STORMWATER DRAINAGE REPORT

FOR THE

SOUTH SENECA - MIDLAND VALLEY AREA
VOL. II
LOWER BROADWAY - BIG SLOUGH AREAS

FOR

THE CITY OF WICHITA AND SEDGWICK COUNTY

VAN DOREN - HAZARD - STALLINGS

MAY 1984

Job No. 82 - 227 - AO - WO

VII. ANALYSIS OF SELECTED ALTERNATE

A. GENERAL: As previously discussed, two major alternates were analyzed. The alternate making use of pond storage with outlets to both the Big Slough and the Wichita-Valley Center Floodway was chosen for further in-depth review. All desired revisions to the preliminary analysis were included to insure that the most current information was considered.

A specific design storm (100 yr - 6 hr) has been utilized as the basis for preliminary system design. It is believed that this level of storm design is prudent and economically achievable without excessive expenditures.

The design storm rainfall of 5.9 inches in a six hour period is very realistic as was indicated by an intense storm that struck the western portions of the City of Wichita on July 3 and 4, 1983. This storm produced rainfall of 3.86-5.56 inches in a five hour and fifteen minute period, causing severe disruption and widespread temporary flooding in several areas with systems inadequate to handle this size of storm. The distribution of rainfall over time indicated a double peak to the storm, but the overall rainfall volume and timing correlated reasonably well with the design storm for the proposed Seneca system.

This storm indicates that the City of Wichita and Sedgwick County have made a wise choice with respect to development of a system to serve the study area. It should be realized, however, that storms of a greater magnitude could cause varying degrees of disruption even within the proposed system. However, this occurrence would have an extremely low frequency.

The general flow pattern of the proposed system envisions a diverse mixture of pipe and channel flow to several outlet points. Numerous individual drainage areas will outlet via direct pipe systems to the Big Slough. These areas include; S-8, S-9, S-10(N), S-11(N), S-12, S-14, S-15, S-16, S-17, S-18, and S-19. A portion of area S-1 will outlet via pipe and a portion via channel (L/M). Area S-10(S) will outlet to the Big Slough with either a direct pipe or in combination with a channel (T/C) serving portions of area S-12. This alternate has been discussed later in

the section considering estimated costs. Both routes have been shown on Appendix A maps for illustration.

Areas S-2, S-3, S-4. S-5, S-6, S-7, S-11(S), and S-13 will outlet to the Big Slough via an existing channel along the north right of way of 55th Street. Areas S-13 and S-7 will be routed through detention ponds 7 and 8 prior to discharge to channel reach N/O. This will allow reduction of potentially high peak flows and reduce the overall impact on the Big Slough.

Direct discharge to the Wichita-Valley Center Floodway was considered for areas LB-12, LB-13, and LB-14. Area LB-13 (City of Haysville) has not been analyzed in depth. Present discharge is through an existing outlet (3 @ 60"). Future improvements along Broadway (LB-14) will include a direct outlet to the Floodway. Area LB-12 will be able to use the existing outlet (1 @ 36") whereas area LB-11 will be shaped to drain into pond #9. All other Lower Broadway areas will drain to the three major channel reaches K/D, A/D, and G/D. From point D, all flow will be routed through pond #9 with final discharge to the Floodway. Pond #9 will act to reduce peak discharges and allow for a reasonable sizing of outlet facilities.

B. DRAINAGE AREA DATA AND CHARACTERISTICS: Individual subdrainage areas were established within the Lower Broadway and Big Slough drainage areas. Table 5 provides a summary of the individual subareas and their assumed characteristics. All subareas are shown on the map exhibit (Appendix A).

Land use was estimated by inspection and assumption of future growth patterns. These assumptions included existing activity as well as indicated zoning. The largest growth component assumed through the area was residential. Additional commercial growth was assumed in the areas shown on the map exhibits.

Through the combination of land use and estimated predominant soil type, an SCS "CN" number was selected to generally model the subarea in question. The predominately residential areas ranged between 70-80 while the mixed residential/commercial areas ranged between 80-90 with some areas in excess of 90.

TABLE 5
SUBDRAINAGE AREA DATA
LOWER BROADWAY BIG SLOUGH DRAINAGE AREA
MAJOR STORMWATER SYSTEM (100 Yr - 6 Hr , AMC II)

