ENGCW-EW

7 September 1965

Honorable Lloyd Meeds

House of Representatives

Dear Mr. Meeds:

This is in further reply to your recent letter inclosing communications from several residents of the Skagit River valley regarding the Avon Bypass and other projects on the river.

Studies to alleviate flood damage in the Skagit River Basin extend back many years. These studies have indicated that a 3-phase type of development would probably be the most practical. The first phase, improvement of the local levee system, would provide a limited degree of protection which could be increased by provision of upstream storage. However, a study of potential upstream storage sites indicates that practical levee heights would still be exceeded because of runoff from uncontrolled areas. Furthermore, because of fish problems and other problems associated with reservoir construction, sufficient storage for effective flood control probably would not be obtainable for many years. Thus, our studies have shown the need for the Avon Bypass as a second phase of development. The Avon Bypass would direct some portion of the flood flows out of the river channel above the principal leveed areas and would increase the degree of protection afforded by the levees. The last, or third phase, would be additional reservoir storage. Although some storage is already provided by the city of Seattle reservoirs, it is considered that additional storage on other tributaries will be necessary and should be provided at some future date.

Over a period of time local interests have provided about 43 miles of levees along both banks of the river from near Sedro Woolley to the mouth to protect the 68,000 acre delta flood plain. The degree of protection afforded by these levees varies from district to district. The capacity of the river channel, as increased by the levees, varies from 91,000 to 140,000 cubic feet per second (cfs) depending on the levee heights in the

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16 districts that constructed the levees. Such a capacity corresponds to a flow that may be expected about once every 3 years in the districts with the lowest levees to once in 14 years in those districts with the higher levees.

Our studies with respect to the feasibility of the existing levees have shown that, because of the porous foundations of the leveed areas and the extensive work in place, increasing levee heights or rebuilding the levees to provide a wider channel has a practical limit. The limit from the standpoint of improved channel capacity is indicated to be about 120,000 cfs. Construction of the Avon Bypass project would increase this degree of protection by diverting a portion of flood flows to Puget Sound.

The Avon Bypass project was authorized by the Flood Control Act of 1936. However, since local interests could not fund the requirements for sponsorship, no work has been accomplished. The Bypass project consists of an 8-mile diversion channel with control structures at the upstream end and near the point of exit. The entrance to the channel is about 1 mile south of Burlington and the channel follows the foot of a hillside area westerly to Padilla Bay. An important element of the Bypass project is an extension and strengthening of levees for a distance of 4 miles upstream from the headworks to provide added flood protection for the city of Burlington.

Officials of Skagit County and of most of the diking districts now support the levee improvements and Avon Bypass. Funds to initiate detailed project planning for the Avon Bypass are included in the budget for Fiscal Year 1966. Initial studies will be carried to a point where the alignment of channel can be determined and a firm estimate obtained of the costs of local interests sponsorship. Further detailed planning will then await results of a county election to raise funds necessary to sponsor the project.

Meanwhile, the levee work, together with minor channel improvements, necessary to provide a minimum capacity of 120,000 cfs within the leveed area is included in a survey report recently completed by the District Engineer, Seattle, and is now under review by the Board of Engineers for Rivers and Harbors. These improvements, when considered in conjunction with the Avon Bypass, would increase the degree of flood protection of the Skagit River delta flood plain to correspond to a flow that could only be expected about once in 35 years.

The final element of the basin plan for flood control is additional upstream storage. Adequate storage control is provided on the main river above Newhalem by the city of Seattle storage dams. These dams control

only 1,175 square miles of the 3,140 square miles within the basin. Effective control of the degree to prevent inundation such as has occurred in the past requires more area control. One possible storage development would consist of a multiple purpose project on the lower Sauk River. Such a storage project in combination with the Avon Bypass and levee and channel improvements would provide a degree of protection comparable to a flow that might be expected once in a 100 years or more. This, or some slightly higher degree of flood protection, represents the minimum degree of protection warranted under a long range plan for control of flood flows in the Skagit River Basin.

