CHIEF ENGINEER'S REPORT FOR THE YEAR

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Tacoma, Washington
January 8, 1932

TO THE JOINT COMMISSION,
INTER-COUNTY RIVER IMPROVEMENT,
KING AND PIERCE COUNTIES, WASHINGTON.

GENTLEMEN:

It affords me great honor to hereby submit for your consideration and approval the annual report of activities and expenditures on river improvement for the year 1931.

A GENERAL SURVEY OF THE PROJECT.

Since the inception of the Inter-County River Improvement project in 1914 much constructive work has been accomplished tending toward permanent and adequate flood control.

The devastating flood of 1906 aroused sufficient interest to crystalize the necessary legislation resulting in the formation of the Inter-County River Improvement by King and Pierce Counties, however, during the past six or seven years the annual precipitation has decreased, and destructive floods in the White and Puyallup Rivers have not been experienced, consequently public interest in this project has diminished to a marked degree. There is a tendency to minimize the hazard that existed and continues to exist in rivers such as the White and Puyallup whose sources lie in the perpetual glaciers and vast snow fields of these river basins covering an area of 914 square miles.

These river basins contain potential devastating floods for at least nine months of the year, requiring only a warm rain and Chinook wind to precipitate it. With the erratic temperature changes possible on the west slope of the Cascade Mountains there are only those seasons when little or no snow is present in these river basins that a freedom from flood may be assured.

Floods of varying magnitude, ranging from 8,000 second feet to

four or five times this amount have been registered at the U. S. G. S. gaging station on the Puyallup River since 1914, however, there is evidence in the Skagit River of flood in 1856 of twice the magnitude of the 1917 flood. Should a flood of this magnitude occur in the White or Puyallup River valleys it would destroy several large towns and cause property damage running into millions.

Those residents living in the Stuck River valley during the flood of 1906 can fully appreciate its far reaching and devastating nature when it was conservatively estimated by Major H.M. Chittenden, U. S. A., that this flood reached the 33,600 second foot stage.

Two very important factors have been and will continue to be hazards to be reckoned with and guarded against, namely, Drift Wood and Sediment in the form of silt, sand, gravel and boulders containing several cubic feet.

This River Improvement Project has been viewed by numerous boards and competent engineers of local and national reputation and without exception all have expressed the opinion that adequate flood control consisted of, FIRST: The elimination of drift wood and its contributing hazard. SECOND: The prevention of sedimentation and its removal where its presence is hazardous. THIRD: The construction of a channal of sufficient capacity. FOURTH: The revetment of all channel levees where practical, and available funds permit.

The report of Mr. A.O. Powell in 1909 covering the White and Puyallup Rivers, has the following comment to make; "The effect of drift to create jams in the river, thereby blocking the channel and producing undue erosion of the banks and frequently cutting out of new channels that cause enormous damage. The sediment constantly builds up the bed and banks of the river causing it to eventually flow along a ridge and requiring constant vigilance to confine the river to its channel."

Great effort and considerable funds have been expended during the early years of this project in accumulating, removing and destroying much of the drift borne down by flood from the upper sections of the river, however, at this late date the islands in the river channel and many of the shallow bars are well covered with quantities of this stranded drift, especially in that portion of the river above the Drift Barrier. This drift wood awaits a flood of sufficient magnitude to float it, when it will be carried down to be lodged at points thruout the lower river where channel constrictions occur and where the present tortuous channel would offer ready lodgement.

The Drift Barrier constructed during 1914 and 1915 proved its value and stability during the succeeding flood of 1917 and 1919 when thousands of cords of dangerous drift was collected and prevented from passing to the lower river channel where much damage would have resulted by the formation of jams and the consequent inundation of riparian property, also the probability of new channels being formed.

The construction of the Auburn Diversion Dam, the dredging and straightening of the channel thru the County Line, Roesli, Murphy and Reservation Sections, with the subsequent revetting of many of the levees thruout these sections have attracted much favorable comment and may be classed as master strokes in the problem of flood control that confronts the two counties involved.

