moore engineering, inc.

1042 14th Ave. E., West Fargo, North Dakota 58078 • Phone: 701-282-4692 • Fax: 701-282-4530

August 26, 1998

Ms. Pernille Buch-Pedersen
Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

RE: LOMR
City of Fargo ND
Community #385364
Case No.: 98-08-358P

Dear Ms. Buch-Pedersen:

The items below are enclosed as revisions requested in the July 10, 1998 letter.

1. The LOMR fee of $2300 has been sent to the National Flood Insurance Program.
2. Form 1 containing the Chief Executive Officer's signature.
3. The modular block retaining wall at stations 15+90 to 16+90 is now at stations 16+00 to 16+70 and has been modified and is not a structural entity. A floodwall has been added and the structural analyses have been enclosed. See also details on pages 12 to 14 of the record drawings (Attachment #2). Also, details have been enclosed demonstrating flow regulation at the lift stations. See also flow lines and seepage control as shown in the record drawings.

If any additional information is required, please contact me at 701-282-4692 or by fax 701-282-4530.

Sincerely,

MOORE ENGINEERING INC.

Clinton J. Weisz

Clinton J. Weisz
Project Manager

CJW/caw
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FEDERAL EMERGENCY MANAGEMENT AGENCY REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM	O.M.B. Burden No. 3067-0148 Expires July 31, 1997	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - ☒ Physical change
     - ☒ Existing
     - ☐ Proposed
   - ☐ Improved methodology
   - ☐ Improved data
   - ☒ Floodway revision
   - ☐ Other _____

   Explain _____
2. Flooding Source: Red River of the North
3. Project Name/Identifier: 4th Street Dike Improvements
4. FEMA zone designations affected: AE
   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)
5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy,City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
385364	Fargo	Cass	ND	385364	0020E	11/02/95

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding
- ☒ Riverine
- ☐ Coastal
- ☐ Alluvial Fan
- ☐ Shallow Flooding *(e.g. Zones AO and AH)*
- ☐ Lakes

Affected by wind/wave action
- ☐ Yes
- ☒ No

Structures
- ☐ Channelization
- ☒ Levee/Floodwall
- ☐ Bridge/Culvert
- ☐ Dam
- ☐ Coastal
- ☐ Fill
- ☐ Pump Station
- ☐ None
- ☐ Channel Relocation
- ☐ Excavation
- ☐ Other *(describe)*

Disciplines*
- ☒ Water Resources
  - ☐ Hydrology
  - ☒ Hydraulics
  - ☐ Sediment Transport
  - ☐ Interior Drainage
- ☐ Structural
- ☒ Geotechnical
- ☐ Land Surveying
- ☐ Other *(describe)*

☐ Other(describe) _____

* **Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? ☒ Yes ☐ No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM ☒ Yes ☐ No

   If yes, give reason: Reconstructed levee will encroach slightly into existing floodway

ATTACHMENT #1

D. The community is willing to assume responsibility for ☒ performing ☐ overseeing compliance with the maintenance and operation plans of the 4th Street Dike Improvements (Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to Flood Insurance Maps: A guide for Community Officials," dated January 1990, this request is for a:

_____a.	CLOMR	A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72)*.
X b.	LOMR	A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. I Parts 60 and 65.)*
_____c.	PMR	A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. I, Parts 60 and 65.)*
_____d.	Other:	Describe_____

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	☐ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☒ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☒ Riverine /Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☐ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☐ Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	☒ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☐ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

