Storm Drainage Calculations

for

Wal-Mart Expansion
University Village Shopping Center
Evansville, Indiana

PRELIMINARY
NOT FOR CONSTRUCTION

Partnership Engineering
Consulting Engineers

W9308In
12-10-93
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SITE DESCRIPTION

An additional 30,000+/-square feet will be added to the west side, the rear (North) and the front (South) of the existing Wal-Mart store at University Village shopping center. This includes an expanded garden center and tire, battery and oil service area. Addition parking will be located South of University Drive and west of the building.

The existing storm drainage system will remain in place. Elevation adjustments will be made to the grate inlets in the front parking area. New inlets will be installed for the proposed parking area South of University drive. These inlets will connect to the existing pipes along University drive. – where do they discharge?

Drainage to detention area in the Northwest corner will be unchanged.

Additional drainage from the expansion area will be routed to the existing detention area in the Northeast corner of the site near Rosenburger Ave.

The expansion of the Wal-mart store was provided for in the original design. Calculations will show that the existing detention area is of adequate size for this development. The detention area has a capacity of 51,600 cu. ft. with a 12" discharge pipe and a concrete spillway. The discharge is to a creek along the Northern property line and flows to the east.

OBJECTIVES

Runoff, detention volume and peak discharge will be calculated for pre-expansion conditions. The drainage calculation received from the City do not reflect the as built conditions.

Runoff, detention volume and peak discharge will be calculated for post-expansion conditions.

Route the detention area to insure adequate storage volume and discharge structure.

Compare results with pre-expansion conditions.

Recommend any design changes if required.

METHODS

Runoff rates will be determined using the "Rational Method" (Q=c*i*a)

A 25 yr. return period will be used for design.

Runoff Coefficients:	Impervious areas	c=0.9
	Pervious areas	c=0.25
	Future development	c=0.70

Pond routing will be determined graphically using the Rational Method Hydrographs.

CALCULATIONS

PRE-EXPANSION

		a	c*a
Drainage areas	Impervious	5.7 ac.	5.41
	Pervious	2.4 ac.	0.55
	Future Development	1.65 ac.	1.15
		9.75 ac.	7.11

Time of Concentration = 10 min.

Rainfall Intensity i = 7.13 in/hr. (25yr. 10min.)

Runoff Q=7.13 * 7.11 = 50.7 cfs

Required Storage Volume 29,040 cu. ft. (Ref. Hydrograph pg. 3)
Peak discharge 8.5 c.f.s. (Ref. Hydrograph pg. 3)

WHY DIFFERENT ?

POST-EXPANSION

		a	c*a
Drainage areas	Impervious	7.7 ac.	7.31
	Pervious	0.4 ac.	0.10
	Future Development	1.65 ac.	1.15
		9.75 ac.	8.56

INCREASE IMPERVIOUS = 2 AC

Time of Concentration = 10 min.

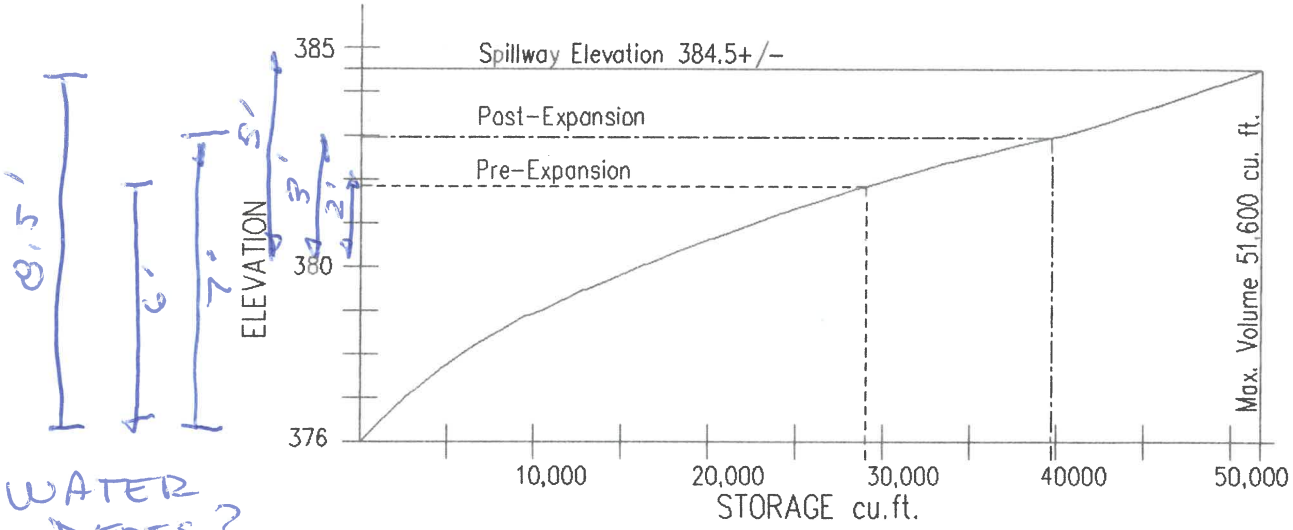
Rainfall Intensity i = 6.19 in/hr. (25yr. 10min.)

