the east end of Lady Island above the outfalls. The remaining test locations for the mill are (2) south side of Lady Island below the outfalls; (3) Hassalo Rock; (4) Fisher; (5) one-half mile west of Ellsworth, and (6) Leiser Point, just east of Vancouver. At each of the last five locations three samples are taken at various distances from shore.

The water obtained in these samples is checked for temperature, pH, spent sulfite liquor concentration and, at some locations, dissolved oxygen. The results are submitted to the Washington State Pollution Control Commission in a bi-weekly report.

The Central Research division laboratory also regularly runs tests for the U. S. Public Health Service on water samples taken at Bonneville Dam. Along with tests on dissolved oxygen, B.O.D., turbidity, S.S.S., phosphate, ammonia, pH, and nitrate, the samples are tested for chloride and sulfate content, bacteria count, chemical oxygen demand, chlorine demand, hardness, total dissolved solids, alkalinity and color.

Supplementing the regular testing program are periodic projects which extend down river as far as Cathlamet and Skamokawa. These are studies

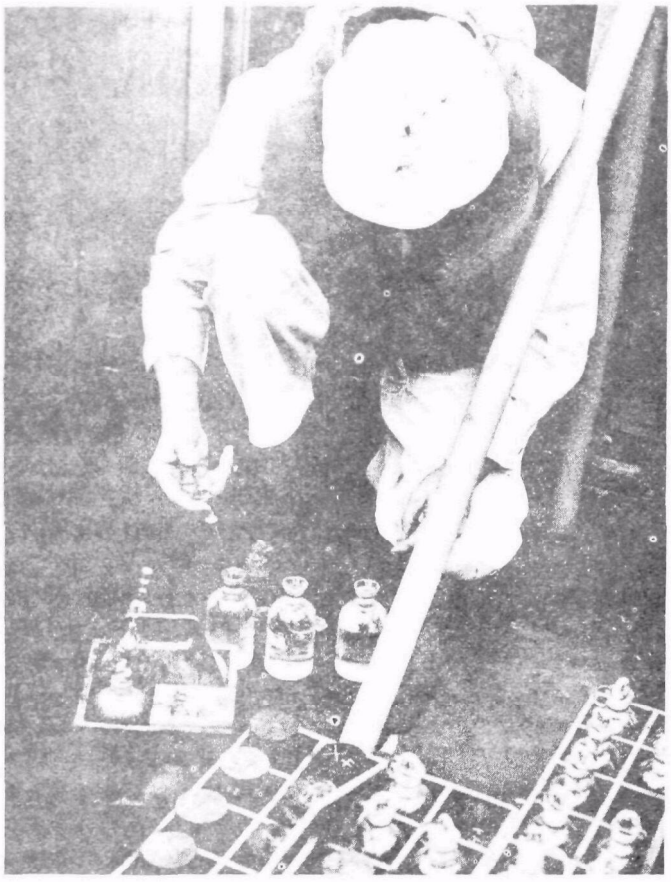


FIGURE 20. Some tests are made in the boat as soon as the water samples are taken from the river.

