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DRAFT
MEMORANDUM

TO: Tera Guetter
Pelican River Watershed District

FROM: Todd Shoemaker, PE

DATE: January 11, 2007

SUBJECT: Downtown Detroit Lakes water quality treatment assessment

CC:

The realignment of US Hwy 10 in Detroit Lakes will allow for new development on a portion of the old highway alignment within the downtown area. Stormwater management (specifically water quality treatment) within this area is of great importance to the Pelican River Watershed District and the City of Detroit Lakes. Therefore, the PRWD requested Wenck staff to assess the water quality treatment efficiency of the previously constructed PRWD ponds and the proposed TH 10 Phase 3 ponds. The result of the assessment will indicate whether additional treatment is required for properties that develop within this area.

Future redevelopment is expected within subwatersheds "West Central 4," "Substation 1," "Central Market," and "Roosevelt 3" as shown on Figure 1. (MnDOT Figure 3-8 from their November, 2006 TH 10 Phase 3 permit application to the PRWD.)

PRWD Ponds

Four ponds were designed for the PRWD by Larson-Peterson in the mid-1990's and constructed later in the decade:

- Pond 2 at the corner of Grant St and Andrews Ave
- Pond 3 near the middle school
- Pond 5 south of 8th St adjacent to the Pelican River
- Pond 6 south of Pond 5 (now called the Industrial Park Pond, included in the TH 10 Phase 3 discussion below)

Design criteria and expected performance of each pond is not known; however, PRWD staff provided the following exhibits for Wenck to review:

1. "Drainage Areas and Proposed Storm Water Detention Ponds," by Larson-Peterson & Associates, Inc., dated April 1999.
2. City storm sewer plan, by unknown, not dated.
3. "Storm Drainage Regions," by unknown, not dated.

4. "Construction Plans for Stormwater Detention Basin #3 and #5," by Larson-Peterson, dated 6/23/99.

Using information from the above exhibits, Wenck staff built a PondNet model (Figure 2) to evaluate the treatment efficiency of Ponds 2, 3 and 5. (Information was not available for Pond 2, so a surface area of 0.5 ac and mean depth of 1 foot were assumed based on the pond outline indicated on the City storm sewer plan and discussion with PRWD staff.) Drainage areas and runoff coefficients were determined based on Figure 3 (Exhibit 1 listed above). The Pond 3 and 5 surface areas and volumes were determined from the construction plans, and total phosphorus runoff concentrations were obtained from the *Minnesota Stormwater Manual.*

The PondNet model predicts a total removal percent of approximately 27% for the three-pond system. However, given assumptions made by Wenck staff and lack of complete information used in creating this model, the total removal efficiency can be assumed in the middle 20% to low 30% range.

Assuming a best-case scenario, even the low 30% total removal efficiency of the system does not satisfy PRWD water quality treatment standards. Therefore, development within the drainage area to these ponds is not exempt from satisfying the PRWD criteria for water quality treatment.

TH 10 Phase 3 Ponds

As part of Phase 3 of the US Highway 10 construction project, MnDOT proposes to construct two new ponds (Substation and Roosevelt) and connect these to the previously constructed Industrial Park Pond (Pond 6 noted above). Initial submittals by MnDOT indicate that this pond system will achieve approximately 54% total phosphorus removal.

It is likely that the excess removal (4%) will be used to "balance" treatment across the MnDOT project to achieve the 50% total phosphorus removal requirement. If that is true (the MnDOT permit has not yet been approved by the PRWD), it is not possible for the excess removal (4%) of the MnDOT ponds to be "traded" to the downtown development area draining to the previously constructed PRWD ponds.