To date King and Pierce Counties, thru the Inter-County River Improvement jointly, expended somewhat in excess of three million dollars in an effort to provide adequate flood control thruout the White, Stuck and Puyallup valleys. This amount at first thought, appears large, but when you consider the twenty-eight and one half miles of river involved, the vast area of highly valuable land benefitted, and the cities such as Auburn, lying in the old bed of the White River, also Sumner and Puyallup, situated in the lower valley,

all are directly benefitted by this improvement. The safety to life and property being dependent upon the successful operation of these improved river channels during maximum flood periods and the care with which they are maintained.

The narrow, sinuous channel thruout the upper end of the Dieringer Section was to a great extent responsible for the inundation and consequent destruction of the channel levee and revetment on the lower 3,600 feet of the County Line Section in 1917. A recurrence of this experience is most probable at any time a flood of the 1917 magnitude obtains unless the channel thruout the Dieringer Section be straightened and deepened.

The Puyallup and Carbon Rivers above the confluence with the Stuck River at Sumner do not properly come within the province of the Inter-County River Improvement project, nevertheless these two rivers contribute to an alarming extent vast quantities of drift and sediment.

A report by Messrs Mitchell and Gardner, U. S. Engineers under date of January 13, 1916, called especial attention to the necessity of a drift barrier on these rivers. Observation during recent years confirms their recommendation, since, the drift carried down by these two rivers ultimately enters that portion of the Puyallup River between Sumner and Commencement Bay. Much of the latter river channel is filled with ever increasing sedimentary islands and the unrevetted banks of alluvial sand offers no resistance to impinging currents caused by a channel conjested with drift wood. Should this situation obtain for but a few hours, many valuable acres of highly cultivated land would be destroyed together with the many dwellings that now cluster the present river levees.

It is unfortunate that at this particular time, we are confronted with a national financial depression of such magnitude that large and substancial reductions in the expenditures of public funds

are demanded. During the past seven or eight years weather conditions have favored flood control development, however, we are warned by the U. S. G. S. that we may anticipate a period of high precipitation occuring within a year of two at which time floods of greater magnitude may be experienced. In view of these impending floods it is very unfortunate that the Inter-County River Improvement project is forced to operate this year on an appropriation approximately 40 % under that of the past four years. There are many miles of unstable, unrevetted levee thruout the Dieringer, Roesli and Puyallup Sections that present a hazard to be seriously considered. The necessary development work thruout these sections has progressed satisfactorily thruout the past years when favorable weather conditions prevailed and funds permitted.

The annual daily climatological report covering temperature, precipitation and discharge of the combined rivers involved is appended hereto.

BUCKLEY SECTION.

A report on this section was requested by the Joint Commission in January, 1931, an early preview was completed and presented the following February, covering the various phases and governing factors.

May it suffice at this time to call attention to the fact that a more careful survey of the entire channel thruout this section revealed a condition of greater magnitude and presenting hazards not revealed by a casual survey. During the summer months a party was sent into the field to make a detailed study of this section and to complete a reconnaissance survey, also to make cross sections of the present river channel at frequent intervals in order that a comparative study may be continued over a period of years.

Three outstanding factors make this section one to be seriously considered and constantly guarded. They are as follows:

A -- The heavily timbered sedimentary islands located in the present channel.

B -- The enormous quantity of stranded drift wood thruout the entire section, also that which is accumulated in compact masses at various points needing only a flood of sufficient magnitude to float it down stream.

C -- The velocity of the current thruout the section due to the gradient represented by the accompanying profile which indicates it to be approximately 40 feet to the mile.

Two facts are apparent; First, - That some quantity of the standing timber on these islands will be undermined and carried down stream during every flood, together with large quantities of this stranded drift wood. During the years following 1915, while the Drift Barrier was intact and functioning, this drift was collected at the barrier and subsequently removed or destroyed, but it was considered wise and prudent by those in charge of operations at a later date, to remove the wire rope mesh from five sections of the Barrier thus permitting the drift to be borne down by flood water to be stranded at points thruout the lower river channel. Fortunately no flood of any appreciable magnitude has been experienced since the removal of these cables from the barrier, and only small portions of drift have passed thru to be collected and disposed of at points beyond.

Second, - These sedimentary islands and vast quantities of stranded drift present a menace, which at average stages of the river act as retards to the movement of silt, sand and boulders, also to check current velocities.