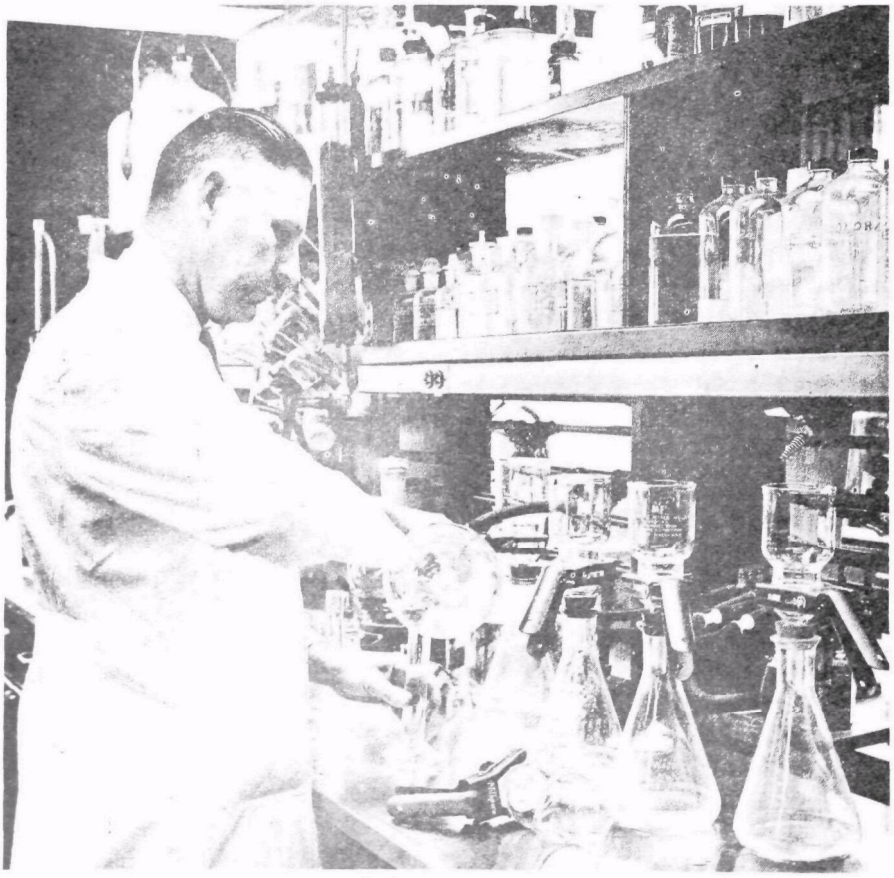


FIGURE 21. Water samples are carefully measured for each test at Crown Zellerbach's Central Research division at Camas.

similar to the one carried out over an eight-day period at Skamokawa in August of 1963, which was described in an earlier section of this report.

The company also maintains contact with commercial fishermen in the lower Columbia River area. During the commercial fishing season Crown Zellerbach scientists periodically accompany fishermen in order to inspect their nets for possible slime growth picked up in the river. The company also performs its own tests with a 400-foot-long commercial fishing net during the closed season or when it is not possible to accompany a commercial fisherman during the season. Special permits from the states of Washington and Oregon allow the company to use the net on a year-around basis for scientific purposes. (The net is of too small a mesh to catch salmon and steelhead. Any other species caught are returned to the river.)

Following the same drifts used by commercial fishermen, it is possible to keep a check throughout the year for slime or other foreign substances which might become enmeshed in the netting.

RESEARCH OUTLOOK

Research holds the key to the ultimate answer of the water quality control question. The final goal of such research is not only devising waste control and treatment systems, but eventual development of programs and techniques for economic utilization of waste materials.

Cellulose fibres from which paper is made, constitute about half of the tree. The remainder is principally lignin, which binds the cellulose fibres together, plus wood sugars. Historically, in papermaking, this "other half of the tree" has been discarded as waste, or burned.

Crown Zellerbach is committed to a program of recovering this other half of the tree. To date, the company has spent millions of dollars on research aimed at the development of saleable chemical products from the lignin and wood sugars in spent sulfite liquor alone. It is currently spending large sums each year in this area of research.

Already, laboratory and pilot-study work carried on in Camas at the company's Central Research and Chemical Products divisions has led to the development of an impressive list of chemicals which have been put into commercial production for industry and agriculture (see Figure 22).

Five chemical plants have been established at four Crown Zellerbach locations in the United States. These include a lignin sulfonate plant at Lebanon, Ore.; a turpentine production facility and a plant for making levulinic acid at Port Townsend, Wash.; a specialty organic chemical plant at Camas, and facilities for producing dimethyl sulfide, dimethyl sulfoxide, tall oil and turpentine at Bogalusa, La.

Today, Crown Zellerbach's line of chemicals is widely sold throughout the United States and the world.