PONDNET 2.1	FLOW AND PHOSPHORUS ROUTING IN POND NETWORKS			
W. Walker March 1989	Press ALT-G for Graphs			
	TITLE-->			
INPUT VARIABLES....	UNITS			
case labels		Pond 2	Pond 3	Pond 5
watershed area	acres	69.50	155.00	56.40
runoff coefficient	-	0.45	0.39	0.80
pond surface area	acres	0.50	1.10	1.90
pond mean depth	feet	1.00	1.70	1.80
upstream pond p load	lbs/yr	0.00	71.61	180.71
upstream pond outflow	ac-ft/yr	0.00	104.25	305.75
OUTPUT VARIABLES.....				
outflow p load	lbs/yr	71.61	180.71	234.48
outflow volume	ac-ft/yr	104.25	305.75	456.15
outflow p conc	ppb	252.73	217.46	189.13
pond removal	%	15.76	17.67	18.30
total removal	%	15.76	19.46	27.26
ASSUMED EXPORT FACTORS.....				
period length	yrs	0.50	0.50	0.50
period precipitation	inches	20.00	20.00	20.00
runoff total p	ppb	300.00	270.00	260.00
runoff ortho p/total p	-	0.30	0.30	0.30
relative decay rate	-	1.00	1.00	1.00
unit runoff	in/yr	18.00	15.60	32.00
unit export	lbs/ac-y	1.22	0.95	1.88
POND WATER BUDGETS.....				
runoff	ac-ft/yr	104.25	201.50	150.40
upstream pond	ac-ft/yr	0.00	104.25	305.75
total inflow	ac-ft/yr	104.25	305.75	456.15
outflow	ac-ft/yr	104.25	305.75	456.15
POND PHOSPHORUS BUDGETS.....				
runoff	lbs/yr	85.01	147.88	106.29
upstream pond	lbs/yr	0.00	71.61	180.71
total inflow	lbs/yr	85.01	219.49	287.00
net sedimentation	lbs/yr	13.40	38.78	52.52
outflow	lbs/yr	71.61	180.71	234.48
HYDRAULIC PARAMETERS.....				
pond volume	acre-ft	0.50	1.87	3.42
vlawmo pond volume	acre-ft	6.52	12.59	9.40
relative volume	inches	0.19	0.37	0.91
residence time	years	0.00	0.01	0.01
residence time	days	1.75	2.23	2.74
overflow rate	ft/yr	208.50	277.95	240.08
inflow phos conc	ppb	300.02	264.12	231.49
outflow phos conc	ppb	252.73	217.46	189.13
p reaction rate	-	0.22	0.26	0.27
1-rp	-	0.84	0.82	0.82

Figure 2. PondNet model for Ponds 2, 3 and 5.