The movement of this material from the higher regions of the river and its subsequent precipitation at points thruout the Auburn and County Line Sections tend to constantly increase in volume and to necessitate its constant removal from these sections to provide necessary channel capacity.

It has been suggested that a thorough investigation be made to determine the feasibility of constructing barriers of cables and

timber thruout the Buckley Section in order to materially reduce this high velocity and cause a precipitation of silt and gravel at certain points thruout the section, where no resultant damage can accrue, rather than permit its transportation to the lower section where thousands of dollars are required annually for its removal.

The action of the Joint Board in recommending the Aerial Survey of the entire river can be fully appreciated when studying the mosaic of the Buckley Section. By the aid of this picture, in a few moments you are able to traverse the ten miles of this section and view it in its entirety, more clearly than by covering the ground on foot. It has been recommended that an annual appropriation be made, covering a period of years, to permit a crew of men to cover this entire section, removing, destroying, or securing any and all drift lodged in or near the channel that would be moved by flood water. This is a task that will require many years to accomplish since only a small portion of the entire annual appropriation may be applied to river clearing in this section and since the clearing done one year will necessarily require repeated clearing each succeeding year, the task becomes one of perpetual maintenance rather than a major stroke of clearing and channel control during one or two years at most.

MUCKLESHOOT SECTION.

This section has been thoroughly traversed by a crew of laborers during the summer months, collecting, piling and destroying much of the stranded drift on the river bars. Some criticism was offered to the methods employed in this clearing method, in that too much expense was incurred in piling and destroying the greater portion of this drift wood, however, the portion of drift so destroyed cannot be carried down and precipitated on the lower river bars, requiring a second or third handling before it finally reaches tide water.

Several substantial brush and pole retards were constructed at a point approximately 3,800 feet above the Auburn Dam where the river tended to erode a new channel and also where it impinged sharpely on

a high gravel cliff. Several other points thruout this section require similar channel control, especially on the right bank in the immediate vicinity of the "Notch in Wall" where the impinging action of the stream undermines the high gravel cliff and causes it to crumble into the channel and be carried down, forming bars and islands at points in the lower channel. Insufficient funds precluded the building of more of these brushed deflectors or retards, however, a continuation of this channel control is scheduled for 1932.

AUBURN SECTION.

Thruout the upper portion of this section, in the vicinity of the Auburn Diversion Dam, numerous brush and pole retards have been built previous to this year. However, during the April freshet a long piece of drift, some eighty feet in length, carried down from the upper river, became stranded on the bar near one of the brush retards, which was carried outward and down stream within a few hours. This instance, alone, indicates the unstability of these types of temporary channel control at any stage of water above the normal summer runoff.

These brush retards were thoroughly reballasted during the summer months which materially assist in lessening the fire hazard and also makes them more stable during flood periods.

The continuation of channel dredging and temporary levee building on the right bank, by No. 2 Diesel drag line unit hascontinued thruout the entire year. This unit ~~has~~ moved approximately 134,100 cubic yards of gravel, dredged from the river channel and placed over and between the brushed pile retards. The dredging by this unit was confined to a point approximately 2,000 feet up stream from the highway bridge to the down stream side of Wing Wall No. 1, approximately 2,400 lineal feet. This portion of the river levee has been subject to serious bank erosion in past years, to the ~~xxxxx~~ intent

that Wing Wall No. 1 was built in 1915 in an effort to prevent further erosion, but unfortunately the inclination of this Wing Wall to the axis of the stream caused serious scour at its base and subsequent destruction to fully half its length, thus permitting a further bank erosion back of the Wing Wall further down stream, on the right bank. A series of seven brushed pile retards were constructed during 1929 and twelve during 1931, thruout this portion of the Auburn Section. The material dredged from the river channel was placed over and between these retards. These retards are, at best, but temporary structures. It is hoped that in the eventuallity of a flood, most of the dredged material placed between the retards would not again be eroded.

The continuation of the channel dredging thruout this portion of the Auburn Section is imperative, since this is the first point where sedimentation begins and if not removed prior to the period of maximum flood stage the river would easily overflow the adjacent territory and probably find its way into some of the old high water channels of pervious years, which must be guarded against at all costs.

