DAEN-CWE-BB 31 January 1980

SUBJECT: Skagit River, Washington, Combined Phase I - Phase II General Design Memorandum

OCE COMMENTS

1. Should the project, as proposed in the subject design memorandum, be authorized and resubmitted at a later date, the fundamental design questions posed in the following paragraphs will need to be resolved before approval would be forthcoming. At that time, the complex nature of the design will necessitate a field conference(s) to resolve OCE's concerns.

2. General. As proposed, it appears that none of the urban areas, including Mount Vernon, would have SPF protection. Large areas of rural land would be provided 1% chance flood protection thereby increasing the likelihood of future urban development. The goal for urban levees is to provide a minimum of SPF protection. Information in the report is not convincing that this goal cannot be met. The following comments address our concern about the level of protection:

a. Statements that higher levees cannot be provided because this would necessitate raising bridges should be supported. Engineering drawings, pictures of the bridges, and water surface profiles under the bridges should be provided for various plans. A discussion of the rationale (with supporting documentation) that bridges must be raised to accommodate higher levels of protection should also be provided. There is no engineering requirement that bridges must be above the design water surface.

b. Alternative plans to provide at least SPF protection to the urban areas should be explored in a systematic manner. Mount Vernon and Burlington are described as major damage centers, therefore, a plan with SPF protection for these areas should be presented.

c. SPF protection for each of the other urban areas should be considered. If SPF protection is not possible for any other urban area, then serious consideration should be given rural protection to the urban areas to reduce future development and alleviate backwater effects.

d. Statements that the optimum level of rural levee protection for rural levees is the 2% chance flood should be supported. Optimization of rural levees should consider the effect of rural levees on the urban areas, both from inundation, seepage, and increases in urban levee heights.

e. Alternative means to reduce levee backwater effects should be presented. At least three possibilities that should be presented are levee setbacks, ring levees for small urban areas, and lower levees for rural areas.

3. Pages 4-13 and 4-20, paragraphs 4.27 and 4.37. A surveillance program for channel conveyance capacity and levee profile elevation should be formulated and coordinated with local interests. This program would include surveying of monumented channel cross sections, and levee profiles, and aerial photographs at regular intervals. These intervals may be adjusted as experience dictated but should be sufficient to be representative of pre- and post-major flood conditions. These details are to be included in the O&M manual furnished to local interests to carry

OCE COMMENTS (CONT'D)

out the regulations prescribed by the Secretary of the Army.

4. Page 4-19, Figure 4-4. The schedule, particularly for the rural levees, appears optimistic. A list of the proposed Feature Design Memoranda should be included.

5. Plates 1 through 16B. Numerous locations are shown where road crossings are at design water surface 2 to 3 feet below the net levee grade. In urban areas road crossing grades should be at the net levee grade, top of freeboard, insofar as possible. When this is not possible, fast acting closure structures should be provided.

6. Page D-12, paragraph 1.03f. What length of record was used as a basis for expected probability? How was this length of record established?

7. Page D-15, paragraph 1.03 1. Records of a Skagit River SPF approval in 1950 cannot be located in this office. Please provide the supporting information. The modified flow is shown as 360,000 cfs on Figure D 1-2 instead of 395,000 cfs. Is there some problem with Fig. D 1-2? What does the adopted hydrograph (peak) for the SPF look like? How does the 1950 analysis compare with present SSARR and gradually varied unsteady flow routing models?

8. Pages D-18 through D-32, paragraph 1.04. All gravity drains should be gated in accordance with EM 1110-2-1410.

9. Pages D-18 through D-32, paragraph 1.04. Where the existing ponding areas and interior drainage system are being retained, information on performance during past floods should be presented. Performance during the design floods, which have longer durations and higher stages resulting in different seepage volumes, should be analyzed and presented.

10. Page D-20, paragraph 1.04c.(2). What frequency of flow will Carpenter Creek channel and levee contain?

11. Page D-22, paragraph 1.04d.(4). Section 3 does not provide sufficient basis for the 7 cfs/mile seepage rate.

12. Page D-23, paragraphs 1.04d.(5b). Interior flooding frequency should be based on a period of record analysis. Tables D1-9 through D1-11 present information on ponding elevations for rainfall events of various frequencies coincident with low river, not interior ponding frequency.

