APPENDIX D

PUMP TECHNICAL INFORMATION

MORRISON
PUMP COMPANY

September 21, 2007

Cathy Busking
Busking Engineering
627 S. Euclid Avenue
Oak Park, IL 60304

MPC No. BQ-27151

RE: MORRISON BUDGET QUOTE NO. 27151
MWRDGC Effluent Pumps

Dear Cathy,

Morrison Pump Company is pleased to provide this Budget Quotation for Pump Equipment for the MWRDGC Effluent Pumping Project, as per our pump selection emailed to you on September 11, 2007. Pumps are per typical municipal, final effluent pump specifications, and per Hydraulic Institute Standards. Specifications are attached.

Equipment	Total Budget Price
Six (6) Morrison Vertical Pumps Model VPS-54-47-02, with 250 HP @ 325 RPM Vertical Electric Motor Drivers, Motor Control Center with VFDs, each pump providing 78,000 GPM @ 7.5 Ft. TDH	**$ 3,500,000.--**

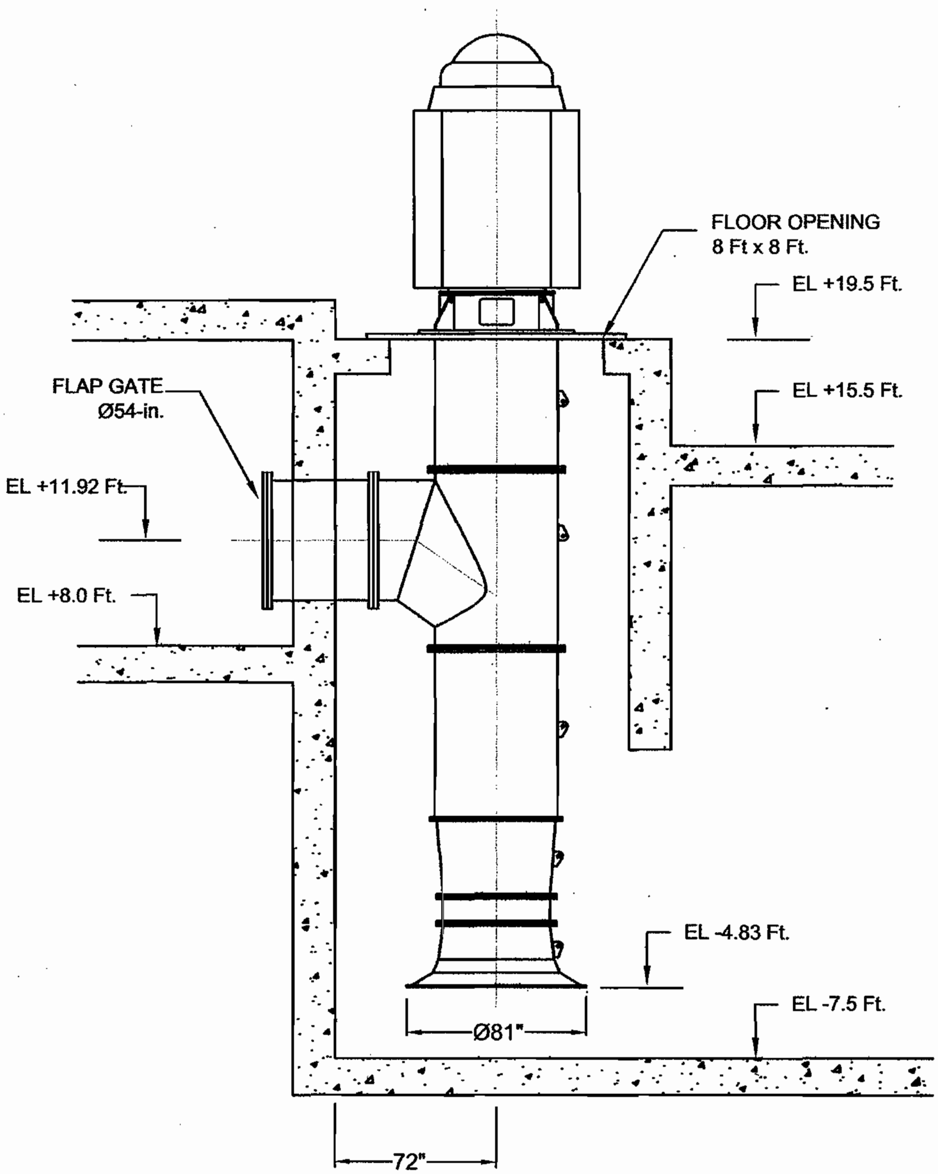
Pricing is to be understood net, delivered to site, without applicable taxes. Included with our equipment are complete technical submittals, factory performance testing, delivery to site, field services for installation & start-up, and one year standard warranty.

Sincerely,

Jorge M. Cortes

2514 Hollywood Blvd. #105, Hollywood, FL 33020
(954) 922-5880 Tel. (954) 922-7729 Fax http://www.morrisonpump.com

GENERAL PUMP LAYOUT



NOTES:

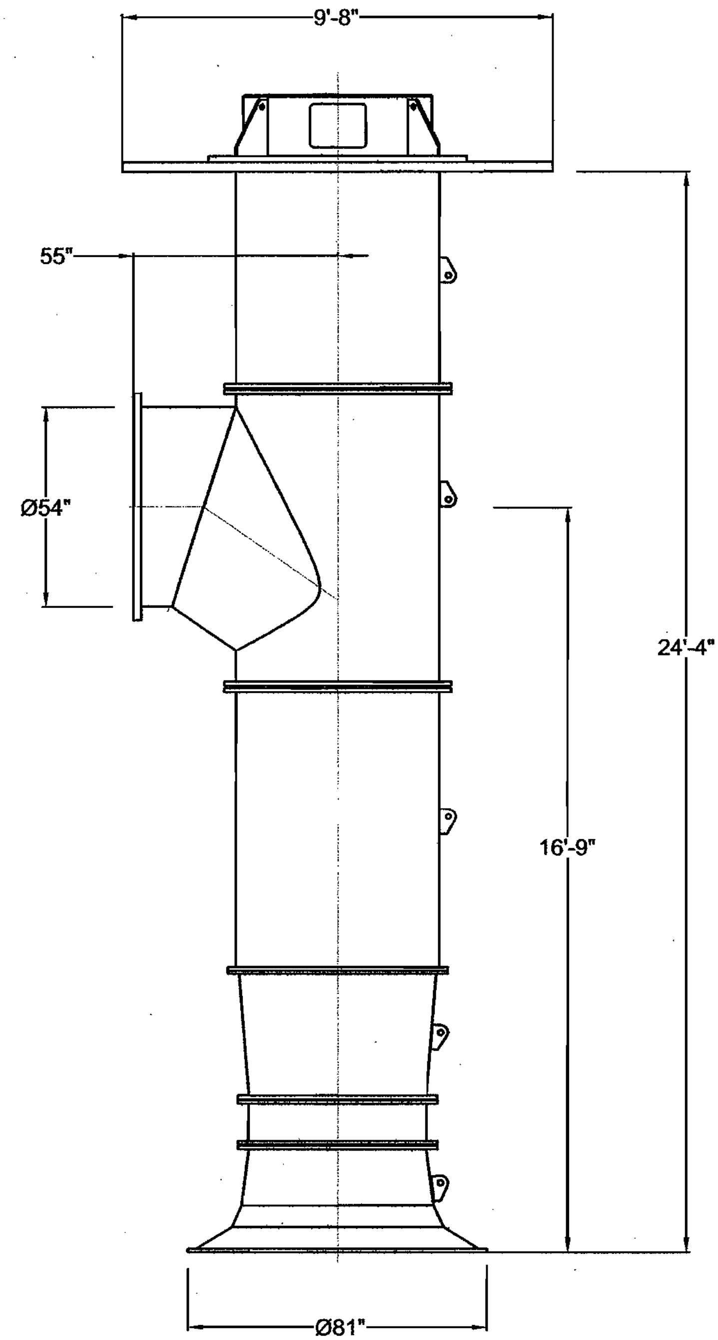
- LAYOUT IS FOR GENERAL REFERENCE ONLY.
- FLOOR OPENING REQUIREMENT = 96" x 96" SQUARE; PUMP BASEPLATE = 116" x 116"
- PUMP DISCHARGE = Ø54-INCHES.
- PUMP SUCITON BELL = Ø81-INCHES.
- ELECTRIC MOTOR = TEFC, VSS, 250 HP @ 325 RPM, 460V/3PH/60HZ

MORRISON PUMP COMPANY

DWG. TITLE: Morrison Pump Model VPS-54-47-02 - Station Layout	DWG NO.: DWG-27151-002
FILE NAME: MWRGC North Side Water Reclamation Plant - CTE Engineering	DATE: 11-SEPT-2007

Electronic Filing - Received, Clerk's Office, October 20, 2008

GENERAL PUMP DIMENSIONS



NOTES:

- DIMENSIONS ARE FOR GENERAL REFERENCE ONLY.
- ESTIMATED PUMP WEIGHT = 20,000 LBS.
- PUMP INCLUDES REMOVABLE (SPLIT) BASEPLATE, 116" X 116" SQUARE

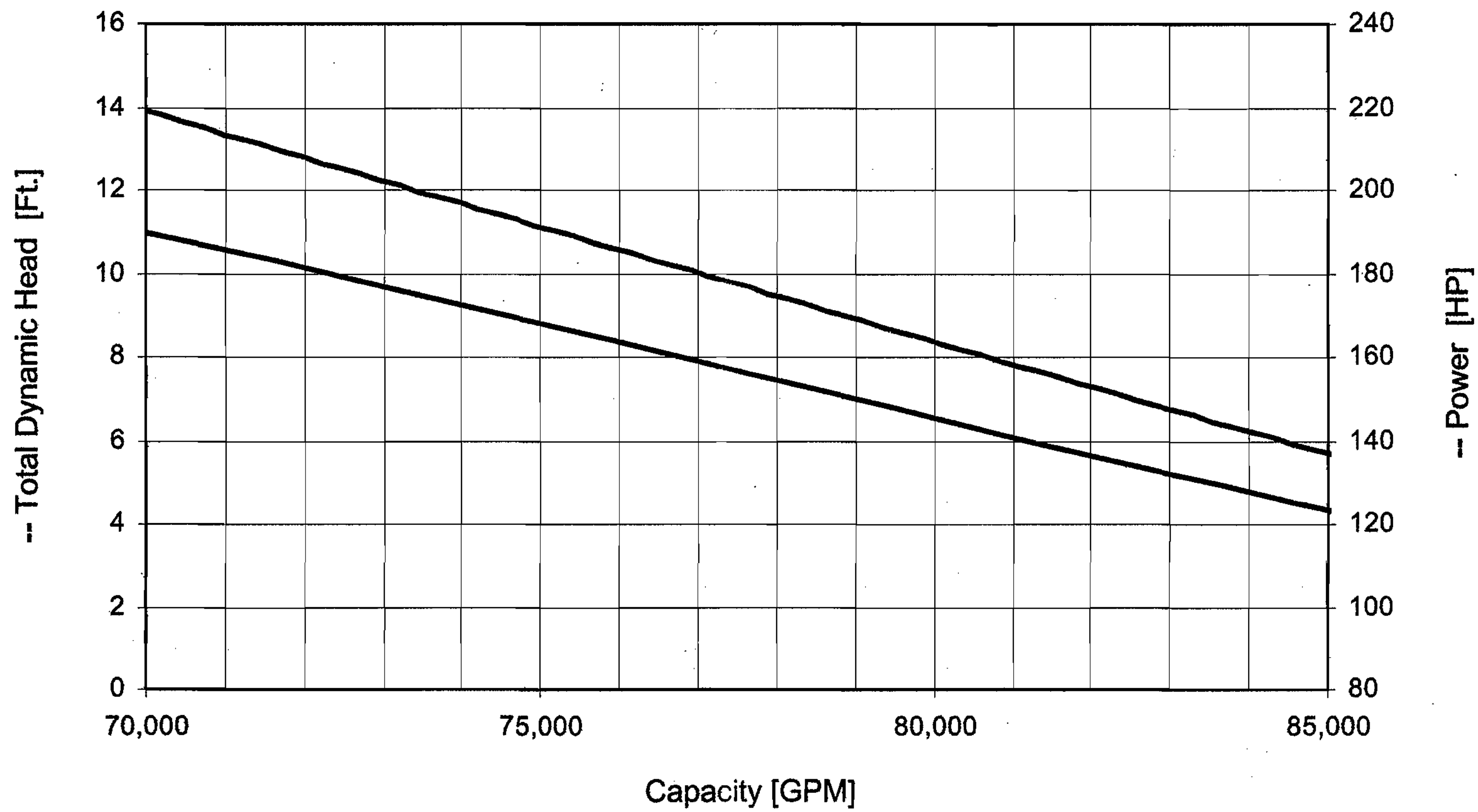
MORRISON PUMP COMPANY

DWG. TITLE: Morrison Pump Model VPS-54-47 General Dimensions	DWG NO.: DWG-27151-001
FILE NAME: MWRGC North Side Water Reclamation Plant - CTE Engineering	DATE: 11-SEPT-2007

Pump Performance

Axial Flow Impeller, Single Stage, High-Efficiency

Project No.: 27151
Project Name: MWRDGC North Side Water Reclamation Plant – CTE Engineering
Date: 11-September-2007



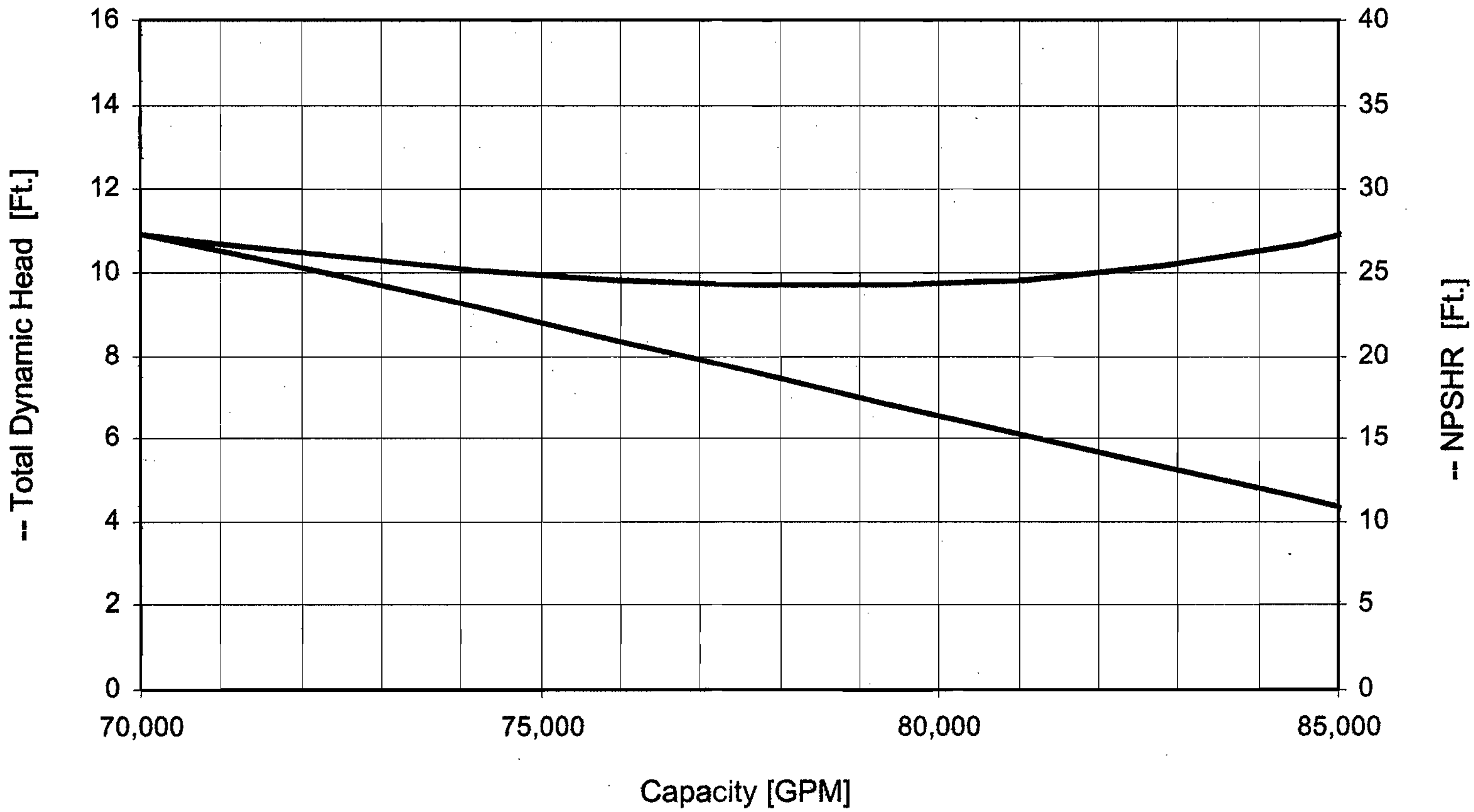
Pump Bowl Model No.: 47-02-CH
Impeller Diameter: 46.9 in. (1190 mm.)
Shaft Speed: 325 RPM

MORRISON PUMP COMPANY

Pump Performance

Axial Flow Impeller, Single Stage, High-Efficiency

Project No.: 27151
Project Name: MWRDGC North Side Water Reclamation Plant – CTE Engineering
Date: 11-September-2007



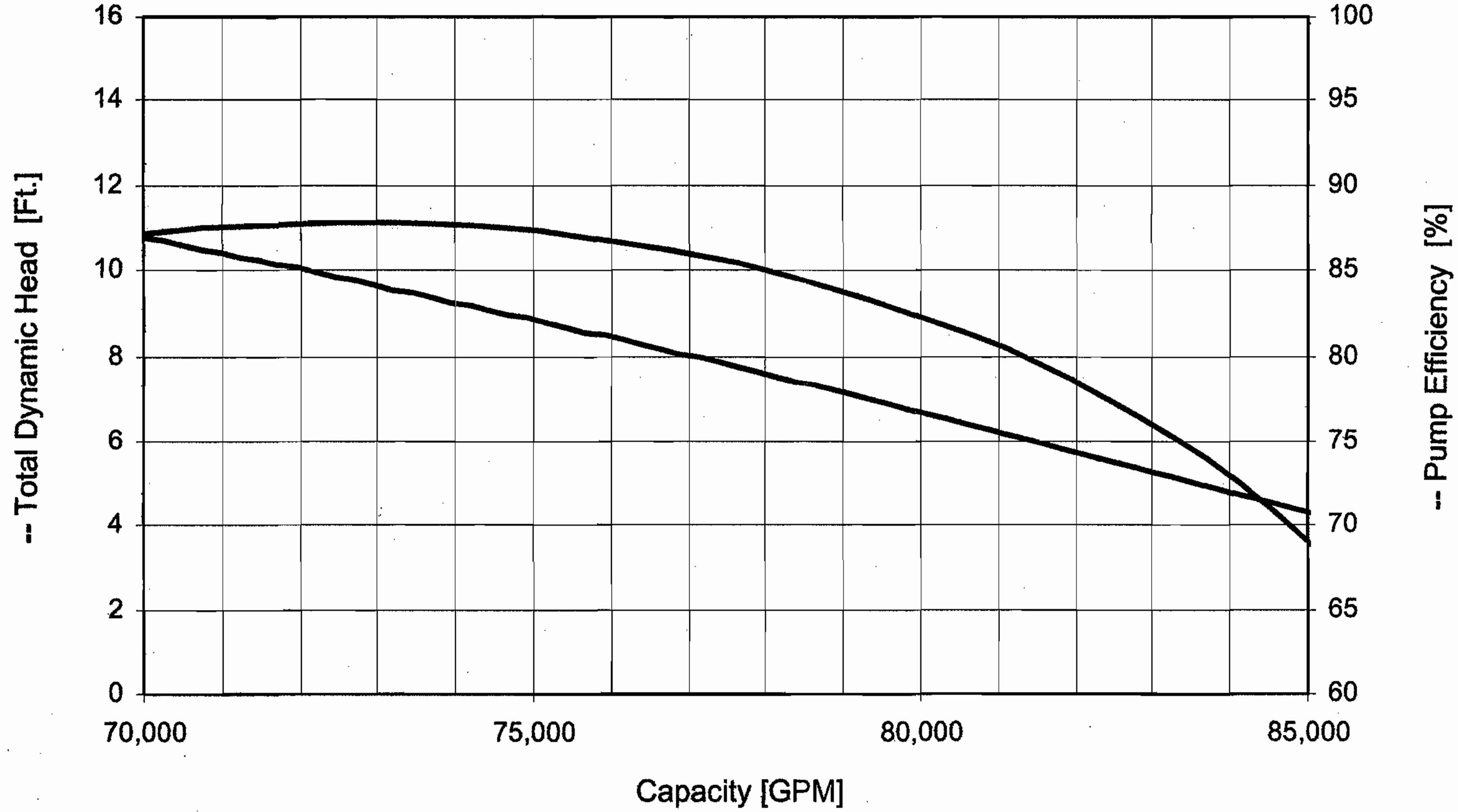
Pump Bowl Model No.: 47-02-CH
Impeller Diameter: 46.9 in. (1190 mm.)
Shaft Speed: 325 RPM

MORRISON PUMP COMPANY

Pump Performance

Axial Flow Impeller, Single Stage, High-Efficiency

Project No.: 27151
Project Name: MWRDGC North Side Water Reclamation Plant – CTE Engineering
Date: 11-September-2007



Pump Bowl Model No.: 47-02-CH
Impeller Diameter: 46.9 in. (1190 mm.)
Shaft Speed: 325 RPM

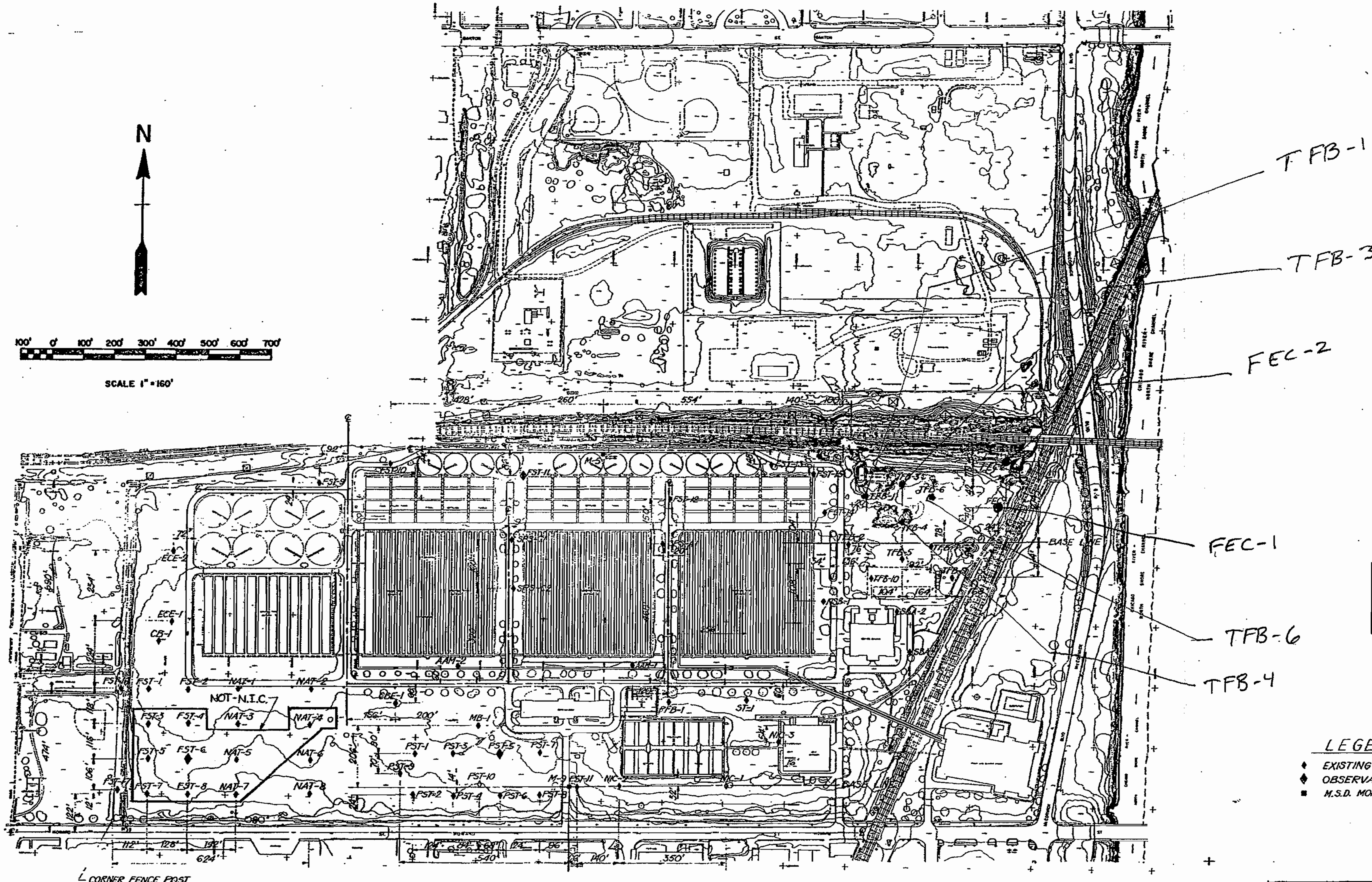
MORRISON PUMP COMPANY

APPENDIX E

HISTORICAL SOIL BORING INFORMATION

File 404

43



OBSERVATION WELLS	
BORING NO.	ELEV. OF ℄ BRASS TIP
FST-11	- 9.00 C.C.D.
PST-5	-12.50 C.C.D.
FST-6	- 9.25 C.C.D.
TFB-4	-12.50 C.C.D.

NOTE: ℄ of Brass Tip 6.5' Below Elevation of Deepest Foundation.