The pile driver unit operated thruout this section on the right bank, driving 2,500 lin. ft. of pile bulkheads and extending others previously driven.

During the earlier portion of the year Fordson Drag line units No. 1 and No. 2 were employed on the right bank dredging the river channel immediately above the highway bridge for a distance of approximately 1,200 feet. This dredged material was placed over and back of the old pile bulkhead. Approximately 17,340 cubic yards of gravel was placed by these units. This bulkhead had been previously rebrushed using approximately 200 cords of brush. This portion of the levee has been the source of much

concern and great expense during the past twenty years. Repeated efforts have failed to maintain this levee, as is clearly shown by accompanying photographs appended hereto. The necessity of permanent revetment is quite imperative at this point, but has been deferred until further dredging and the lowering of the stream floor has been completed.

During September and October the Waukesha drag line unti was placed on the left bank adjacent to the highway bridge. This unit continued up stream approximately 500 feet, moving 6,300 cubic yards of gravel. This dredged material was placed on the levee to increase its height, which at this point was entirely too low to withstand a flood of more than five foot elevation. Unfortunately the available funds at this time prevent the continuation of this unit, however, it is programmed to continue the dredging thruout the lower portion of this section as early in 1932 as available funds will permit.

COUNTY LINE SECTION.

The sedimentation on the channel floor, reduced the channel capacity sufficiently to cause the overflow and destruction of the revetment and levee on the lower thirty six hundred feet in this section in 1917, presenting a problem that will require continuous dredging over a period of years in an effort to secure sufficient channel capacity.

This section presents a natural settleing basin, since it is located at the point where the gradient of the channel changes from forty to four feet to the mile, causing a constant precipitation, which, if not removed, will be the cause of further damage similar to that experienced in 1917.

Diesel drag line unit No. 1 has been employed constantly thruout the year on the right bank dredging this precipitate from the

channel and placing it over and between previously constructed brushed pile retards similar to those employed in the Auburn Section.

This unit moved approximately 115,820 cubic yards of material during the year.

The pile driver equipment drove 1,100 lin. ft. additional pile retards on the right bank between those retards driven during 1929 and 1930. During October the pile driver crew removed the eroded ends of the pile retards driven in 1925, '26 and '27 on the left bank. These retards represent temporary construction but serve amply during the period of channel dredging.

DIERINGER SECTION.

This section is unique in that it remains to a great extent the only undeveloped portion of the original project.

The alignment of the channel thruout this section with one or two exceptions, follows the old sinuous course described by the flood of 1906, when the Stuck River was forced out of its course, and the entire valley inundated. After the recession of the 1906 flood, a sinuous channel with irregular banks, conjested with more or less drift and debris, remains to this day in spite of repeated recommendations from various boards and eminent engineers. As a result of this early effort, the creation of a drainage improvement district, securing state aid, was formed. Finally in 1914 the Inter-County River Improvement came into existance and since the date of its inception several surveys have been made in an effort to consumate the developement of this remaining link in the river improvement.

EXHIBIT "D", forming a portion of this report clearly indicates the present sinuous course and also indicates the original channel proposed by Mr. A. O. Powell in 1907. Later, a compromise plan was proposed by Mr. W. J. Roberts then Chief Engineer, in which the greatest irregularities in the present sinuous channel would be eliminated and which would involve the least acquisition of necessary right of way.

The river thruout this section traverses much highly developed land, and each year this land development continues until within a short period of time the necessary right of way for proper channel alignment will be prohibitive.

The extreme sinuosity of the present channel contributes largely to the sedimentation accruing in the upper portion of this section, which accretion has grown to such an extent in past years that ~~xxxx~~ channel dredging became necessary to prevent further congestion and flooding of riparian property.

At the present time we are again confronted with this situation. Unfortunately the 1932 budget has been reduced to the extent of precluding any dredging in this section, however hazardous the situation may be.

During the past sixteen years approximately $ 90,000.00 has been expended in this section and with the exception of a very small portion of revetment and levee building adjacent to the Williams Highway Bridge and at the Highway Bridge in the city of Sumner, the work was performed on the old sinuous channel walls, no effort being made toward proper alignment. Much of this work consisted of retards, brushed pile bulkheads and other forms of temporary channel control, all of which will require constant renewal over a period of from four to ten years. Had this alignment been followed as originally proposed, the length of channel thruout this section would have been shortened by one and 16/100 miles and the temporary construction and amintenance thruout the past fifteen or sixteen years would have been more than sufficient to dredge and properly revet the ~~xxxxx~~ channel thruout the entire section.