Runoff Q=7.13 * 8.56 =61.0 cfs

DIDN'T USE IT ANY WAY ?

Required Storage Volume 39,400 cu. ft. (Ref. Hydrograph pg. 3)
Peak discharge 9.0 c.f.s. (Ref. Hydrograph pg. 3)

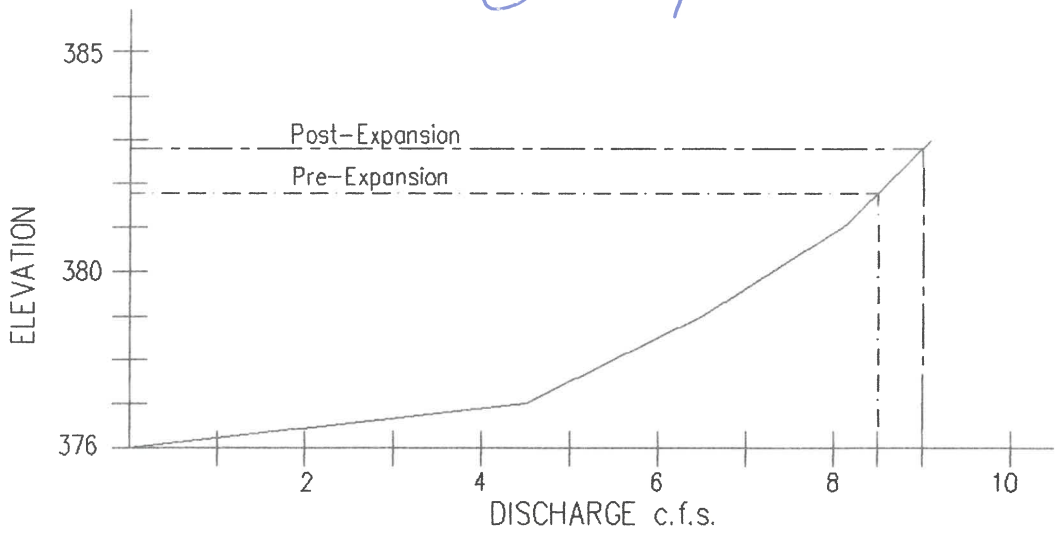