LEGEND

- ♦ EXISTING BOREHOLES
- ♦ OBSERVATION WELLS
- ■ M.S.D. MONUMENT

NOTE - N.I.C. FUTURE WORK NOT IN THIS CONTRACT

REVISIONS		
NO.	DATE	BY
△	5/1/84	MSDGC

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES

BORING LOCATION PLAN

Correct
Approved — Assistant Chief Engineer
Approved — Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn Z.B. | Checked R.W.B. | Reviewed | DATE APR 1986 | SHEET NO 2C-39

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

FEC-1

WESTENHOFF & NOVICK, INC — CONSULTING ENGINEERS
FIELD BORING LOG — Sheet 1 of 2

Project No. 2003 — Project Name & Location: North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-1
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 14.0 ft during drilling; at dry ft after 0 hrs; at 16.92 ft after 326 hrs
Sampler: Type SS; Size ID 1-3/8"; Hammer Wt 140 lb.; Hammer Fall 30"
Surface Elev 22.87 — Date Start 5-26-77 — Date Finish 5-26-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
1-2.5	2	2	4	.5	SS-1		
3.5-5.0	3	3	5	-	SS-2		
6-8.5	6	7	10	-	SS-3		
8.5-10					NR		
11-13.5				4.0	ST-4	30"	20"
13.5-15	5	7	9	3.75	SS-5		
16-18.5				.5	ST-6	30"	25
18.5-20	2	2	2	.5	SS-7		

Soil Identification & Drillers Notes:
- Fill: Dk Gr & Yel-Br Clayey SILT and Yel-Br & Blk SAND, little f-m Gravel; blk cinder noted, Silt layers noted, Gravel (fill) layer noted.
- Very Stiff Yel-Br mottled Gr Silty CLAY, little f-c Sand, trace f-m Gravel; Silt layers noted.
- Medium to Stiff Gr Clayey SILT, little f-c Sand, trace f. Gravel.
- Soft Gr Silty CLAY, little f-c Sand, trace f. Gravel.

Remarks: NR - No Recovery — Boring No. FEC-1

FIELD BORING LOG — Sheet 2 of 2 (FEC-1)

Project No. 2003 — North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-1
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 14.0 ft during drilling; at dry ft after 0 hrs; at 16.92 ft after 326 hrs
Sampler: SS; 1-3/8"; 140 lb.; 30"
Surface Elev 22.87 — Date Start 5-26-77 — Date Finish 5-26-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
21-23.5				.25	ST-8	30"	19"
23.5-25	2	2	3	.25	SS-9		
26-28.5				-	ST-10	30"	20"
28.5-30	4	4	5	.5	SS-11		

Soil Identification & Drillers Notes:
- Medium Gr Silty CLAY, little f-c Sand, trace f. Gravel.
- Gr f-c SAND, little f-m Gravel, little Silt, trace Clay.
- Stiff Gr Silty CLAY, little f-c Sand, trace f. Gravel.
- End of Boring.

Remarks: — Boring No. FEC-1

FEC-2

FIELD BORING LOG — Sheet 1 of 2 (FEC-2)

Project No. 2003 — North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-2
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 20.0 ft during drilling; at dry ft after 0 hrs; at dry ft after 168 hrs
Sampler: SS; 1-3/8"; 140 lb.; 30"
Surface Elev 22.75 — Date Start 6-8-77 — Date Finish 6-8-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
1-2.5	6	7	12	4.5	SS-1		
3.5-5	5	6	8	4.5	SS-2		
6-8.5				2.0	ST-3	30"	12"
8.5-10	3	4	5	1.5	SS-4		
11-13.5				3.5	ST-5	30"	20"
13.5-15	2	3	4	1.1	SS-6		
16-18.5				-	ST-7	30"	11"
18.5-20	7	15	24	-	SS-8		

Soil Identification & Drillers Notes:
- Fill: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f-c Gravel; cinders, roots, wood, and organic material noted, Silt seams and pockets noted, Sand layer at 18'.

Remarks: — Boring No. FEC-2

FIELD BORING LOG — Sheet 2 of 2 (FEC-2)

Project No. 2003 — North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-2
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 20.0 ft during drilling; at dry ft after 0 hrs; at dry ft after 168 hrs
Sampler: SS; 1-3/8"; 140 lb.; 30"
Surface Elev 22.75 — Date Start 6-8-77 — Date Finish 6-8-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
21-23.5				.25	ST-9	30"	30"
23.5-25	2	2	2	.35	SS-10		
26-28.5				.3	ST-11	30"	30"
28.5-30	2	3	4	.75	SS-12		

Soil Identification & Drillers Notes:
- Soft Gr Silty CLAY, little f-c Sand, trace f. Gravel; pink Silty Clay pockets noted, Silt layers noted.
- Medium Gr Silty CLAY, little f-c Sand, trace f. Gravel.
- End of Boring

Remarks: — Boring No. FEC-2

FIELD BORING LOG — Sheet 1 of 2 (FEC-3)

Project No. 2003 — North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-3
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 25.0 ft during drilling; at dry ft after 0 hrs; at 4.0 ft after 168 hrs
Sampler: SS; 1-3/8"; 140 lb.; 30"
Surface Elev 20.54 — Date Start 6-8-77 — Date Finish 6-8-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
1-2.5	4	4	5	4.5	SS-1		
3.5-5.0	3	3	4		NR		
6-8.5				.7	ST-2	36"	12"
8.5-10	2	3	4	2.1	SS-3		
11-13.5				1.0	ST-4	36"	20"
13.5-15	2	3	5	.6	SS-5		
16-18.5				.3	ST-6	36"	30"
18.5-20	2	2	2	.2	SS-7		

Soil Identification & Drillers Notes:
- Fill: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f-m Gravel; Silt seams and pockets noted, thin blk Silty Clay seams noted.
- Medium Gr mottled Yel-Br Silty CLAY, trace f-c Sand, trace f Gravel.
- Medium Gr Clayey Silt, little f-c Sand, trace f. Gravel; pink Silty Clay pockets noted, Silty Clay and Sand layers noted.
- Soft Gr Silty CLAY, little f-c Sand, trace f. Gravel; pink Silty Clay pockets noted.

Remarks: NR - No Recovery — Boring No. FEC-3

FIELD BORING LOG — Sheet 2 of 2 (FEC-3)

Project No. 2003 — North Side Sewage Treatment Works, Skokie, Ill.
Client: Metropolitan Sanitary District of Greater Chicago — Boring No. FEC-3
Boring Contractor: Raymond Internatl — Type Rig: CME
Soils Engr: C. Machnich — Inspector: J. Trezzo — Driller: D. Ferrari
Ground Water Observations: At 25.0 ft during drilling; at dry ft after 0 hrs; at 4.0 ft after 168 hrs
Sampler: SS; 1-3/8"; 140 lb.; 30"
Surface Elev 20.54 — Date Start 6-8-77 — Date Finish 6-8-77

Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Q_u	No & Type	Pen	Rec
21-23.5				.25	ST-8	36"	30"
23.5-25	2	2	2	.25	SS-9		
26-28.5				.4	ST-10	36"	30"
28.5-30	2	2	3	.4	SS-11		

Soil Identification & Drillers Notes:
- Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.
- End of Boring

Remarks: — Boring No. FEC-3

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

Revisions No.	Date	By

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
NORTH SIDE SEWAGE TREATMENT WORKS
CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES
BORING LOGS

Correct — Approved: Assistant Chief Engineer — Approved: Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. — Drawn — Checked R.W.S. — Reviewed — DATE APR., 1986 — SHEET NO. 2C-43

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TFB-1a

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG

SHEET 1 OF 3

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-1
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 26.00 FT. DURING DRILLING; AT dry FT AFTER 0 HRS.; AT 4.5' FT AFTER 1 HRS.; AT 6.66 FT AFTER 336 HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA — OFFSET — SURFACE ELEV 22.05 — DATE START 5/26/77 — DATE FINISH 5/26/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_p	SAMPLE NO & TYPE	PEN	REC.
						Blk, Gr & Yel-Br Silty CLAY, little f-c Sand, trace f-m Gravel; blk Silty Clay seams noted, Silt seams noted and roots noted.				
		1.0-2.5	3	4	6		4.5+	SS-1		
		3.5-5.0	3	4	6		1.0	SS-2		
5										
		6.0-8.5				Stiff Blk Organic Silty CLAY, trace f-m Sand; roots and Sand seams noted.	1.25	ST-3	30"	19"
		8.5-10.0	2	4	4		.5	SS-4		
10						Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f-m Gravel; pink Silty Clay pockets noted, Sand seams noted.				
		11.0-13.5					2.0	ST-5	30"	25"
		13.5-15.0	2	3	4	Soft Gr Silty CLAY, little f-c Sand, trace f-m Gravel.		NR		
15										
		16.0-18.5					.25	ST-6	30"	30"
		18.5-20.0	1	1	2		.2	SS-7		
20										

REMARKS: NR = No recovery — BORING NO. TFB-1 — SHEET __ OF __

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG

SHEET 1 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, Ill.
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. ST-1
BORING CONTRACTOR Raymond Internatl TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 9.0 FT DURING DRILLING; AT dry FT AFTER 0 HRS.; AT 7.0 FT AFTER 31 HRS.; AT __ FT AFTER __ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1-3/8"	
HAMMER WT.		140 lb.	
HAMMER FALL		30"	

LINE & STA — OFFSET — SURFACE ELEV 23.24 — DATE START 5-18-77 — DATE FINISH 5-18-77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_p	SAMPLE NO & TYPE	PEN	REC.
						Fill: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f-m Gravel; cinders and Silt layers noted.				
		1-2.5	6	9	11		4.5+	SS-1		
		3.5-5.0	2	3	4		1.25	SS-2		
5										
		6-8.5					1.5	ST-3	30"	16"
		8.5-10	2	2	2		1.25	SS-4		
10						Very Stiff Gr mottled Reddish Yel-Br Silty CLAY, little f-c Sand, trace f. Gravel.				
		11-13.5					.25	ST-5	30"	24"
		13.5-15	5	7	8		.25	SS-6		
15						Stiff Gr Clayey SILT, little f-c Sand, trace f. Gravel.				
		16-18.5					.5	ST-7	30"	30"
		18.5-20	2	2	3	Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.	.6	SS-8		
20										

REMARKS: — BORING NO. ST-1 — SHEET __ OF __

TFB-1b

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG

SHEET 2 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, Ill.
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. ST-1
BORING CONTRACTOR Raymond Internatl TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 9.0 FT DURING DRILLING; AT dry FT AFTER 0 HRS.; AT 7.0 FT AFTER 31 HRS; AT __ FT AFTER __ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1-3/8"	
HAMMER WT.		140 lb.	
HAMMER FALL		30"	

LINE & STA — OFFSET — SURFACE ELEV ~~23.24~~ — DATE START 5-18-77 — DATE FINISH 5-18-77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_p	SAMPLE NO & TYPE	PEN	REC.
						Soft Gr. Silty CLAY, little f-c Sand, trace f. Gravel.				
		21-23.5					.25	ST-9	30"	30"
		23.5-25	1	1	2		.25	SS-10		
25										
						Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.				
		26-28.5					.45	ST-11	30"	30"
		28.5-30	2	2	3	End of Boring.	.45	SS-12		
30										

REMARKS: — BORING NO. ST-1 — SHEET __ OF __

TFB-1c

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG

SHEET 2 OF 3

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-1
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 26.00 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.5' FT AFTER 1 HRS; AT 6.66 FT AFTER 336 HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA — OFFSET — SURFACE ELEV 22.05 — DATE START 5/26/77 — DATE FINISH 5/26/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_p	SAMPLE NO & TYPE	PEN	REC.
		21.0-23.5					.2	ST-8	30"	28"
		23.5-25.0	1	2	2		.2	SS-9		
25										
		26.0-28.5				Medium Gr Silty CLAY, little f-c Sand, trace f Gravel.	.25	ST-10	30"	28"
		28.5-30.0	2	2	2		.4	SS-11		
30						Medium to Stiff Gr Silty CLAY, little f-c Sand, trace f Gravel.				
		31.0-33.5					1.6	ST-12	30"	28"
		33.5-35.0	5	7	8	Medium to Stiff Gr Clayey SILT, little to some f-c Sand, trace f-m Gravel.	2.25	SS-13		
35										
		36.0-38.5					.75	ST-14	30"	30"
		38.5-40.0	5	7	8		.75	SS-15		
40										

REMARKS: — BORING NO. TFB-1 — SHEET __ OF __

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG

SHEET 3 OF 3

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-1
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 26.00 FT. DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.5' FT AFTER 1* HRS; AT 6.66 FT AFTER 336 HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA — OFFSET — SURFACE ELEV 22.05 — DATE START 5/26/77 — DATE FINISH 5/26/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_p	SAMPLE NO & TYPE	PEN	REC.
						Medium to Stiff Gr Silty CLAY, little f-c Sand, trace f-m Gravel.				
		41.0-43.5					1.0	ST-16	30"	26"
		43.5-45.0	3	4	5		.9	SS-17		
45										
		46.0-48.5				Dense to Very Dense Gr SILT, some f-c Sand, little f-m Gravel.	4.5+	ST-18	30"	18"
		48.5-50.0	15	19	22			SS-19		
50										
		51.0-52.5	20	29	37	Very Dense Gr Clayey SILT, little f-c Sand, trace f-m Gravel; gr Silt seams and pockets noted.	2.0	SS-20		
		53.5-55.0	18	24	31		2.0	SS-21		
55						Very Dense Gr SILT, some f-c Sand, little f Gravel, trace Clay; seams of gr.Clayey Silt noted.				
		56.0-57.5	27	32	44		4.5+	SS-22		
		58.5-60.0	29	39	27	End of Boring	4.5+	SS-23		
60										

REMARKS: — BORING NO. TFB-1 — SHEET __ OF __

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

REVISIONS		
NO.	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES

BORING LOGS

Correct
Approved — Assistant Chief Engineer
Approved — Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn | Checked R.W.B. | Reviewed | DATE APR., 1986 | SHEET NO 2C-65

TFB-3a

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-2
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 9' FT DURING DRILLING; AT 24.00 FT AFTER 1 HRS; AT 5.50 FT AFTER 96 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 22.16 DATE START 5/19/77 DATE FINISH 5/19/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Q_{up}	No & Type	Pen	Rec.
						FILL: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f Gravel; hair roots and decayed wood noted; thin Sand seams and Silt pockets noted.				
		1.0-2.5	6	8	10		4.5+	SS-1		
5		3.5-5.0	5	6	8		2.25	SS-2		
		6.0-8.5				Stiff Blk organic CLAY, little f-c Sand, trace f-m Gravel; peat and roots noted.	2.75	ST-3	30"	15"
10		8.5-10.0	4	5	6	Stiff Gr mottled Yel-Br Silty CLAY, trace f Gravel; pink Silty Clay pockets noted, Silt seams noted.	1.0	SS-4		
		11.0-13.5					1.75	ST-5	30"	26"
						Very Stiff Gr Clayey SILT, little f-c Sand, trace f Gravel.				
15		13.5-18.5	3	5	6		1.75	SS-6		
						Soft Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.				
		16.0-18.5					.2	ST-7	30"	30"
20		18.5-20.0	1	1	2		.2	SS-8		

REMARKS: ___ BORING NO. TFB-2 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-2
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT 9' FT DURING DRILLING; AT 24.00 FT AFTER 1 HRS; AT 5.50 FT AFTER 96 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 22.16 DATE START 5/19/77 DATE FINISH 5/19/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Q_{up}	No & Type	Pen	Rec.
		21.0-23.5					.2	ST-9	30"	29"
25		23.5-25.0	1	1	2	Soft Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.	.25	SS-10		
		26.0-28.5					.25	ST-11	30"	22"
30		28.5-30.0	1	2	2		.2	SS-12		
		31.0-33.5					.25	ST-13	30"	21"
35		33.5-35.0	2	3	4	Medium Gr Silty CLAY, little f-c Sand, trace f Gravel.	.6	SS-14		
		36.0-38.5					.7	ST-15	30"	30"
						Stiff Gr Silty CLAY, little f-c Sand, trace f Gravel.				
40		38.5-40.0	3	4	5	End of Boring	1.0	SS-16		

REMARKS: ___ BORING NO. TFB-2 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-3
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.50 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.52 DATE START 5/25/77 DATE FINISH 5/25/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Q_{up}	No & Type	Pen	Rec.
						FILL: Yel-Br, Gr & Blk Silty CLAY, little f-c Sand, trace f Gravel; blk Silty Clay seams and roots noted, Silt pockets noted.				
		1.0-2.5	7	9	5		4.5+	SS-1		
5		3.50-5.0	2	3	4		1.8	SS-2		
						Stiff Blk Organic CLAY, trace f-c Sand, trace f Gravel; Sand pockets and roots noted.				
		6.0-8.5					.75	ST-3	30"	12"
10		8.5-10.0	4	5	6	Stiff Yel-Br mottled Gr Silty CLAY, trace f-c Sand, trace f Gravel; pink Silty Clay pockets noted.	1.25	SS-4		
		11.0-13.5					1.5	ST-5	30"	18"
						Stiff Gr Clayey Silt, little f-c Sand, trace f Gravel.				
15		13.5-15.0	1	2	2		.75	SS-6		
						Soft Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.				
		16.0-18.5					.25	ST-7	30"	30"
20		18.5-20.0	1	1	1		.25	SS-8		

REMARKS: ___ BORING NO. TFB-3 SHEET ___ OF ___

TFB-3b

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-3
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.5 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.52 DATE START 5/25/77 DATE FINISH 5/25/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Q_{up}	No & Type	Pen	Rec.
		21.0-23.5					.25	ST-9	30"	30"
25		23.5-25.0	1	1	2		.25	SS-10		
		26.0-28.5					.25	ST-11	30"	30"
30		23.5-30.0	3	3	4	Medium Gr Clayey SILT, little f-c Sand, trace f-m Gravel.	.25	SS-12		
		31.0-33.5				Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.	.5	ST-13	30"	30"
35		33.5-35.0	2	3	4		.5	SS-14		
						Stiff Gr Silty CLAY, little f-c Sand, trace f-m Gravel.				
		36.0-38.5					.9	ST-15	30"	30"
40		38.5-40.0	4	5	5	End of Boring	1.0	SS-16		

REMARKS: ___ BORING NO. TFB-3 SHEET ___ OF ___

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

REVISIONS		
NO.	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP

SECONDARY TREATMENT FACILITIES

BORING LOGS

Correct ___
Approved ___ Assistant Chief Engineer
Approved ___ Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn | Checked R.W.B. | Reviewed | DATE APR./1986 | SHEET NO. 2C-66

TFB-4

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-4
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 19' FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.60 FT AFTER 48 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 22.02; DATE START 5/23/77; DATE FINISH 5/23/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
						FILL: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f Gravel; Silt seams noted.				
		1.0-2.5	3	4	4		1.1	SS-1		
5		3.5-5.0	2	3	4		.75	SS-2		
		6.0-8.5				Stiff Blk Organic CLAY, trace f-m Sand; Silt pockets noted.	1.1	ST-3	30"	16"
10		8.5-10.0	2	3	3	Stiff to Very Stiff Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel; Clayey Silt layer noted, roots noted and pink Silty Clay pockets noted	.75	SS-4		
		11.0-13.5						ST-5	30"	21"
15		13.5-15.0	2	3	3		.75	SS-6		
						Soft Gr Silty CLAY, little f-c Sand, trace f Gravel: pink Silty Clay pockets noted, gr Clayey Silt layer noted at 19'.				
		16.0-18.5					.25	ST-7	30"	30"
20		18.5-20.0	1	2	2		.25	SS-8		

REMARKS: ___ BORING NO. TFB-4 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-4
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 19 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.60 FT AFTER 48 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 22.02; DATE START 5/23/77; DATE FINISH 5/23/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
		21.0-23.5					.25	ST-9	30"	30"
25		23.5-25.0	1	1	2		.25	SS-10		
		26.0-28.5					.4	ST-11	30"	30"
						Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.				
30		28.5-20.0	1	2	3	Stiff Gr Clayey SILT, little to some f-c Sand, trace f Gravel.	.75	SS-12		
		31.0-33.5					.75	ST-13	30"	28"
35		33.5-40.0	3	4	6		1.0	SS-14		
						Stiff Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted at 43'.				
		36.0-38.5					1.25	ST-15	30"	26"
40		38.5-40.0	4	5	6		1.2	SS-16		

REMARKS: ___ BORING NO. TFB-4 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 3 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-4
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 19 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.60 FT AFTER 48 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 22.02; DATE START 5/23/77; DATE FINISH 5/23/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
		41.0-43.5					1.2	ST-17	30"	27"
45		43.5-45.0	3	4	5		1.2	SS-18		
						Hard Gr Clayey SILT, some f-c Sand, trace f-m Gravel; Sand layer noted.				
		46.0-48.5					4.5+	ST-9	30"	20"
50		46.5-50.0	15	19	23		4.5+	SS-20		
						Hard Gr Silty CLAY, little f-c Sand, trace f Gravel.				
		51.0-53.5	9	17	28		.0	SS-21		
55		53.5-55.0	21	25	33		3.5	SS-22		
						Very Dense Gr SILT; little f-c Sand, trace Clay trace f-m Gravel.				
		56.0-58.5	17	25	25/1"		4.5	SS-23		
60		58.5-60.6	110/1"			End of Boring		NR		

REMARKS: NR - No Recovery BORING NO. TFB-4 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-5
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 9 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 5.17 FT AFTER 24 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 21.99; DATE START 5/24/77; DATE FINISH 5/24/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
						FILL: Yel-Br, Blk & Gr Silty CLAY, trace to little f-c Sand, trace f Gravel; roots and blk Silty Clay layers noted, Sand pockets noted.				
		1.0-2.5	3	4	4		2.25	SS-1		
5		3.5-5.5	2	3	4			NR		
		6.0-8.5				Stiff Blk Organic CLAY, trace f-c Sand, trace f Gravel; br Silt seams noted.	.7	ST-2	30"	13"
10		8.5-10.0	3	4	4	Stiff to Very Stiff Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel.		NR		
		11.0-13.5					.32	ST-3	30"	18"
15		13.5-15.0	4	4	5		.8	SS-4		
						Medium Gr Silty CLAY, little f-c Sand, trace f Gravel; gr Clayey Silt layer at 14'; pink Silty Clay pockets noted.				
		16.0-18.5					.4	ST-5	30"	30"
20		18.5-20.0	1	1	2		.25	SS-6		

REMARKS: NR - No recovery BORING NO. TFB-5 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-5
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 9 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 5.17 FT AFTER 24 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 21.99; DATE START 5/24/77; DATE FINISH 5/24/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
						Soft Gr Silty CLAY, little f-c Sand, trace f-m Gravel; pink Silty Clay pockets noted.				
		21.0-23.5					.15	ST-7	30"	30"
25		23.5-25.0	2	2	3		.4	SS-8		
		26.0-28.5				Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel: pink Silty Clay pockets noted.	.4	ST-9	30"	29"
30		28.5-30.0	2	2	2		.75	SS-10		
						Stiff Gr. Clayey SILT, little f-c Sand, trace f Gravel.				
		31.0-33.5					.8	ST-11	30"	25"
35		33.5-35.0	2	4	5		.8	SS-12		
						Stiff Gr Silty CLAY, little f-c Sand, trace f-m Gravel:				
		36.0-38.5						NR		
40		38.5-40.0	7	10	12		1.0	SS-13		

REMARKS: ___ BORING NO. TFB-5 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 3 OF 3

PROJECT NO 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-5
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE
GROUND WATER OBSERVATIONS: AT 9 FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 5.17 FT AFTER 24 HRS; AT ___ FT AFTER ___ HRS
SAMPLER: TYPE SS; SIZE ID 1-3/8"; HAMMER WT 140 lbs; HAMMER FALL 30"
LINE & STA; OFFSET; SURFACE ELEV 21.99; DATE START 5/24/77; DATE FINISH 5/24/77

Depth Below Surface	Casing Blows per ft	Sample Depths From-To	Blows 0-6	Blows 6-12	Blows 12-18	Soil Identification & Drillers Notes / Indicate Elevation of Strata Change	Rup	No & Type	Pen	Rec.
		41.0-43.5					1.0	ST-14	30"	29"
						Very Stiff Gr Clayey SILT, some f-c Sand, trace f-m Gravel				
45		43.5-45.0	7	8	10		2.0	SS-15		
		46.0-48.5					4.5+	ST-16	30"	11"
50		48.5-50.0	12	16	23		4.5+	SS-17		
						Hard Gr Silty CLAY, little f-c Sand, trace f Gravel.				
		51.0-52.5	19	27	32		4.5+	SS-18		
55		53.5-55.0	25	33	41	Very Dense Gr SILT, trace to little f-c Sand, trace Clay, trace f Gravel.	4.5+	SS-19		
		56.0-57.5	12	18	31		2.5	SS-20		
60		58.5-60.0	20	32	39	End of Boring	4.5+	SS-21		

REMARKS: ___ BORING NO. TFB-5 SHEET ___ OF ___

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

REVISIONS		
NO.	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES

BORING LOGS

Correct ___
Approved ___ Assistant Chief Engineer
Approved ___ Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn | Checked R.W.B. | Reviewed | DATE APR., 1986 | SHEET NO 2C-67

67

TFB-6

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-6
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.17 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.30 DATE START 5/25/77 DATE FINISH 5/25/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_{up}	NO & TYPE	PEN	REC.
						FILL: Blk, Gr & Yel-Br Silty CLAY, little f-c Sand, trace f Gravel; blk Silty Clay seams noted, blk cinders noted.				
		1.0-2.5	4	5	8		.0	SS-1		
5		3.5-5.0	3	3	4		2.5	SS-2		
						Stiff Blk Organic Silty CLAY, trace f-c Sand, trace f Gravel; Silt lenses noted.				
		6.0-8.5					1.0	ST-3	30"	13"
10		8.5-10.0	2	3	4	Very Stiff Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f-m Gravel; Sand lenses noted, Clayey Silt layer noted at 12'.	20	SS-4		
		11.0-13.5					28	ST-5	30"	20"
15		13.5-15.0	2	3	4	Soft Gr Sitly CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.	.25	SS-6		
		16.0-18.5					.25	ST-7	30"	29"
20		18.5-20.0	2	2	3		.25	SS-8		

REMARKS: BORING NO. TFB-6 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-6
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.17 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.30 DATE START 5/25/77 DATE FINISH 5/25/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_{up}	NO & TYPE	PEN	REC.
		21.0-23.5					.25	ST-9	30"	30"
25		23.5-25.0	1	1	2		.25	SS-10		
						Medium Gr Silty CLAY, little f-c Sand, trace f-m Gravel.				
		26.0-28.5					.75	ST-11	30"	30"
30		28.5-30.0	3	4	6	Stiff Gr Clayey SILT, little f-c Sand, trace f Gravel.	1.0	SS-12		
						Stiff to Very Stiff Gr Silty CLAY, little f-c Sand, trace f-m Gravel; Silt seams noted.				
		31.0-33.5					1.25	ST-13	30"	28"
35		33.5-35.0	5	7	9			NR		
		36.0-38.5					1.25	ST-14	30"	22"
40		38.5-40.0	7	9	11	End of Boring	.6	SS-15		