During the past year it became necessary to construct three brushed and pole retards for channel control in the upper portion of this section where the stream makes its first reverse curve below the Stewart Highway Bridge. At this point a large gravel accretion is

forming, causing the currnet to impinge heavily upon the left levee at several places resulting in dangerous erosions. The precipitation of this gravel cannot be avoided without correcting the channel alignment, which remains to be undertaken at a later date.

As previously referred to in this report the extreme sinuosity of the channel in the upper portion of this section immediately below the Stewart Highway bridge remains the primary cause of the destruction of the lower 3,600 feet of levee and revetment in the County Line Section during the flood of 1917. Were we to take the sum total of moneys expended in temporary work thruout the Dieringer Section and to this add the loss sustained in the destruction of the 3,600 feet of levee and revetment in the County Line Section, add to this the cost of channel dredging during the past two years, and the construction of thirty-seven brushed pile retards built in the lower 3,600 feet of County Line shannel, the construction cost of a well aligned channel thruout the Dieringer Section could have been absorbed and sufficient funds remain for necessary maintenance over a long period of years.

In the lower portion of this section where it enters the city of Sumner and on the left bank approximately 1,700 feet of unrevetted channel presents a hazard that required immediate attantion. During the month of December a crew of six men were placed here to temporarily repair an old timber bulkhead that is in a bad state of decay and which remains as evidence of channel control effort many years previous to the inception of this Inter-County project.

In event of another flood of the 1917 volume, this portion of undeveloped channel would jeopardize the safety of several dwellings that now occupy the river bank at this point. I am authoratatively informed that during the past eight years the river bank at this point has eroded forty feet, until at present these dwellings occupy quite a precarious position on the edge of the none too stable river channel as shown in the accompanying progress pictures. The temporary control work recently placed at this point would not serve

to divert the current sufficiently in event of a flood, but serves only as a slight deflector during normal periods.

Should this temporary control work fail during a flood, at least 400 feet of levee and revetment immediately below would in all probability be destroyed and the Highway Bridge piers and approaches jeopardized.

This portion of the river is under constant observation and requires sufficient funds to adequately revet the levee if further damage by erosion it to be avoided.

Permit me, to at this time strongly urge upon the Joint Commission the advisibility of seriously considering the development of the Dieringer Section at the earliest possible date.

ROESLI SECTION.

As shown on the accompanying map this section joins with the Dieringer Section at a point represented by the old original highway bridge into the city of Sumner. The alignment of the channel in this section thru the city of Sumner is a continuation of the erratic sinuosity noticable in the Dieringer Section and follows closely the old channel described by the 1906 flood.

Sumner occupies an extremely precarious position, being bounded on two sides by unrestrained torrential mountain streams that fluctuate with each change in temperature and precipitation. Previous reference has been made in this report to the hazard resulting from the ever increasing sedimentation at the confluence of the Stuck and Puyallup Rivers, in this section. Small and scarcely preceptable amounts of this precipitated sediment can be traced to the Stuck River, since the precipitation in the Stuck River is most complete thruout the Auburn, County Line and upper Dieringer Sections.

A noticable gravel accretion ~~ix~~ forming at the confluence of these rivers shows clearly on the progress photographs attached hereto.

This gravel accretion has assumed alarming proportions thruout this entire section below the confluence and well into the Puyallup Section which is adjacent thereto. At several points in this section immediately up stream from the North Puyallup Highway bridge this gravel accretion has formed thru the center of the channel causing sharp impingment of the current into the left levee. The rapidly diminishing funds of the latter part of 1931 precluded the dredging out of these islands, however, the necessity for this work increases daily. The greatly reduced 1932 budget eliminated this most necessary dredging operation. Should this and similar necessary work be deferred until an emergency of sufficient magnitude demands an increased appropriation, much damage to the present revetment and levee may result.