Future Development Refers to Outlot 4



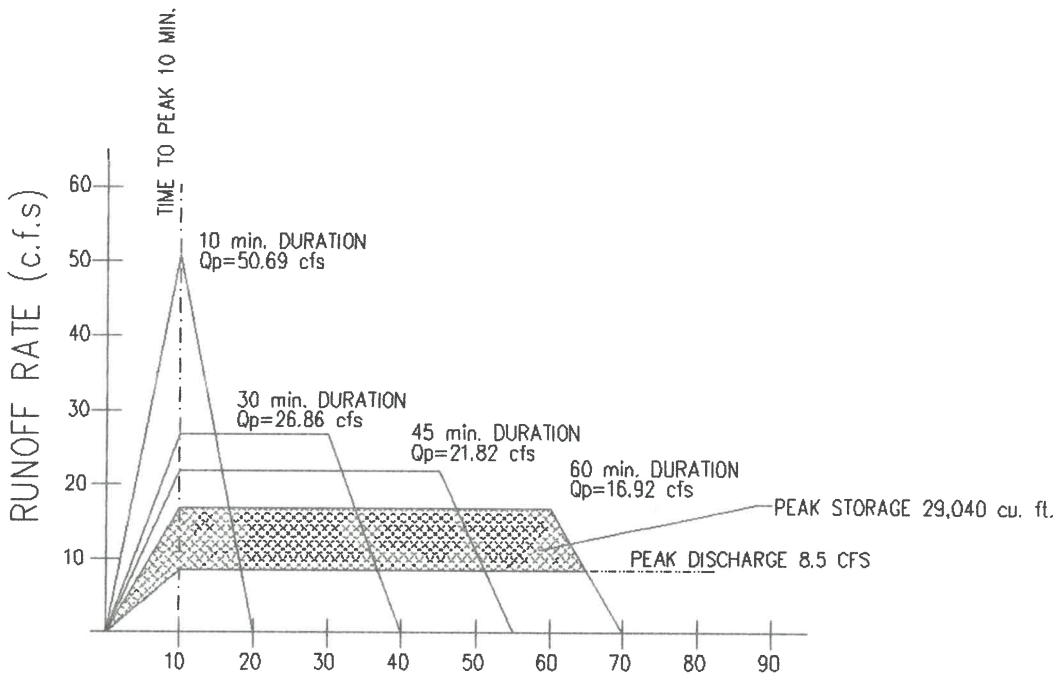
STAGE-STORAGE CURVE

(1) IS POND BOTTOM 376 or 380

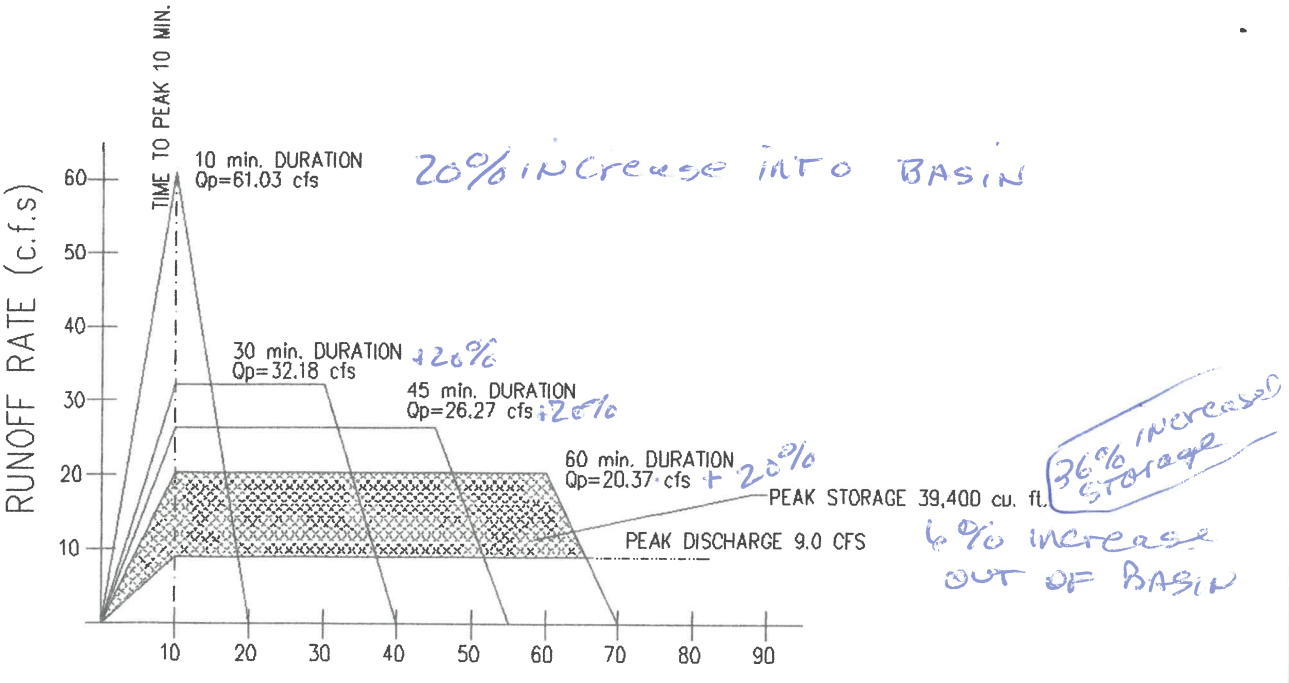
(2) IS pond Bottom "Dry"