13. Page D-23, paragraph 1.04e. How will these pumps operate against the higher heads and greater seepage (higher levees) over the economic life of the project? What is their cost?

OCE COMMENTS (CONT'D)

14. Page D-27, paragraph 1.04f. Control of urban ponding areas by fee or easement should be discussed.

15. Page D-27, paragraph 1.04f(3) and (4) and g(1). Information should be provided on the most critical events of record and the SPF centered over the urban areas for high and low river stages.

16. Page D-33, paragraph 2.02. Flood hydrographs (peak flows) for levee design floods should be presented.

17. Page D-34, paragraph 2.03a. With regard to paragraph 12a.4., EM 1110-2-1601, and the existing levee failure mode described in the subject GDM, the sensitivity of the 2 feet below levee top for start of overland flow and 1 foot below levee top for total failure assumptions should be checked. Existing levee failure at more or less distance below top of levee could radically change areas flooded and existing average annual flood damages.

18. Page D-41, paragraph 2.03b. Analysis of flood proofing needs appears to be a feasibility study effort, nor a design detail.

19. Page D-43, paragraph 2.03c. Design of the overflow areas requires further discussion and supporting information. See comment 25.

20. Page D-43, paragraphs 2.03d. and e. The provisions of paragraph 12a.4, EM 1110-2-1601 should be applied to the free board determinations. It is not clear, from the presentation, if the procedure indicated in the referenced EM paragraph was applied.

21. Page D-58, paragraph 2.04. Could the flap gate prevent backflooding of the area? Would there be time to backflood the area? Who would open the gates?

22. Page D-68, paragraph 3.06b. Presentation should be revised to include concrete materials data as required by EM 1110-2-2000, Appendix A, paragraph 2.

23. Page D-74, paragraph 4.03b. The 1V to 2H landside levee slopes are steeper than can be mowed with conventional equipment (EM 1110-2-1913). The present levee slopes appear to be about the same slope. If this deviation from the EM is based on the levee district's experience with maintaining the present levee, information on the present state of maintenance should be presented.

OCE COMMENTS (CONT'D)

24. Page D-77, paragraph 4.04. Functional design (Superiority of portions of Burlington levee and controlled overflow areas) of the right bank urban levees appears to be based on a precision that may not be practical. The following comments address concerns for the performance of the proposed plan under actual flood situations.

a. Profiles for the West Mount Vernon, Avon, and Mount Vernon reach show the 1% chance flood at and sometimes above the SPF. This is apparently because the right bank levees are assumed to overtop before the peak of the SPF arrives. This appears unreasonable because the approximation of one foot of overlflow (head on weir) assumed over the right bank levee overflow section would require the river to be at about the top of the left bank levee. The right bank 1% chance flood levee is superior to the left bank SPF levee at some locations, even where superelevation is not a consideration. Therefore, it is difficult to conceive how the left bank levee provides higher (SPF) protection than the right bank (1% chance flood) levee.

b. There is less than adequate difference between the crest of the design overflow area and the net design grade of the levee. Generally, this difference is about 1.0-foot, but at one location (overflow No. 5), it is only 0.4-foot. Therefore, overtopping could take place at locations other than at the designated design overflow areas. Also, less than one foot of head on the crest of the design overflow section appears inadequate to insure the required volume of flow into the protection area. A complete presentation (discussion with supporting information) should be provided.

c. What legally binding restriction would prevent floodfighting the right bank urban levee and who would enforce (police) the restriction?

d. Designing freeboard for initial overtopping at least hazardous locations is a valid concept. However, it should be applied to all levees regardless of level of protection and is usually accomplished by sloping freeboard for the full length of the levee. That is, add extra freeboard at the upstream end and slope to no added freeboard near the downstream end.

e. The water surface profiles, Appendix D, paragraph 2.03c and table D2-2, appear to be inconsistent with the assumption as to how the designed overflow areas will function. For example, overflow areas 3a is assumed to overflow at 183,000 cfs (1% chance flood) but plate 63 shows the 1% chance profile 2 feet below the crest of the designed overflow

f. It should be clarified as to whether the design overflow crest is assumed to erode, when overtopped, or not.