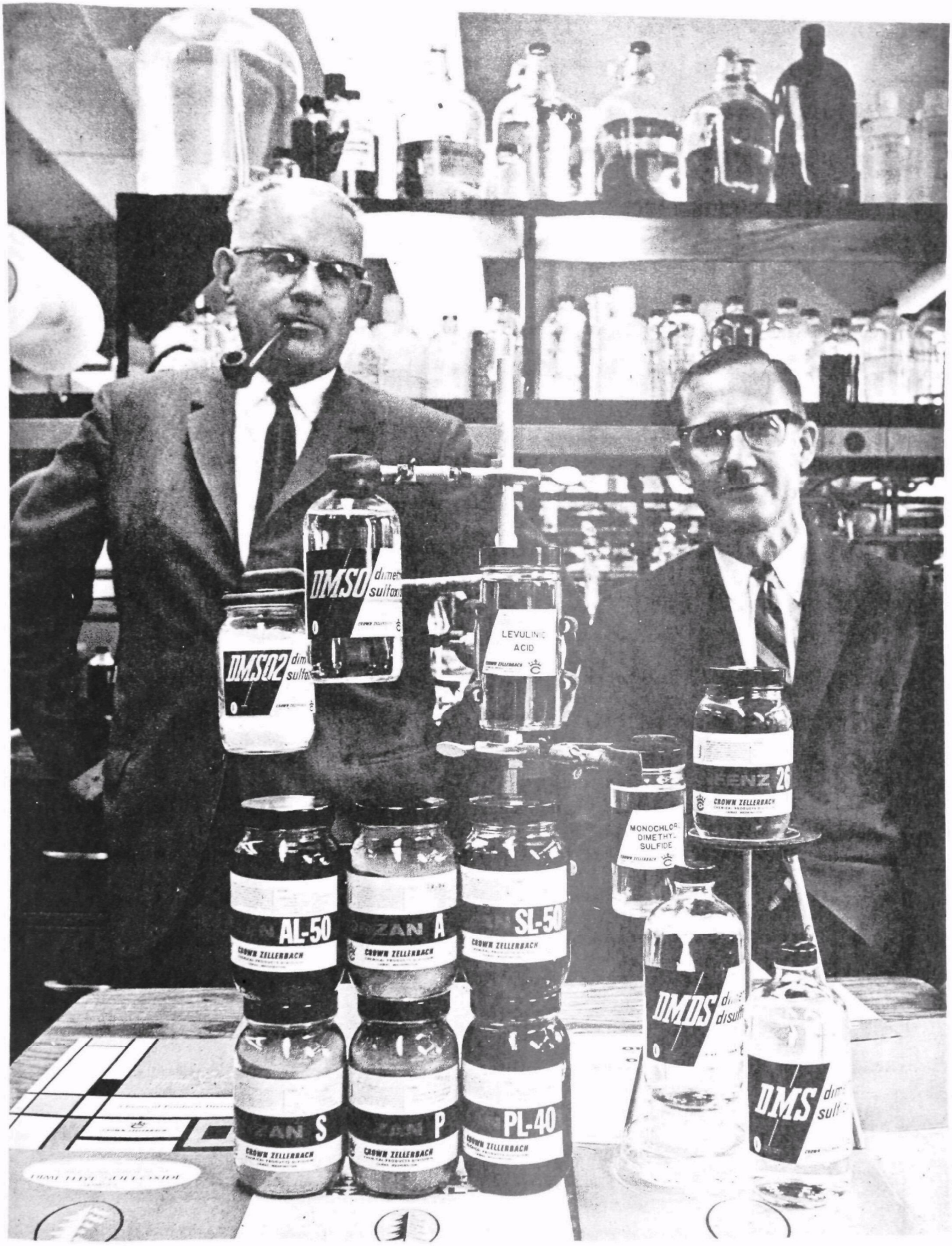


FIGURE 22. Chemical products derived from wood-pulping process at Crown Zellerbach's Camas research lab are displayed by Chemical Products division general manager E. H. Nunn and assistant general manager R. B. Bailey.

At the specialty organic chemicals plant at Camas, research and development, plus pilot plant tests of new chemicals, are carried out by the Chemical Products division.

As a result of the varied research work under way in the Central Research and Chemical Products divisions' laboratories in Camas, as many as ten products may be ready for test runs on pilot plant scale at any one time---only one or two of them may prove to be profitable. Scientists in the laboratories come up with one or two developments monthly that qualify for patents.

Current projects include study on a process for the hydrogenation of lignin from woodpulp spent liquors. The company obtained an option on the process from the Noguchi Institute of Tokyo, which developed it. A specially designed building for such research under high pressures, with walls one foot thick has been built at Camas for study of the process. In the process, lignin can be converted into a number of compounds which have a considerable potential utility as raw materials for the synthetic organic chemical industry.

The process can utilize lignin from either the sulfite or kraft pulping processes as well as lignin left after the hydrolysis of wood to produce sugars.