STAGE-DISCHARGE CURVE



Pre-Expansion Hydrograph



Post-Expansion Hydrograph

CONCLUSION

The discharge hydrographs show that the existing detention area has adequate storage volume for a 25 yr. design storm.

The available storage volume is 51,600 at Elevation 384.5+/-. The discharge structure for the pond consists of a 12" pipe and a concrete spillway.

36% increase

The post-expansion hydrograph shows a required storage volume of 39,400 cu. ft. and peak discharge of 9.0 c.f.s. ← 6% increase

The pre-expansion hydrograph shows a storage volume of 29,040 and peak discharge of 8.5 c.f.s

Both hydrographs include runoff from the future development of Outlot 4.

The capacity of the existing detention facility is sufficient for the proposed expansion. The existing outlet structure and pond configuration will be unchanged during expansion.

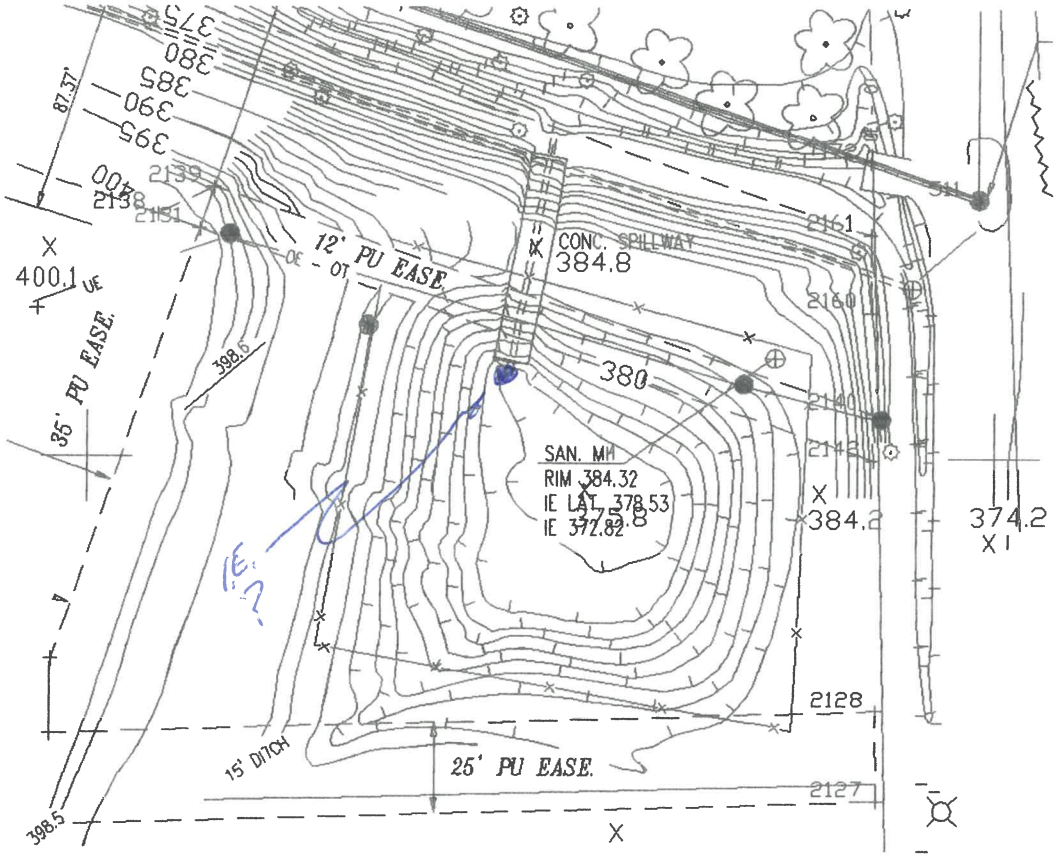
The increased discharge will only be 0.5 cfs. due to the additional head above the discharge pipe. Since the pond was designed for a greater capacity than is used at present the increased discharge should be allowable. The discharge structure allows the detention area to be drained in approximately 1.5 hrs. therefore there will not be a problem from repeated rainfall events. The concrete spillway will allow for pond over topping during storm which exceed the design criteria without damage to the pond.