OCE COMMENTS (CONT'D)

25. Pages D-80 through 82, paragraph 4.04F, and Plates 1 through 16B. From inspection of Plate 1 through 16B, it appears, that to protect urban areas the urban levee design grade should be extended downstream of the urban areas. For example, on Plate 83 where the left bank urban levee ends and the rural levee starts, the levee grade is about elevation 34 above and 33 below station 673+58 (one foot difference 2% chance flood to SPF). Therefore, when the rural levee is overtopped, it appears this level (elevation 33) of flooding would back into part of Mount Vernon.

26. Pages D-94 and 95, paragraph 4.05g and Table D4-5. The landscaping description in Volume 1 does not give the complete picture of the subject. More detailed information should be presented in Appendix D.

27. Pages D-85 through 88, paragraph 4.06b. Information should be presented on the warning time available, the manpower required to erect the wall, and the manpower likely to be available during a major flood.

28. Pages D-91 and D-110, paragraphs 4.06c and 5.07f. If the existing drainage structures are going to be retained and extended, information should be presented on the original construction and present condition of these structures.

29. Pages D-114 to D-135, paragraph 6.01.

a. Unit prices for some items appear to be low, for example:

(1) Embankment: $4.70/c.y. should be at least $6.00/c.y.

(2) Slope protection cost estimates are low, especially for riprap: gravel blanket - $6 to $8/c.y. should be $10 to $11/c.y.; riprap - $12.10/c.y. should be $20.00/c.y. Since all of these items will need to be hauled from borrow areas at least 8 miles away and the embankment will be placed in layers and compacted, why do these items cost more in the rural levees than in the urban levees? The above suggested cost estimates are based on work in the Southeast U.S. around October, 1978 and should be adequate for the Northwest, perhaps on the low side.

b. The cost estimate of $196,000 for landscaping the urban areas seems inadequate considering the quantity and quality of the environmental "fixup" that is portrayed on Plates 20 through 23 of Volume 1. The $196,000 is in addition to the $571,400 for topsoil and seeding required for soil stabilization and an unknown cost for the overland levee sections. Therefore, additional discussion and reanalysis of landscaping should be presented.

30. Plates D-23 and D-24. The SPF profile should be shown.

31. Plates D-26 to D-35. The borings indicate that much of the existing levees are sand. Potential through seepage problems should be analyzed and discussed.

NPDPL-PF (17 Jan 80) 3rd Ind
SUBJECT: Skagit River, Washington

DA, North Pacific Division, Corps of Engineers, P.O. Box 2870, Portland, OR 97208 8 February 1980

TO: District Engineer, Seattle

The Skagit River General Design Memorandum is returned per your request in the basic letter.

FOR THE DIVISION ENGINEER:

D. E. OLSON
Chief, Planning Division

2 Incl
Incl 3 nc except 1 cy wd
Incl 4 nc except 9 cys wd

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 11 March 1980

SUBJECT OF CONVERSATION: Skagit River

INCOMING CALL		
PERSON CALLING: Don Nelson	ADDRESS: Skagit Co. Engr's Office	PHONE NUMBER AND EXTENSION:
PERSON CALLED: Gardner	OFFICE:	PHONE NUMBER AND EXTENSION:

OUTGOING CALL		
PERSON CALLING:	OFFICE:	PHONE NUMBER AND EXTENSION:
PERSON CALLED:	ADDRESS:	PHONE NUMBER AND EXTENSION:

SUMMARY OF CONVERSATION

1. He said that Kunzler has mentioned Federal non-structural programs and funding, and Nelson would like to know more about them.

2. I told him about FEMA interest in relocation or floodproofing, and Corps levee study at Hamilton.

3. I told him that FPMS can provide planning service for flood warning and evacuation system, if we are formally requested by the County. We don't know what funds may be available for such a system.

3/13

GARDNER

cc:
Cook/Towle
Farrar
Dice
Harnisch

WORTHINGTON / RP file

P 002312

DA FORM APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

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