REMARKS: BORING NO. TFB-6 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 1 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-7
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.60 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.78 DATE START 5/25/77 DATE FINISH 5/25/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_{up}	NO & TYPE	PEN	REC.
						FILL: Blk, Yel-Br & Gr Silty CLAY, little f-c Sand, trace f Gravel; blk Silty Clay seams noted., blk cinders noted, Silt pockets noted.				
		1.0-2.5	3	3	3		2.25	SS-1		
5		3.5-5.0	3	2	3		1.25	SS-2		
						Medium Blk Organic Silty CLAY, trace f Gravel; yel-br Silty Clay seams noted, Sand layer noted.				
		6.0-8.5					.75	ST-3	30"	20"
						Very Stiff Yel-Br mottled Gr Silty CLAY, little f-c Sand, trace f Gravel.				
10		8.5-10.0	2	2	3		.9	SS-4		
		11.0-13.5				Stiff to Very Stiff Gr Clayey SILT, little f-c Sand, trace f Gravel.	.0	ST-5	30"	23"
15		13.5-15.0	4	5	7		.5	SS-6		
						Medium Gr Silty CLAY, little f-c Sand, trace f Gravel.				
		16.0-18.5					.5	ST-7	30"	30"
20		18.5-20.0	3	4	5		.6	SS-8		

REMARKS: BORING NO. TFB-7 SHEET ___ OF ___

WESTENHOFF & NOVICK, INC. — CONSULTING ENGINEERS

FIELD BORING LOG — SHEET 2 OF 2

PROJECT NO. 2003 PROJECT NAME & LOCATION North Side Sewage Treatment Works, Skokie, IL
CLIENT Metropolitan Sanitary District of Greater Chicago BORING NO. TFB-7
BORING CONTRACTOR Raymond International TYPE RIG CME LOCATION
SOILS ENGR C. Machnich INSPECTOR J. Trezzo DRILLER D. Ferrari STRUCTURE

GROUND WATER OBSERVATIONS: AT dry FT DURING DRILLING; AT dry FT AFTER 0 HRS; AT 4.17 FT AFTER 360 HRS; AT ___ FT AFTER ___ HRS

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE ID		1-3/8"	
HAMMER WT		140 lbs	
HAMMER FALL		30"	

LINE & STA ___ OFFSET ___ SURFACE ELEV 21.78 DATE START 5/25/77 DATE FINISH 5/25/77

DEPTH BELOW SURFACE	CASING BLOWS PER FT	SAMPLE DEPTHS FROM-TO	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	SOIL IDENTIFICATION & DRILLERS NOTES / INDICATE ELEVATION OF STRATA CHANGE	Q_{up}	NO & TYPE	PEN	REC.
						Soft Gr Silty CLAY, trace f-c Sand, trace f Gravel.				
		21.0-23.5					.25	ST-8	30"	29"
25		23.5-25.0	1	1	1		.25	SS-10		
		26.0-28.5				Medium to Stiff Gr Clayey SILT, little f-c Sand, trace f-m Gravel; 1 coarse gravel noted.	.75	ST-11	30"	30"
30		28.5-30.0	2	2	3		.75	SS-12		
						Stiff Gr Silty CLAY, trace f-c Sand, trace f-m Gravel.				
		31.0-33.5					.5	ST-13	30"	30"
35		33.5-35.0	7	9	10		.4	SS-14		
		36.0-38.5					.9	ST-15	30"	29"
40		38.5-40.0	5	6	8	End of Boring	1.25	SS-16		

REMARKS: BORING NO. TFB-7 SHEET ___ OF ___

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

REVISIONS		
NO.	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES

BORING LOGS

Correct ___
Approved ___ Assistant Chief Engineer
Approved ___ Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn | Checked R.W.B. | Reviewed | DATE APR., 1986 | SHEET NO. 2C-68

FEC-1

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC-1
Page No. 1 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
SS-1 *	1.0-2.5	6				13.5										Dk Gr & Yel-Br Clayey SILT and Gr SILT in layers and lenses, trace f-c Sand, trace f Gravel; cinders noted.
SS-2	3.5-5.0	8														Blk f-c SAND, little f-c Gravel, little Silt; cinders noted.
SS-3	6.0-7.5	17														Yel-Br & Blk f-c SAND and f-m Gravel little Silt, cinders noted.
ST-4	12.0-12.7		2.37		2.8	21.1	108.4	35.8	15.7							Yel-Br mottled Gr Silty CLAY, little f-c Sand, trace f Gravel; Silt layers and 1 medium Gravel.
SS-5 *	13.5-15.0	16			4.5+	13.8	123.5									Gr Clayey SILT, little f-c Sand, trace f Gravel.
ST-6	17.3-18.1		0.75		0.7	19.9	112.5	26.8	14.1							Same as SS-5.
SS-7	18.5-20.0	4		0.93	0.8	23.3	106.8									Gr Silty CLAY, little f-c Sand, trace f Gravel.
ST-8	21.9-22.6		0.38		0.3	27.5	98.8	34.5	15.8							Gr Silty CLAY, little f-c Sand, trace f Gravel.
SS-9 *	23.5-25.0	5				24.3										Same as SS-7.

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC-1
Page No. 2 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
ST-10	26.0-27.7					11.1	126.3									Gr f-c SAND, little f-m Gravel, little Silt, trace Clay.
SS-11	28.5-30.0	9		1.39	1.1	21.5	113.0									Same as SS-7 (more Sand).

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

FEC-2a

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC-2
Page No. 1 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
SS-1 *	1.0-2.5	19				12.0										Yel-Br & Gr Silty CLAY, little f-c Sand, trace f Gravel; roots, organic material and Silt pockets noted.
SS-2	3.5-5.0	14		4.73	4.5+	16.6	114.8									Dk Gr, Yel-Br & Blk Silty CLAY, little f-c Sand, trace f-m Gravel; cinders and hair roots noted.
ST-3	6.0-7.0		1.20		2.6	18.4	113.8									Br-Gr mottled Blk Silty CLAY, little f-c Sand, trace f Gravel; Sand seam & roots noted.
SS-4 *	8.5-10.0	9				16.9										Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel; thin Silt seams and roots noted.
ST-5	12.0-12.7		.43		.4	25.3	101.8									Dk Gr, Yel-Br & Br-Gr Silty CLAY, little f-c Sand, trace f Gravel; 2 coarse pieces of Gravel noted, wood pieces noted.
SS-6	13.5-15.0	7		2.40	2.7	20.0	109.4									Gr Silty CLAY with thin Blk Silty CLAY layers, little f-c Sand, trace f Gravel; 1" layer of yel-br SiltyClay, trace f-m Sand at end.
ST-7	16.0-16.9		0.78		1.2	20.1	106.4									Yel-Br mottled Blk Silty CLAY, little f-c Sand, trace f-m Gravel; organic material, roots and wood pieces noted

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

FEC-2b

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC 2
Page No. 2 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
SS-8	18.5-20.0	39				10.1										Reddish-Yel-Br f-c SAND, some f Gravel; blk Silty Clay lenses noted.
ST-9	22.7-23.5		0.45		0.4	23.8	105.1	31.9	15.4							Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.
SS-10 *	23.5-25.0	4				22.5										Same as ST-9.
ST-11	27.7-28.5		0.46		0.3	24.6	104.8									Same as ST-9 (1/2" Silt layers noted)
SS-12	28.5-30.0	5		2.20	2.1	18.2	119.4									Same as SS-10

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC-3
Page No. 1 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
SS-1	1.0-2.5	9		6.36	4.5+	12.7	117.8	32.4	15.8							Yel-Br & Gr slightly mottled Silty CLAY, little f-c Sand, trace f Gravel; thin Silt seams and pockets noted.
ST-2	6.0-6.3		0.72		1.1	26.0	99.4	50.5	19.5							Gr mottled Yel-Br & Dk Gr Silty CLAY, little f-c Sand, trace f-m Gravel; thin blk Silty Clay seams noted.
	6.3-7.0							36.7	16.7							top 3" Gr mottled Br & Dk Gr Silty CLAY, trace f-m Sand.
SS-3	8.5-10.0	7		4.89	4.5+	27.4	98.7	57.2	20.9							Gr mottled Yel-Br Silty CLAY, trace f-m Sand.
ST-4	11.0-12.7		0.65		2.1	27.1		33.5	15.9							11-11.7 Gr & Yel-Br mottled Silty CLAY, trace f-c Sand, trace f Gravel. 11.7-12.7 Gr mottled Yel-Br changing to Gr Clayey SILT, some f-c Sand, trace f-m Gravel; Sand seams noted and Silty Clay layers noted.
SS-5	13.5-15.0	7		1.78	1.7	16.0	119.1									Gr Clayey SILT, little f-c Sand, trace f Gravel; Silty Clay and Sand layers noted.
ST-6	17.7-18.5		0.45		0.5	23.1	107.6									Gr Silty CLAY, little f-c Sand, trace f Gravel.

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. FEC-3
Page No. 2 of 2

Sample Type No.	Depth ft.	N. or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type Unified	Description
SS-7	18.5-20.0	4		0.73	0.7	21.7	108.5									Same as ST-6.
ST-8	22.7-23.0		0.43		0.3	26.3	101.5	33.0	15.9							Same as ST-6 (pink Silty Clay pockets noted).
SS-9	23.5-25.0	4		0.73	0.5	21.6	110.2									Same as SS-7.
ST-10	27.7-28.5		0.87		1.0	21.0	112.7									Same as SS-7 (medium Gravel noted).
SS-11	28.5-30.0	5		1.94	1.4	18.4	107.1									Same as SS-7 (more Sand).

Remarks: * denotes broken, deformed, disturbed or small sample

Prepared by JAT Date 8/29/77
Checked by ______ Date ______

REVISIONS		
NO	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 78-020-CP

SECONDARY TREATMENT FACILITIES

LABORATORY TEST DATA

Correct ______
Approved ______ Assistant Chief Engineer
Approved ______ Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn | Checked R.W.B. | Reviewed | DATE APR., 1984 | SHEET NO 2C-72

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

TFB-1

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. TFB-1
Page No. 1 of 3

Sample Type No.	Depth ft.	N or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type (Unified)	Description
SS-1 *	1.0-2.5	10			4.5+	12.9										Gr Br Silty CLAY, little f-c Sand, trace f-m Gravel; thin seams of yel-br Silt and blk Clay noted.
SS-2	3.5-5.0	10		3.11	2.6	18.6	116.8									Yel-Br slightly mottled Gr Silty CLAY, little f-c Sand, trace f Gravel thin blk Silty Clay seams and Silt noted.
ST-3	6.8-7.6		1.31		2.7	30.3	89.4	47.8	27.8							Blk Organic Silty CLAY, trace f-m Sand; roots and Sand seam noted.
SS-4	8.5-10.0	8		1.58	1.8	28.3	100.8									Yel-Br mottled Gr & Dk Gr Silty CLAY, trace f Gravel; blk Silty Clay seams noted, thin Silt and Sand seams noted.
ST-5	12.3-13.1		2.02		2.2	15.7	121.4									Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f-m Gravel; pink Silty Clay pocket noted, Sand seam noted.
ST-6	17.7-18.5		0.48		.2	23.4	107.0	30.8	14.7							Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets and weathered granite noted.
SS-7 *	18.5-20.0	3		.42	.4	23.8	105.6									Gr Silty CLAY, little f-c Sand, trace f Gravel.
ST-8	22.5-23.3		.35		.2	27.6	100.7									Same as ST-6 (1 medium Gravel noted).

Remarks: * Denotes broken, deformed, disturbed or small sample

Prepared by J.T. Date 7/15/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. TFB-1
Page No. 2 of 3

Sample Type No.	Depth ft.	N or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type (Unified)	Description
SS-9 *	23.5-25.0	4			.4	23.9										Same as SS-7.
ST-10	27.5-28.3		.52		.3	24.7	104.6	38	22							Same as ST-6.
SS-11	28.5-30.0	4		1.0	.6	20.6	112.5									Gr Silty CLAY, little f-c Sand, trace f Gravel.
ST-12	32.5-33.3		1.10		1.2	19.1	115.4									Same as SS-11.
SS-13	33.5-35.0	15		4.77	4.5+	12.9	126.4									Gr Clayey SILT, little f-c Sand, trace f-m Gravel.
ST-14	37.7-38.5		.75		.7	17.8	120.0	28.9	14.3							Gr Clayey SILT, some f-c Sand, trace f-m Gravel.
SS-15 *	38.5-40.0	15			1.0	20.0										Gr Silty CLAY, little f-c Sand, trace f Gravel.
ST-16	42.5-43.3		1.46		1.7	22.6	108.1									Same as SS-15 (1 medium Gravel noted).
SS-17 *	43.5-45.0	9			1.3	22.9										Gr Silty CLAY, trace f-c Sand, trace f Gravel.
ST-18 a	46.0-47.2		.69		.8	22.8	106.0	37.3	16.0							Same as SS-15.

Remarks: * Denotes broken, deformed, disturbed or small sample.

Prepared by J.T. Date 7/15/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. TFB-1
Page No. 3 of 3

Sample Type No.	Depth ft.	N or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type (Unified)	Description
ST-18 b	47.2-47.5				4.5+	11.4	124.1									Gr SILT, some f-c Sand, trace Clay, trace f Gravel.
SS-19	48.5-50.0	41		2.22		9.5	127.2									Lt Gr & Gr layered SILT, some f-c Sand, little f-m Gravel; Sand seam noted, fractured limestone Gravel noted.
SS-20 *	51.0-52.5	66		1.98	2.0	13.9	119.1									Gr Clayey SILT, little f-c Sand, trace f-m Gravel.
SS-21	53.5-55.0	55		2.03	1.3	18.2	114.5									Same as SS-20. (Silt seam and pockets noted).
SS-22	56.0-57.5	76			4.5+	8.7		20.0	13.8							Gr SILT, some f-c Sand, traceClay little f Gravel; irregularly laminated seams of gr Silt and Clayey Silt noted.
SS-23	58.5-60.0	66		4.14		7.6	125.9									Same as SS-22.

Remarks: * Denotes broken, deformed, disturbed or small sample

Prepared by J.T. Date 7/15/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. TFB-2
Page No. 1 of 2

Sample Type No.	Depth ft.	N or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type (Unified)	Description
SS-1	1.0-2.5	18			4.5+	12.4 16.4										50% Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel. 50% Dk Gr Silty CLAY, little f-c Sand, trace f Gravel; hair roots noted.
SS-2	3.5-5.0	14		3.69	4.0	17.9	118.2									Gr mottled Yel-Br Silty CLAY, little f-c Sand. trace f Gravel thin Sand seam noted.
ST-3a	6.0-6.7		2.07		3.6	17.8	114.5									Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel; Sand veins, Silt pockets noted, roots and decayed wood noted.
ST-3b	6.7-7.3		1.46		3.1	31.5	87.1									Blk organic CLAY, little f-c Sand, trace f-m Gravel; peat and roots noted.
SS-4	8.5-10.0	11		2.83	2.8	21.1	109.2									Yel-Br mottled Gr Silty CLAY, trace f-c Sand, trace f Gravel; blk Silty Clay pockets noted, Silt seams noted, roots noted.
ST-5	12.4-13.2		3.61		3.3	18.1	115.8									Gr mottled Yel-Br Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted.
SS-6	13.5-15.0	11		3.29	3.5	15.4	122.9									Gr Clayey SILT, little f-c Sand, trace f Gravel.

Remarks: *Denotes broken, deformed, disturbed or small sample.

Prepared by J.T. Date 7/15/77
Checked by ______ Date ______

WESTENHOFF & NOVICK INC.
CHICAGO, ILLINOIS

SUMMARY OF SOIL TEST RESULTS

Project North Side Sewage Treatment
Job No. 2003 Boring No. TFB-2
Page No. 2 of 2

Sample Type No.	Depth ft.	N or S.P.T.	Unconf-Comp-t.s.f. Test	Estimated Rimac	Estimated Pocket Pen.	Wc %	γdry p.c.f.	L.L. %	P.L. %	Gravel %	Sand %	Silt %	Clay %	Sp. Gravity	Soil Type (Unified)	Description
ST-7	17.7-18.5		.43		.5	20.6	112.2									Gr Silty CLAY, little f-c Sand, trace f Gravel.
SS-8 *	18.5-20.0	3			.4	23.3										Same as ST-7.
ST-9	22.6-23.4		.40		.2	25.3	104.7									Gr Silty CLAY, little f-c Sand, trace f Gravel; pink Silty Clay pockets noted, 1 medium Gravel noted.
SS-10 *	23.5-25.0	3			.6	23.8										Same as SS-8 (1 medium Gravel noted).
ST-11	27.0-27.8		.40		.3	25.4	102.5									Same as ST-9
SS-12 *	28.5-30.0	4			.3	24.8										Same as SS-10.
ST-13	31.9-32.7		.41		.3	21.9	108.8									Same as ST-9.
SS-14 *	33.5-35.0	7		1.56	1.8	20.3	121.6									Same as SS-8.
ST-15	37.7-39.5		.64		.5	23.4	105.2									Gr Silty CLAY, little f-c Sand, trace f Gravel.
SS-16 *	38.5-40.0	9		1.87	2.0	19.0	118.2									Same as SS-8.

Remarks: * Denotes broken, deformed, disturbed or small sample.

Prepared by J.T. Date 7/15/77
Checked by ______ Date ______

RETA ENGINEERS / A JOINT VENTURE
CHICAGO

REVISIONS		
NO	DATE	BY
		—

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

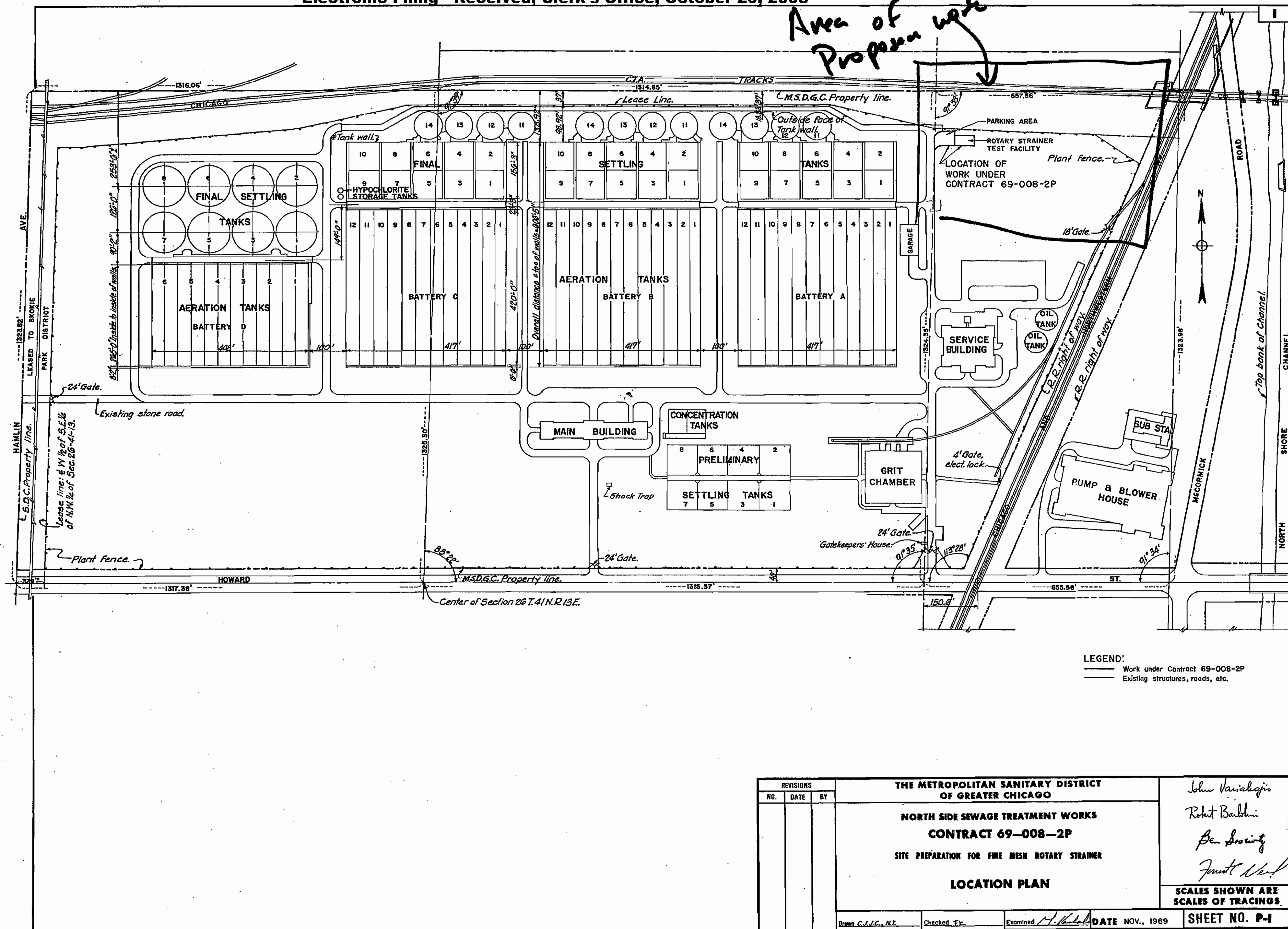
CONTRACT 78-020-CP
SECONDARY TREATMENT FACILITIES

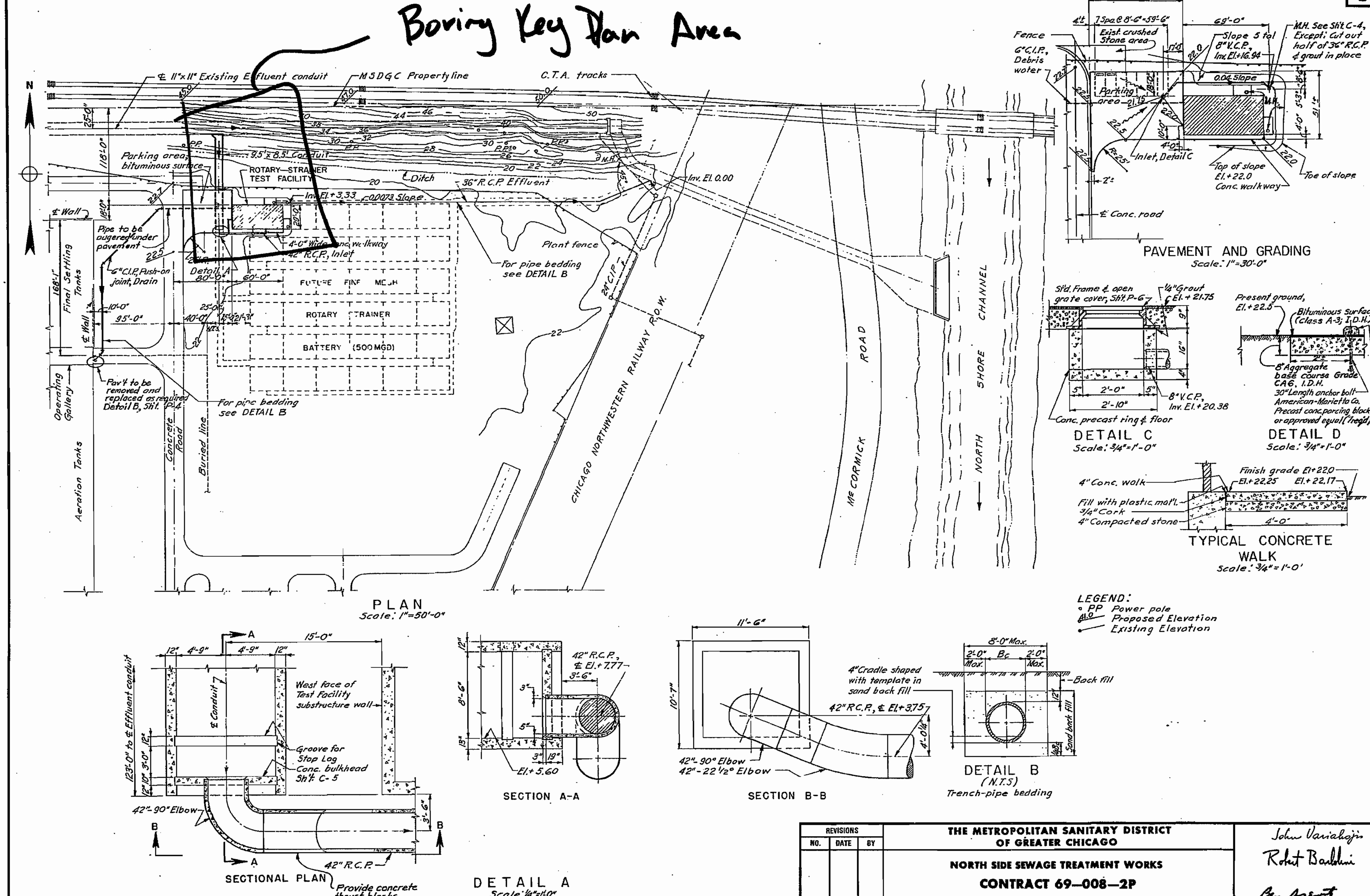
LABORATORY TEST DATA

Correct ______
Approved ______ Assistant Chief Engineer
Approved ______ Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Designed D.W. | Drawn ______ | Checked R.W.B. | Reviewed ______ | DATE APR., 1986 | SHEET NO 2C-94


Area of Proposed work
1
C.T.A. TRACKS
CHICAGO
M.S.D.G.C. Property line.
Lease Line.
Outside face of Tank wall.
Tank wall.
PARKING AREA
ROTARY STRAINER TEST FACILITY
LOCATION OF WORK UNDER CONTRACT 69-008-2P
Plant Fence.
18'Gate.
GARAGE
FINAL SETTLING TANKS
HYPOCHLORITE STORAGE TANKS
AERATION TANKS
BATTERY D
BATTERY C
BATTERY B
BATTERY A
Overall distance c. to c. of walls
SERVICE BUILDING
OIL TANK
R.R. right of way.
CHICAGO AND NORTHWESTERN
Top bank of Channel.
NORTH SHORE CHANNEL
ROAD
McCORMICK
HAMLIN AVE.
LEASED TO SKOKIE PARK DISTRICT
S.D.C. Property line.
Lease line: ¢ W ½ of S.E.¼ of N.W.¼ of Sec.26-41-13.
24'Gate.
Existing stone road.
MAIN BUILDING
CONCENTRATION TANKS
PRELIMINARY SETTLING TANKS
Shock Trap
GRIT CHAMBER
4' Gate, elect. lock.
SUB STA.
PUMP & BLOWER HOUSE
24' Gate.
Gatekeepers' House.
Plant Fence.
HOWARD ST.
Center of Section 26 T.41 N.R.13E.
LEGEND:
Work under Contract 69-008-2P
Existing structures, roads, etc.
REVISIONS
NO. DATE BY
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
NORTH SIDE SEWAGE TREATMENT WORKS
CONTRACT 69—008—2P
SITE PREPARATION FOR FINE MESH ROTARY STRAINER
LOCATION PLAN
SCALES SHOWN ARE SCALES OF TRACINGS
Drawn C.J.J.C., N.T.
Checked
Examined
DATE NOV., 1969
SHEET NO. P-1



REVISIONS		
NO.	DATE	BY

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

NORTH SIDE SEWAGE TREATMENT WORKS

CONTRACT 69—008—2P

SITE PREPARATION FOR FINE MESH ROTARY STRAINER

GENERAL PLAN AND TOPOGRAPHY DETAILS

Drawn N.T. Checked F.K. Examined [signature] DATE NOV., 1969

[signatures]

SCALES SHOWN ARE SCALES OF TRACINGS

SHEET NO. P-2

PROJECT: SITE PREPARATION FOR FINE MESH ROTARY STRAINER, NORTH SIDE PLANT
CLIENT: METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, 100 E. Erie St., Chicago.
BORING 1 DATE STARTED 8-12-69 DATE COMPLETED 8-12-69 JOB L-7520

ELEVATIONS
GROUND SURFACE +21.53 C.C.D.
END OF BORING -35.97 C.C.D.

