HYDROLOGY G18/D10 3 PLANS

G18/D10

3 PLANS

DRAINAGE REPORT

ADDITIONS AND ALTERATIONS
DEL NORTE BAPTIST CHURCH

APRIL, 1982

Submitted to
City of Albuquerque
Engineering Division
Hydrology Section

By
Flatow, Moore, Bryan & Associates
5608 Zuni, S.E.
Albuquerque, New Mexico

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DRAINAGE REPORT INFORMATION SHEET G18-D10

PROJECT TITLE Additions & Alterations to Del Norte Baptist Church

ZONE ATLAS PAGE NO. G-18 CITY ADDRESS 5800 Montgomery NE.

LEGAL ADDRESS Tract B & Lot C-2-B of Altamont Unit 6

ENGINEERING FIRM Flatow, Moore, Bryan & Assoc CONTACT Dick Bryant

ADDRESS 5608 Zuni Rd. S.E. PHONE 268-6783

OWNER Del Norte Baptist Church CONTACT

ADDRESS 5800 Montgomery N.E. PHONE

ARCHITECT/SURVEYOR Flatow, Moore, Bryan CONTACT Rusty Shaffer

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DATE SUBMITTED 5-6-82

BY Richard C Bryant, P.E.

The subject site is located at 5800 Montgomery Boulevard, N.E., west of San Pedro Drive, N.E., in Albuquerque, New Mexico. The property contains 3.4 acres and is <u>not</u> located in a Flood Zone.

The proposed construction will be completed in two separate phases. Phase I is a 7200 square foot addition to the present church building, for new classrooms, and will be built on land that is presently a lawn area.

PHASE ONE HYDROLOGY

The increased flow for the 100-year storm due to the Phase I addition will be:

$$\Delta Q = 7200 \text{ sq. ft.} \times (.09 - 0.4) \times \frac{2.4''}{12''/\text{ft.}}$$

$$\Delta Q = \underline{720 \text{ cu. ft.}}$$

This water will be directed north, away from the building to be detained in a shallow ponding area formed on the lawn by constructing a curb varying in height from zero to 8-3/8", or 0.7 foot. Using cross-sections 15 feet apart with the average-end-area formula, the capacity of this pond is calculated to be 795 cu. ft.

To design a weir in the curb, to release water through the drive pad into Montgomery Boulevard, find the runoff rate:

$$Q_{100} = C\, i_{100}\, A$$

$$A = 7200 \text{ sq. ft.} = 0.165 \text{ acre}$$

$$S = 0.005 \qquad S^{1/2} = 0.0707$$

$$K = \frac{L}{\sqrt{S}} = \frac{215}{0.0707} = 3040.56$$

$$t_c = 0.0078\, K^{.77} = 0.0078\ (3040.56)^{.77}$$

$$t_c = 3.75$$

$$i_{100} = \frac{163}{t_c + 20} = \frac{163}{23.75} = 6.863$$

$$Q_{100} = (0.9 - 0.4)\ (6.863)\ (0.165)$$

$$Q_{100} = \underline{0.566 \text{ cfs}}$$

Weir equation: $\frac{Q}{L} = 3.00 \left(H + 1.2 \frac{V_a^2}{2g}\right)^{3/2}$

$$\frac{Q}{L} = 3 \left(0.7 + 0.0186 \left[\frac{Q}{dL}\right]^2\right)^{3/2}$$

Try L = 1.0 ft.; then $\frac{Q}{dL} = \frac{0.566}{0.700} = 0.8086$

$$3L \left(0.7 + 0.0186 \times 0.654\right)^{3/2} = Q$$

$$L \left(0.71216\right)^{1.5} = 0.1887$$

$$L = 0.314 \text{ ft.}$$

Plugging back in, $\frac{Q}{dL} = 2.575$

$$\frac{Q}{L} = 3 \left(0.7 + 0.0186 \times 6.631\right)^{1.5}$$

$$3L \left(0.823\right)^{1.5} = Q$$

$$L = \frac{0.1887}{0.7471} = 0.25 \text{ ft., or 3 in.}$$

Use a weir <u>3 inches wide</u> and <u>8-3/8 inches high</u> in the 6-inch-wide curb.

PHASE TWO HYDROLOGY

Phase II is to consist of 23,900 square feet of new floor space mostly in an auditorium. For the construction to be accomplished with the same finish floor elevation, it will be necessary to remove a portion of the present parking area and re-grade most of the remaining parking areas. A retaining wall is designed for the uphill side of the property, and another retaining wall in the southwest corner of the property will retain floodwaters.