As programmed in the 1932 budget three additional brushed pile retards are to be constructed on the right bank immediately below the confluence. ~~xx~~ This is a point where a rebound from the Puyallup River, as it enters the Stuck channel, is most noticable. The reconstruction of the old sheet pile bulkhead on the right bank at the confluence is also programmed for 1932. Past experience has revealed a very noticable channel scour where sheet-pile bulkheads have been employed and as in this instance, this bulkhead occupies a position nearly at right angle to the axis of the Puyallup River. This condition causes an extreme tendency to scour on the face of this bulkhead to the extent that the floor of the stream has scoured beneath the sheet piling.

As programmed, this sheet pile bulkhead is to be removed and the space between the two longitudinal rows of piles is to be filled with brush which will be well packed and ballasted to prevent its destruction by impinging currents and buffeting drift wood. During the summer months of this year three brush and pole retards were constructed on the right bank of the Puyallup immediately above the confluence with the Stuck. This channel control effort, while

temporary in its nature, is not without marked benefit, but should be dispensed with as early as possible and superceeded by more permanent construction.

There is a noticable effort to place this entire river project on a maintenance basis as soon as the major construction can be concluded. With this in mind the temporary channel control methods employed at present should give way to a design of more permanent nature.

The rebrushing of the pile bulkhead extending from the right bank of the Puyallup River at the confluence, out and down stream to form a diversion groin between the two currents, was concluded during the late summer. This brushed pile bulkhead has functioned admirably since its construction in 1924, however, it is unfortunate that it had not been built to extend at least 200 feet further down stream. This added extension would have had a very desirable blending effect between the two rivers and have avoided much of the impinging action that now occurs on the right bank of the Stuck River as a result of the angular approach of the Puyallup River to the axis of the Stuck.

It became apparent during the early summer that some channel control effort would be necessary on the right bank of the Stuck River at, and immediately above the confluence, if serious erosion was to be avoided. Several old brush retards constructed in 1927 had decayed and were destroyed. These were replaced by one rather large brush pole retard well constructed and heavily ballasted. Two other somewhat smaller and of the same design occupied a position immediately up stream from the sheet pile bulkhead and on the face of the present concrete revetted levee.

PUYALLUP SECTION.

Considerable permanent channel construction has been in progress thruout this section for several years, resulting in what may be considered as near an ideal section as any on the river. The alignment of well planned parallel revetted levees provides ample passage for floods of the 1917 magnitude with a sufficient factor of safety to provide for contingencies that might occur in event of a temporary constriction caused by the lodgement of drift.

As programmed in the 1931 budget there remained 1,400 feet of levee and revetment to be completed on the right bank below the Meridian Street Bridge to carry the completed work to a point formerly occupied by the old Short Line P. S. E. R. R. Bridge. After this work had been in progress for some time, it became obvious that an error had been made in the 1931 estimated distance necessary to complete this right levee; it requiring an additional 420 lin. feet of construction to complete the section, a total of 1,820 lin. ft. An additional 800 lin ft. was constructed to complete the remaining portion to connect with the old revetment in the Murphy Section.

When the connection between the new revetment and the old slab in the Murphy Section was about to be completed it became evident that no brush mattress had ever been placed at the toe of the old adjacent revetment. To have allowed this to pass thru another year uncompleted did not seem wise and the placing of this brush mattress and the renewal of the concrete revetment at the toe of the slope for a distance of 480 feet necessitated the expenditure of $11,929.03 which sum appears in this report under the numerical Item 5-A.

With this additional expenditure on the right bank of this section to complete, and properly connect it with the revetment and levee previously constructed, the budgeted fund for the south bank adjacent to and immediately below the Meridian Street Bridge, was reduced by an equal amount, resulting in the construction of

approximately 750 lin. ft. on the south side. However, the 1932 budget provides for a continuation of this levee and revetment construction. Barring contingencies beyond our control the construction of this south side, or left bank, will be extended 1,400 feet to connect with the old revetment now in place at this point, available funds permitting.

RESERVATION SECTION.

During the year this section has been under constant observation, knowing that much of the lumber mattress placed during 1918 is in a bad state of decay, requiring only the force of an impinging current to complete its destruction. Several instances of this condition obtained to an alarming extent, requiring immediate attention on the left bank 560 feet down stream from the Clarks Creek confluence.

