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REFERENCE OR OFFICE SYMBOL	SUBJECT
NPSEN-FM	Skagit River Levee and Channel Improvement Project, Interim F&M Report

TO: Ch, Planning Br WAF
REG PLNG (BROOKS)

FROM: Ch, F&M Br

DATE: 27 April 1978

CMT 1

Graybeal/Newbill/3712

Our interim report regarding foundation and materials investigations on subject project is attached.

Ward

WARD

1 Incl
as

cc w/incl:
Reg Plng (Brooks)
F&M Br (Newbill)

P004455

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NPSEN-FM

Skagit River Levee and Channel Improvement Project,
Interim F&M Report

Ch, Planning Br

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27 April 1978
Graybeal/Newbill/3712

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as

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cc w/incl:
Reg Plng (Brooks)
F&M Br (Newbill)

P004456

24 April 1978

SKAGIT RIVER LEVEE AND CHANNEL IMPROVEMENT PROJECT

INTERIM F&M REPORT

1. References.

a. Skagit River Flood Control and Other Improvements Report dated March 1965.

b. Regional Planning Branch Work Request No. SLCJ-4 dated 20 July 1977.

2. Purpose. The purpose of this interim report is to comment on the methods of recent foundation and materials investigations, preliminary findings, and remaining F&M work for Skagit River Levee and Channel Improvement Project.

3. General. Boring logs of 32 hand-auger holes are contained in the 1965 report describing the authorized project. To add to this information, field exploration was conducted between 23 January and 18 March 1978 in response to Work Request SLCJ-4. A total of 168 borings were made using power auger, rotary drill, hand auger, and wash boring equipment; 124 borings to explore the authorized flood control project; and 44 borings to explore alternative plans, not included in the 1965 report, to provide higher-level flood protection to urban areas of Mount Vernon and Burlington, Washington. Some additional exploration will be necessary to complete the design analysis and prepare contract plans and specifications.

Borings were made to identify soil stratum in existing levees, foundations, and channel bottom. Soils were visually classified in the field according to the Unified Soil Classification System. Standard Penetration Tests, using 2-inch diameter split-spoon samplers, were performed every 5-foot depth to evaluate compactness of sands and consistency of silts or clays. Samples were retained in quart jars for use in laboratory classification tests to confirm visual classifications. Boring logs are being prepared at this time for inclusion in appropriate design memoranda and contract documents. Ground-surface elevations and grid coordinates will be added to logs when recent survey data is received. Location of all borings will be plotted when maps become available.

4. Existing Levees. Borings to evaluate the embankment material and foundation soils on the levee alinement were generally spaced about 2,000 feet apart to uniformly cover the existing system. A truck-mounted power auger was used to bore a 16-inch diameter open hole in which standard penetration tests were taken. This method was successful only above the ground-water table. Below water level, the loose, sandy sides of the hole caved, and the auger could not advance an open

hole to greater depth. Maximum depth of the 16-inch auger holes was 20 feet. Holes to 70 feet deep were made with two rotary drills where sides of the hole were held open by 4-inch diameter steel casing. Rotary holes were drilled on or adjacent to existing levees where underseepage had been experienced during the December 1975 flood. In most cases, the steel casing was advanced in 5-foot increments by reaming and cleaning with water. Standard penetration tests were taken at the bottom of each increment. Hand-auger borings were made in the few locations that were inaccessible with a drill truck. Maximum depth of these 3-inch diameter open holes was 12 feet, and no standard penetration tests were attempted.

The existing levees are predominantly fine sands and silty sands of loose-to-medium compaction. Foundation soils are very similar to the levee materials in most cases, and are composed of alluvial and estuarian marine sedimentary deposits consisting of fine sands, silts, and clays, with wood debris and shells. However, some deposits of medium to coarse sands and fine gravels were also encountered by rotary-drill borings, mostly in the upstream portion of the project. Specific soil conditions and locations will be identified during the design process when plans, profiles, and sections are prepared.

6. Channel Widening and Deepening. Wash borings were performed in the river at three areas identified in the 1965 report for widening and deepening (North Fork R.M. 3.8 to R.M. 4.7, North Fork R.M. 7.0 to R.M. 8.1, and South Fork at Freshwater Slough R.M. 4.0 to R.M. 4.7) and at a fourth area through downtown Mount Vernon (Skagit R.M. 11.5 to R.M. 13.5). Work was done from a self-propelled barge, and consisted of driving 4-inch steel casing down in 5-foot increments, cleaning out the casing with water, and taking standard penetration tests. Most of the holes were spaced about 1,000 feet apart and were drilled to a depth of 30 feet.

River-bottom materials investigated consist mostly of sands and silts with seashells, wood debris, and logs, except near the mouth of North Fork. In this area, gravels and bedrock were encountered in the channel bottom between R.M. 3.9 to R.M. 4.2, so additional shallow wash borings were made to define the areal extent of gravels and rock.

Several rotary-drill holes were drilled in proposed widening areas on existing levee centerline and landward. These encountered the same type of sedimentary deposits as found in the channel bottom and levee foundations, except on the right bank of the main river, vicinity R.M. 12.5, where debris from a sanitary landfill was encountered.

7. Increased Flood Protection. Rotary-drill and power-auger methods previously described were used on the proposed upstream extension of the authorized levee project between Burlington and Sedro Woolley. These borings, on or upstream of the existing levees, encountered sands and silty sands similar to those encountered elsewhere and described previously.

Several rotary-drill holes were located generally on the western city limit line in the Big Bend area of Mount Vernon. These were drilled to investigate foundation conditions for an alternative levee alinement designed to provide higher-level flood protection to Mount Vernon. Typical loose, fine sands and silty sands were encountered, with gravelly and clayey deposits at depth.

An 8-inch diameter, hollow-flight power auger was used on the left bank, R.M. 12.5 to R.M. 12.8, in downtown Mount Vernon to investigate foundation conditions along a proposed floodwall. Under the roadway materials, loose, fine sand and silty sands were encountered. In this drilling operation the sides of the hole are held open by the auger itself, and standard penetration test split-spoon samples were taken through the hollow stem. However, sampling of materials below the ground-water table was not possible because water pressure would force the loose, fine sands up the hollow stem, blocking the sampler and disturbing the soil below. These hollow-flight holes along the proposed floodwall alinement were sampled to a 20-foot depth.

8. Design Analysis. Information from the Skagit River Flood Control Council is needed before we can fully evaluate soil conditions and design the levee improvements. Items that would be helpful and should be included in the questionnaire being prepared by the study manager are: dates and locations of construction and/or restoration; location of problem areas where overtopping, seepage, slope failure, bank erosion, and breaching have been encountered; and any suggestions regarding proposed location for impervious trenches or blankets and borrow areas. Details of flood-fighting activities, such as length and location of sandbagging, gravel berms, boils, etc., should also be requested.

Seepage and stability analyses will be performed when contour maps and cross sections from recent survey data become available. Specific soil conditions will be identified during the design process when plans, profiles, and sections are prepared. Evaluation of potential borrow sources will be conducted when fill quantities and locations are known.