Area Designation	Land Use(Acres)* Residential	Commercial	Predominate Soil Group	CN (AMC II)	Area Sq.Miles	Design Storm Rainfall/Runoff Inches *	Time of Concentration Hr.	Lag Time Hrs
LB-1	99	-	B	72	4.15	5.9/2.95	0.47	0.40
LB-2	58	-	B	72	0.09	5.9/2.95	0.47	0.28
LB-3	31	-	B	75	0.05	5.9/3.24	0.46	0.29
LB-4	78	-	B	75	0.10	5.9/3.24	0.45	0.27
LB-5	45	-	B	75	0.07	5.9/3.24	0.47	0.28
LB-6	45	-	B	75	0.07	5.9/3.24	0.48	0.29
LB-7	58	-	B	75	0.09	5.9/3.24	0.47	0.28
LB-8	38	-	B	72	0.06	5.9/2.95	0.43	0.11
LB-9	38	-	B	72	0.06	5.9/2.95	0.52	0.31
LB-10	32	-	B	89	0.06	5.9/4.72	0.37	0.17
LB-11	38	-	B	*	0.08	*	*	*
LB-12	51	-	B	*	0.14	*	*	*
LB-13	54	-	B	*	0.14	*	*	*
LB-14	39	-	B	*	0.06	*	*	*
S-1	71	-	B	*	0.11	*	*	*
S-2	32	-	D	84	0.05	5.9/4.38	0.47	0.23
S-3	38	-	D	84	0.06	5.9/4.38	0.37	0.34
S-4	32	-	B	84	0.05	5.9/4.38	0.47	0.23
S-5	140	-	D	87	0.25	5.9/4.47	0.70	0.41
S-6	-	70	D	95	0.11	5.9/5.40	0.40	0.34
S-7	-	18	B	93	0.04	5.9/5.04	0.43	0.19
S-8	42	113	B	89	0.24	*	*	*
S-9	-	58	C	94	0.09	*	*	*
S-10(N)	34	-	C	85	0.05	*	*	*
S-10(S)	34	35	C	89	0.10	5.9/4.72	0.52	0.21
S-11(N)	-	23	B	95	0.04	*	*	*
S-11(S)	38	-	B	93	0.06	5.9/5.04	0.43	0.20
S-12	-	64	-	*	0.10	*	*	*
S-13	45	-	-	*	0.07	5.9/3.95	0.51	0.31
S-14	111	-	-	*	0.17	*	*	*
S-15	-	32	-	*	0.05	*	*	*
S-16	89	14	-	*	0.16	*	*	*
S-17	131	-	-	*	0.19	*	*	*
S-18	14	24	-	*	0.04	*	*	*
S-19	38	-	-	*	0.06	*	*	*

* Hydrograph not calculated at this time.

The design storm rainfall was applied and direct runoff calculated for each subarea (see hydrograph example - Section IV). Times of concentration were calculated for existing developed subareas. Undeveloped subarea time of concentration calculations assumed patterns of development and future flow routing of stormwater flows through streets, pipe, and channel systems. The lag time has been defined as approximately 0.6 T_c.

The above characteristics were combined with the hydrologic equations in Section IV to produce runoff hydrographs for selected subareas. The subareas were added and channel routed as appropriate until the floodway levee or Big Slough outlets were reached. Reservoir routing techniques were used to move the flood hydrograph through the detention/retention ponds included in the system.

C. STORAGE POND CHARACTERISTICS: The proposed major stormwater system makes use of both existing and new storage pond facilities. The storage areas have been designed to attenuate or reduce the peak stormwater flow as it passes through a given storage pond. This is accomplished by storage of the flood flows and controlled release from the storage pond. The controlled release is accomplished through the use of fixed structures such as pipes, reinforced concrete boxes, and weirs. These structures allow the system to automatically respond to all levels of flood flow as the flood hydrograph passes through the system. Storm events larger than the design storm could cause limited flooding and disruption, however, the system will normally function without long term detrimental impact.

The storage pond configuration used varied between regular and irregular shaped "ponds" and widened "detention" channels or elongated ponds. All storage facilities play a key role in the stormwater system and should be designed and maintained to insure their ready availability in a storm event.

The following storage pond characteristics were utilized in conjunction with flood hydrograph routings:

Pond #7

El.	Storage - AFT	Outflow - CFS
67.0	0	0
68.0	6	0.5
69.0	12	1.0
70.0	18	1.5
71.0	24	5.6
72.0	30	10.5
73.0	36	13.8

Pond #7 Outlet: 1 @ 24" Dia. RCP
n = .013
L = 515 ft.
S =.0010 ft/ft
Entrance W/Headwall - Rounded
FL @ 67.0

Pond #8 (Pepsi Channel)

El.	Storage - AFT	Outflow - CFS
66.00	0	0
67.00	3.3	0.2
68.00	5.1	0.4
69.00	7.8	0.6
70.00	11.3	0.8
70.63	14.1	1.0
70.68	14.3	2.0
70.78	14.8	3.0
70.89	15.2	4.0
71.05	15.9	7.0
71.24	16.7	26.0
71.46	17.7	59.0
71.72	18.8	109.0
72.02	20.1	180.0

Pond #8 Outlet: 1 @ 18" Dia. RCP + 50' Rectangular Weir
n = .013
L = 110 ft.
S =.0080 ft/ft
Entrance W/Headwall - Rounded
FL @ 66.0 (18" dia.) FL @ 71.05 (Weir)

Pond #9 (At Wichita-Valley Center Floodway)

El.	Storage - AFT	Outflow - CFS
52.0	0	0
53.0	14	9
54.0	28	28
55.0	43	57
56.0	58	75
57.0	73	84
58.0	89	104
59.0	106	130
60.0	125	153