The increase from 8.5 cfs. to 9.0 cfs. peak discharge will not adversely affect the down stream storm structures or property. ← IF IT WERE PERCEIVE TO, INSTALL orifice plate

.5 cfs × 10 × 60 = 300 cu ft more @ 10 min

RAINFALL DATA INTENSITIES
EVANSVILLE IN
Generated from NWS Hydro-35 (1977) and WB TP-40 (1961)

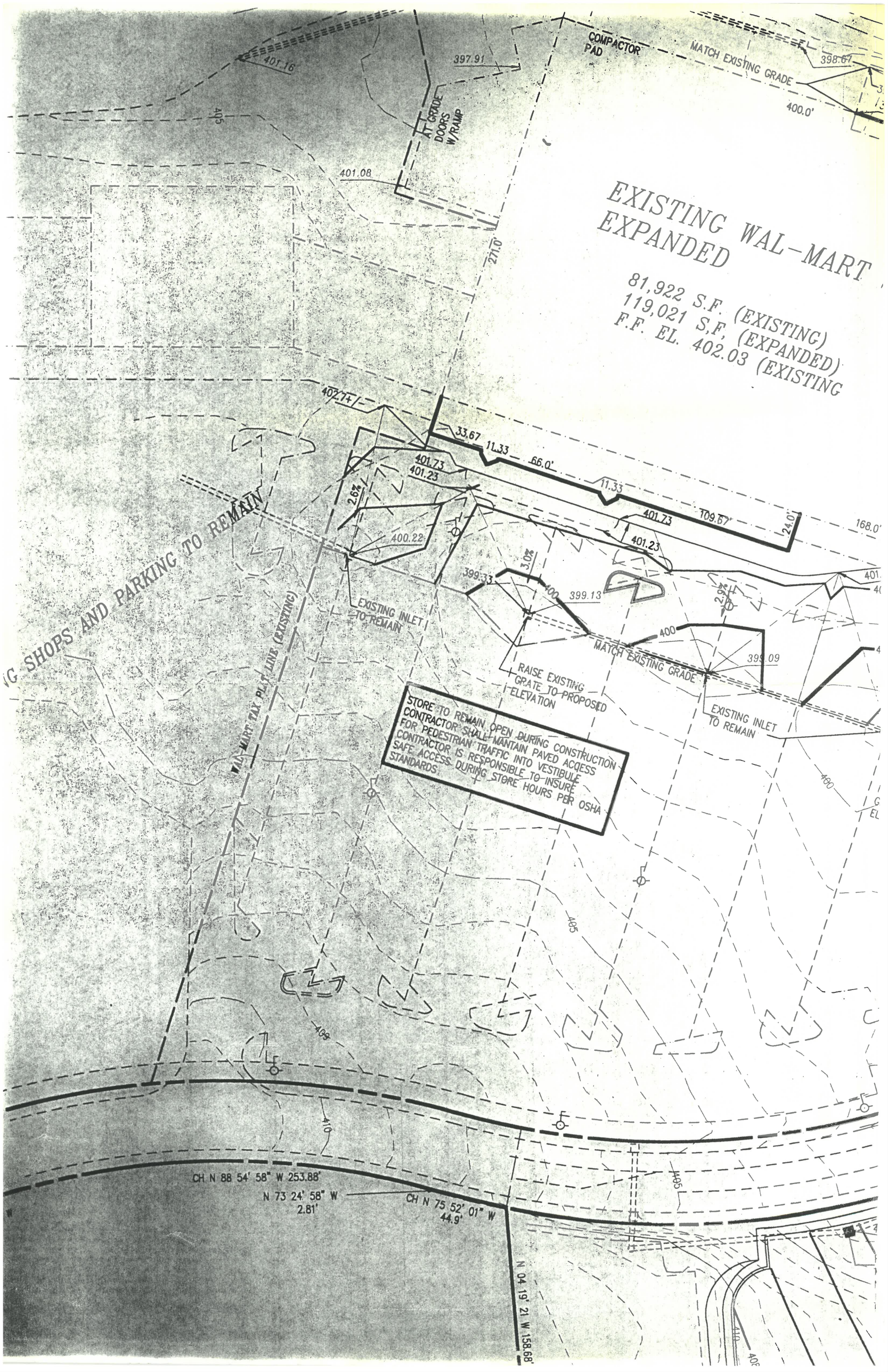
TIME/ PERIOD	Year 2	Year 5	Year 10	Year 25	Year 50	Year 100
5 min.	5.52	6.46	7.16	8.20	9.02	9.84
6 min.	5.36	6.28	6.96	7.99	8.79	9.59
7 min.	5.19	6.10	6.77	7.77	8.56	9.34
8 min.	5.03	5.92	6.58	7.56	8.33	9.09
9 min.	4.86	5.74	6.38	7.34	8.09	8.84
10 min.	4.70	5.56	6.19	7.13	7.86	8.59
11 min.	4.46	5.30	5.91	6.82	7.53	8.23
12 min.	4.23	5.04	5.63	6.51	7.19	7.88
13 min.	3.99	4.78	5.36	6.20	6.86	7.52
14 min.	3.76	4.52	5.08	5.89	6.53	7.16
15 min.	3.52	4.26	4.80	5.58	6.19	6.80
20 min.	3.14	3.80	4.28	4.97	5.52	6.06
25 min.	2.75	3.33	3.75	4.36	4.84	5.32
30 min.	2.37	2.87	3.23	3.76	4.17	4.58
40 min.	2.08	2.52	2.83	3.30	3.66	4.02
50 min.	1.79	2.17	2.44	2.84	3.15	3.46
60 min.	1.50	1.82	2.05	2.38	2.64	2.90
2 hr	0.95	1.14	1.28	1.48	1.64	1.80
3 hr	0.70	0.84	0.95	1.10	1.22	1.33
4 hr	0.60	0.73	0.82	0.95	1.05	1.16
5 hr	0.51	0.61	0.69	0.80	0.89	0.98
6 hr	0.41	0.50	0.56	0.65	0.73	0.80
8 hr	0.35	0.43	0.48	0.57	0.63	0.69
10 hr	0.29	0.36	0.41	0.48	0.53	0.58
12 hr	0.23	0.29	0.33	0.39	0.43	0.48
18 hr	0.19	0.23	0.26	0.31	0.34	0.38
24 hr	0.14	0.17	0.19	0.22	0.25	0.28