We are investigating the storage potential of the basin in conjunction with other Federal and State agencies as a part of the Puget Sound Comprehensive Basin Study. There may be a significant impact from any new storage project on the fishery resource of the basin and on plans for national parks, or primitive areas in the upper Skagit River Basin. Evaluation of these alternatives will be complex and time consuming and there undoubtedly will be strong pro and con sentiments about location of storage projects and their place in a basin plan. The over-all study of storage is scheduled for completion in 1969 as a part of the Comprehensive Basin Study.

In summary, the Bypass is an important element of a three-fold long range plan to develop a high level of flood protection in the basin. Because this project is already authorized, it could provide a large measure of flood control for the basin at an early date. Addition of upstream storage to the Bypass and levee and channel improvement could provide the additional flood protection measures needed for long range development of the basin.

Replies to specific questions and comments contained in the communication inclosed with your letter are set forth below:

Statement: Dredging of North and South Forks of the river is the proper answer to flood control. This method is used on Nooksack, Columbia and other rivers.

Response: All alluvial streams transport large amounts of sediment. The Skagit River is no exception. These sediments deposit in a delta at the mouth of the river discharges into an estuary. Skagit River has such a delta and it extends several miles into Skagit Bay. The estimated bedload of Skagit River is in the order of 700,000 cubic yards per year. Dredging of the North and South Fork channels would result in filling of dredged areas by the heavy sediment load of the river, in a short span of perhaps two to three years. This is one fallacy of dredging as a flood control measure. An even more important point is that in the lower reaches of the river tidal stages are the principal hydraulic control with respect to flood

stages. That, even extensive dredging would only result in a very limited lowering of the stages at the upper end of the North and South Fork [illegible] of the Skagit River and on the main stem of Skagit River. Some of the most valuable lands to be protected from flooding are in the vicinity of Burlington, Mount Vernon and areas several miles upstream from the North and South Forks. The downstream effect of any lowering of the water surface at the Forks would be small in reduction of upstream flood stages. Thus, even if dredging were feasible, the flood control effect upstream would be completely minor. Finally, reference is made to the Nooksack and Columbia Rivers as examples of flood control by dredging. Dredging on the Columbia River is solely in the interest of navigation between the Port of Portland, other ports along the river and the mouth of the Columbia River. Flood control effect of this dredging is virtually negligible. On the Nooksack River, dredging is done only in Bellingham Bay downstream from the mouth of the river, where important navigation channels are maintained. There is no dredging for flood control on the Nooksack River. With respect to other rivers noted, the Corps of Engineers does not have any flood control projects which are dependent on dredging for a flood control benefit on any of the United States streams cited.

Statement: Bypass will fill up with sediment the same as any other outlet to the river.

Response: The Bypass will be used for passing flood flows on the average of only once every four to six years. The duration of the use of the Bypass for any one flood will probably be 24 to 48 hours. This limited time, in itself, would forestall any serious silting. However, in addition, there is a head works control at the upstream end of the Bypass consisting of a concrete overflow structure 12 feet above the bottom of the river surmounted by tainter gates 19 feet high. This overflow structure would prevent most of the heavy sediment load of the Skagit River from entering the Bypass.

In addition, the gates would be open only long enough to take care of flows in excess of about 100,000 cfs on the main river. Both the timing and the volume of flow through the Bypass would be so limited that there is no basis for considering silting of the Bypass as a potential problem.

Statement: Construction of dikes in Skagit Bay, adjacent to the southerly end of the Swinomish channel entrance and various flood control structures constructed by the Corps of Engineers for navigation in the North and South Forks of the rivers have caused sediment deposits that have obstructed the lower channels of the river. This sedimentation has resulted in aggravation of upstream flood problems.