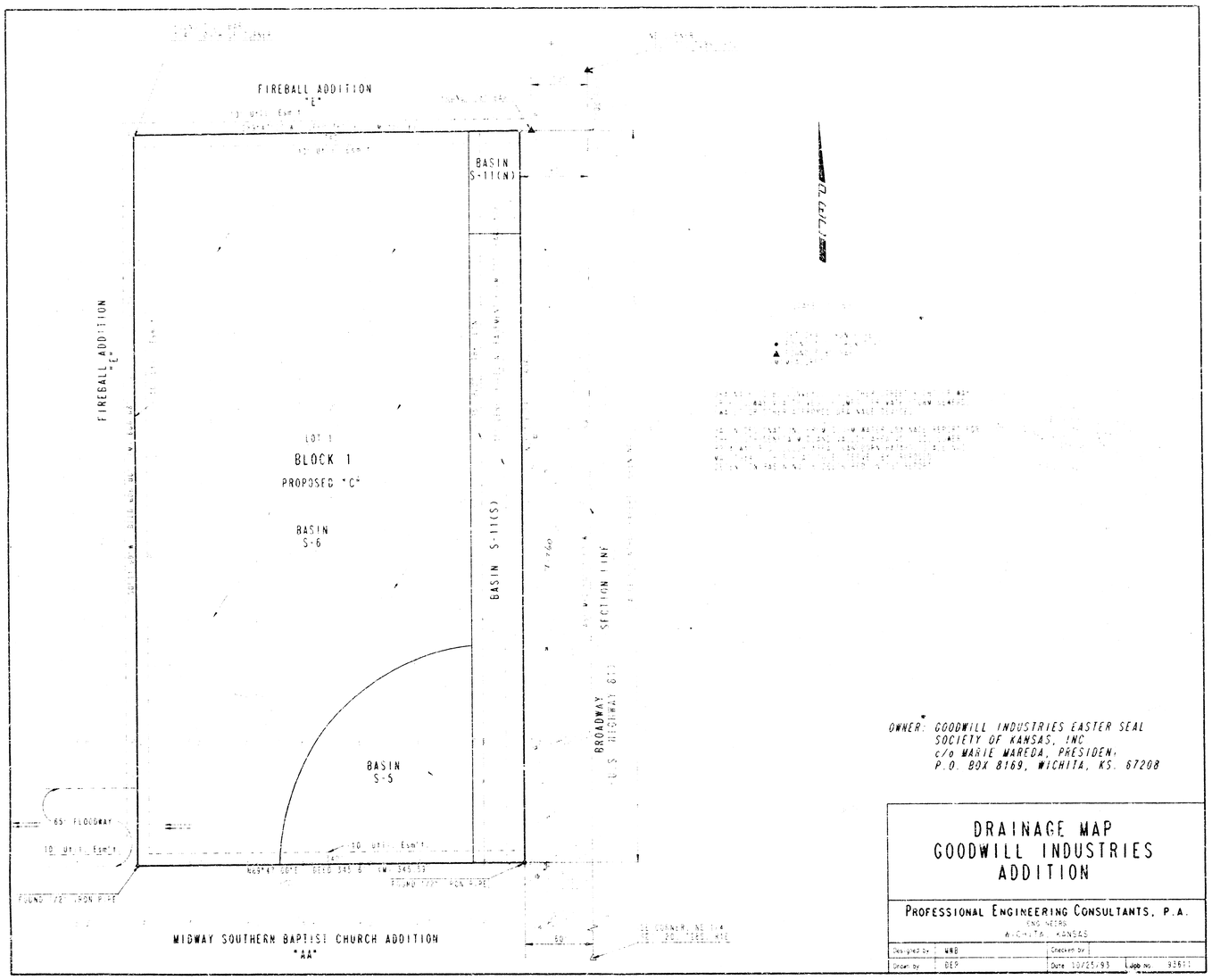
Pond #9 Outlet: 1 @ 60" Dia. RCP
n = .013
L = 800 ft.
S =.0010 ft/ft
Entrance W/Headwall - Rounded
FL @ 52.0

D. CHANNEL AND PIPE CHARACTERISTICS: Preliminary design of all channel pipe and pond reaches was accomplished prior to hydrograph routings. All channel reaches were checked with respect to normal depth (Dn), critical depth (Dc), normal velocity (Vn), and critical velocity (Vc). Due to the erodible nature of the existing soils, peak flow velocities were maintained between 3-4 fps in all channels. Channel flowline elevations were adjusted to insure adequate freeboard at design flows. General channel and pipe criteria listed previously were utilized for hydraulic calculations.

Table 6 lists the major system characteristics. Reach length is an approximate measurement and would vary somewhat depending on actual design.

Table 7 also provides a summary of proposed RCB structures as shown on the map exhibits.

Table 8 indicates an estimate of right-of-way needed to implement the proposed system. These estimates could vary considerably depending on the final design configuration. However, these figures have been used for cost estimating purposes. Available City right of way has been considered where appropriate.



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DRAINAGE MAP
GOODWILL INDUSTRIES ADDITION

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
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