Economics are a determining factor in the development of products from lignin. At present, the market is not adequate to absorb all of the chemical products which could be produced by Crown Zellerbach's mills. Realization of the hope of total utilization of "the other half of the tree" and a corresponding final answer to water quality control problems at pulp and paper mills depend on a variety of factors. Among these are

continued research for new products; development of markets for these chemical products; new methods for obtaining pure chemicals from lignin and other wastes so they can compete economically with other processes, and economic growth, particularly in the use of chemical products.

APPENDIX D

ADDENDUM TO

POLLUTION REPORT ON LOWER COLUMBIA RIVER

BACTERIOLOGICAL QUALITY OF THE LOWER COLUMBIA RIVER

Annual bacteriological surveys have been conducted on a sixteen-mile reach of the Lower Columbia River from the Portland-Vancouver area to just upstream of St. Helens (See Figure 1) during the fall, or critical season, of the years 1960, 1962, 1963 and 1964. Results obtained as a result of these cooperative surveys by the Oregon State Sanitary Authority, the Washington Pollution Control Commission and the Public Health Service are summarized in this report (See Table 1). The purpose of the study is to assess progress in bacterial pollution abatement by the cities of Portland and Vancouver.

Results indicate the cities have generally made steady progress in improving the bacteriological quality of the Columbia River over the past four years. If conditions continue to improve at the same pace, the 1965 survey should indicate some portions of the Lower Columbia to be safe for recreational purposes including water contact sports. Past improvement is considered to be the result of the concern of both the cities and the two state regulatory agencies which resulted in increased efficiency in waste interception and treatment plant operation.

The City of Portland has continuously operated effluent chlorination facilities at the Columbia Boulevard treatment plant since June 1962. The Columbia Boulevard treatment plant discharges directly to the Columbia River above the mouth of the Willamette River. A major step in the cleanup of wastes discharged from Portland into the Willamette River was achieved with the dedication of the Tryon Creek treatment facility on July 12, 1965. The plant provides secondary treatment, including effluent chlorination of wastes from the southwest section of Portland,

Lewis & Clark College, and the City of Lake Oswego. An additional interceptor to the plant will collect waste from the Dunthorpe-Riverdale area to further reduce the bacterial load on the Willamette River.

Additional waste interception and treatment is planned by the City of Portland for the northwest part of the city, the industrial areas, and the harbor area. These projects will all reduce bacterial pollution of the Columbia as well as the Willamette River. The last Oregon Legislature passed a law to provide the necessary legal backing for control of marine pollution from house boats and pleasure crafts. It is the stated policy of the Oregon State Sanitary Authority to eliminate the discharge of all untreated wastes in the area at an early date.

The City of Vancouver likewise has made considerable progress in the abatement of pollution in the Lower Columbia River. In 1959 there were five major outfalls discharging raw sewage directly to the river. An interceptor program was initiated and is now completed so that all wastes receive primary treatment and effluent chlorination. These projects and completion dates are listed as follows:

1. 18th Street interceptor completed 1961;
2. Jantzen interceptor completed 1962;
3. Portco interceptor completed 1963;
4. Fruit Valley interceptor completed 1964;
5. Port Industrial interceptor completed 1964.

Additional planning is under way by the city to minimize the influence of storm water overflows, modify and improve the existing treatment plant, and construct an additional plant to serve the residential and industrial areas west of the city.

Survey Methods

During each of the surveys samples were collected from each station at six-hour intervals by two sampling crews using outboard motor boats. Each of the surveys covered a period of three days except for the 1962 survey which was terminated after two days because of the Columbus Day storm. At each station the samples were taken at one foot depth from three to five cross-sectional points. The samples representative of shore conditions were collected within 100 feet from shore. Additional intermediate samples were collected at all stations to represent mid-stream conditions as follows:

Station 1 - one point
Stations 2 and 3 - three points
Stations 4 and 5 - two points

All samples were iced immediately after collection and delivered after each run to the Public Health Service Portland Laboratory for analysis. Bacteriological determinations were conducted in accordance with procedures described in Standard Methods for the Examination of Water and Sewage. In the 1960 survey the most probable number (MPN) technique was employed. The 1962 and 1963 studies were run using the MPN technique for all samples with duplicate tests being performed on selected samples using the membrane filter (MF) technique for comparative purposes. As a result of these comparative tests, it was concluded that the MF technique gave valid results for these waters. The 1964 survey was conducted using only the MF technique. It is planned to again employ the MF procedure in the 1965 survey.