WATER TABLE
AT END OF BORING -15.0' Caved In
24 HOURS
Water Encountered at -27.0' While Drilling

Sample No.	Type	N	WC	Q_u	γ Dry
1	ST		18.4		
2	ST		26.7	1.6 / 3.5*	93
3	ST		21.0	0.66 / 0.75*	104
4	ST		20.8	0.27 / 0.5*	89
5	ST		21.3	0.34 / 0.5*	
6	ST		19.0		
7	ST		18.7	1.37	110
8	ST		19.5	1.96	108
9	ST		26.9	3.0*	
10	ST		10.2	3.38 / 4.5+*	125
11	ST		15.3	4.88 / 4.5+*	

Depth	Elev.	Soil Descriptions
2.0	+19.53	Black clayey TOPSOIL
11.0	+10.53	Stiff to tough brown and gray silty CLAY, trace sand, moist
14.5	+ 7.03	Stiff brown silty CLAY, trace small gravel, moist
33.5	-11.97	Stiff to soft gray silty CLAY, trace sand and small gravel, moist
44.0	-22.47	Tough gray silty CLAY, trace fine to coarse sand, moist
46.0	-24.47	Tough to very tough gray silty CLAY, moist
49.0	-27.47	Firm gray clayey SAND and GRAVEL, wet
50.0	-28.47	Very tough gray silty CLAY, trace sand and gravel, moist
56.0	-34.47	Hard gray silty CLAY, trace sand and small gravel, moist
		Dense SAND and GRAVEL, wet

End of Boring at 57.5 feet
Auger Refusal at 57.5 feet due to possible bedrock.

*- Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer.

TESTING SERVICE CORPORATION
DRILL RIG NO. 26

PROJECT: SITE PREPARATION FOR FINE MESH ROTARY STRAINER, NORTH SIDE PLANT
CLIENT: METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, 100 E. Erie St., Chicago.
BORING 2 DATE STARTED 8-13-69 DATE COMPLETED 8-13-69 JOB L-7520

ELEVATIONS
GROUND SURFACE +21.64 C.C.D.
END OF BORING -34.36 C.C.D.

WATER TABLE
AT END OF BORING -53.0'
24 HOURS
Water Encountered at -11.0' While Drilling

Sample No.	Type	N	WC	Q_u	γ Dry
1	ST		16.3		112
2	ST		17.8		110
3	ST		42.3		79
4	ST		30.0	1.27 / 1.8*	93
5	ST		11.6	2.70 / 3.8*	122
6	ST		19.1	0.61 / 0.5*	106
7	ST		26.5	0.45 / 0.5*	97
8	ST		23.8	0.32 / 0.3*	98
9	ST		25.3	0.35 / 0.3*	98
10	ST		24.1	0.48 / 0.5*	99
11	ST		21.3	0.61 / 0.7*	104
12	ST		17.7	0.72 / 0.7*	88
13	ST		16.3	0.92 / 1.0*	109
14	ST		19.6	0.93 / 1.0*	104
15	ST		19.3	0.86 / 1.0*	105
16	ST		22.8	0.51 / 0.5*	100
17	ST		22.7		106

Depth	Elev.	Soil Descriptions
2.0	+19.64	FILL - Brown and gray silty CLAY, some TOPSOIL, moist
6.0	+15.64	FILL - Brown and gray silty CLAY, trace small gravel, moist
7.5	+14.14	Black clayey TOPSOIL
11.0	+10.64	Tough brown and gray silty CLAY, trace sand and gravel, moist
13.5	+ 8.14	Very tough gray silty CLAY, little sand and shale, moist
53.0	-31.36	Stiff to soft gray silty CLAY, trace sand and gravel, moist
		Firm gray clayey SILT, moist

End of Boring at 56.0 feet
Auger Refusal at 56.0 feet due to possible bedrock

*- Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer.

TESTING SERVICE CORPORATION
DRILL RIG NO. 26

PROJECT: SITE PREPARATION FOR FINE MESH ROTARY STRAINER, NORTH SIDE PLANT
CLIENT: METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, 100 E. Erie St., Chicago, I
BORING 3 DATE STARTED 8-15-69 DATE COMPLETED 8-15-69 JOB L-7520

ELEVATIONS
GROUND SURFACE +19.64 C.C.D.
END OF BORING -35.36 C.C.D.

WATER TABLE
AT END OF BORING
24 HOURS
Water Encountered at -15.0' While Drilling

Sample No.	Type	N	WC	Q_u	γ Dry
1	ST		28.1		90
2	ST		24.0		
3	ST		25.4	1.75 / 1.7*	95
4	ST		17.0	1.64 / 2.0*	106
5	ST		22.4	0.79 / 0.6*	104
6	ST		20.2	0.47 / 0.3*	104
7	ST		22.7	0.34 / 0.3*	100
8	ST		21.4	0.29 / 0.3*	104
9	ST		22.3	0.23 / 0.3*	95
10	ST		22.8	0.26 / 0.2*	101
11	ST		19.5	0.81 / 0.7*	108
12	ST		14.8	1.10 / 1.0*	112
13	ST		20.8	1.05 / 1.2*	106
14	ST		20.4	1.23 / 1.2*	98
15	ST		20.5		108
16	ST		9.7		119

Depth	Elev.	Soil Descriptions
1.5	+18.14	FILL - Black clayey TOPSOIL
3.5	+16.14	FILL - Brown silty CLAY
10.0	+ 9.64	Tough brown silty CLAY, trace sand and gravel, moist
28.5	- 8.86	Stiff to soft gray silty CLAY, trace sand and gravel, moist
43.5	-23.86	Tough gray silty CLAY, trace sand and gravel, moist
		Firm gray clayey SILT, moist

End of Boring at 55.0 feet
Auger Refusal at 55.0 feet due to possible bedrock

*- Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer.

TESTING SERVICE CORPORATION
DRILL RIG NO. 26

GENERAL NOTES

DETAILS AND NOTES RELATIVE TO EXISTING WORK ARE REASONABLY CORRECT BUT ARE NOT GUARANTEED BY THE SANITARY DISTRICT.

THE CONTRACTOR SHALL CHECK ALL DETAILS, ELEVATIONS, AND MATERIALS IN THE FIELD AND SHALL ARRANGE THE NEW WORK TO SUIT, ALL AS APPROVED BY THE ENGINEER. THE COST OF SUCH WORK SHALL BE INCLUDED IN THE UNIT AND LUMP SUM PRICES FOR THE VARIOUS ITEMS.

THE SOIL BORING INFORMATION IS BELIEVED TO BE ACCURATE BUT IS NOT GUARANTEED BY THE SANITARY DISTRICT. THE CONTRACTOR MUST SATISFY HIMSELF BY MAKING BORINGS OR BY ANY OTHER METHOD AS HE MAY PREFER, AS TO THE CHARACTER OF SOILS AND THE AMOUNT OF WATER, BOULDERS, ROCK AND OTHER MATERIALS HE MAY ENCOUNTER IN THE WORK TO BE PERFORMED UNDER THIS CONTRACT.

ALL EXCAVATION SHALL BE PERFORMED WITHIN THE NARROWEST PRACTICAL LIMITS SO THAT THE LOAD CARRYING CAPACITY OF THE SOIL UNDER ANY NEARBY FOOTING WILL NOT, IN THE OPINION OF THE ENGINEER, BE UNNECESSARILY DECREASED.

ALL EXPOSED EDGES OF NEW CONCRETE WORK SHALL HAVE A 1/2-INCH CHAMFER AS SHOWN HERE:

THE FOLLOWING ABBREVIATIONS ARE USED IN LOCATING REINFORCEMENT BARS; "B" DENOTES BOTTOM; "T" DENOTES TOP; "N.F." DENOTES NEAR FACE; "F.F." DENOTES FAR FACE; "E.F." DENOTES EACH FACE.

MAIN REINFORCEMENT BARS IN THE TOP AND BOTTOM OF SLABS NOT IN CONTACT WITH SOIL SHALL HAVE A 1-INCH CLEAR COVERING OF CONCRETE FROM THE FACES TO WHICH THEY ARE ADJACENT, EXCEPT AS NOTED.

MAIN REINFORCEMENT BARS IN SLABS IN CONTACT WITH SOIL SHALL HAVE A 3-INCH CLEAR COVERING OF CONCRETE.

MAIN REINFORCEMENT BARS IN WALLS SHALL HAVE A 2-INCH CLEAR COVERING OF CONCRETE.

REINFORCING BARS AT OPENINGS SMALLER THAN 12-INCH DIAMETER SHALL BE REARRANGED IN FIELD TO SUIT, AS APPROVED BY THE ENGINEER.

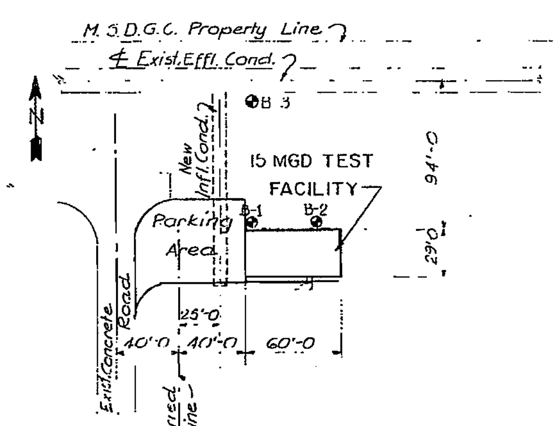
PIPE SLEEVES, FRAMES, ANCHOR BOLTS, INSERTS, ETC., SHALL BE SET IN PLACE BEFORE CONCRETE IS POURED. THE CONTRACTOR IS REQUIRED TO CHECK ALL DRAWINGS AND SHOP DETAILS OF EQUIPMENT AND PREFABRICATED HOUSING FOR THE SIZE AND LOCATION OF ALL INSERTS.

IN REMOVING EXISTING CONCRETE AND MASONRY, PROPER PRECAUTION SHALL BE TAKEN TO PREVENT THE SPALLING OF THE CONCRETE AND MASONRY BEYOND THE CUTTING LINES. ANY PATCHING REQUIRED SHALL BE DONE AS DIRECTED BY THE ENGINEER AND SHALL BE AT THE CONTRACTOR'S EXPENSE.

WHERE NEW CONCRETE IS TO COVER EXISTING CONCRETE SURFACES, SUCH SURFACES SHALL BE THOROUGHLY CLEANED AND LEFT ROUGH TO INSURE GOOD CONTACT BETWEEN THE OLD AND THE NEW CONCRETE.

THROUGHOUT THIS SET OF DRAWINGS EXISTING STRUCTURES ARE SHOWN IN LIGHT LINES; NEW AND ALTERED WORK IS SHOWN IN HEAVY OUTLINES.

ALL CROSS HATCHED AREAS BOUNDED BY HEAVY FULL LINES INDICATE MATERIALS TO BE REMOVED.



BORING LOCATION PLAN
Scale: 1" = 50'

REVISIONS		
NO.	DATE	BY

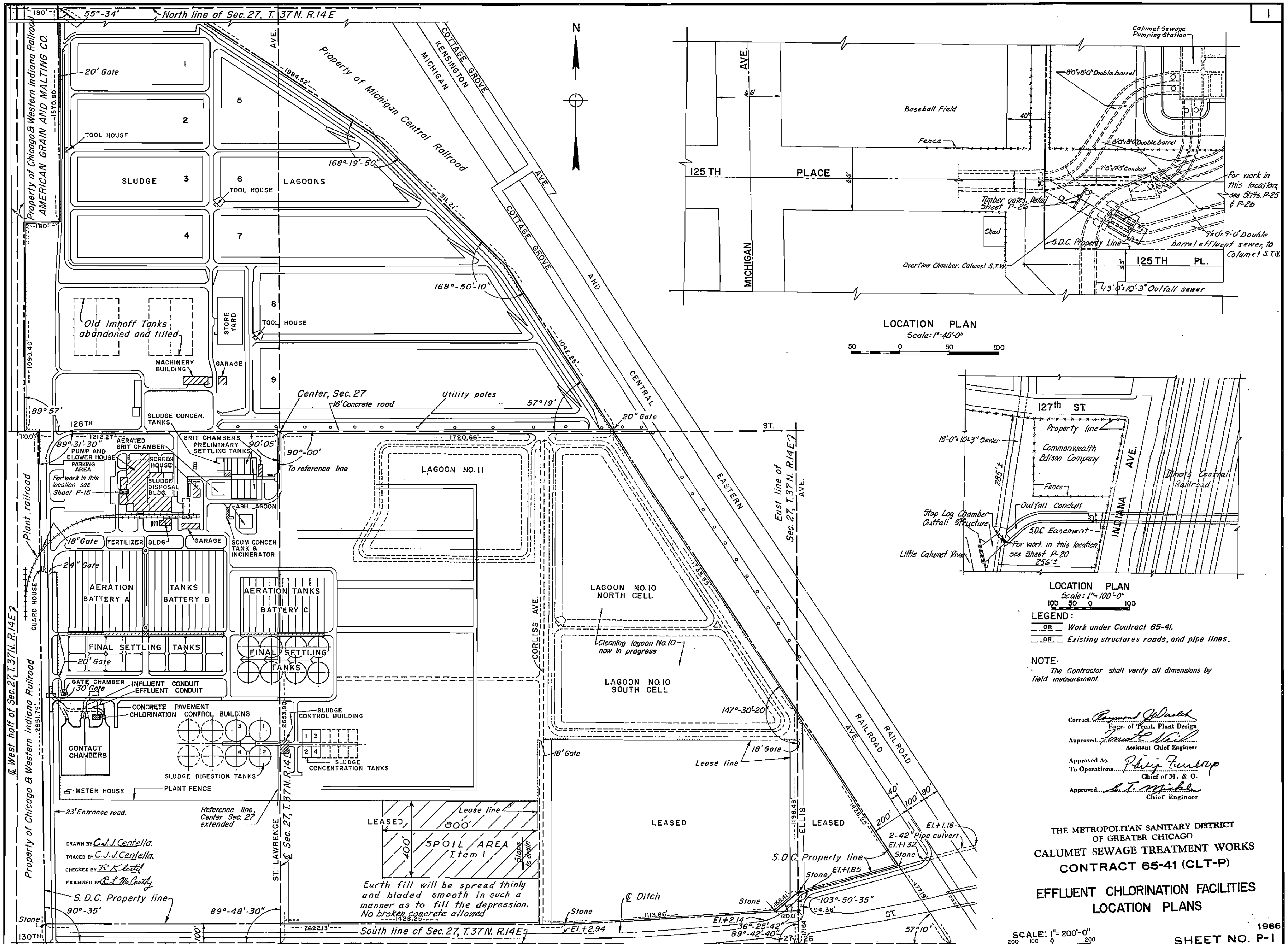
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

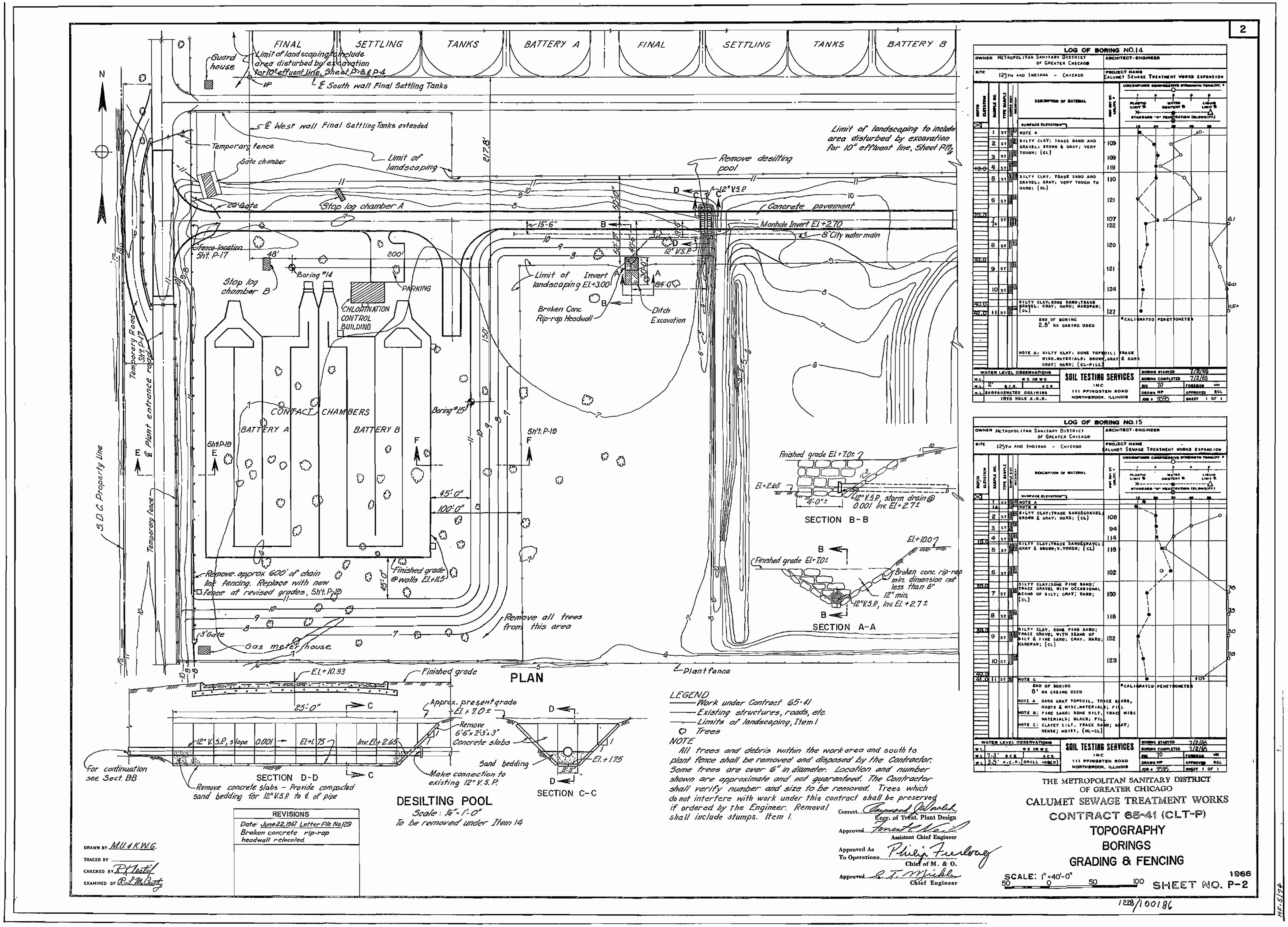
NORTH SIDE SEWAGE TREATMENT WORKS
CONTRACT 69-008-2P
SITE PREPARATION FOR FINE MESH ROTARY STRAINER
SOIL BORING LOG

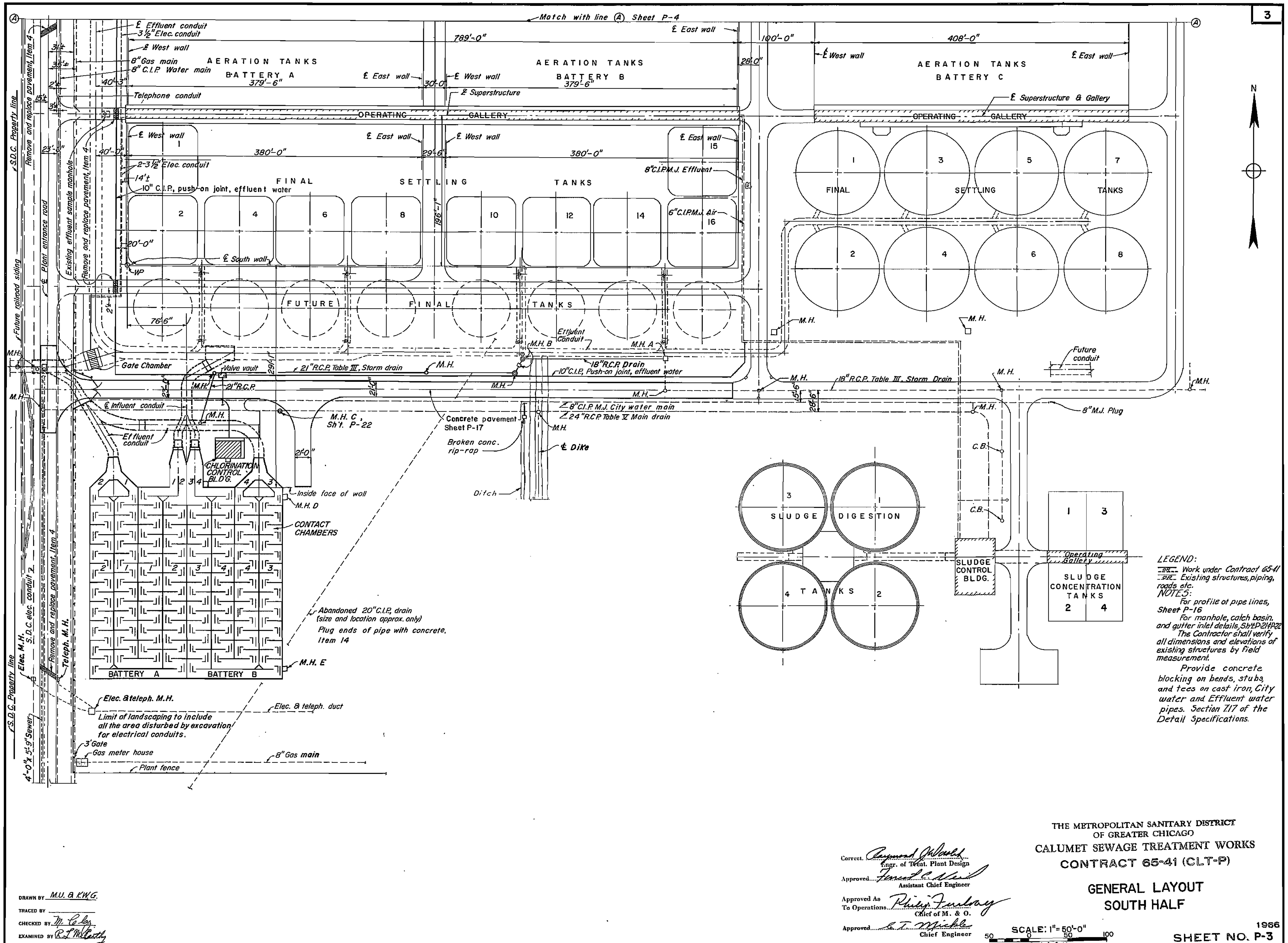
Correct: Leslie Sombai, Engineer of Structural Design
Approved: Robert Barbolini, Assistant Chief Engineer
Approved As To Operations: Ben Sosewitz, Acting Chief of M. & O.
Approved: Acting Chief Engineer