For Phase II, the drainage area boundaries will be altered to direct more runoff to the south, where a detention pond will be formed on the parking lot. Drainage Area I will shrink from 29% to 17% of the property. Calculations below are based on the increased runoff due to:

(a) Existing parking lot 'A',
(b) Existing parking lot 'B',
(c) Phase I addition, and
(d) Phase II addition, deducting the area of proposed auditorium space that is presently in parking lot 'A'.

$$\Delta Q = 150' \times 127' \times (0.9 - 0.4) \times \frac{2.4''}{12''/ft.}$$

$$+ \; 150' \times 170' \times (0.9 - 0.4) \times 0.2'$$

$$+ \; 7200 \text{ sq. ft.} \times (0.9 - 0.4) \times 0.2'$$

$$+ \; 14{,}333 \text{ sq. ft.} \times (0.9 - 0.4) \times 0.2'$$

$$Q = 1905 + 2550 + 720 + 1433 = \underline{6608 \text{ cu. ft.}}$$

This volume equals the pond capacity, calculated by taking cross-sections and using the average-end-area method. The maximum pond depth will be 38.75 - 37.50 = <u>1.25 ft.</u>

Design a drop inlet to release the 5-year runoff into Hendrix Road.

$$Q_5 = C \; i_5 \; A$$

$$Q_5 = 0.9 \times 3.43 \times \frac{66{,}083 \text{ sq. ft.}}{43{,}560}$$

$$Q_5 = 4.68 \text{ cfs}$$

For a steel plate, determine number of openings needed.

$$Q = C_c \, A_o \sqrt{2gH} \qquad C_c = 0.82$$

$$Ao = \frac{Q}{C_c \sqrt{2gH}}$$

$$Ao = \frac{4.68}{0.82 \sqrt{2 \times 32.2 \times 1.25}}$$

$$Ao = 0.636 \text{ sq. ft., or } 91.6 \text{ square inches}$$

Use <u>92 holes</u>, 1-1/8" in diameter each. For ease in cleaning, form a concrete box <u>3 ft. by</u> 3 ft., inside dimensions.

For a trench drain under the Hendrix Road sidewalk, try Manning's equation, with w = 12":

$$Q = \frac{1.486}{n} \; ar^{2/3} \; S^{1/2}$$

$$S = 1/4 \text{ in./ft.} = 0.0208 \qquad S^{1/2} = 0.1442$$

$$r = \frac{a}{pw} \qquad pw = 6.75'' + 12'' + 6.75''$$

$$pw = 25'' = 2.083 \text{ ft.}$$

$$a = 6.75 \times 12 = 81 = 0.5625 \text{ sq. ft.}$$

$$n = 0.012 \text{ for concrete}$$

$$Q = 123.8 \times 0.5625 \times \left(\frac{0.5625}{2.083}\right)^{2/3} \times 0.1442$$

$$Q = 4.20 \text{ cfs} \quad \text{(not sufficient)}$$

Use pipe flow form of equation:

$$D = \left(\frac{Qn}{0.463 \quad S\ 1/2}\right)^{3/8}$$

$$D = \left(\frac{4.68 \times 0.012}{0.463 \times 0.1442}\right)^{3/8}$$

$D = 0.937$ ft., or a rectangular cross-section 14.7 inches wide.

Use <u>M = 15"</u> width

For the 100-year storm, determine flow rate:

$$i_{100} = \frac{163}{t_c + 20} \qquad t_c = 0.0078 \ K^{.77}$$

$$S = \frac{50.00 - 36.50}{567} = 0.0238 \qquad S^{1/2} = 0.1543$$

$$K = \frac{L}{\sqrt{S}} = \frac{567}{0.1543} = 3674.66$$

$$K^{0.77} = 556.18$$

$$t_c = 0.0078 \times 556.18 = 4.34$$

$$i_{100} = \frac{163}{24.34} = \underline{6.70 \text{ in./hr.}}$$

$$Q_{100} = C\ i_{100}\ A$$

$$= 0.9 \times 6.70 \times 1.517 = \underline{9.15 \text{ cfs}}$$

For a drop structure in the southwest corner of the lot, place a box structure against the corner of the retaining wall, using the north and east walls of the box as a weir.

Calculating the flow over the weir,

$$Q = CLH^{3/2} \qquad \frac{H}{D} = 0.33$$

Length of weir, $L = \frac{CH^{1.5}}{Q}$ $\qquad C$ = weir coefficient = 3.32

$$L = \frac{3.32 \times 0.354}{9.15}$$

$L = 7.8$ ft. Use a box <u>4 ft. by 3.8 ft.</u>

d_c = critical depth on weir

$$d_c = \sqrt[3]{\frac{Q^2}{L^2 g}}$$

$$d_c = \sqrt[3]{\frac{(9.15)^2}{(7.8)^2 \times 32.2}}$$

$d_c = 0.35$ ft. O.K.