NWDEN-ES
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7 September 1965

Observation: The Swinomish channel dikes were completed in 1930 and are maintained and utilized today as a part of the Swinomish Channel Navigation Project. Navigation improvements constructed by the Corps of Engineers on the Skagit River consist of low sills and mattresses on the South and North Forks, which were completed about 1910, but have not been maintained because of the general reduction in navigation commerce on the Skagit River. The structures have deteriorated and in some instances disappeared completely. The effect of this construction is a small head loss at low flows on the river. This head loss essentially disappears at flood stages. We have reviewed soundings at the mouth of the North Fork for the period 1938 to date, based on condition surveys by the Corps of Engineers. We find that there has been deposition of sediment at some locations and scour at other locations without any conclusive evidence of change. Comparison of thalweg surveys, which are soundings of the deepest portions of the channel, made in 1932 and again in 1961, show that in 1961 at the confluence of the North and South Fork channels the depth was about one foot deeper than in 1932. Further check of possible stage changes upstream was made by comparing the U. S. Geological Survey relationship of discharge to elevation in the vicinity of Mount Vernon for the period 1938 to 1963. This comparison showed that for flood discharges on the river elevations at Mount Vernon are essentially the same today as they were in 1938. Low water stages for less than flood flows show an increase of about one to one and a half feet under present day conditions as compared to 1938. We believe most of this increase in low flow stages is attributable to the construction and improvement of levees adjacent to the river bank in the reach from Mount Vernon through the North and South Fork tributaries to the mouth.

It is quite true that, as one correspondent states, over a long period of time the delta will continue to aggrade and this would have some effect on flood stages, particularly in the lower reaches of the river. However, aggradation is occurring so slowly that it will not be a significant problem in the next 25 to 50 years.

Although all the foregoing information indicates that the now abandoned navigation structures on the Skagit River do not have any significant effect on upstream flood stages, we plan a further review of the desirability of removing these structures in connection with construction planned in our pending report on levee and channel improvements.

Statement: Construction of overbank floodways on the North Fork and South Fork and setback of existing dikes would be better than the Bypass plan of improvement.

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Question: The proposal to setback the dikes and to construct floodway has been considered in our studies as a possible alternative to the bypass and the levee and channel improvements. The setback of dikes would be required from just above the mouth of the river, to 20 miles upstream to the vicinity of Burlington, to provide equivalent flood protection to that of the Avon Bypass and the levee and channel improvements. Cost of the floodway plan would be several million dollars more than the cost of the bypass and the levee and channel improvements to provide the same degree of flood protection. The high cost of this plan results from the extensive development of roads, utilities, lands and buildings adjacent to existing dikes.

Statement: When the river is extremely low, how are they going to get water into the Bypass?

Response: The only purpose of getting water into the Bypass during low water periods is to provide a minimum circulation that will keep the water in the Bypass from becoming stagnant. The Bypass plan includes low level sluice openings that would permit the necessary flows to enter the Bypass even during low water periods on the Skagit River.

Statement: What would happen to the trout fishery on the Bypass if the gates were opened during flood periods?

Response: The proposed sport fishery on the Bypass is planned as a put and take fishery by the State Department of Game; that is, the fishery would be restocked every year. Because the Bypass would only be used on the average of once every four to six years, the loss of the resident fishery at these intervals would not pose any significant problem and could be easily replenished in the anticipated annual restocking which is customary in almost all trout lakes in the State of Washington.

The construction of a bypass to divert flood waters from a general reach of river is a new concept in the State of Washington. We have become increasingly aware that the functional operation of a bypass is unfamiliar to many residents of Skagit valley. However, this type of diversion has been used successfully in other locations. An example in the United States is the Morganza Floodway on the lower Mississippi River. Another very recent example of a bypass river diversion now under construction is on the Red River in the Province of Manitoba, where a $63,000,000 thirty mile long diversion canal is being constructed around the city of Winnipeg. The capacity of the Winnipeg channel is 60,000 cfs, similar to the Avon Bypass, and the headworks are also generally similar. The Canadian project is described in the June 17, 1965 issue of "Engineering New Record" magazine.

NPSCW-EM
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7 September 1965

I trust that the foregoing information on the Bypass and on related flood control matters provides the details needed to reply to the objections raised by your constituents and to clarify the purpose of the Bypass.

Sincerely yours,

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Mrs. Watson's
ltr, 1 Jul 65, w/incl

JACKSON GRAHAM
Major General, USA
Director of Civil Works

Copies furnished:
~~NPS~~
Seattle District