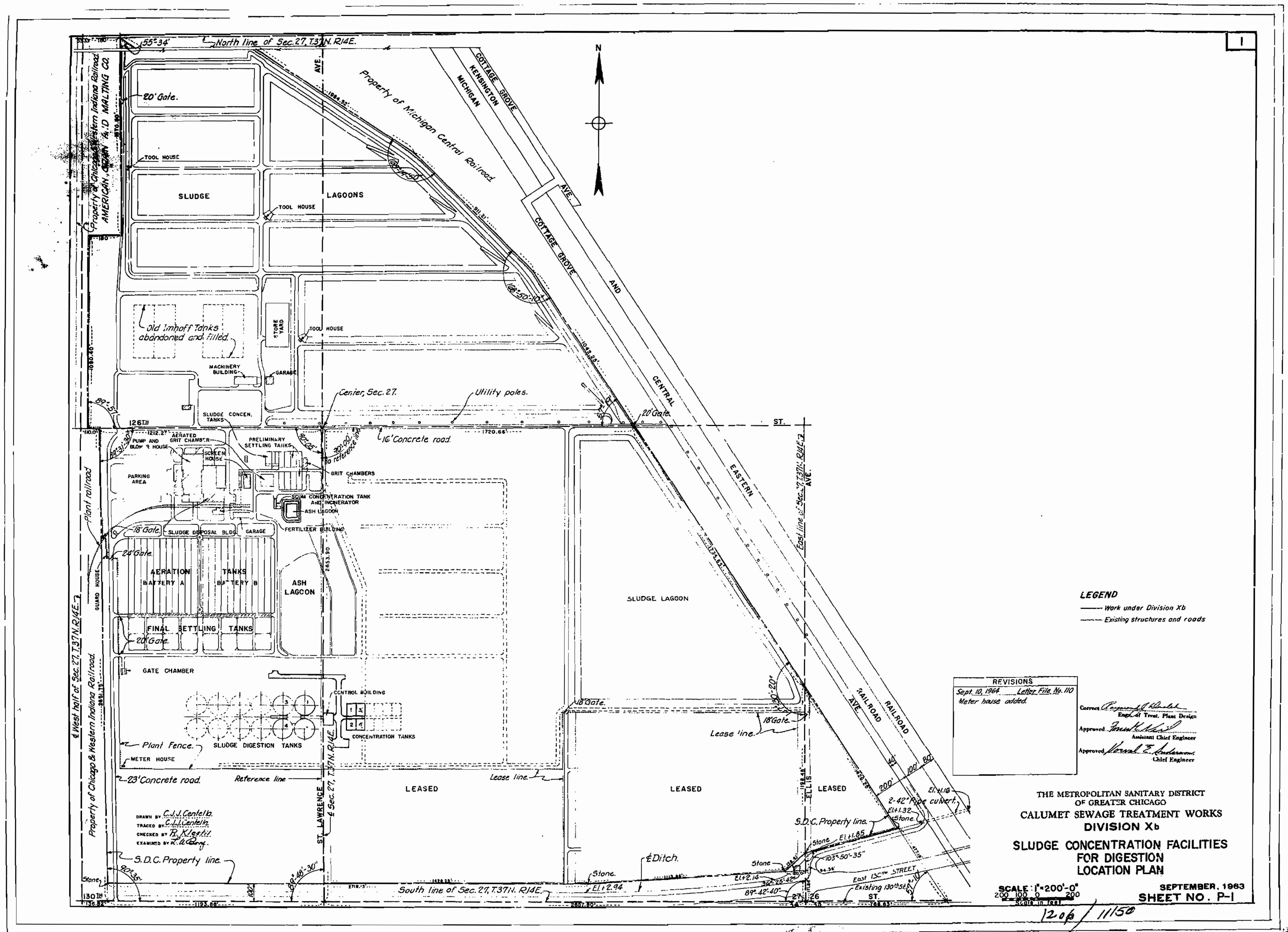
SCALES SHOWN ARE SCALES OF TRACINGS

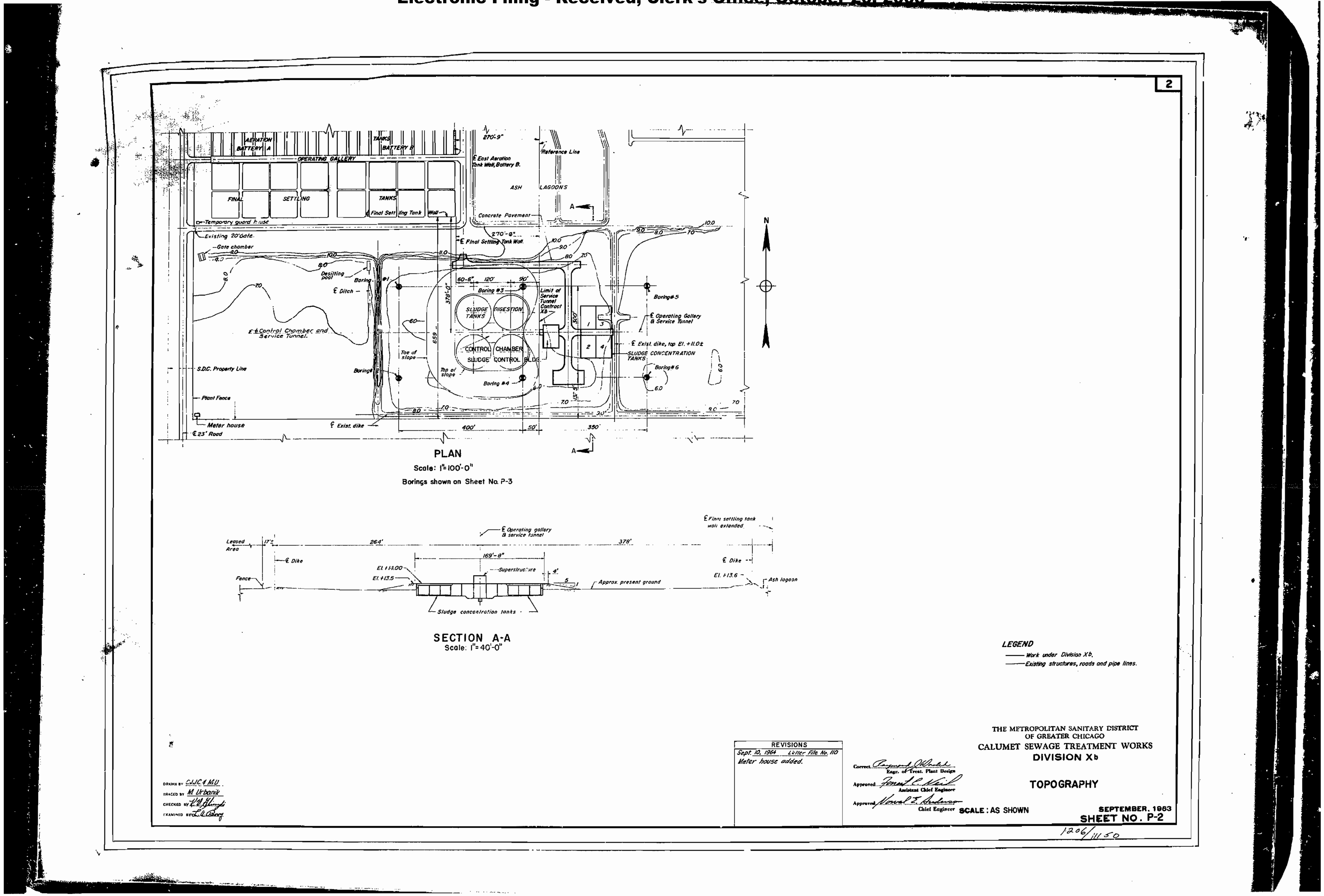
Drawn E. Czike | Traced | Checked J.L.P. MWK | DATE NOV., 1969 | SHEET NO. C-1


North line of Sec. 27, T. 37 N. R.14 E
Property of Michigan Central Railroad
Property of Chicago & Western Indiana Railroad
AMERICAN GRAIN AND MALTING CO.
COTTAGE GROVE
KENSINGTON
MICHIGAN
20' Gate
TOOL HOUSE
SLUDGE
LAGOONS
Old Imhoff Tanks abandoned and filled
MACHINERY BUILDING
STORE YARD
GARAGE
Center, Sec. 27
16' Concrete road
Utility poles
126TH
SLUDGE CONCEN. TANKS
AERATED GRIT CHAMBER
PUMP AND BLOWER HOUSE
PARKING AREA
For work in this location see Sheet P-15
GRIT CHAMBERS PRELIMINARY SETTLING TANKS
SCREEN HOUSE
SLUDGE DISPOSAL BLDG.
To reference line
LAGOON NO. 11
ASH LAGOON
FERTILIZER BLDG
SCUM CONCEN TANK & INCINERATOR
Plant railroad
GUARD HOUSE
AERATION BATTERY A
TANKS BATTERY B
AERATION TANKS BATTERY C
FINAL SETTLING TANKS
GATE CHAMBER
INFLUENT CONDUIT
EFFLUENT CONDUIT
CONCRETE PAVEMENT
CHLORINATION CONTROL BUILDING
CONTACT CHAMBERS
SLUDGE CONTROL BUILDING
SLUDGE DIGESTION TANKS
SLUDGE CONCENTRATION TANKS
METER HOUSE
PLANT FENCE
23' Entrance road.
Reference line, Center Sec. 27 extended
CORLISS AVE.
LAGOON NO. 10 NORTH CELL
Cleaning lagoon No. 10 now in progress
LAGOON NO. 10 SOUTH CELL
EASTERN
CENTRAL
AND
RAILROAD
East line of Sec. 27, T. 37 N. R.14 E
18' Gate
Lease line
LEASED
SPOIL AREA Item 1
Earth fill will be spread thinly and bladed smooth in such a manner as to fill the depression. No broken concrete allowed
ST. LAWRENCE
ELLIS
S.D.C. Property line
Ditch
South line of Sec. 27, T. 37 N. R.14 E
130TH
ST.
DRAWN BY C.J.J. Centella.
TRACED BY C.J.J. Centella.
CHECKED BY R. Klestil
EXAMINED BY R.L. McCarthy
125 TH PLACE
MICHIGAN AVE.
Baseball Field
Fence
Calumet Sewage Pumping Station
8'-0"x8'-0" Double barrel
7'-0"x7'-0" Conduit
For work in this location, see Shts. P-25 & P-26
Timber gates, Detail Sheet P-26
Shed
S.D.C. Property Line
9'-0"x9'-0" Double barrel effluent sewer, to Calumet S.T.W.
Overflow Chamber, Calumet S.T.W.
125TH PL.
13'-0"x10'-3" Outfall sewer
LOCATION PLAN
Scale: 1"=40'-0"
127th ST.
Property line
Commonwealth Edison Company
Illinois Central Railroad
INDIANA AVE.
Outfall Conduit
Stop Log Chamber Outfall Structure
S.D.C. Easement
For work in this location see Sheet P-20
Little Calumet River
LOCATION PLAN
Scale: 1"=100'-0"
LEGEND:
Work under Contract 65-41.
Existing structures roads, and pipe lines.
NOTE:
The Contractor shall verify all dimensions by field measurement.
Correct. Engr. of Treat. Plant Design
Approved. Assistant Chief Engineer
Approved As To Operations. Chief of M. & O.
Approved. Chief Engineer
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
CONTRACT 65-41 (CLT-P)
EFFLUENT CHLORINATION FACILITIES LOCATION PLANS
SCALE: 1"=200'-0"
1966
SHEET NO. P-1

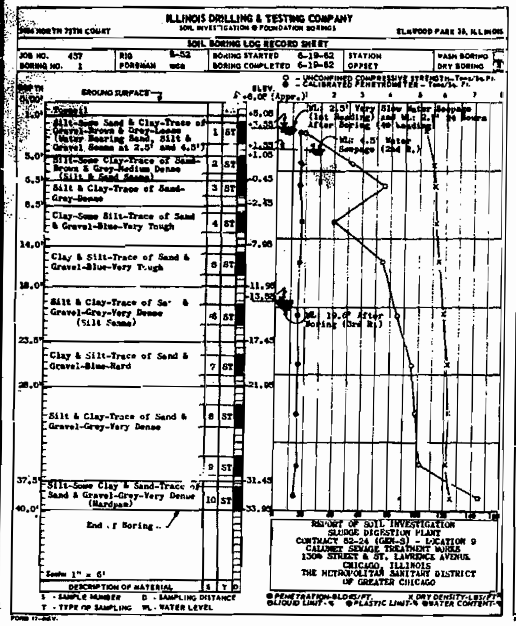

2
FINAL SETTLING TANKS BATTERY A
FINAL SETTLING TANKS BATTERY B
Guard house
Limit of landscaping to include area disturbed by excavation for 10" effluent line, Sheet P-8 & P-4
℄ South wall Final Settling Tanks
℄ West wall Final Settling Tanks extended
Temporary fence
Gate chamber
Limit of landscaping
22' Gate
Stop log chamber A
Limit of landscaping to include area disturbed by excavation for 10" effluent line, Sheet P-17
Remove desilting pool
Concrete pavement
Manhole Invert El +2.70
8" City water main
Fence location Sh't. P-17
Boring #14
Stop log chamber B
CHLORINATION CONTROL BUILDING
PARKING
Limit of landscaping
Invert El.+3.00
Broken Conc. Rip-rap Headwall
Ditch Excavation
CONTACT CHAMBERS
BATTERY A
BATTERY B
Boring #15
Sh't. P-19
Temporary Road ℄ Plant entrance road Sh't. P-17
S.D.C. Property line
Temporary fence
Remove approx 600' of chain link fencing. Replace with new fence at revised grades, Sh't. P-19
Finished grade @ walls El.+11.5
Remove all trees from this area
3' Gate
Gas meter house
El.+10.93
Finished grade
Plant fence
PLAN
SECTION B-B
Finished grade El+7.0±
12" V.S.P. storm drain @ 0.001 Inv. El+2.7±
SECTION A-A
Broken conc. rip-rap min. dimension not less than 6"
12" V.S.P., Inv. El. +2.7±
SECTION D-D
For continuation see Sect. BB
Remove concrete slabs - Provide compacted sand bedding for 12" V.S.P. to ℄ of pipe
Approx. present grade El.+7.0±
Remove 6'6"x2'3"x3" Concrete slabs
Sand bedding
Make connection to existing 12" V.S.P.
SECTION C-C
DESILTING POOL
Scale: 1/4"=1'-0"
To be removed under Item 14
LEGEND
Work under Contract 65-41
Existing structures, roads, etc.
Limits of landscaping, Item I
Trees
NOTE
All trees and debris within the work area and south to plant fence shall be removed and disposed by the Contractor. Some trees are over 6" in diameter. Location and number shown are approximate and not guaranteed. The Contractor shall verify number and size to be removed. Trees which do not interfere with work under this contract shall be preserved if ordered by the Engineer. Removal shall include stumps. Item I.
REVISIONS
Date: June 22, 1967 Letter File No. 129
Broken concrete rip-rap headwall relocated.
LOG OF BORING NO. 14
OWNER METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
SITE 125TH AND INDIANA - CHICAGO
PROJECT NAME CALUMET SEWAGE TREATMENT WORKS EXPANSION
SOIL TESTING SERVICES INC
111 PFINGSTEN ROAD NORTHBROOK, ILLINOIS
LOG OF BORING NO. 15
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
CONTRACT 65-41 (CLT-P)
TOPOGRAPHY
BORINGS
GRADING & FENCING
Correct. Engr. of Treat. Plant Design
Approved. Assistant Chief Engineer
Approved As To Operations. Chief of M. & O.
Approved. Chief Engineer
SCALE: 1"=40'-0"
1966
SHEET NO. P-2
DRAWN BY M.U. & K.W.G.
TRACED BY
CHECKED BY
EXAMINED BY
1228/10018G

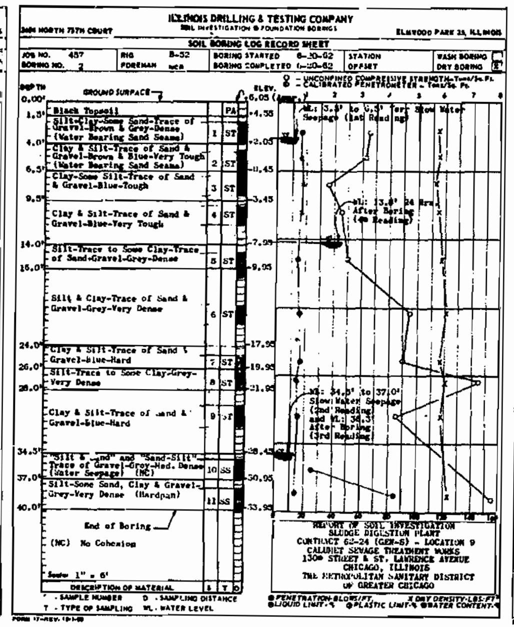

3
Match with line (A) Sheet P-4
AERATION TANKS
BATTERY A
379'-6"
AERATION TANKS
BATTERY B
379'-6"
AERATION TANKS
BATTERY C
789'-0"
100'-0"
408'-0"
℄ Effluent conduit
3½" Elec. conduit
℄ West wall
8" Gas main
8" C.I.P. Water main
Telephone conduit
℄ East wall
℄ Superstructure
℄ Superstructure & Gallery
OPERATING GALLERY
FINAL SETTLING TANKS
380'-0"
10" C.I.P., push-on joint, effluent water
2-3½" Elec. conduit
℄ South wall
8" C.I.P.M.J. Effluent
6" C.I.P.M.J. Air
FUTURE FINAL TANKS
76'-6"
Gate Chamber
Valve vault
21" R.C.P. Table III, Storm drain
18" R.C.P. Drain
10" C.I.P. Push-on joint, effluent water
18" R.C.P. Table III, Storm Drain
8" C.I.P. M.J. City water main
24" R.C.P. Table V Main drain
℄ Influent conduit
Effluent conduit
M.H. C, Sh't. P-22
Concrete pavement Sheet P-17
Broken conc. rip-rap
℄ Dike
Ditch
CHLORINATION CONTROL BLDG.
Inside face of wall
M.H. D
CONTACT CHAMBERS
BATTERY A
BATTERY B
M.H. E
Abandoned 20" C.I.P. drain (size and location approx. only)
Plug ends of pipe with concrete. Item 14
Elec. & teleph. M.H.
Limit of landscaping to include all the area disturbed by excavation for electrical conduits.
Elec. & teleph. duct
3' Gate
Gas meter house
8" Gas main
Plant fence
S.D.C. Property line
Remove and replace pavement, Item 4
Plant entrance road
Existing effluent sample manhole
Future railroad siding
Elec. M.H.
S.D.C. elec. conduit
Teleph. M.H.
4'-0" x 5'-9" Sewer
Future conduit
8" M.J. Plug
SLUDGE DIGESTION TANKS
SLUDGE CONTROL BLDG.
SLUDGE CONCENTRATION TANKS
Operating Gallery
FINAL SETTLING TANKS
N
LEGEND:
Work under Contract 65-41
Existing structures, piping, roads etc.
NOTES:
For profile of pipe lines, Sheet P-16
For manhole, catch basin, and gutter inlet details, Sh't P-21 & P-22
The Contractor shall verify all dimensions and elevations of existing structures by field measurement.
Provide concrete blocking on bends, stubs, and tees on cast iron, City water and Effluent water pipes. Section 7.17 of the Detail Specifications.
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
CONTRACT 65-41 (CLT-P)
GENERAL LAYOUT
SOUTH HALF
Correct. Engr. of Treat. Plant Design
Approved. Assistant Chief Engineer
Approved As To Operations. Chief of M. & O.
Approved. Chief Engineer
SCALE: 1"=50'-0"
Scale in feet
1966
SHEET NO. P-3
DRAWN BY M.U. & K.W.G.
TRACED BY
CHECKED BY
EXAMINED BY
1228/100186

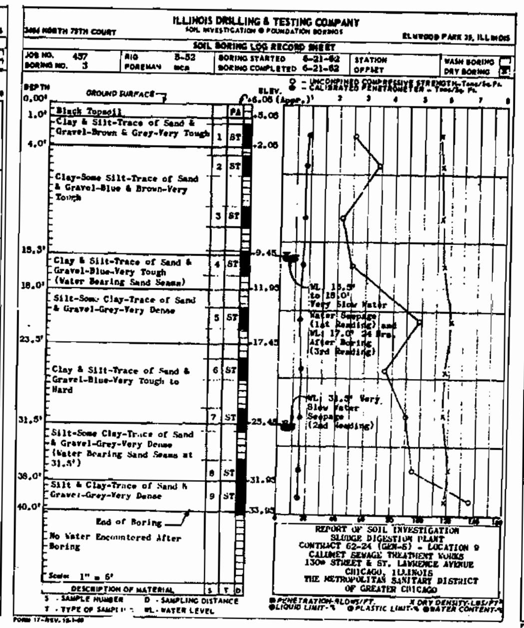

North line of Sec. 27, T37N, R14E.
Property of Michigan Central Railroad
COTTAGE GROVE
KENSINGTON
MICHIGAN
AVE.
COTTAGE GROVE AND CENTRAL EASTERN
RAILROAD
AVE.
RAILROAD
Property of Chicago & Western Indiana Railroad
AMERICAN MALTING CO.
20' Gate.
TOOL HOUSE
SLUDGE
LAGOONS
TOOL HOUSE
Old Imhoff Tanks abandoned and filled.
STORE YARD
TOOL HOUSE
MACHINERY BUILDING
GARAGE
SLUDGE CONCEN. TANKS
Center, Sec. 27.
Utility poles.
20' Gate.
126TH
ST.
AERATED GRIT CHAMBER
PUMP AND BLOW'R HOUSE
PRELIMINARY SETTLING TANKS
SCREEN HOUSE
PARKING AREA
GRIT CHAMBERS
16' Concrete road.
SCUM CONCENTRATION TANK AND INCINERATOR
ASH LAGOON
Plant railroad
18' Gate.
SLUDGE DISPOSAL BLDG.
GARAGE
FERTILIZER BUILDING
24' Gate.
AERATION BATTERY A
TANKS BATTERY B
ASH LAGOON
GUARD HOUSE
FINAL SETTLING TANKS
20' Gate.
GATE CHAMBER
CONTROL BUILDING
Plant Fence.
SLUDGE DIGESTION TANKS
CONCENTRATION TANKS
METER HOUSE
23' Concrete road.
Reference line
Lease line.
LEASED
SLUDGE LAGOON
18' Gate.
18' Gate.
Lease line.
LEASED
LEASED
ELLIS
East line of Sec. 27, T37N, R14E.
AVE.
ST. LAWRENCE
℄ Sec. 27, T37N, R14E.
℄ West half of Sec. 27, T37N, R14E.
S.D.C. Property line.
S.D.C. Property line.
℄ Ditch.
Stone.
2-42" Pipe culvert.
East 130th STREET
Existing 130th St.
South line of Sec. 27, T37N, R14E.
130TH
LEGEND
Work under Division Xb
Existing structures and roads
REVISIONS
Sept. 10, 1964 Letter File No. 110
Meter house added.
Correct
Engr. of Treat. Plant Design
Approved
Assistant Chief Engineer
Approved
Chief Engineer
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xb
SLUDGE CONCENTRATION FACILITIES FOR DIGESTION LOCATION PLAN
SCALE: 1"=200'-0"
Scale in feet
SEPTEMBER, 1963
SHEET NO. P-1
1206 / 11150

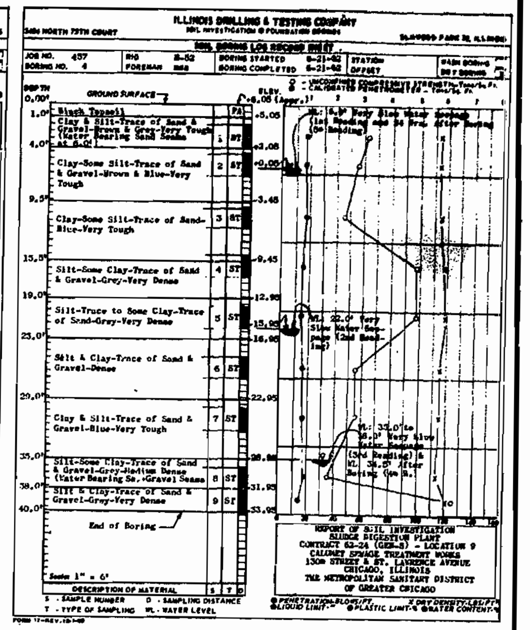

2
PLAN
Scale: 1"=100'-0"
Borings shown on Sheet No. P-3
SECTION A-A
Scale: 1"=40'-0"
LEGEND
Work under Division Xb.
Existing structures, roads and pipe lines.
REVISIONS
Sept. 10, 1964 Letter File No. 110
Meter house added.
THE METROPOLITAN SANITARY DISTRICT
OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xb
TOPOGRAPHY
SCALE: AS SHOWN
SEPTEMBER, 1963
SHEET NO. P-2
Engr. of Treat. Plant Design
Assistant Chief Engineer
Chief Engineer
AERATION BATTERY A
TANKS BATTERY B
OPERATING GALLERY
FINAL SETTLING TANKS
ASH LAGOONS
SLUDGE DIGESTION TANKS
CONTROL CHAMBER
SLUDGE CONTROL BLDG.
SLUDGE CONCENTRATION TANKS
Sludge concentration tanks
Approx. present ground
Ash lagoon
Meter house
S.D.C. Property Line
Plant Fence
Temporary guard house
Existing 20' Gate
Desilting pool
Boring #1
Boring #3
Boring #4
Boring #5
Boring #6
400'
50'
350'
264'
379'
169'-8"
El. +14.00
El. +13.5
El. +13.6

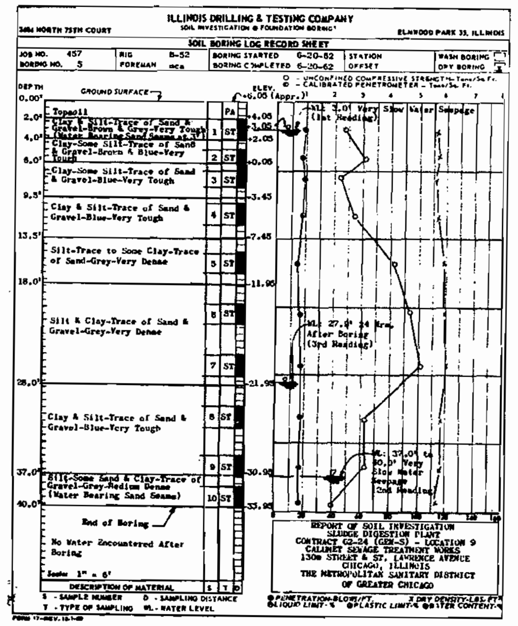
3

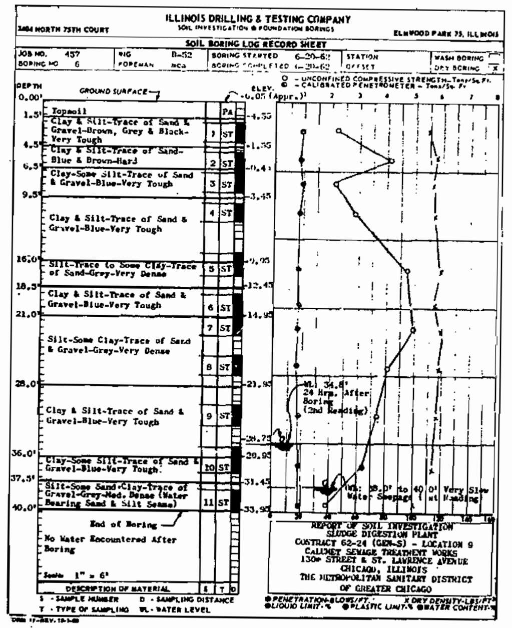












BORING LOGS
WHILE THIS INFORMATION IS BELIEVED TO BE ACCURATE, THE SANITARY DISTRICT DOES NOT GUARANTEE THE SAME. THE CONTRACTOR MUST SATISFY HIMSELF BY MAKING BORINGS OR TEST PITS, OR BY SUCH OTHER METHODS AS HE MAY PREFER, AS TO THE CHARACTER, LOCATION AND AMOUNTS OF WATER, PEAT, CLAY, SAND, QUICKSAND, GRAVEL, GLACIAL DRIFT, BOULDERS, CONGLOMERATE, ROCK, GAS AND OTHER MATERIAL TO BE ENCOUNTERED AND WORK TO BE PERFORMED.