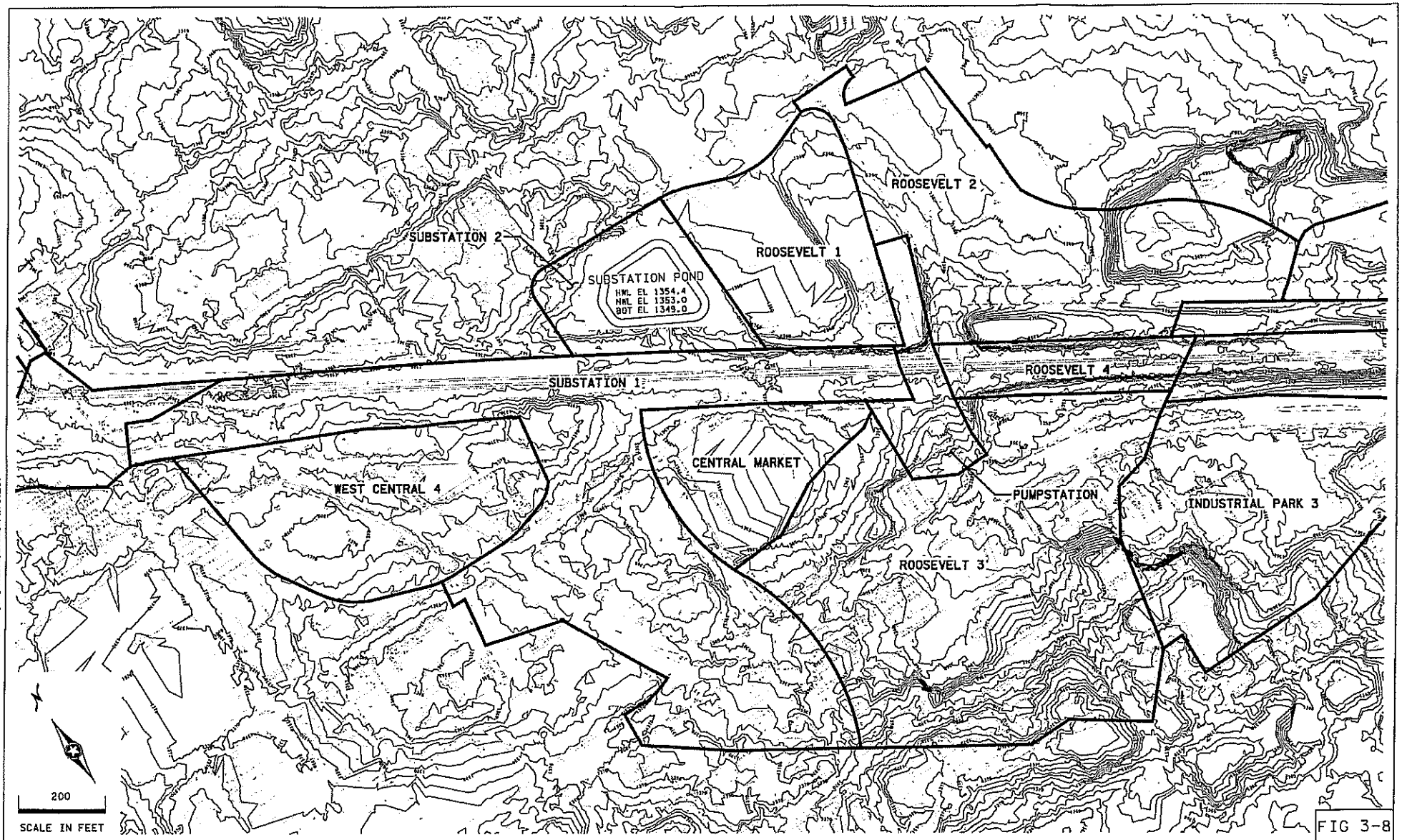


FIG 3-8

NO.	REVISIONS	BY	APP.	DATE

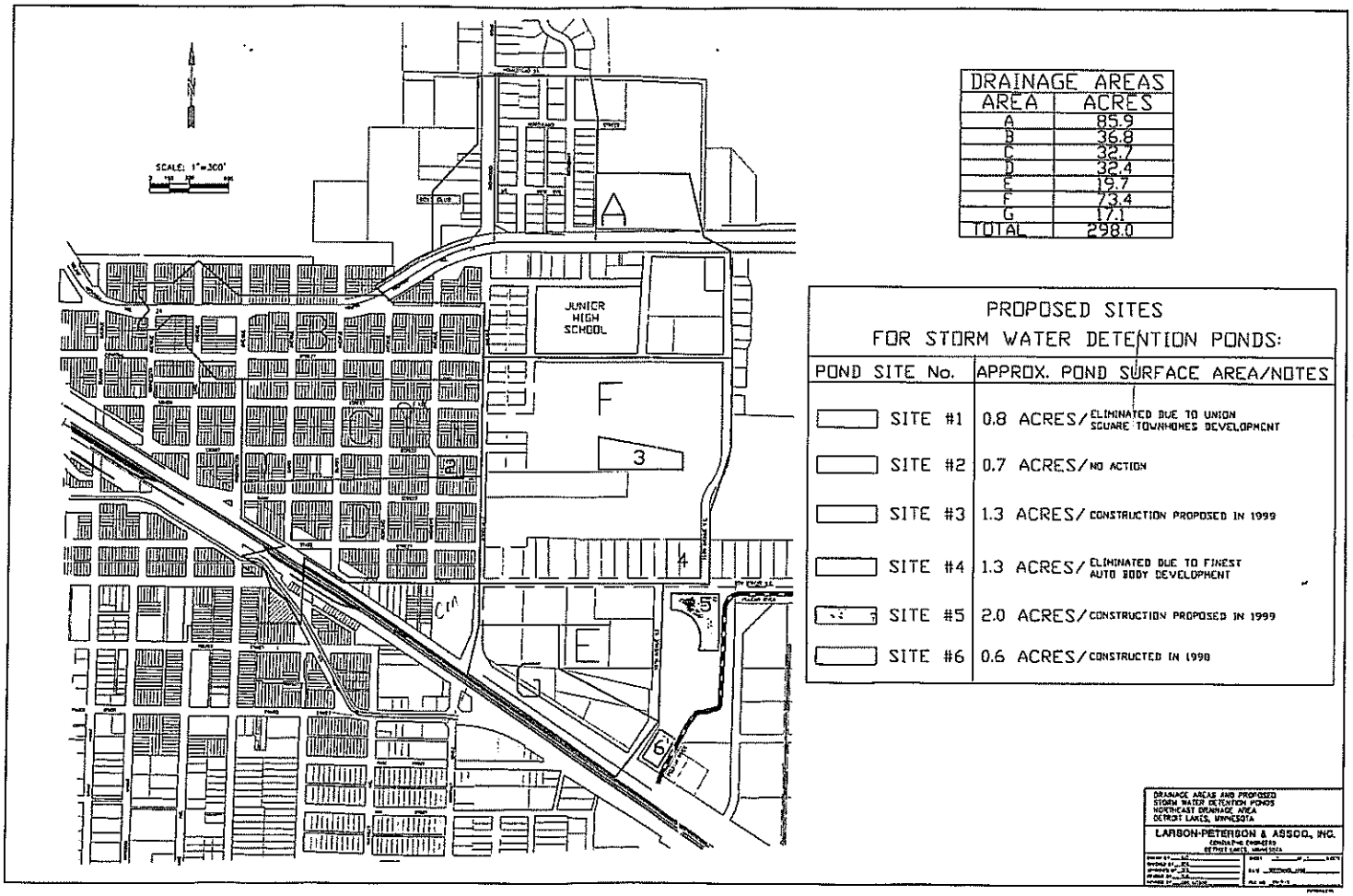
DESIGNED | CHECKED
DRAWN | APPROVED
DATE | JOB NO. 38247

HNTB
7900 International Drive, Suite 600
Minneapolis, Minnesota 55425 (952) 620-4668

S.P. 0301-47
(T.H. 10)

MINNESOTA DEPARTMENT OF TRANSPORTATION
T.H. 10 DETROIT LAKES
PROPOSED DRAINAGE AREAS
SHEET 2 OF 6

SHEET
OF



DRAINAGE AREAS	
AREA	ACRES
A	85.9
B	36.8
C	32.7
D	32.4
E	19.7
F	73.4
G	17.1
TOTAL	298.0

PROPOSED SITES
FOR STORM WATER DETENTION PONDS:

POND SITE No.	APPROX. POND SURFACE AREA/NOTES
SITE #1	0.8 ACRES/ELIMINATED DUE TO UNION SQUARE TOWNHOMES DEVELOPMENT
SITE #2	0.7 ACRES/NO ACTION
SITE #3	1.3 ACRES/CONSTRUCTION PROPOSED IN 1999
SITE #4	1.3 ACRES/ELIMINATED DUE TO FINEST AUTO BODY DEVELOPMENT
SITE #5	2.0 ACRES/CONSTRUCTION PROPOSED IN 1999
SITE #6	0.6 ACRES/CONSTRUCTED IN 1998

DRAINAGE AREAS AND PROPOSED STORM WATER DETENTION PONDS NORTHEAST DRAINAGE AREA DETROIT LAKES, MINNESOTA

LARSON-PETERSON & ASSOC., INC.