Survey Results

A summary of the results obtained during the four surveys is presented in Table 1. Coliform densities at all stations below the Portland-Vancouver area have shown a general decline since 1960 at midstream locations and near the Oregon shore. Counts near the Washington shore at the lower stations reached a peak during the 1963 survey reflecting the influence of sewage by-passing during interceptor constructions at Vancouver. Although counts near the Washington shore were consistently lower during the 1964 survey, they were still generally higher than counts found at the same time at midstream locations or near the Oregon shore. This was apparently due to storm runoff and some sewage by-passing still taking place at Vancouver.

Although significant reduction in coliform bacteria has occurred during the period 1960-1964 at all downstream stations, average concentrations along the shores are still above that recommended by the State Health Departments for water contact recreation (240 per 100 ml). Average concentrations in the midstream sector of Stations 2 and 3 were, however, found to be within this limit for the first time in 1964. If comparable improvement is demonstrated by the results of the 1965 survey to be conducted later this month, some portions of the Columbia shore downstream from Portland and Vancouver may be satisfactory for water contact recreation.

TABLE 1

SUMMARY OF RESULTS LOWER COLUMBIA BACTERIOLOGICAL SURVEY

Coliform Bacteria per 100 ml

Year	Dates		Interstate Br. Station 1	Mathews Point Station 2	Hewlett Point Station 3	Reeders Beach Station 4	Henrici Landing Station 5
1960	9/19, 20 & 21				Oregon Shore		
		Maximum	460	46,000	110,000	>110,000	110,000
		Minimum	15	930	9,300	24,000	9,300
		Median	150	11,000	46,000	110,000	46,000
		Average	225	16,975	46,275	77,677	34,358
					Midstream		
		Maximum	240	>110,000	>110,000	>110,000	46,000
		Minimum	23	<30	150	230	2,400
		Median	43	11,000	4,600	11,000	15,500
		Average	93	37,641	19,026	22,773	17,225
					Washington Shore		
		Maximum	1,100	>11,000	110,000	>110,000	>11,000
		Minimum	93	430	2,300	910	930
		Median	240	>11,000	9,300	9,300	11,000
		Average	756	8,335	20,700	18,634	9,085
1962	10/9 & 11				Oregon Shore		
		Maximum	24,000	46,000	23,000	8,000	9,300
		Minimum	91	<30	930	390	2,300
		Median	5,025	9,300	2,300	4,300	5,150
		Average	5,387	657	5,278	8,415	5,912
					Midstream		
		Maximum	9,300	46,000	46,000	43,000	43,000
		Minimum	430	150	230	930	150
		Median	2,300	4,300	4,300	5,150	5,150
		Average	3,591	7,873	12,605	9,268	9,134
					Washington Shore		
		Maximum	4,300	110,000	46,000	93,000	15,000
		Minimum	390	9,300	4,300	4,300	4,300
		Median	4,300	24,000	17,000	15,150	9,300
		Average	3,273	32,362	18,737	23,400	7,975

TABLE 1
(Continued)
Coliform Bacteria per 100 ml

Year	Dates		Interstate Br. Station 1	Mathews Point Station 2	Hewlitt Point Station 3	Reeders Beach Station 4	Henrici Landing Station 5
1963	9/16, 18 & 20				Oregon Shore		
		Maximum	4,300	23,000	23,000	23,000	43,000
		Minimum	150	430	430	210	930
		Median	680	1,615	5,150	3,300	23,000
		Average	1,016	4,015	10,953	5,776	22,790
					Midstream		
		Maximum	4,300	43,000	150,000	93,000	43,000
		Minimum	150	91	230	200	2,300
		Median	430	930	2,300	5,900	9,300
		Average	1,125	3,752	14,744	16,997	16,071
					Washington Shore		
		Maximum	4,300	93,000	240,000	240,000	93,000
		Minimum	150	9,300	21,000	21,000	4,300
		Median	1,615	33,000	68,000	84,000	43,000
		Average	1,930	43,787	102,000	78,875	35,800
1964	9/14, 16 & 18				Oregon Shore		
		Maximum	160	7,600	2,000	2,700	2,000
		Minimum	70	60	200	170	160
		Median	80	390	710	510	475
		Average	92	1,363	892	902	767
					Midstream		
		Maximum	100	290	520	1,400	2,100
		Minimum	46	60	120	100	140
		Median	75	90	160	220	820
		Average	76	122	233	390	888
					Washington Shore		
		Maximum	1,800	15,000	43,000	31,000	7,100
		Minimum	300	2,300	430	310	1,500
		Median	570	4,200	4,900	6,200	3,050
		Average	856	5,344	10,192	9,214	3,462