DRAWN BY I.D.T.&T.Co.
TRACED BY C.J.J.C.
CHECKED BY C.J.J.C.
EXAMINED BY L.A.Bary

Correct ______ Engr. of Treat. Plant Design
Approved ______ Assistant Chief Engineer
Approved ______ Chief Engineer

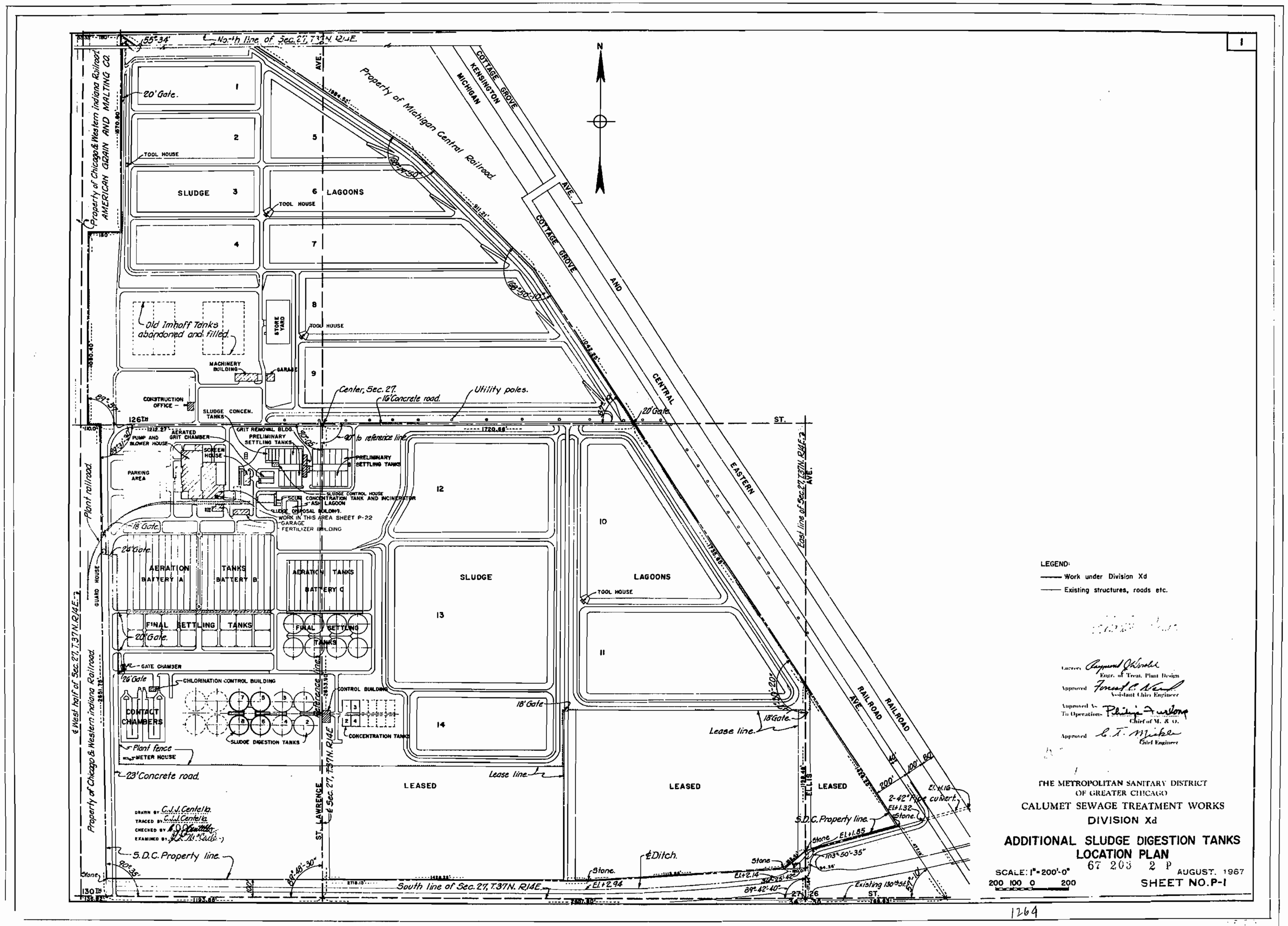
THE METROPOLITAN SANITARY DISTRICT
OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xb

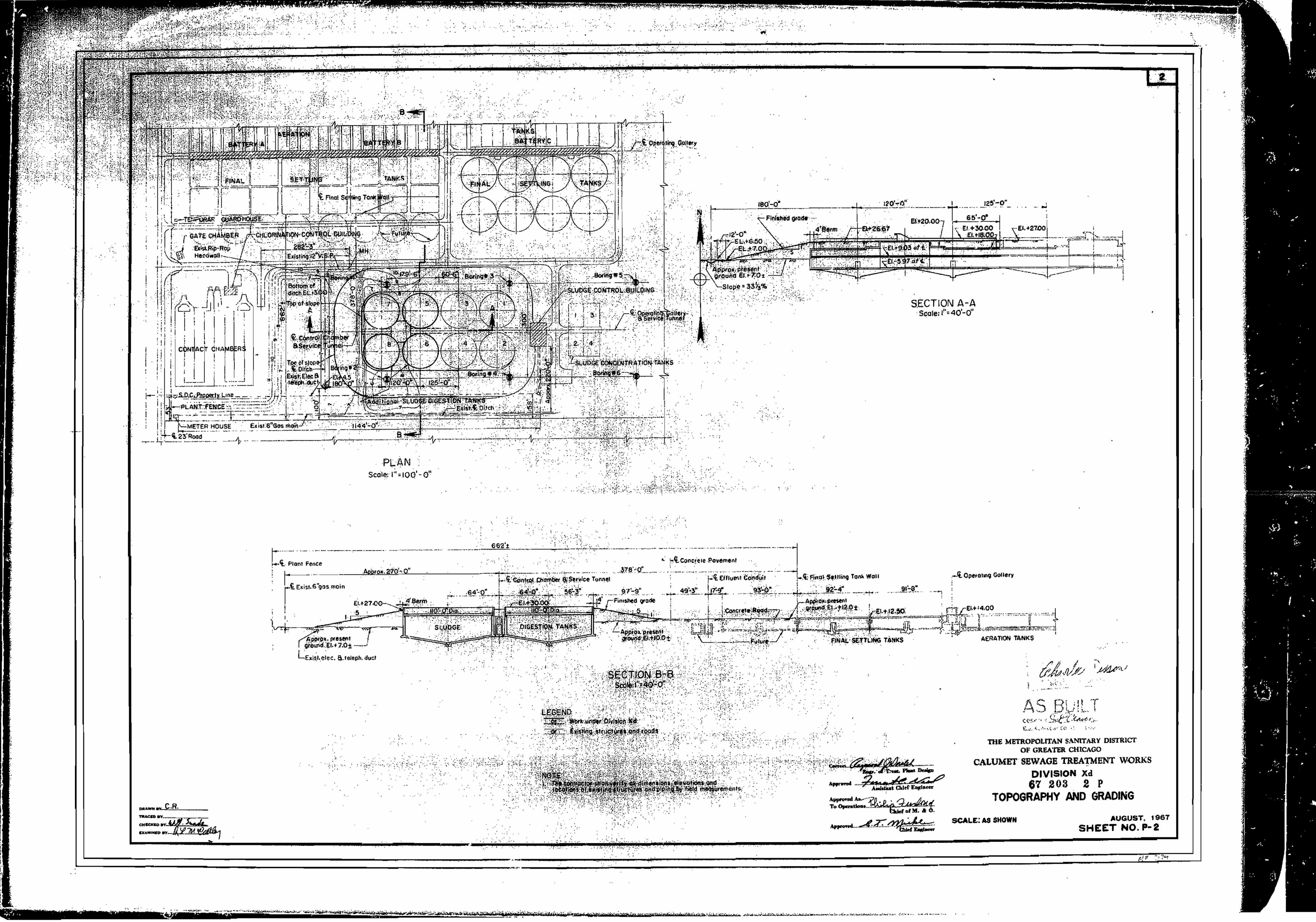
BORINGS

SCALE:

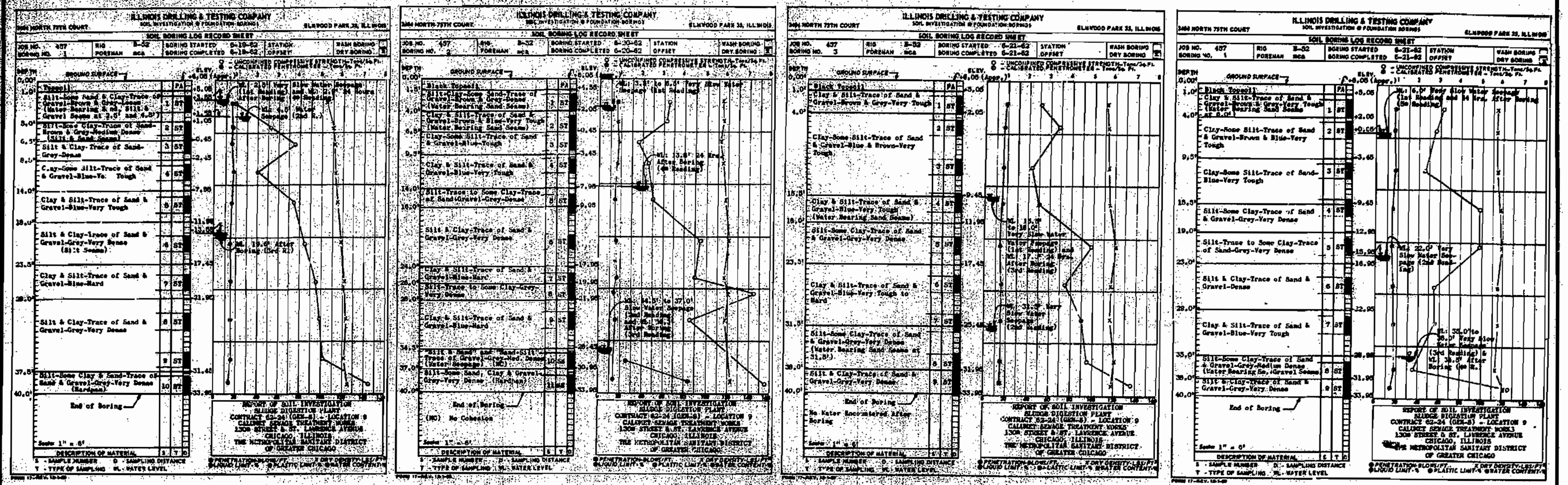
SEPTEMBER, 1963
SHEET NO. P-3

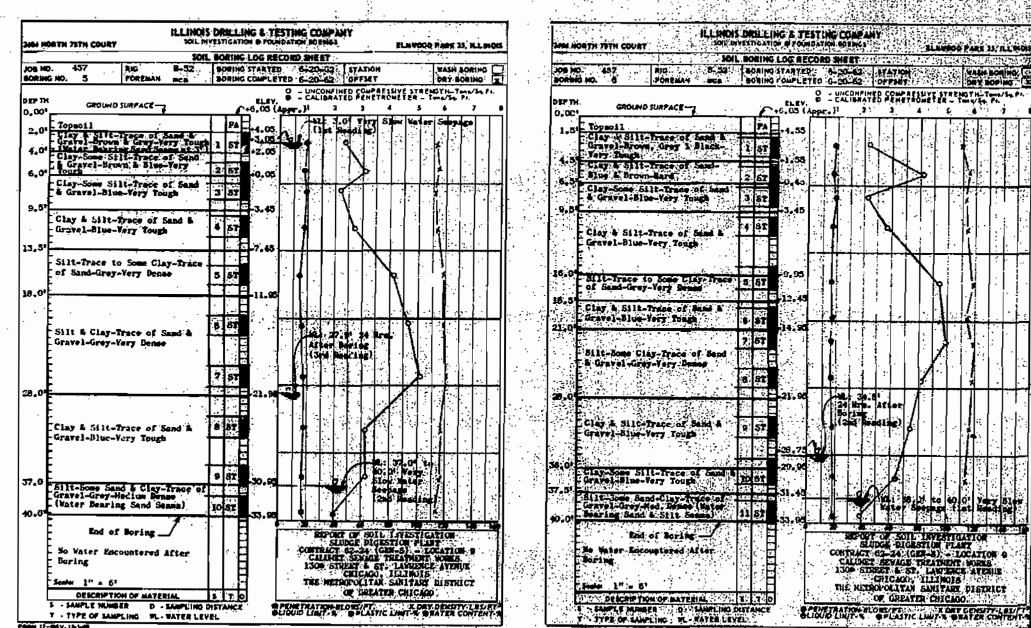
1206/11150


North line of Sec. 27, T.37N. R14E.
Property of Chicago & Western Indiana Railroad
AMERICAN GRAIN AND MALTING CO.
Property of Michigan Central Railroad
COTTAGE GROVE AVE.
KENSINGTON
MICHIGAN
CENTRAL
EASTERN
RAILROAD
SLUDGE
LAGOONS
TOOL HOUSE
20' Gate.
Old Imhoff Tanks abandoned and filled.
MACHINERY BUILDING
STORE YARD
GARAGE
CONSTRUCTION OFFICE
SLUDGE CONCEN. TANKS
126TH ST.
Center, Sec. 27.
16' Concrete road.
Utility poles.
AERATED GRIT CHAMBER
PUMP AND BLOWER HOUSE
GRIT REMOVAL BLDG.
PRELIMINARY SETTLING TANKS
SCREEN HOUSE
PARKING AREA
Plant railroad.
AERATION TANKS BATTERY A
BATTERY B
AERATION TANKS BATTERY C
FINAL SETTLING TANKS
GUARD HOUSE
GATE CHAMBER
CHLORINATION CONTROL BUILDING
CONTACT CHAMBERS
SLUDGE DIGESTION TANKS
CONCENTRATION TANKS
Plant fence
METER HOUSE
23' Concrete road.
LEASED
Lease line.
ST. LAWRENCE AVE.
S.D.C. Property line.
South line of Sec. 27, T.37N. R14E.
Existing 130th ST.
East line of Sec. 27, T.37N. R14E.
LEGEND:
Work under Division Xd
Existing structures, roads etc.
THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xd
ADDITIONAL SLUDGE DIGESTION TANKS
LOCATION PLAN
SCALE: 1"=200'-0"
67 203 2 P
AUGUST, 1967
SHEET NO. P-1
1264


2
AERATION TANKS
BATTERY A
BATTERY B
BATTERY C
FINAL SETTLING TANKS
GATE CHAMBER
CHLORINATION CONTROL BUILDING
CONTACT CHAMBERS
SLUDGE CONTROL BUILDING
SLUDGE CONCENTRATION TANKS
Additional SLUDGE DIGESTION TANKS
METER HOUSE
PLANT FENCE
PLAN
Scale: 1" = 100'-0"
SECTION A-A
Scale: 1" = 40'-0"
SECTION B-B
Scale: 1" = 40'-0"
SLUDGE DIGESTION TANKS
FINAL SETTLING TANKS
AERATION TANKS
LEGEND
Work under Division Xd
Existing structures and roads
NOTE
1. The contractor shall verify all dimensions, elevations and locations of existing structures and piping by field measurements.
AS BUILT
THE METROPOLITAN SANITARY DISTRICT
OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xd
67 203 2 P
TOPOGRAPHY AND GRADING
Correct
Engr. of Treat. Plant Design
Approved
Assistant Chief Engineer
Approved As To Operations
Chief of M. & O.
Approved
Chief Engineer
SCALE: AS SHOWN
AUGUST, 1967
SHEET NO. P-2
DRAWN BY C.R.

3





BORING LOGS
WHILE THIS INFORMATION IS BELIEVED TO BE ACCURATE, THE SANITARY DISTRICT DOES NOT GUARANTEE THE SAME. THE CONTRACTOR MUST SATISFY HIMSELF BY MAKING BORINGS OR TEST PITS, OR BY SUCH OTHER METHODS AS HE MAY PREFER, AS TO THE CHARACTER, LOCATION AND AMOUNTS OF WATER, PEAT, CLAY, SAND, QUICKSAND, GRAVEL, GLACIAL DRIFT, BOULDERS, CONGLOMERATE, ROCK, GAS AND OTHER MATERIAL TO BE ENCOUNTERED AND WORK TO BE PERFORMED.

DRAWN BY I.D.T.&T.Co.
TRACED BY C.N.J.C.
CHECKED BY C.N.J.C.
EXAMINED BY R.F. McCarthy

Charles Payson

AS BUILT
CORRECT F.E. Craven
E.J. ALBRECHT CO. TECH. ENGR.

Correct Raymond J. Weidel, Engr. of Treat. Plant Design
Approved ..., Assistant Chief Engineer
Approved As To Operations Philip Freidtong, Chief of M. & O.
Approved C.T. Mickle, Chief Engineer

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
CALUMET SEWAGE TREATMENT WORKS
DIVISION Xd
67-203 2 P
TEST PITS AND BORINGS

AUGUST, 1967
SHEET NO. P-3

MF 7/74

APPENDIX F

COST ESTIMATE BREAKDOWN TABLES

NSWRP CAPITAL COST ESTIMATION FOR ULTRAVIOLET DISINFECTION SYSTEM AND LOW LIFT PUMP STATION

A. GENERAL SITEWORK

DIVISION	ITEM DESCRIPTION	UNITS	NO.	MATERIAL & LABOR UNIT COST	INSTALLED COST TOTAL	REMARKS
1	GENERAL REQUIREMENTS (Field personnel, Field Offices, Testing & Misc. Project Overheads)				$1,682,710	15% of Installed Cost for all divisions
2	SITEWORK					
	General Equipment Mobilization/Demob (not including pile driving equipment)	LS	1	$10,000.00	$10,000	
	Road work (Concrete Pavement)	SY	3,710	$232.81	$863,735	
	Site Excavation (not structures or conduits)	CY	3,056	$2.68	$8,194	Embankment excavation by BH and onsite stocl
	Fencing Removal	LF	1,625	$6.44	$10,472	posts every 20 '
	Fencing	LF	1,524	$49.69	$75,729	
	Fence Gates (20')	Ea	2	$3,574	$7,147	
	Clearing and Grubbing	SF	238,737	$0.50	$119,369	converted unit to SF
	Strip topsoil and stockpile	SY	13,889	$1.43	$19,854	
	Final Grading	SY	13,889	$1.00	$13,889	
	Sheeting/Shoring	SF	8,340	$43.99	$366,882	+50% for weekend work only
	Retaining Wall (15'H)	LF	530	$2,105.00	$1,115,650	Adjusted to remove sub profit
	Hand Mining/Connection/Bulkheading at U/S Connection	LS	1	$450,000.00	$450,000	
	Bulkheading and Removal at Gate Structure #3	LS	1	$120,000.00	$120,000	
	Misc. Utility Demolition	LF	1,300	$12.31	$16,009	
	Erosion Control/Final Seeding	SF	250,000	$0.40	$99,918	
	Silt Fence	LF	2,500	$3.00	$7,500	
	Survey, Construction Staking	Days	120	$1,095.52	$131,462	
	Temporary Power Feed	Ea	2	$5,000.00	$10,000	
	Temporary Connections	Ea	10	$500.00	$5,000	
	Temporary Heating	SF	14,100	$11.86	$167,189	
	Temporary Lighting	SF	14,100	$14.40	$203,039	
	Power Use for Temporary Facilites	csf/Mo	131	$3.14	$4,936	
	Water Bill	Mo	36	$70.30	$2,531	
	Temp Access Road	SY	1,225	$10.83	$13,262	Assume 33% of final roadway
	CPM Scheduling	Proj	65.4 mil	0.04%	$26,160	
	Cleaning	Proj	65.4 mil	0.30%	$196,200	
	Commissioning	Proj	65.4 mil	0.50%	$327,000	
	Special Equipment Startup	Days	50	$725.82	$36,291	UV Equipment - 25 days, Pumps 25 days
	PIPES					
	Steam (12" dia) & Condensate Return (4" dia)	LF	475	$420.00	$199,500	
	Drain (24" dia)	LF	550	$379.85	$208,918	
	Non-potable Water (6" dia)	LF	490	$55.70	$27,293	
	WNP Hydrants	Ea	4	$1,874.69	$7,499	
	Storm Sewer (24" RCP)	LF	660	$128.38	$84,731	
	City Water (6" dia)	LF	145	$55.70	$8,077	
	Potable Fire Hydrants	Ea	4	$1,874.69	$7,499	
	3" STL Casing Pipe with 1" PVC Sampling Line	LF	45	$47.62	$2,143	
	Effluent (36" RCP)	LF	500	$207.12	$103,560	
	EFFLUENT CONDUITS					
	Conduit, Effluent to Gate Structure (GS) # 1	LF	25	$2,869.00	$71,725	
	Conduit, GS1 to GS2	LF	425	$2,161.00	$918,425	
	Conduit, GS1 to LLPS	LF	52	$2,869.00	$149,188	
	Conduit, LLPS to UV Bldg	LF	100	$2,869.00	$286,900	
	Conduit, UV Bldg to GS2	LF	120	$2,869.00	$344,280	
	Conduit, GS2 to GS3	LF	115	$3,191.00	$366,965	
	MANHOLES					
	Manholes	Ea	19	$2,542.54	$48,308	Excavation/Backfill Incidental to Pipe
	Drop Manholes	Ea	1	$9,249.82	$9,250	+25% for drop manhole
	Inlet/Catch Basin	Ea	24	$1,318.14	$31,635	Excavation/Backfill Incidental to Pipe
	GATE STRUCTURES					
	GS1					
	Excavation	CY	583	$24.07	$14,031	
	General Backfill	CY	96	$7.09	$681	
	Engineered Backfill	CY	65	$25.13	$1,634	
	Diposal of Spoil	CY	487	$19.65	$9,569	
	Piling Mobilization	CY	1	$13,942.98	$13,943	
	Concrete Filled Pipe Piles (50')	LF	1,500	$67.37	$101,057	Adjusted for VLF
	Pile Load Test	Ea	1	$18,805.44	$18,805	
	Temporary Sheeting/Shoring	SF	2,160	$29.39	$63,473	
	Dewatering	LS	1	$5,000.00	$5,000	
	Concrete					
	Base Slabs (includes labor)	CY	41	$500.00	$20,500	
	Walls (includes labor)	CY	88	$920.00	$80,960	
	Elevated Slabs (includes labor)	CY	41	$1,000.00	$41,000	
	Gates	Ea	2	$90,000.00	$180,000	Material Only
	Gate installation	Ea	2	$27,000.00	$54,000	Installation
	Hatch (SS)	Ea	1	$10,170.00	$10,170	
	GS2					
	Excavation	CY	867	$24.07	$20,865	
	General Backfill	CY	263	$7.09	$1,864	
	Engineered Backfill	CY	59	$25.13	$1,483	
	Diposal of Spoil	CY	604	$19.65	$11,868	
	Piling Mobilization	LS	1	$13,942.98	$13,943	
	Concrete Filled Pipe Piles (50')	LF	1,500	$67.37	$101,057	Adjusted for VLF
	Pile Load Test	Ea	1	$18,805.44	$18,805	
	Temporary Sheeting/Shoring	SF	3,038	$29.39	$89,274	
	Dewatering	LS	1	$5,000.00	$5,000	
	Concrete					
	Base Slabs (includes labor)	CY	36	$500.00	$18,000	
	Walls (includes labor)	CY	147	$920.00	$135,240	
	Elevated Slabs (includes labor)	CY	36	$1,000.00	$36,000	
	Gates	Ea	2	$90,000.00	$180,000	Material Only
	Gate installation	Ea	2	$27,000.00	$54,000	Installation
	Hatch (SS)	Ea	2	$10,170.00	$20,340	

	GS3					
	Excavation	CY	2,008	$24.07	$48,325	
	General Backfill	CY	521	$7.09	$3,693	
	Engineered Backfill	CY	122	$25.13	$3,066	
	Diposal of Spoil	CY	1,487	$19.65	$29,218	
	Dewatering	LS	1	$25,000.00	$25,000	
	Concrete					
	Base Slabs (includes labor)	CY	285	$500.00	$142,500	
	Walls (includes labor)	CY	46	$920.00	$42,320	
	Elevated Slabs (includes labor)	CY	13	$1,000.00	$13,000	
	Bulkhead Installation & Removal	LS	1	$150,000.00	$150,000	
	Gates	Ea	1	$90,000.00	$90,000	Material Only
	Gate installation	Ea	2	$27,000.00	$54,000	Installation
	Hatch (SS)	Ea	1	$10,170.00	$10,170	
16	ELECTRICAL DUCT BANK					
	6 cells, 5" conduit from Battery E to UV Building	LF	1,020	$200.00	$204,000	
	6 cells, 5" conduit from UV Building to PS	LF	140	$200.00	$28,000	
	4 cells, 5" conduit from UV Building to Pump and Blower Bldg.	LF	1,000	$160.00	$160,000	
	500 kcmil (15 kV)	LF	4,710	$20.00	$94,200	
	4/0 AWG (600 V)	LF	690	$7.00	$4,830	
	Fiber Optic Cable	LF	1,850	$95.00	$175,750	
	Electrical Manholes	Ea	18	$12,500.00	$225,000	
	TRANSFORMER YARD (*70% OF COST ALLOCATED TO UV)					Cost is allocated porportionally between
	Switchgear Yard, 50ft x 50ft, fence and stone	LS	1	$50,000.00	$35,000*	Battery E, Tertiary Filters, and UV.
	Medium-Voltage Air Interrupter Switchgear					UV is 70% of total (5 MVA of 7MVA)
	Transformer Primary Switch, 38KV, 600A	EA	2	$99,000.00	$138,600*	
	Motor operated main and tie switches, 15 KV, 600A	EA	3	$54,800.00	$115,080*	
	Feeder switches, 15 KV, 600A	EA	4	$54,800.00	$153,440*	
	Substation Transformers	MVA	20	$39,100.00	$547,400*	
	Site Lighting Poles	Ea	10	$3,280.70	$32,807	
	Battery E Switchgear Modifications	LS	1	$66,792.00	$66,792	Labor = 20% of material cost
	SUBTOTAL				**$12,900,777**	
	GC Markup on Subs @ 5% (except for General Conditions)				**$560,903**	
	Subtotal				**$13,461,680**	**A**
	Escalation to Midpoint of Construction @ 7.5%				**$1,009,626**	**B = A X 0.075**
	Subtotal				**$14,471,306**	**A+B**
	Contractor OH&P @ 15%				**$2,019,252**	**C = (A+B) X 0.15**
	Subtotal				**$15,480,932**	**A+B+C**
	Planning Level Contingency @ 30%				**$4,644,280**	**D = (A+B+C) x 0.3**
	Subtotal				**$20,125,212**	**A+B+C+D**
	Misc. Capital Costs					
	Legal and Fiscal Fees @ 15%				**$3,018,782**	**E = (A+B+C+D) x 0.15**
	Engineering Fees including CM @ 20%				**$4,025,042**	**F = (A+B+C+D) x 0.2**
	Subtotal				**$7,043,824**	**E+F**
	GENERAL SITEWORK PROJECT TOTAL				**$27,170,000**	**A+B+C+D+E+F**