A retard constructed in 1930 was rebrushed, adjacent to this a portion of the concrete revetment required replacing.

On the right bank 3,550 feet down stream from the Clarks Creek confluence an identical condition prevailed. Three retards built in 1930 required rebrushing, also a section of concrete revetment 10 ft. wide by 100 feet long required replacing.

The replacement of this timber mattress with fir brush has been anticipated for years, however, this delay may be quite expensive in event of a flood should a large portion of this mattress be removed allowing the current to erode the levee.

As illustrated on the accompanying progress pictures attached hereto, the formation of sedimentary islands thruout this section are much in evidence to the extent that serious current impingment is being experienced.

Much relief from these islands and their resultant erosion is anticipated when the stream will be dredged to complete the contemplated State Highway levee on the left bank thruout this section.

The profile of the channel bed thruout this section has been completed and forms a portion of this report under separate cover. This profile clearly indicates the sedimentation of this section from Clarks Creek to the lower terminus, grading from small amounts at the upper limit of tide water to four and five feet at the Indian Ferry Bridge.

This sedimentation consists of the finest silt that has been carried in suspension from the upper river and deposited upon entering this tide water section. A flood of sufficient magnitude occuring over a period of several days might result in sufficient scour to remove much of this accumulation.

INTER-COUNTY RIVER IMPROVEMENT

EXPENDITURES FOR THE MONTH OF

DECEMBER, 1931.

ITEM.	AMOUNT ALLOWED.	TOTAL EXPENDED PREVIOUS MOS.	TOTAL EXPENDED IN DECEMBER.	TOTAL EXPENDED TO DATE.
1.	$ 4,800.00	$ 4,765.00	.....	$ 4,765.00
1-A.		2,803.98	.....	2,803.98
2.	33,000.00	32,598.79	327.61	32,926.40
3.	25,000.00	22,486.17	1,295.77	23,781.94
3-A.		438.92	.....	438.92
4.	5,000.00	5,236.84	.....	5,236.84
5.	42,000.00	28,996.90	50.00	29,046.90
5-A.		11,929.03	.....	11,929.03
6.	20,200.00	13,755.01	1,533.90	15,288.91
6-A.		6,578.87	.....	6,578.87
7.	10,000.00	5,465.82	786.24	6,252.06
	$ 140,000.00	$ 135,055.33	$ 3,993.52	$ 139,048.85
		Revolving Fund		1,000.00

Item 1-A included total cost of Aerial Survey, and reconnaissance survey of the Buckley Section.

Item 3-A covered cost of channel control in upper Dieringer Sec.

Item 5-A covered construction cost of work in Murphy Section.

Item 6-A covered initial cost of Diesel Donkey No. 3, also the necessary equipment, including sled, buildings, lines, blocks, etc.

SUMMARY OF 1931 ACTIVITIES.

BUCKLEY SECTION.

Reconnaissance survey completed. Cross section and profile of same prepared. Right of way secured.

Expenditures, including engineering and Aerial Survey $ 1,946.23

1932 Budgeted amount for this section ..... $ 3,000.00

Nature of Improvement;

Clearing, retards, channel control and right of way.

MUCKLESHOOT SECTION.

Drift wood in main channel collected and destroyed.

Three brush retards constructed for channel control.

Exepnditures including labor and material, also

Aerial Survey of this section 4,908.00

1932 Budgeted amount for this section 1,000.00

Clearing, retards and channel control

AUBURN SECTION.

Drift wood collected and destroyed; 157,740 Cu. Yds. gravel dredged from river channel; 2,500 lin. ft. of brushed pile retards constructed. Three rock and pole retards constructed; two brush and pole retards reconstructed; all brush retards reballasted.

Expenditures, including labor, material, supplies, maintenance of equipment including Aerial survey of this section 33,017.90

1932 Budgeted amount for this section $18,000.00

Brush pile retards, channel clearing, channel control and gravel removal.

COUNTY LINE SECTION.

Dredging channel, removing 115,820 cu. yds. of gravel. 1,100 lin. ft. brushed pile retards constructed. Expenditures including labor, material, supplies and equipment maintenance, also aerial survey of this Section ..... $ 23,842.44

1932 Budgeted amount for this section $ 18,000.00

Brushed pile retards, channel clearing, channel control and gravel removal.