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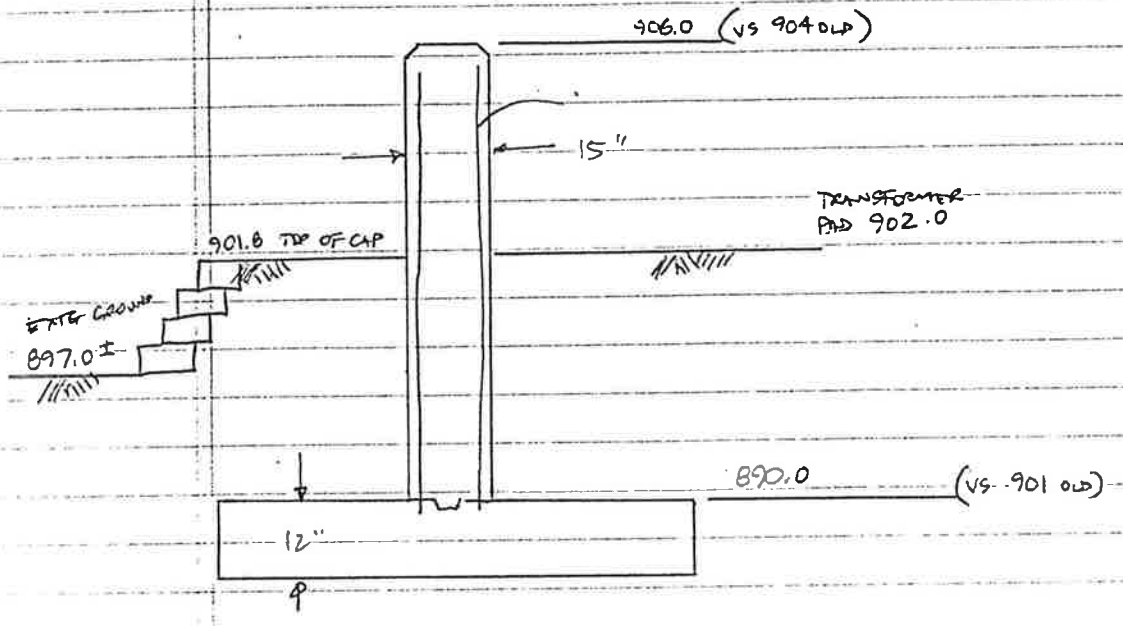
(1)

RET. WALL – 4TH ST DIKE
REVISITED



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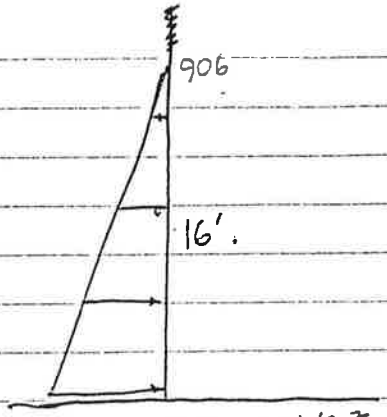
ANALYZE WALL:

4TH ST DIKE



$$w = \frac{0.624(16)(16)}{2} = 8^{k}$$

$0.0624(16') = 1.0^{k/ft^2}$

$$M = 0.1283wl = 16.42^{k\text{-}ft}$$

$$V_{MAX} = \frac{2w}{3} = \frac{16^{k}}{3} = 5.33^{k}$$

IF LOOK HORIZONTALLY: PCA RECT. CONC. TANKS

~~SLAB~~ ~~WALLS~~ FREE @ TOP & ~~HINGED~~ @ BOT. TABLE # 2

$a = 16'$

$b = 220$ $\quad b/2 = 13.75$ · TOO LARGE CAN'T DO THIS

SEE NEXT ~~PAGE~~ FOR RESULTS

CONCANAL.WB3

ASSUMING SANDBAGS ON BACK SIDE & W/SOIL TO TOP + NO SOIL ON RIVER SIDE (WASH OUT.)