NSWRP CAPITAL COST ESTIMATION FOR ULTRAVIOLET DISINFECTION SYSTEM AND LOW LIFT PUMP STATION

B. LOW LIFT PUMP STATION

DIVISION	ITEM DESCRIPTION	UNITS	NO.	MATERIAL UNIT COST	INSTALLED COST TOTAL	REMARKS
1	GENERAL REQUIREMENTS (Field personnel, Field Offices, Testing & Misc. Project Overheads)				$1,618,783	15% of Installed Cost for all divisions
2	SITEWORK					
	Excavation	CY	12,500	$24.07	$300,828	
	General Backfill	CY	609	$7.09	$4,317	
	Engineered Backfill	CY	260	$25.13	$6,534	
	Disposal of Spoil	CY	11,891	$19.65	$233,647	
	Piling Mobilization	LS	1	$13,942.98	$13,943	
	Concrete Filled Pipe Piles (50')	LF	10,000	$67.37	$673,715	
	Pile Load Test	Ea	3	$18,805.44	$56,416	
	Temporary Sheeting/Shoring	SF	10,530	$29.39	$309,431	
	Dewatering	LS	1	$40,000	$40,000	
3	CONCRETE					
	Base Slabs (includes labor)	CY	885	$500.00	$442,500	
	Walls (includes labor)	CY	391	$920.00	$359,720	
	Elevated Slabs (includes labor)	CY	124	$1,000.00	$124,000	
4	MASONRY					
	Exterior Walls	SF	13,850	$45.00	$623,250	Revised up due to complex features
5	METALS					
	Handrails and Railings	LF	900	$100.00	$90,000	
	Structural Steel	TONS	53	$5,000	$265,000	
	SS Ladder (Roof Access)	LF	40	$745.80	$29,832	
	Metal Stairs	Ea	3	$8,000.00	$24,000	
	Metal Decking (Roof) (includes insulation)	SF	4,600	$3.10	$14,243	
6	WOOD & PLASTICS				$0	
7	THERMAL & MOISTURE PROTECTION					
	Roofing System	SF	4,600	$7.00	$32,200	
	Roof Drainage System	SF	4,600	$1.00	$4,600	
8	DOORS & WINDOWS					
	Doors (SS)	Ea	6	$6,500	$39,000	
	Windows	SF	1,310	$25	$32,750	
	Skylights	SF	567	$45	$25,515	
	Overhead Door	Ea	1	$15,000	$15,000	
	Submerged Manways	Ea	4	$7,500	$30,000	
	Hatches (SS)	Ea	3	$10,170	$30,510	
9	FINISHES					
	High Performance Coating (Walls)	SF	11,480	$2.00	$22,960	
	Floor Coating	SF	4,600	$2.25	$10,350	
10	SPECIALITIES				$0	
11	EQUIPMENT					
	Pumps (includes motors)	Ea	6	$729,250	$4,375,500	Installation = 25% Eqpm. Cost
	Perforated Plate Baffles	Ea	6	$36,500	$219,000	
13	SPECIAL CONSTRUCTION (incl. INSTRUMENTATION)					
	Lightning Protection Systems	LS	1	$7,080	$7,080	
	Distributed Control System (DCS) Modifications	LS	1	$40,000	$40,000	
	Input/Output (I/O) Point List	EA	109	$1,500	$163,500	
14	CONVEYING SYSTEMS					
	Bridge Crane/Hoist	LS	1	$85,466	$85,466	Installation = 40% Eqpm. Cost
15	MECHANICAL					
	Plant Water	LS	1	$20,000	$20,000	
	City Water	LS	1	$20,000	$20,000	
	Slide Gates	Ea	4	$117,000	$468,000	+30% for installation
	Slide Gates (Bonnet)	Ea	2	$234,000	$468,000	+30% for installation
	Plug Valves (8")	Ea	2	$1,300	$2,600	
	Motorized Louvres, Med	Ea	4	$2,000	$8,000	
	Exhaust Fans, Wall	Ea	6	$2,800	$16,800	
	Unit Heaters, Suspended	Ea	6	$2,000	$12,000	
	Building Plumbing	LS	1	$25,000	$25,000	
	Butterfly Valves (60")	Ea	6	$30,000	$180,000	+20% For Installation
	Flap Gate (60")	Ea	6	$12,000	$72,000	+20% For Installation
16	ELECTRICAL					
	Building Systems					
	Basic Material	SF	4,600	$4.62	$21,260	
	Devices	SF	4,600	$0.35	$1,611	
	Equipment Connections	SF	4,600	$2.67	$12,267	
	Service & Distribution	SF	4,600	$2.11	$9,720	
	Lighting	SF	4,600	$5.65	$25,990	
	Intercom System	SF	4,600	$0.47	$2,183	
	Fire Alarm & Detection	SF	4,600	$0.51	$2,339	
	Low Voltage Switchgear					
	Main Breaker, 3000A w/ Metering	EA	2	$77,114	$154,228	
	Tie Breaker, 3000A	EA	1	$74,614	$74,614	
	Feeder Breaker, 1600A	EA	6	$36,348	$218,088	
	Space for Future Breaker	EA	2	$5,500	$11,000	
	MCC RVSS	Ea	4	$22,500	$90,000	
	Variable Frequency Drive, 250 horsepower	EA	2	$65,688	$131,375	
	SUBTOTAL				**$12,410,667**	
	GC Markup on Subs @ 5% (except for General Conditions)				**$539,594**	
	Subtotal				**$12,950,261**	**A**
	Escalation to Midpoint of Construction @ 7.5%				**$971,270**	**B = A X 0.075**
	Subtotal				**$13,381,936**	**A+B**
	Contractor OH&P @ 15%				**$2,007,290**	**C = (A+B) X 0.15**
	Subtotal				**$15,389,227**	**A+B+C**
	Planning Level Contingency @ 30%				**$4,616,768**	**D = (A+B+C) x 0.3**
	Subtotal				**$20,005,995**	**A+B+C+D**
	Misc. Capital Costs					
	Legal and Fiscal Fees @ 15%				**$3,000,899**	**E = (A+B+C+D) x 0.15**
	Engineering Fees including CM @ 20%				**$4,001,199**	**F = (A+B+C+D) x 0.2**
	Subtotal				**$7,002,098**	**E+F**
	LOW LIFT PUMP STATION PROJECT TOTAL				**$27,010,000**	**A+B+C+D+E+F**

C. UV DISINFECTION BUILDING

DIVISION	ITEM DESCRIPTION	UNITS	NO.	MATERIAL UNIT COST	INSTALLED COST TOTAL	REMARKS
1	GENERAL REQUIREMENTS (Field personnel, Field Offices, Testing & Misc. Project Overheads)				$2,965,715	15% of Installed Cost for all divisions
2	SITEWORK					
	Excavation	CY	6,000	$24.07	$144,398	
	General Backfill	CY	2,300	$7.09	$16,304	
	Engineered Backfill	CY	400	$25.13	$10,053	
	Disposal of Spoil	CY	3,700	$19.65	$72,701	
	Piling Mobilization	LS	1	$13,942.98	$13,943	
	Concrete Filled Pipe Piles (50')	LF	16,000	$67.37	$1,077,944	
	Pile Load Test	Ea	3	$18,805.44	$56,416	
	Temporary Sheeting/Shoring	SF	8,000	$29.39	$235,086	
	Dewatering	LS	1	$25,000.00	$25,000	
3	CONCRETE					
	Base Slabs (includes labor)	CY	900	$500.00	$450,000	
	Walls (includes labor)	CY	930	$920.00	$855,600	
	Elevated Slabs (includes labor)	CY	500	$1,000.00	$500,000	
4	MASONRY					
	Interior Walls	SF	2,067	$25.00	$51,675	
	Exterior Walls	SF	6,500	$45.00	$292,500	Revised up due to complex features
5	METALS					
	SS Ladder (Roof Access)	LF	16	$745.80	$11,933	
	Structural Steel	Tons	1	$5,000.00	$5,000	
	Gratings	SF	1,300	$30.00	$39,000	
6	WOOD & PLASTICS					
	Misc Blocking	LS	1	$5,000.00	$5,000	
7	THERMAL & MOISTURE PROTECTION					
	Roofing System	SF	8,550	$7.00	$59,850	
	Roof Drainage System	SF	8,550	$1.00	$8,550	
8	DOORS & WINDOWS					
	Doors (SS)	Ea	11	$6,500	$71,500	
	Windows	SF	1,030	$25.00	$25,750	
	Skylights	SF	480	$30.00	$14,400	
	Overhead Door	Ea	1	$15,000.00	$15,000	
	Hatches	Ea	3	$10,170.00	$30,510	
9	FINISHES					
	High Performance Coatings (walls)	SF	8,000	$2.00	$16,000	
	Floor Coating	SF	5,007	$2.25	$11,266	
	Accoustic Ceiling	SF	2,000	$4.00	$8,000	
10	SPECIALITIES				$0	
11	EQUIPMENT					
	UV Reactors	LS	1	$10,339,140.55	$10,339,141	Installation = 15% Eqpm. Cost
	Effluent Sampling System, Pump/Sampler	LS	1	$10,000.00	$10,000	
13	SPECIAL CONSTRUCTION (incl. INSTRUMENTATION)					
	Lighting Protection Systems	LS	1	$7,080.00	$7,080	
	Distributed Control System (DCS) Modifications	LS	1	$40,000.00	$40,000	
	Input/Output (I/O) Point List	EA	164	$1,000.00	$164,000	
14	CONVEYING SYSTEMS				$0	
15	MECHANICAL					
	Misc. Piping	LS	1	$25,000.00	$25,000	
	Weir Gates, Motorized	Ea	5	$169,000.00	$845,000	+30% for installation
	Slide Gates, Motorized	Ea	5	$188,500.00	$942,500	+30% for installation
	Motorized Louvres, Med	Ea	2	$860.00	$1,720	
	Motorized Louvres, Large	Ea	2	$2,000.00	$4,000	
	Exhaust Fans, Wall	Ea	3	$1,300.00	$3,900	
	Exhaust Fans, Roof	Ea	3	$3,125.00	$9,375	
	Unit Heaters, Suspended	Ea	5	$2,000.00	$10,000	
	Unit Heaters, Overhead	Ea	2	$4,500.00	$9,000	
	Air Handling Units	Ea	1	$3,500.00	$3,500	
	AHU/ACCU	Ea	1	$10,500.00	$10,500	
	Building Plumbing	LS	1	$10,000.00	$10,000	
	Flow Meters, A/V	Ea	2	$20,190.00	$40,380	+20% for installation
	Mud Valves	Ea	5	$1,000.00	$5,000	
	Hatches, Special	Ea	10	$15,000.00	$150,000	
16	ELECTRICAL					
	Building Systems					
	Basic Material	SF	8,550	$4.62	$39,516	
	Devices	SF	8,550	$0.35	$2,995	
	Equipment Connections	SF	8,550	$2.67	$22,801	
	Service & Distribution	SF	8,550	$2.11	$18,067	
	Lighting	SF	8,550	$5.65	$48,308	
	Intercom System	SF	8,550	$0.47	$4,058	
	Fire Alarm & Detection	SF	8,550	$0.51	$4,348	
	Medium-Voltage Circuit Breaker Switchgear					
	Main Breaker	EA	2	$109,050.00	$218,100	
	Tie Breaker	EA	1	$109,050.00	$109,050	
	Feeders (2 high)	EA	7	$188,364.00	$1,318,548	
	Feeders (2 high) - Prepared Space	EA	3	$34,070.00	$102,210	
	Control Power Section	EA	2	$48,630.00	$97,260	
	Control Power Transformer, 75 KVA	EA	2	$25,250.00	$50,500	
	Secondary Unit Substations					
	Transformer, 1500 KVA, 80 deg C, VPI	EA	5	$74,745.00	$373,725	
	Feeder Breaker, 1600A	EA	12	$36,348.00	$436,176	
	Space for Future Breaker	EA	8	$5,500.00	$44,000	
	Padmount Transformer, 1500 KVA, Pump Station Service	EA	2	$64,150.00	$128,300	
	SUBTOTAL				**$22,737,150**	
	GC Markup on Subs @ 5% (except for General Conditions)				**$988,572**	
	Subtotal				**$23,725,722**	**A**
	Escalation to Midpoint of Construction @ 7.5% (18 months to midpoint)				**$1,779,429**	**B = A X 0.075**
	Subtotal				**$24,516,579**	**A+B**
	Contractor OH&P @ 15%				**$3,677,487**	**C = (A+B) X 0.15**
	Subtotal				**$28,194,066**	**A+B+C**
	Planning Level Contingency @ 30%				**$8,458,220**	**D = (A+B+C) x 0.3**
	Subtotal				**$36,652,286**	**A+B+C+D**
	Misc. Capital Costs					
	Legal and Fiscal Fees @ 15%				**$5,497,843**	**E = (A+B+C+D) x 0.15**
	Engineering Fees including CM @ 20%				**$7,330,457**	**F = (A+B+C+D) x 0.2**
	Subtotal				**$12,828,300**	**E+F**
	UV DISINFECTION BUILDING PROJECT TOTAL				**$49,490,000**	**A+B+C+D+E+F**
	PROJECT GRAND TOTAL				**$103,670,000**	

NSWRP ANNUAL O&M COSTS FOR UV DISINFECTION SYSTEM AND LOW LIFT PUMP STATION

PRESENT WORTH FACTOR	
Life, N	**20**
Ineterest, i	4.875
Inflation, j	3
Present Worth Factor	**23.17**

Average Energy Cost, $/kWh	$0.0684

A. GENERAL SITEWORK

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical	10	24	240.0	$16.42	$5,994	23.17	$138,887
Subtotal					**$5,994**		**$138,887**
	No. of Operators (per day)	**Time (hrs/day/operator)**	**Total Time (hrs/day)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Routine Maintenance	1	2	2	$95.00	$69,350	23.17	$1,606,840
Labor - Operator	0	0	0	$95.00	$0	23.17	$0
Electrician	0	0	0	$165.00	$0	23.17	$0
Subtotal		NSWRP			**$69,350**		**$1,606,840**
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**			**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	1,099,218	5%			$54,961	23.17	$1,273,444
Subtotal					**$54,961**		**$1,273,444**
General Sitework Total Annual O&M					**$130,305**		
General Sitework Total Present Worth O&M Cost							**$3,019,171**

B. LOW LIFT PUMP STATION

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical (333 MGD Avg Q)	375	24	9000.0	$615.85	$160,121	23.17	$3,709,994
Subtotal					**$160,121**		**$3,709,994**
	No. of Operators (per day)	**Time (hrs/day/operator)**	**Total Time (hrs/day)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Routine Maintenance	2	2	4	$95.00	$138,700	23.17	$3,213,679
Labor - Operator	2	8	16	$95.00	$395,200	23.17	$9,156,784
Electrician	1	1	1	$165.00	$60,225	23.17	$1,395,413
Subtotal					**$594,125**		**$13,765,876**
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**			**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	6,998,132	5%			$349,907	23.17	$8,107,336
Subtotal					**$349,907**		**$8,107,336**
Low Lift Pump Station Total Annual O&M					**$1,104,152**		
Low Lift Pump Station Total Present Worth O&M Cost							**$25,583,206**

C. DISINFECTION SYSTEM

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical	3,182	24	76,368	$5,225.68	$1,358,677	23.17	$31,480,540
Subtotal					**$1,358,677**		**$31,480,540**
*Annual Energy Costs based on 24 hours operation for 9 months (March thru November)							
	No. of Operators (per day)	**Time (hrs/unit-time/operator)**	**Total Time (hrs/unit-time)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Electrician for routine maintenance	1	2 per week	2 per week	$165.00	$12,257	23.17	$283,998
Electrician to replace UV lamps	2	8 per week	16 per week	$165.00	$137,657	23.17	$3,189,516
Electrician for lamp cleaning/inspection	2	40 per week	80 per week	$165.00	$688,286	23.17	$15,947,580
Labor - Operator	2	8 per day	16 per day	$95.00	$395,200	23.17	$9,156,784
Subtotal					**$1,233,400**		**$28,577,878**
*Annual Maintenance Costs based on - (a) operation for 9 months (March thru November); (b) based on 365 days only for lamp replacement.							
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**	**Number of Units Replaced per Year**	**Cost per Unit ($)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	5,308,916	5%			$265,446	23.17	$6,150,379
Lamp (replacement)			1680	$215.00	$361,200	23.17	$8,369,004
Ballast (replacement)			336	$877.50	$294,840	23.17	$6,831,443
Quartz sleeve (replacement)			168	$338.00	$56,784	23.17	$1,315,685
Scraper wiper (replacement)			560	$40.00	$22,400	23.17	$519,008
Subtotal					**$1,000,670**		**$23,185,519**
UV System Total Annual O&M					**$3,592,747**		
UV System Total Present Worth O&M Cost							**$83,243,937**

Project Grand Total Annual O&M	**$4,830,000**	
Project Total Present Worth O&M Cost		**$111,900,000**

A. NSWRP UV PILOT PLANT

DIVISION	ITEM DESCRIPTION	UNITS	NO.	UNIT COST	INSTALLED COST TOTAL
1	General Requirements	LS	1		$149,630
2	Site Work	SF	10,000	$15	$150,000
3	Concrete Channel	LF	100	$1,450	$145,000
3	Gates	Ea	2	$75,000	$150,000
3	Discharge Piping (48" RCP)	LF	500	$12	$6,064
3	Trenching and Backfill	LF	500	$11	$5,320
11	UV Reactor (20 MGD)	Ea	1	$350,000	$350,000
10	Metal Sandwich Building	SF	1200	$134	$161,150
16	Temporary Power	LS	1	$30,000	$30,000
	SUBTOTAL				**$997,534**
	GC Markup on Subs @ 5% (except for General Condi				**$49,877**
	Subtotal				**$1,047,411**
	Escalation to Midpoint of Construction @ 7.5% (18 m				**$78,556**
	Subtotal				**$1,076,090**
	Contractor OH&P @ 15%				**$161,413**
	Subtotal				**$1,237,503**
	Planning Level Contingency @ 30%				**$371,251**
	Subtotal				**$1,608,754**
	Misc. Capital Costs				
	Legal and Fiscal Fees @ 15%				**$241,313**
	Engineering Fees including CM @ 20%				**$321,751**
	Subtotal				**$563,064**
	NSWRP PILOT PLANT PROJECT TOTAL				**$2,180,000**

A. NSWRP ComEd Service

DIVISION	ITEM DESCRIPTION	UNITS	NO.	UNIT COST	INSTALLED COST TOTAL
1	General Requirements	LS	1		$176,723
2	Miscellaneous Restoration	SF	10,000	$15	$150,000
	Underground Duct (Service from TSS-85)				
	6 cells, 5" conduit from Battery E to UV Building	LF	120	$200.00	$24,000
	500 kcmil (15 kV)	LF	540	$20.00	$10,800
	Electrical Manholes	Ea	2	$12,500.00	$25,000
	ComEd Second Service				
	Flagman (2)	Days	30	$ 1,050.00	$ 31,500.00
	Digging holes in earth	EA	50	$ 436.20	$ 21,810.13
	Wood electric utility pole, 45ft	EA	50	$ 1,788.34	$ 89,416.90
	Wood poles, material handling and spotting	EA	50	$ 611.91	$ 30,595.32
	Erect poles& backfill holes in earth	EA	50	$ 3,113.72	$ 155,685.75
	Double Crossarm, each 10 ft x 3-1/2 in x 4-1/2 in	EA	50	$ 1,115.17	$ 55,758.72
	Double Crossarm, each 8 ft x 3-1/2 in x 4-1/2 in	EA	50	$ 1,036.21	$ 51,810.50
	Crossarm, material handling and spotting	EA	50	$ 273.04	$ 13,652.10
	Install crossarm	EA	50	$ 1,490.13	$ 74,506.55
	Conductor, 795 to 954	W-Mi	6	$ 21,119.70	$ 126,718.20
	Wire, material handling and spotting	W-Mi	6	$ 1,116.55	$ 6,699.32
	Insulators, Pedestal type	EA	300	$ 125.68	$ 37,703.58
	Overhead ground wire	W-Mi	2	$ 10,766.64	$ 21,533.28
	Overhead ground wire, material handling and spotting	W-Mi	2	$ 702.40	$ 1,404.79
	ROW clearing	acre	7	$ 964.41	$ 6,750.87
	ROW restoration	acre	7	$ 1,933.48	$ 13,534.33
	Surveying	LS	1	$113,000.00	$ 113,000.00
	Soil Boring	LS	1	$ 16,272.00	$ 16,272.00
16	**Substation Modifications**				
	TSS-85 Protective Device Adjustment	LS	1	$ 50,000.00	$ 50,000.00
	TSS-88 Protective Device Adjustment	LS	1	$ 50,000.00	$ 50,000.00
	SUBTOTAL				**$1,354,875**
	GC Markup on Subs @ 5% (except for General Conditions)				**$67,744**
	Subtotal				**$1,422,619**
	Escalation to Midpoint of Construction @ 0%				**$0**
	Subtotal				**$1,422,619**
	Contractor OH&P @ 15%				**$213,393**
	Subtotal				**$1,636,012**
	Planning Level Contingency @ 30%				**$490,804**
	Subtotal				**$2,126,815**
	Misc. Capital Costs				
	Legal and Fiscal Fees @ 15%				**$319,022**
	Engineering Fees including CM @ 20%				**$425,363**
	Subtotal				**$744,385**
	NSWRP COMED SERVICE IMPROVEMENTS PROJECT TOTAL				**$2,880,000**

A. CWRP CHLORINE CONTACT CHAMBER DEMOLITION

					INSTALLED COST
DIVISION	**ITEM DESCRIPTION**	**UNITS**	**NO.**	**UNIT COST**	**TOTAL**
2	Demolition				
	Exterior Walls (18")	SF	17395	24.30	$422,767
	Interior Walls	SF	63840	22.71	$1,450,006
	Disposal at Landfill	CY	3922	12.89	$50,554
	Structural Backfill	CY	4002	11.50	$46,008
	Common Backfill	CY	36021	10.70	$385,373
	SUBTOTAL				**$2,360,000**
	Extended Total				**$4,980,000**

CWRP ANNUAL O&M COSTS FOR UV DISINFECTION SYSTEM AND LOW LIFT PUMP STATION

PRESENT WORTH FACTOR	
Life, N	**20**
Ineterest, i	4.875
Inflation, j	3
Present Worth Factor	**23.17**

Average Energy Cost, $/kWh	$0.0684

A. GENERAL SITEWORK

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical	10.67	24	256.0	$17.52	$6,394	23.17	$148,146
Subtotal					**$6,394**		**$148,146**
	No. of Operators (per day)	**Time (hrs/day/operator)**	**Total Time (hrs/day)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Routine Maintenance	1	2	2	$90.00	$65,700	23.17	$1,522,269
Labor - Operator	0	0	0	$90.00	$0	23.17	$0
Electrician	0	0	0	$159.50	$0	23.17	$0
Subtotal		NSWRP			**$65,700**		**$1,522,269**
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**			**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	1,172,499	5%			$58,625	23.17	$1,358,341
Subtotal					**$58,625**		**$1,358,341**
General Sitework Total Annual O&M					**$130,719**		
General Sitework Total Present Worth O&M Cost							**$3,028,756**

B. LOW LIFT PUMP STATION

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical (305 MGD Avg Q	331	24	7944.0	$543.59	$141,333	23.17	$3,274,688
Subtotal					**$141,333**		**$3,274,688**
	No. of Operators (per day)	**Time (hrs/day/operator)**	**Total Time (hrs/day)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Routine Maintenance	2	2	4	$90.00	$131,400	23.17	$3,044,538
Labor - Operator	1	8	8	$90.00	$187,200	23.17	$4,337,424
Electrician	1	1	1	$159.50	$58,218	23.17	$1,348,899
Subtotal					**$376,818**		**$8,730,861**
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**			**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	7,464,674	5%			$373,234	23.17	$8,647,825
Subtotal					**$373,234**		**$8,647,825**
Low Lift Pump Station Total Annual O&M					**$891,384**		
Low Lift Pump Station Total Present Worth O&M Cost							**$20,653,375**

C. DISINFECTION SYSTEM

Item	Operating (kW)	Time of Operation (hrs/day)	Power Usage (kW-hr/day)	Energy Cost ($/day)	Annual Cost ($)	Present Worth Factor	Present Worth ($)
OPERATIONS							
Energy - Electrical	2,903	24	69,672	$4,767.49	$1,239,547	23.17	$28,720,304
Subtotal					**$1,239,547**		**$28,720,304**
*Annual Energy Costs based on 24 hours operation for 9 months (March thru November)							
	No. of Operators (per day)	**Time (hrs/unit-time/operator)**	**Total Time (hrs/unit-time)**	**Labor Rate ($/hr)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
MAINTENANCE							
Electrician for routine maintenance	1	2 per week	2 per week	$165.00	$12,257	23.17	$283,998
Electrician to replace UV lamps	2	8 per week	16 per week	$165.00	$137,657	23.17	$3,189,516
Operator for lamp cleaning/inspectio	2	40 per week	80 per week	$165.00	$688,286	23.17	$15,947,580
Labor - Operator	2	8 per day	16 per day	$95.00	$395,200	23.17	$9,156,784
Subtotal					**$1,233,400**		**$28,577,878**
*Annual Maintenance Costs based on - (a) operation for 9 months (March thru November); (b) based on 365 days only for lamp replacement.							
	Construction Cost of New Equip. & Piping ($)	**% for Annual Parts & Supplies**	**Number of Units Replaced per Year**	**Cost per Unit ($)**	**Annual Cost ($)**	**Present Worth Factor**	**Present Worth ($)**
PARTS AND SUPPLIES							
Parts and Supplies	5,662,843	5%			$283,142	23.17	$6,560,404
Lamp (replacement)			1680	$215.00	$361,200	23.17	$8,369,004
Ballast (replacement)			336	$877.50	$294,840	23.17	$6,831,443
Quartz sleeve (replacement)			168	$338.00	$56,784	23.17	$1,315,685
Scraper wiper (replacement)			560	$40.00	$22,400	23.17	$519,008
Subtotal					**$1,018,366**		**$23,595,544**
UV System Total Annual O&M					**$3,491,313**		
UV System Total Present Worth O&M Cost							**$80,893,726**

Project Grand Total Annual O&M	**$4,520,000**	
Project Total Present Worth O&M Cost		**$104,600,000**

A. CWRP ComEd Service					
					INSTALLED COST
DIVISION	ITEM DESCRIPTION	UNITS	NO.	UNIT COST	TOTAL
1	General Requirements	LS	1		$7,500
16	**Substation Modifications**				
	TSS-85 Protective Device Adjustment	LS	1	$ 50,000.00	$ 50,000.00
	SUBTOTAL				**$57,500**
	GC Markup on Subs @ 5% (except for General Conditions)				**$2,875**
	Subtotal				**$60,375**
	Escalation to Midpoint of Construction @ 0%				**$0**
	Subtotal				**$60,375**
	Contractor OH&P @ 15%				**$9,056**
	Subtotal				**$69,431**
	Planning Level Contingency @ 30%				**$20,829**
	Subtotal				**$90,261**
	Misc. Capital Costs				
	Legal and Fiscal Fees @ 15%				**$13,539**
	Engineering Fees including CM @ 20%				**$18,052**
	Subtotal				**$31,591**
	CWRP COMED SERVICE IMPROVEMENTS PROJECT TOTAL				**$130,000**

DISINFECTION COST STUDY

HYDRAULIC EVALUATION

FOR

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

STICKNEY WATER RECLAMATION PLANT

TECHNICAL MEMORANDUM

June 2, 2008

Prepared By

CTE | AECOM

303 EAST WACKER DRIVE, SUITE 600
CHICAGO, ILLINOIS 60601

MWRDGC Project No. 07-026-2P
CTE Project No. 60040695

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1 INTRODUCTION

This technical memorandum has been developed as part of the Preliminary Cost Opinion for Ultraviolet (UV) Disinfection Facilities Study at the Metropolitan Water Reclamation District of Greater Chicago's (MWRDGC, or District) Stickney Water Reclamation Plant (SWRP) in Illinois. This memorandum continues the work that began in TM1-WQ which was developed previously as part of a Water Quality (WQ) Strategy for affected Chicago Area Waterways.