Use a trench drain under the sidewalk to convey Q_{100} into Hendrix Road. Per City Engineering drawing K-16-1, average depth = 6.75 in. and for a width of 24 in., wetted perimeter P = 24 in. + 13 in. = 3.08 ft.

area, a = 6.75 x 24 = 1.125 sq. ft.

hydraulic radius, $r = \frac{a}{Pw} = \frac{1.125}{3.083} = 0.3649$ ft.

Slope S = 2.08%

$$Q = \frac{1.486}{n} ar^{2/3} s^{1/2}$$

$$Q = \frac{1.486}{0.012} \times 1.125 \times 0.3649^{2/3} \times 0.0208^{1/2}$$

Q = 10.26 cfs capacity

O.K. to handle Q_{100} = 9.15 cfs, so use <u>M = 24 in. width</u>.

Off-site flow affecting this site consists of runoff from one-half of the adjoining 150-by-170 foot lot, Area III. To admit this flow, design a weir in the north retaining wall:

A = 75 ft. x 170 ft. = 12,750 sq. ft.

A = 0.2[illegible] acre

$S = \frac{49.44 - 46.45}{186} = 0.016$ $S^{1/2} = 0.1265$

$$K = \frac{L}{\sqrt{S}} = \frac{186}{0.1265} = 1470.36 \qquad K^{.77} = 274.7$$

$$t_c = 0.0078 \; K^{.77} = 2.143$$

$$i_{100} = \frac{163}{t_c + 20} = \frac{163}{22.143} = 7.36$$

$$Q_{100} = C \, i_{100} \, A$$

$$Q_{100} = 0.9 \times 7.36 \times 0.293$$

Q_{100} = <u>1.94 cfs</u>, runoff from Area III

Orifice equation:

$$Q = C_c \, A_o \sqrt{2gH}$$

$$C_c = 0.82$$

$$A_o = \frac{Q}{0.82 \sqrt{2gH}}$$

$$A_o = \frac{1.94}{0.82 \sqrt{32.2}}$$

$$A_o = 0.417 \text{ sq. ft.}$$

Width of Opening $= \frac{A_o}{0.5 \text{ ft.}} = 0.834$ ft.

Use width = <u>10 inches</u>

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 26, 1982

Dick Bryant
Flatow Moor Bryant & Associates
5608 Zuni S.E.
P. O. Box 8266
Albuquerque, New Mexico 87108

RFF: DEL NORTE BAPTIST CHURCH (FILE NO. G18-D10)

Dear Mr. Bryant:

The master drainage plan submitted for the referenced site is conceptually approved.

Phase 1 is acceptable as is for construction plans. However, Phase 2 will require the submittal of a drainage plan supporting the approved drainage scheme and sufficiently detailed for construction.

If you have any questions regarding the above, please feel free to call me at 766-7644.

Sincerely,

Fred J. Aguirre, P.E.
Civil Engineer/Hydrology

FJA/el

cc: Drainage File
Reading File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 15, 1982

Dick Bryant
Flatow Moore Bryant & Associates
5608 Zuni SE
P. O. Box 8266
Albuquerque, New Mexico 87108

REF: DEL NORTE BAPTIST CHURCH (FILE NO. G18-D101

Dear Mr. Bryant:

The following are my comments for the referenced site, please address the comments and resubmit the plan for review.

Note: The numbers preceeding the comments below correspond to a Drainage Plan Checklist located in the Development Process Manual, Section 7, Pages 106 - 109.

9. Watershed Area - delineation of off-site contributing watersheds on City of Albuquerque Ortho-Topo Area Maps at scale 1" = 200' or 1" = 500'.
10. Storm Flows - quantification of off-site rate of flow caused by contributing watersheds for the :
    B. 100 year frequency storm.
11. Flow Depth and Velocity
    C. Locations indicated for A and B above. (Location where offsite flows enter site)
13. Proposed Treatment - adequate treatment of off-site flows including:
    A. Definition of required drainage facilities. (The redirection and concentration of off-site flows must obtain the concurrence of the property owner(s) conveying such flows, otherwise the existing flow pattern entering the site must remain the same.)
17. Proposed Treatment - adequate treatment of on-site flows including:
    A. Definition of required drainage facilities.
        1. Pond volume calculations including routing if applicable.
        2. Positive discharge of pond with required rate rate and outlet calculations. (The allowable discharge rate for the site is the Q5 undeveloped. Also, why are you analyzing the rectangular trench with a pipe flow equation?)
24. Proposed Conditions:
    P. Proposed construction of private storm drain improvements within the City's rights-of-way. (The proposed trench drains must be per City standards.)

Also attached is Sheet C-2 with some typographical error indicated in red.

If you have any questions, please feel free to call me at 766-7644.

Sincerely,

Fred J. Aguirre, PE
Civil Engineer/Hydrology

FJA/el

Attachment

cc: Drainage File
Reading File