AVAILABLE STORAGE VOLUME 51,600 cu. ft.

EXISTING DENTION AREA
N.T.S.

See PG 4


EXISTING WAL-MART
EXPANDED
81,922 S.F. (EXISTING)
119,021 S.F. (EXPANDED)
F.F. EL. 402.03 (EXISTING
G SHOPS AND PARKING TO REMAIN
WAL-MART TAX PLAT LINE (EXISTING)
COMPACTOR PAD
MATCH EXISTING GRADE
AT GRADE DOORS W/RAMP
EXISTING INLET TO REMAIN
RAISE EXISTING GRATE TO PROPOSED ELEVATION
STORE TO REMAIN OPEN DURING CONSTRUCTION
CONTRACTOR SHALL MAINTAIN PAVED ACCESS FOR PEDESTRIAN TRAFFIC INTO VESTIBULE
CONTRACTOR IS RESPONSIBLE TO INSURE SAFE ACCESS DURING STORE HOURS PER OSHA STANDARDS
CH N 88 54' 58" W 253.88'
N 73 24' 58" W 2.81'
CH N 75 52' 01" W 44.9'
N 04 19' 21 W 158.68'
401.16
397.91
398.67
400.0'
401.08
271.0'
402.74
33.67
11.33
66.0'
401.73
401.23
2.6%
400.22
109.67'
24.0'
168.0'
3.0%
399.33
399.13
399.09
2.9%
400
405
410