LRFD

INPUT:

MOMENT (UNFACTORED)=	16.42 k-ft	
SHEAR (UNFACTORED)=	5.33 k	
FACTOR=	2.2	
BAR SIZE=	8	
SPACING=	12 in o.c.	
THICK=	15 in	
COVER=	3 in	
B (WIDTH)=	12 in	STRIP SECTION
f'c=	4 ksi	
BETA1 FOR RHO bal=	0.85	
PHI FACTOR (moment)=	0.9	
PHI FACTOR (shear)=	0.85	
fy (STEEL)=	60 ksi	

OUTPUT:

de=	11.5 in		
Asbar=	0.79 sq in.		
As=	0.79 sq in.		
Mu=	36.124 k-ft		
Vu=	11.726 k		
RHO=	0.0057246		
RHO bal=	0.0285068		
.375 RHO bal=	0.0106901	Is > RHO?	YES
.50 RHO bal=	0.0142534	Is > RHO?	YES
a=	1.1617647		
MOMENT STRENGTH PROVIDED:	38.817463 k-ft	Is > Mu?	YES
SHEAR STRENGTH PROVIDED:	17.455773 k	Is > Vu?	YES
t&s REINF REQUIRED:	0.36 sq in.		

IF LOOK AT SAND BAGS 2' ABOVE SOIL PRESSURE

$$M = 0.1283\left[\frac{(18')(18')(0.05)}{2}\right](18') = 18.71^{k\text{-ft}}$$

(w = 0.05, L = 18')

$$V = \frac{2w}{3} = 5.4^{k}$$

$\therefore M_u = 41.162 > 39.82^{k\text{-ft}}$

NO GOOD FOR 1 foot WILL BE OK

EROSION NOT A PROBLEM

LOOK AT HIGHER ELEVATION FOR FIG

LATERAL LOAD = 0.05 k/ft³

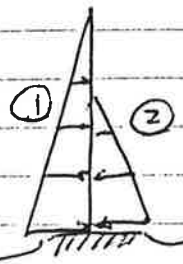
USE 895.0

∴ 906 − 895 = 11' HIGH WALL

902 − 895 = 7' AT GROUND

WATER HIGH ON WALL

USE WATER 0.0624



W = TOTAL LOAD = $W_1 = \frac{1}{2}(11)(0.05)$ = 3.78

$W_2 = \frac{1}{2}(7)(0.05)$ = 1.225

0.05(7) = 0.35

∴ USE $M_{max} = \frac{Wl}{3}$

9(0.0624) = 0.562

$M_{1_{max}} = \frac{3.78(9)}{3}$ = 11.34 k-ft

$M_{2_{max}} = \frac{-1.225(7)}{3}$ = −2.86 k-ft

GET M_{max} @ $M_{1max} - M_{2max}$ = 8.48

M_{max} = 8.48 k-ft

V_1 = 3.78

V_2 = −1.225 k

2.555

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CONCANAL.WB3

LRFD

INPUT:

MOMENT (UNFACTORED)=	8.48 k-ft	
SHEAR (UNFACTORED)=	2.56 k	
FACTOR=	2.2	
BAR SIZE=	6	
SPACING=	12 in o.c.	
THICK=	15 in	
COVER=	3 in	
B (WIDTH)=	12 in	STRIP SECTION
f'c=	4 ksi	
BETA1 FOR RHO bal=	0.85	
PHI FACTOR (moment)=	0.9	
PHI FACTOR (shear)=	0.85	
fy (STEEL)=	60 ksi	

OUTPUT:

de=	11.625 in		
Asbar=	0.44 sq in.		
As=	0.44 sq in.		
Mu=	18.656 k-ft		
Vu=	5.632 k		
RHO=	0.0031541		
RHO bal=	0.0285068		
.375 RHO bal=	0.0106901	Is > RHO?	YES
.50 RHO bal=	0.0142534	Is > RHO?	YES
a=	0.6470588		
MOMENT STRENGTH PROVIDED:	22.376912 k-ft	Is > Mu?	YES
SHEAR STRENGTH PROVIDED:	17.645509 k	Is > Vu?	YES
t&s REINF REQUIRED:	0.36 sq in.		