DIERINGER SECTION.

Construction of three brush and pole retards in the upper end of the section; revetment repaired on left bank at Salmon Creek confluence; pile bulkhead brushed and brush pole retard constructed at lower end of section on left bank.

Expenditures include, labor, material, and also aerial survey of this section, amounting to 1,592.07

1932 Budgeted amount for this section ... $ 2,000.00

Retards and channel control.

ROESLI SECTION.

The construction of six brush and pole retards, also the rebrushing of 780 lin ft. of brush pile retards on left bank below confluence, also the rebrushing of 660 lin.ft. of brush pile diversion groin between the two rivers.

Expenditures include labor, material and aerial survey of this section, amounting to ..... ~~5,236.84~~ 5441.84

1932 Budgeted amount for this section 10,000.00

Reconstruction of 1,200 ft. pile bulkhead, filling same with brush and ballast 4,200.00

Three brush pile retards, 600 lin ft. 2,100.00

Rebrushing retards	.....	$ 1,000.00
Channel Dredging	.....	2,700.00
Total		$ 10,000.00

PUYALLUP SECTION.

The construction of 1,820 lin. ft. of Type 7 concrete revetted levee with 35 ft. wide brush mattress at toe of slope on the right bank below the Meridian Street bridge; also the construction of 750 lin. ft. of Type 7 concrete revetted levee with 25 ft. wide brush mattress on left bank adjacent to, and down stream from Meridian Street bridge.

The dredging of 49,920 cu. yds. of gravel dredged from channel to construct levee.

The destruction and removal of two concrete piers.

Expenditures for this section including labor, material, equipment maintenance and aerial survey amounted to ..... $ ~~29,046.30~~ 29.098.40

1932 Budgeted amount for this section $ 12,000.00

Channel dredging, levee and revetment construction, 800 lin. ft.

MURPHY SECTION.

The construction of 800 lin. ft. of Type 7 concrete revetted levee with 25 ft. wide brush mattress, also the construction of 430 lin. ft. of concrete revetment and the dredging and placing of a brush matt at the toe of this repaired revetment.

Expenditures for labor, material, supplies and equipment maintenance and aerial survey amounted to $ ~~12,034.03~~ 12.006 53

1932 Budgeted amount for this section $2,500.00
Replacement of lumber mattress and
revetment repair.

RESERVATION SECTION.

The reconstruction of four brush pole retards, also the repair and replacement of 250 lin. ft. of revetment and brush mattress.

Expenditures cover labor, material and aerial survey, amounting to ..... $ 2,183.35

1932 Budgeted amount for this section $2,500.00
Mattress replacement and revetment repair.

Other Budgeted Items for 1932 are:

GENERAL CONTROL:

Office, Engineering, Litigation, Emergency
Channel control 9,000.00

MAINTENANCE:

Maintenance, repair and replacement of
buildings, and operating equipment 9,000.00

During the year the following items of equipment were purchased:

May.	
Aerial Survey	$ 1,337.75
Ford 1½ Ton dump truch, Model AA 131 with closed cab dual wheels and hydraulic hoist	940.72
MARCH.	
Chevrolet Coupe, complete	730.50
JUNE.	
92 H.P. Buda Diesel Engine with two drum drag line scraper hoist	6,350.00
Additional equipment, as blocks, fairleads, and tools	395.98
JULY.	
40 H.P. Used Waukesha Engine	565.00
TOTAL	$ 10,319.95

The following items were sold

1	Herculese Engine					2,500.00
1	Used Buick Coupe					250.00
1	Used Reo Truck					115.00
2	Rolls Wire reenforcing fabric					26.40
	Segregated scrap iron					
	1350#	@	10.00	per ton	6.75	
	5475	@	4.00	" "	10.95	
	11825	@	15.00	" "	88.69	
	4525	@	10.00	" "	22.63	
	8050	@	6.00	" "	24.15	
	10850	@	4.00	"	21.70	174.87
13	Empty wood cable reels					19.50
				TOTAL		$ 3,085.77

INTER-COUNTY RIVER IMPROVEMENT

H. Essig

CHIEF ENGINEER