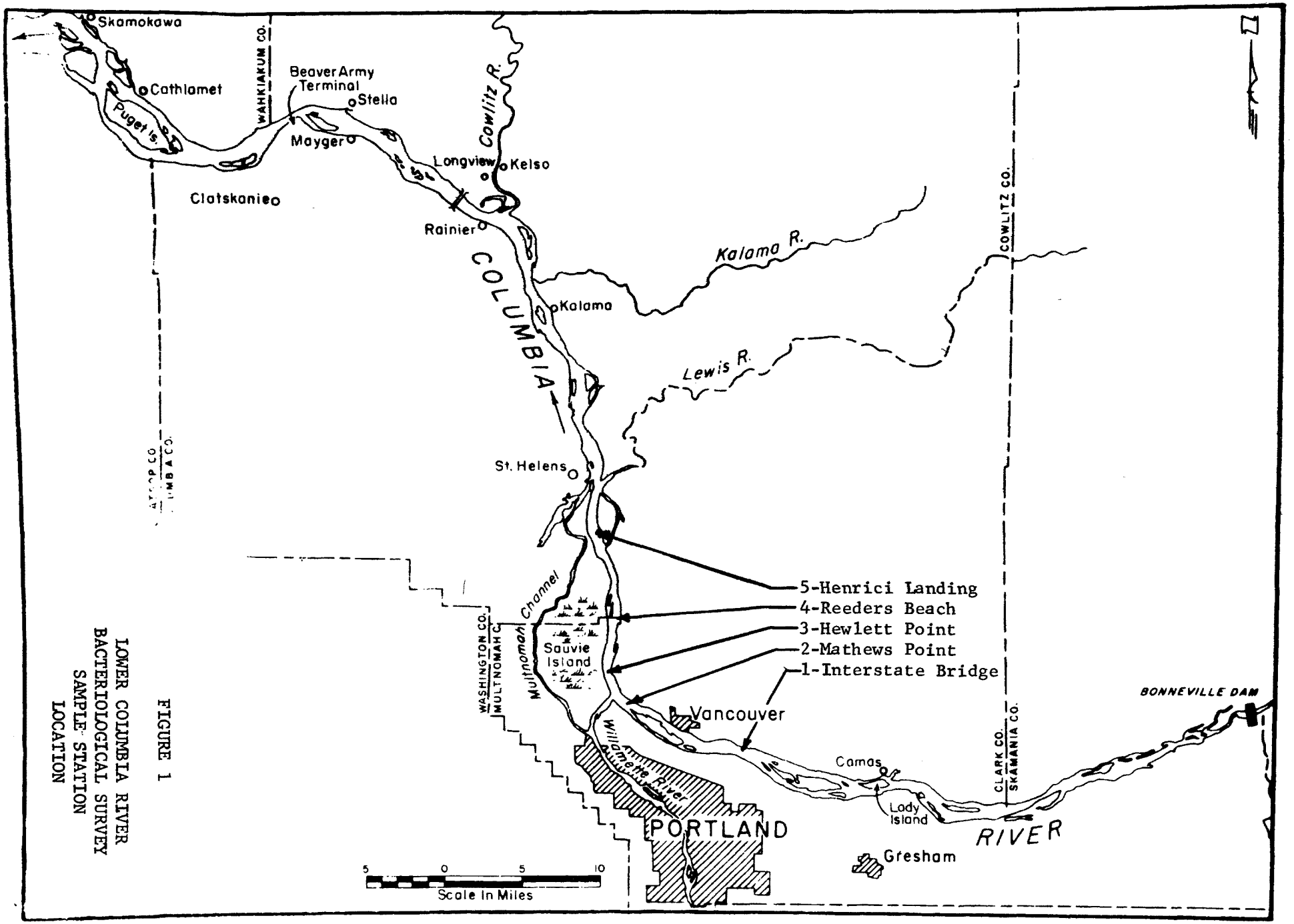


FIGURE 1

LOWER COLUMBIA RIVER
BACTERIOLOGICAL SURVEY
SAMPLE STATION
LOCATION