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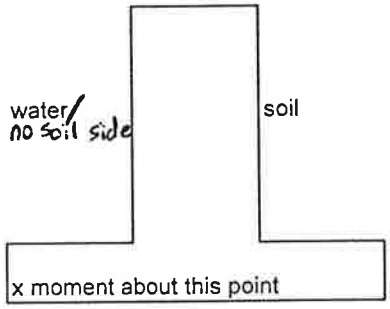
FOOTING ANALYSIS FOR CONTINUOUS T-TYPE CANTILEVER RETAINING WALL

WINGWALL THICKNESS:	15 INCHES	
LATERAL PRESSURE (basis):	0.0624 K/FT^2	WATER HYDRO PRESSURE
WEIGHT OF CONCRETE:	0.15 K/FT^3	
WEIGHT OF MOIST SOIL:	0.115 K/FT^3	FROM 7519 MIDWEST TESTING
ALLOWABLE EXCESS BEARING PRESSURE:	1.5 KSF	
WEIGHT OF WATER:	0.0624 K/FT^3	
FACTOR OF SAFETY (STABILITY):	1.5	
FACTOR OF SAFETY (BEARING PRESSURE):	3	
HEIGHT OF WALL:	11 FEET	
DEPTH OF EMBANK ABOVE FTG - OUTSIDE FACE(soil):	11 FEET	
DEPTH OF EMBANK ABOVE FTG - INSIDE FACE(river):	7 FEET	
DEPTH OF FOOTING:	12 INCHES	
HEIGHT OF WATER ON OUTSIDE FACE:	0 FEET	
HEIGHT OF WATER ON INSIDE FACE:	0 FEET	
ELEVATION OF ORIGINAL GROUND:	902 FEET	
FINISH GRADE FOR TOP OF FOOTING:	895 FEET	

SWITCHED THESE TO GET CORRECT MOMENT ARM



FOR SLIDING:		
COHESION (DRAINED)=	0.5 K/FT^2	FROM 7519 MIDWEST TESTING
ANGLE OF INTERNAL FRICTION (DRAINED):	0 DEGREES	FROM 7519 MIDWEST TESTING

TRIAL DIMENSIONS (TRY TO MAKE AS EVEN AS POSSIBLE TO DIST SOIL PRESSURES EVENLY):

OUTSIDE LENGTH (FROM WALL FACE):	2.5 FEET	FS1=	4.0123071
INSIDE LENGTH (FROM WALL FACE):	4 FEET	FS2=	3.2721919
DEPTH OF KEY:	0 FEET		
WIDTH OF KEY:	0 FEET		

NO KEY ANALYSIS:

FOR OVERTURNING ANALYSIS:

IF KEY IS PRESENT:
SHEARING RESISTANCE OF THE BASE ASSUMED = 0
AND AN ASSUMED SOIL PRESSURE EQUAL TO RESIST
HORIZONTAL FORCES IS PROVIDED

POSITIVE MOMENT IS COUNTERCLOCKWISE

TO RESIST OVERTURNING (M AT INSIDE TOE):

	WEIGHT (k/ft)	MOMENT ARM (feet)	MOMENT (k-ft)
WEIGHT OF SOIL: soil	3.1625	6.5	20.55625
WEIGHT OF SOIL: wat	2.0125	1.25	2.515625
WEIGHT OF WALL:	2.0625	4.625	9.5390625
WEIGHT OF FOOTING	1.1625	3.875	4.5046875
	8.4		37.115625

FORCES TENDING TO OVERTURN:

	PRESSURE (k/ft)	MOMENT ARM (feet)	MOMENT (k-ft)
UPLIFT:	0		
SOIL - OUTSIDE: soil	-4.4928	4	-17.9712
SOIL - INSIDE: river	5.2728	2.3333333	12.3032
WATER - OUTSIDE:	0	0	0
WATER - INSIDE:	0	0	0

0.78 -5.668

PROVIDED FACTOR OF SAFETY:
6.5482754 IS OK? GOOD

MOMENT ARM FOR TOTAL LOADING:
Xr = SUM M / SUM V = 3.7437649

RESULTANT RATIO (ASCE) - TELLS IF WILL HAVE COMPRESSION UNDER FTG:
0.4830664 IS OK? GOOD

IS RESULTANT WITHIN MIDDLE THIRD OF BASE?
2.5833333 FEET TO 5.1666667 FEET
IS OK? GOOD

FOR SLIDING ANALYSIS:

SUM OF HORIZONTAL FORCES: 0.78 k

T <= (SUM VERTICAL*TAN(ANGLE) + C*LENGTH OF SLIP PLANE)/FS

RIGHT HAND SIDE = 2.5833333

IS OK? GOOD

FOR BEARING CAPACITY ANALYSIS:

COMPUTE ECCENTRICITY e:

e = B/2 - Xr e = -0.131235 FEET
WITH SIGN CHANGE
FOR +M COUNTERCLOCKWISE

IS e <= B/6 YES - FOOTING UNDER COMPRESSION

q = SUM VERT/BASE * (1 +/- 6*e/BASE)

TOTAL BEARING PRESSURES:		EXCESS BEARING PRESSURES:	
qmin =	1.0641677 k/ft^2	qmin =	0.3738497 k/ft^2
qmax =	1.1939938 k/ft^2	qmax =	0.4584083 k/ft^2

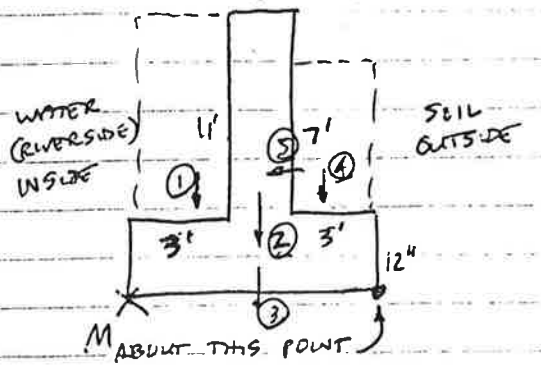
IS LESS THAN TOTAL ALLOWABLE?

DEPTH FROM ORIGINAL GRND SURFACE TO BOT FTG: 8 FEET

qALLOW= 1.5
IS OK? GOOD

FOOTING COMPARISION:

cost of piling per foot=	35		
cost of concrete per CY	100		
capacity of pile=	70 tons	length of piling=	85
number of piling required=	0.06	per foot of retaining wall	
CY of footing concrete=	0.287037	per foot of retaining wall	
feet retaining wall=	30		
cost of concrete=	28.703704	per foot of retaining wall	
cost of piling=	178.5	per foot of retaining wall	



TO RESIST:

① WT OF SOIL ① = 11(3)(0.115) = 3.80 * INCLUDES SOME WATER. HEIGHT (4')
② WT OF WALL ② = 11(15"/12")(0.150) = 2.063
③ WT OF FTG ③ = 1(7.25)(0.150) = 1.088
④ WT OF SOIL ④ = 7(3)(0.115) = 2.415
⑤ ~~WT SOIL ⑤ = 7(0.05)(7)/2 = 1.225~~ ~~WRONG~~
10.591

MOMENT ARMS		M_R MOMENT
④	1.5'	3.63 k-ft
②	3 + 15/12/2 = 3.625	7.48
③	" " = 3.625	3.94
④	3' + 15/12/2 + 1.5' = 5.125	19.48
⑤	7/3 + 1 = 3.33	4.08
		38.61

TO OVERTURN:

USE WATER
11(0.0624)(11)/2 = 3.78 k

Arm: 11/3 + 1 = 4.67'

M_o MOMENT = 17.65

$$FS = \frac{M_R}{M_o} = \frac{38.61}{17.65} = 2.19 > 1.5 \therefore OK$$

$$\text{ASCE RESULTANT RATIO} = \frac{-17.65 + 38.61}{\frac{10.591}{7.25'}} = 0.27$$

NO GOOD BUT CLOSE
NEEDS TO BE BETWEEN 0.33 & 0.87

$$X_L = \frac{M_R}{\Sigma V} = \frac{38.61}{10.591} = 3.65$$