The TM1-WQ documented the results of a Consoer Townsend Envirodyne Engineers (CTE) study of effluent disinfection alternatives for the District's North Side, Calumet and Stickney WRPs. Based on economic and non-economic evaluation of alternatives, ozone disinfection and UV disinfection were selected and study-level basis of design and cost estimates were developed. Both alternatives were developed including three components: a low lift pump station, a tertiary filter facility, and a UV or ozone disinfection facility. The need for tertiary filtration to support disinfection was based on limited sampling that showed transmittance values less than the IEPA minimum of 65% and energy savings with a less turbid flow stream. Because of the limited available information, the estimates that were developed were broken into two alternatives for each disinfection technology: one with tertiary filters and one without tertiary filters. In both cases, a low lift pump station was included based on conceptual level evaluations of the available hydraulic driving head for the existing and proposed conditions.

Subsequent to the TM1-WQ evaluation, additional transmittance data was obtained and the District requested that the costs be further developed without including tertiary filtration. This additional evaluation is also based on the comments received from the United Stated Environmental Protection Agency (USEPA) as part of the Use Attainability Analysis (UAA) evaluations, and new information obtained since the previous work.

1.1 Objective

The primary objectives of the evaluation presented in this technical memorandum are:

- To update the hydraulic evaluation conducted during the preparation of TM-1WQ
- To develop the hydraulic basis of design for further evaluation and development of the conceptual design of UV disinfection facilities
- To determine the need for a low lift pump station with the addition UV disinfection facilities both prior to and after the potential addition of tertiary filters

For the purposes of the Disinfection Cost Study, sound engineering judgment will be used to make assumptions regarding the most likely arrangement of the proposed facilities based on the current status of the future planned improvements to the SWRP.

In the following discussion, the results of this evaluation are given. The sections that follow summarize the determination of the process flow through the UV Disinfection Facilities, the hydraulic profile through the proposed UV Disinfection System, and the details of the Low Lift Pump Station.

2 PROPOSED FACILITIES

The proposed facilities considered in this study revolve around adding disinfection process facilities to the existing process train and all associated improvements required due to that addition. As such, the improvements would include a disinfection facility/building based on ultraviolet disinfection technology, additional effluent flow conduits and a new plant outfall, gate structures to redirect flow to the new facilities, and a low lift pump station. Tertiary filters would not be included, although the proposed disinfection facilities would be designed to allow the future addition of tertiary filters. The decision to proceed with UV technology for disinfection was made by the District based on several factors including track-record of the technology, the need to avoid release of additional chemicals to the environment such as chlorination byproducts, security concerns related to chlorine use and storage and the cost comparison between the short-listed disinfection technology alternatives (ultraviolet treatment and ozonation) performed as part of TM-1WQ. UV technology was shown to be less costly than ozonation with substantially less concern regarding byproducts and security compared to chlorination/dechlorination.

2.1 Key Considerations for Design Development

In order to further develop the design for the UV Disinfection Facilities, CTE has reviewed the basis for the decisions that were incorporated into TM-1WQ in order to confirm the validity of those decisions. This review has identified several issues that must be addressed during the conceptual design of the facilities.

2.1.1 Site Constraints

Proposed Treatment Train

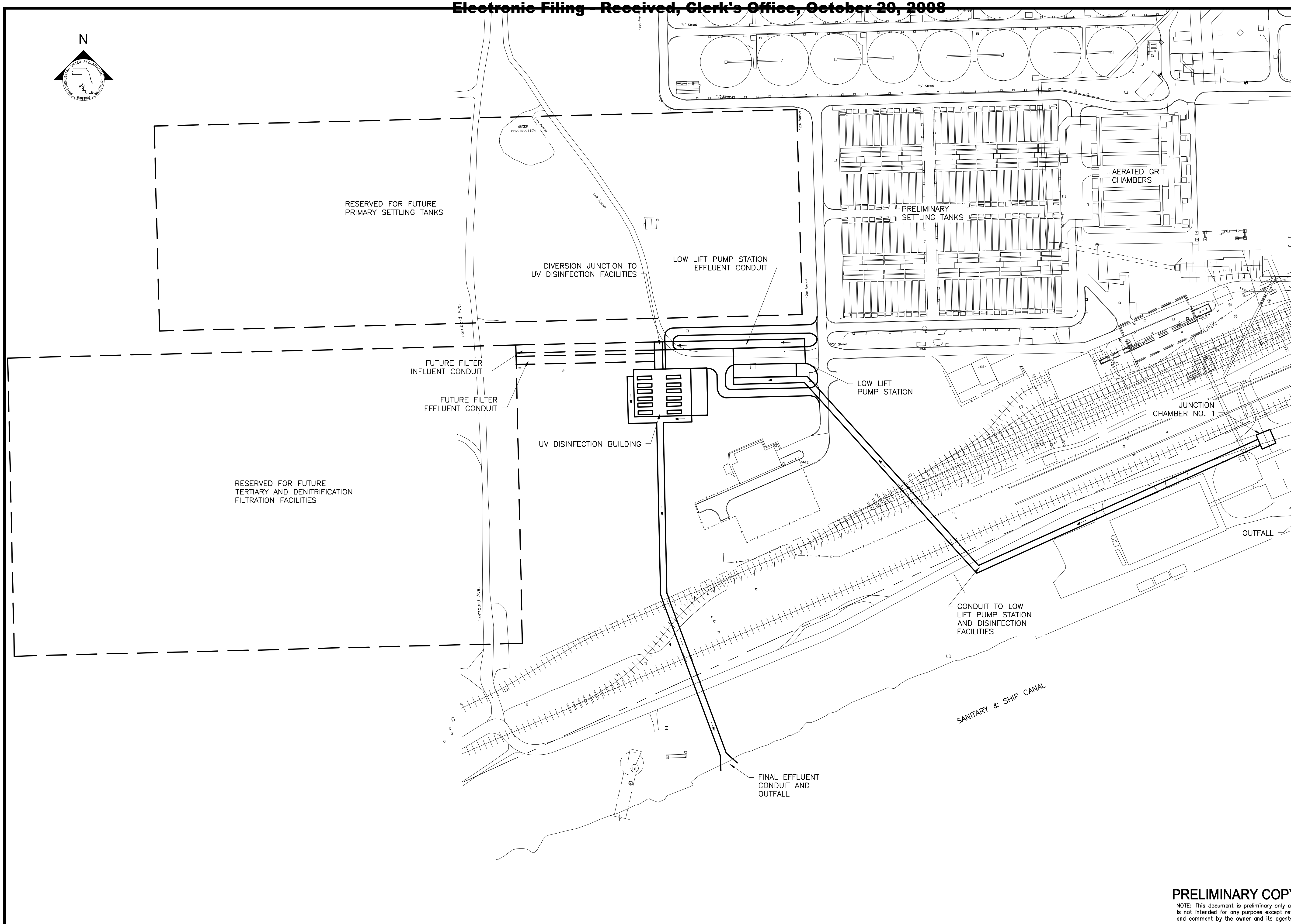
Disinfection facilities are usually located at the farthest possible downstream point in the process treatment train for the reason that the more treatment the effluent receives to remove both dissolved and suspended contaminants, the more effective the disinfection process.

One major change from TM-1WQ is the relaxation of the assumed need for tertiary filtration as part of the disinfection facilities. TM-1WQ presented scenarios with and without filtration based on the lack of information to demonstrate that filtration was not required for effective disinfection. For the purposes of this study, it is assumed that tertiary filtration would not be required in the near term. However, if tertiary filtration is implemented in the future, it would be beneficial for filtration to occur prior to disinfection to leverage the benefits of lower suspended solids and BOD concentrations that would make disinfection both more efficient and potentially allow the UV facilities to be downsized.

Space

Appendix A shows the proposed future site plan from the SWRP Master Plan as included in TM1-WQ. The TM1-WQ allocated space in the southwest area of the existing site for disinfection and tertiary filtration due to the amount of available open space and the relative proximity to the Ship and Sanitary Canal (SSC). However, this would require an extensive effluent conduit to convey flow from near the Pump and Blower Building nearly 1,500 LF to this location and a new effluent outfall into the SSC. Also, the majority of the space needs in this location are allocated to future tertiary filtration. The filter space allocated is based on denitrification media filtration at 1.5 gpm/sf. Although other filtration technologies are available with smaller space requirements, it is prudent at this time to assume denitrification filtration for planning purposes.

In consideration of these points, the location provided in TM-1WQ is recommended as it provides sufficient open space for the new facilities as well as provides flexibility for future implementation of tertiary filters is so required. The arrangement of the new facilities in the south-west area of the plant has been altered from TM-1WQ to provide for better usage of the site, as shown in **Figure 1**.



Rev. | Description | Appr. | Date

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Approved: MWRD Assistant Chief Engineer

Designed by: XX | Checked by: XX | Correct: ENG
Drawn by: MB | Reviewed by: XX
Date: JUN 2008 | Scale: 1:100

STICKNEY WATER RECLAMATION PLANT
CONTRACT 07-026-2P
UV DISINFECTION COST STUDY

SWRP
SITE PLAN

PRELIMINARY COPY

NOTE: This document is preliminary only and is not intended for any purpose except review and comment by the owner and its agents.

Sheet Number: FIGURE 1

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2.1.2 Hydraulic Constraints/Need for Additional Pumping

The final key consideration for development of the potential disinfection facilities at SWRP is the hydraulic constraints that may limit the ability to convey flow through the facilities by gravity. CTE has completed hydraulic evaluations to estimate the headloss through the UV Disinfection Facilities including the required conduits to evaluate the ability to flow through the proposed facilities by gravity.

The flow through the SWRP is currently via gravity from Aeration Batteries A, B, C and D, underneath the Pump and Blower Building to the plant outfall discharging into the Ship and Sanitary Canal (SSC). The existing hydraulic condition was analyzed from the existing effluent aerator downstream of Battery B, as this represents a hydraulic break point, to the outfall in order to determine the head available for the disinfection facilities. CTE conducted this hydraulic evaluation based on three assumptions:

1. A water surface elevation (WSE) of 3.5 ft CCD in the SSC based on the hydraulic profile from the Contract 78-102-EP, West-Southwest Treatment Works, February, 1985[1] was used as the historical hydraulic basis of design for the existing facilities. This does not meet the 100-year flood requirements.

2. Secondary effluent to the new disinfection facilities would be diverted through a new junction chamber located just downstream of the Pump and Blower Building, at a point approximately 800-ft upstream of the outfall. At this location, secondary effluent from all Aeration Batteries (A, B, C & D) could be diverted to the new facilities.

3. Peak flow of 1,440 MGD was used to size the hydraulic conduits.

The difference between the water surface elevation at the Pump and Blower house and the historical water surface elevation in the SSC is the head available to convey flow through the new disinfection facilities by gravity. **Table 1** presents the results of that evaluation.

Table 1 - Theoretical Water Surface Elevation Assuming All Gravity Flow, Existing Conditions

Location	WSE
WSE just downstream of Pump and Blower House	5.45
WSE in SSC, taken from 1985 Hydraulic Profiles max water elevation	3.50
Available head, ft.	1.95

Note: All WSE in Chicago City Datum (CCD).

Per Table 1, only 1.95 ft of head is available to convey flow through the proposed disinfection facilities by gravity under previous hydraulic analysis conditions. Without tertiary filters, the headloss through the UV disinfection facilities, including associated flow splitting and control systems, is estimated to be 7.64 feet. Thus the available head is insufficient to direct flow through the potential disinfection facility by gravity alone.

---

[1] El 3.5 ft CCD is listed as the water level in the Sanitary and Ship Canal for which the hydraulics were evaluated, based on a maximum design flow rate of 2,000 MGD. This profile appears to be the last official hydraulic profile conducted for the SWRP.

As a result, additional pumping would be required after the implementation of the UV disinfection facilities to meet the required peak flow rate of 1,440 MGD.

Considering that this is a conceptual level evaluation, additional headloss is possible and likely to be identified during final design as the details of flow splitting arrangements and other site constraints create less than ideal flow conditions.

3 HYDRAULIC ANALYSIS OF THE UV DISINFECTION FACILITIES

3.1 Objectives

Hydraulic analyses of the SWRP had not been performed as part of the Master Plan, thus the objective is to identify any possible hydraulic bottlenecks in the proposed disinfection facilities for the recommended site plan indicating where detailed analysis will be required during the design phase. For this study a preliminary model was created to evaluate the hydraulics following the addition of the UV Disinfection Facilities inclusive of the required addition effluent conduits, gate structures, UV channels and reactors and the Low Lift Pump Station (LLPS).

3.2 Overview

The hydraulic analysis was completed using a spreadsheet utilizing standard open channel and closed conduit flow equations to represent the SWRP from the effluent conduit at the Pump and Blower house through a new junction chamber to the new LLPS, through the new UV facility and discharged to the outfall. The hydraulics evaluated were for the year 2040 conditions, utilizing a peak flow of 1,440 MGD, which includes both infrastructure and permit-related improvements. The hydraulic analysis considered the existing plant hydraulics starting from the hydraulic break created by the effluent aerator, downstream of Battery B.

Although a WSE Elevation in the SSC of 3.5 ft CCD was utilized to determine if effluent pumping is required based on the historical hydraulic basis of design, the 100-year flood elevation for the Sanitary and Ship Canal has been calculated using the USACE's Chicago Underflow Plan (CUP) Design Report. The CUP report used observed high water levels to model the predicted high water levels throughout the Chicago Area Waterways at each of the construction phases. The observed high water level at the SWRP outfall is approximately 4.1 ft CCD (since 1965) and the peak modeled level for the 1957 event (estimated at greater than the 100-year flood) is 10.1 ft CCD. Appendix B provides select pages from this report.

From the CUP report, a water surface elevation of 9.0 ft CCD was estimated at the SWRP outfall for the 100-year flood. For the conceptual design of the new UV facilities in this study, the water surface elevation of 9.0 ft CCD will be utilized as a worst case hydraulic constraint in order to ensure the new facilities can operate during the 100-year flood.

3.3 Assumptions

Due to the preliminary nature of the selected site plan, assumptions were made in the development of the hydraulic model. These assumptions are as follows:

1. Peak flow of 1,440 MGD. Flows above 1,440 MGD are diverted to the TARP system.

2. SWRP drawings obtained from MWRDGC are on the Chicago City Datum (CCD) or the National Geodetic Vertical Datum (NGVD). All elevations were converted to CCD using conversion CCD = NGVD – 579.48.
3. The CCD has not changed since the plant was originally constructed in the 1920's.
4. The estimated 100-yr flood elevation is +9.00 CCD, as calculated in the Chicago Canal System Model, UNET. Appendix B provides selected pages from the USACE's Chicago Underflow Plan (CUP) Design Report presenting these results. Pre-Stage 1 (Stage 1 of the McCook Reservoir Construction) values are used since the USACE's current estimate for completion of Stage 1 construction in 2020 or later.
5. Post Aeration is not included in this study. Additional headloss and costs would be associated with the inclusion of post-aeration.
6. Velocity in Disinfection Influent and Effluent Distribution Chambers is zero to allow adequate flow distribution.
7. Batteries A, B, C and D are all at the same elevation and flow is equally divided between the Batteries A, B, C and D, with each receiving 360 MGD.
8. The UV process requires approximately 6 ft of submergence, thus the disinfection channel effluent weir is assumed to be 5.5 ft above invert to ensure a submerged weir at low flow conditions.
9. The following modeling equations were used:
   a. Pressure Flow – Hazen Williams Equation
   b. Open-Channel Flow – Manning's Equation
   c. Flow junctions – Pressure Momentum Analysis
10. Hydraulic coefficients used in developing this model include:
    a. Hazen Williams – 110 (concrete)
    b. Manning's
       i. Regular channel – 0.013
       ii. Aerated channel – 0.035

3.4 Results

The results of the hydraulic analysis are presented in **Table 2**. Table 2 presents the estimated water surface elevations through the plant from the existing Effluent Aerator through the new LLPS and UV Disinfection Building and to the new outfall.

The flow path starts with a new effluent conduit that would direct secondary effluent by gravity approximately 1,500 ft west from the new junction chamber near the Pump and Blower Building to the new LLPS. Flow would then be lifted 15.8 ft to the new UV influent conduit. Flow would travel by gravity through the UV facilities, which would be split into two banks of six UV reactors, into an effluent conduit and to a new outfall discharging into the SSC.

Table 2 - Summary of Proposed WSE including UV Disinfection Facilities

Location	WSE
Effluent Aerator Discharge Weir Elevation	10.96
WSE in Effluent Aerator	10.32
WSE just downstream of Pump and Blower House	5.45
WSE at New Junction Chamber	4.00
WSE in LLPS Influent Conduit	1.22
WSE in LLPS Wet Well just u/s of curtain wall	-1.25
WSE just downstream of Low Lift PS	14.59
WSE just upstream of Influent gate	14.01
WSE just upstream of Effluent Weir gate	11.89
WSE at downstream of Disinfection Effluent Chamber	9.73
WSE in Sanitary and Ship Canal, Approximate 100 yr flood elevation	9.00

The estimated water service elevation at the existing effluent aerator remains below the existing aerator weir elevation, thus maintaining the existing hydraulic break. **Figure 2** contains the hydraulic profile of the flow path through the proposed UV disinfection facilities and the available freeboard at the locations where water surface elevations (WSE's) were calculated at the maximum day flow.

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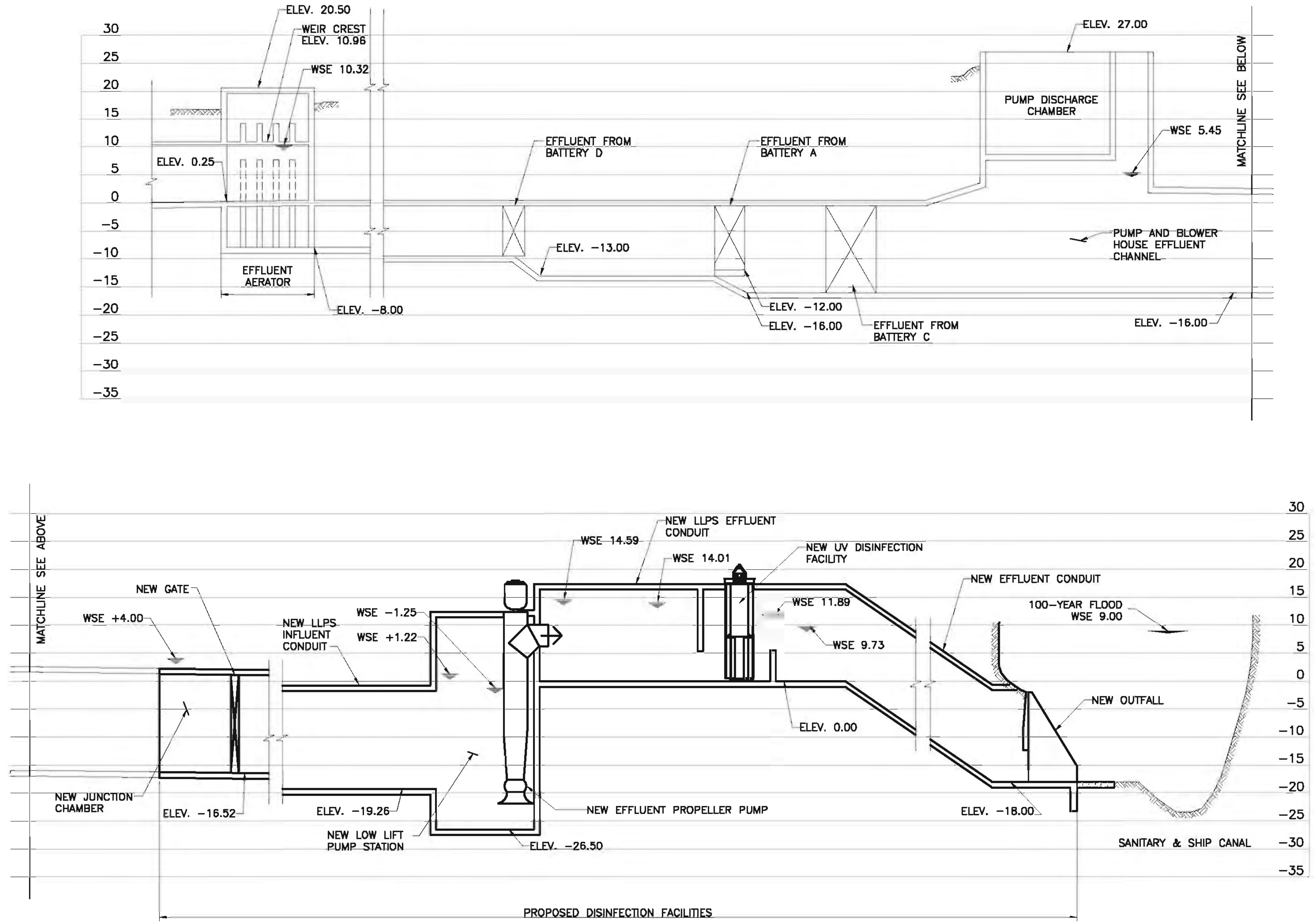

Rev. | Description | Date | Appr. | By

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Approved: MWRD Assistant Chief Engineer

Designed by: XX | Checked by: XX | Correct:
Drawn by: LK | Reviewed by: XX | CTE AECOM
Date: 1/2008 | Scale: NTS

CONTRACT 07-026-2P
STICKNEY WATER RECLAMATION PLANT
ULTRAVIOLET DISINFECTION FACILITIES

PROPOSED HYDRAULIC PROFILE
DISINFECTION FACILITIES

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4 UV DISINFECTION FACILITIES

The District has preliminarily selected the medium-pressure high-intensity (MP-HI) UV disinfection technology for potential disinfection of final effluent at its water reclamation plants. This section presents the preliminary basis of design of the UV system to be used at the SWRP.

4.1 Background

A Technical Memorandum on the UV Disinfection Technology was completed for the North Side WRP UV Disinfection Cost Study. The memorandum incorporated the following information which is relevant to the Stickney WRP:

- Information from literature including technical proceedings from the Water Environment Federation (WEF), Water Environment Research Foundation (WERF), proceedings from the latest Disinfection conference series undertaken by WEF, American Water Works Association (AWWA), and International Water Association (IWA). This information provided the latest updates in the UV disinfection technology.

- Updated recommendations on the UV system from four manufacturers – Trojan Technologies, Aquionics, Calgon Carbon, and Severn Trent Services (STS)/Quay.

- Reference information on experience of UV disinfection at five selected facilities – Racine WWTP (Racine, WI), R.L. Sutton WRF (Cobb County, GA), Grand Rapids WWTP (Grand Rapids, MI), Jacksonville WWTP (Buckman, FL), and Valley Creek WWTP (Valley Creek, AL). A summary of important inferences from the phone survey are as follows.

    1. Fouling due to iron in the effluent has been a problem at the Racine, Sutton, and Grand Rapids facilities. Fouling results in lower then expected disinfection performance, higher operating costs, and higher M&O efforts. The iron in the effluent at all three plants was primarily from the chemical phosphorus removal using Ferric Chloride. At Grand Rapids WWTP, the chemical addition is upstream of the secondary treatment process; staining of sleeves was found only when the chemical addition was in the secondary clarifiers. At the Sutton WRF, fouling of lamps due to iron is observed although chemical addition is upstream of secondary process and sand filters are used upstream of the UV disinfection system. At the Racine WWTP, fouling may be due to ferric chloride addition and/or due to the additional iron brought by the ferric sludge from another water treatment plant, although operational controls are used to prevent both sources from occurring simultaneously.

    2. Calcium fouling due to hardness in the source water is not a significant problem because of the automatic mechanical/chemical cleaning system that dissolves and wipes away any scales. The lack of calcium hardness was observed in all five plants including the Racine and Grand Rapids utilities which have Lake Michigan source water and is attributed to the automatic cleaning system performance.

    3. The frequency of cleaning and changing of the cleaning solution is specific to the utility and would have to be determined only by experience; however it is likely to be more than the typical case stated in the literature.

4. Labor requirements varied amongst facilities, with some facilities requiring more labor to handle the fouling caused by iron salt addition.

5. As long as other processes in the plant are performing as desired, all five facilities were satisfied with the UV disinfection system because it met their disinfection goals.

In conclusion, the phone survey had revealed that fouling of the quartz sleeves is a concern for this application, particularly if iron salts are added for phosphorous removal in the future. In addition, the phone survey results suggest that the manufacturer's recommended labor assumptions for routine maintenance including cleaning and inspection of the lamps is too low for this application. As transmissivity is directly related to lamp fouling, additional lamps and/or more frequent cleaning may be required in the future if iron salts are to be utilized in processes upstream of this technology.

Using this information and the updated information available from manufacturers, a preliminary basis of design of the MP-HI UV disinfection system has been developed for disinfection of the final effluent at the SWRP.

4.2 Basis of Design

The MP-HI system involves sending the secondary or tertiary effluent through channels containing banks of MP-HI UV lamps. The Trojan UV4000™Plus system is used here to develop the basis of design for the UV disinfection system. The system consists of a power supply, an electrical system, a reactor, MP-HI lamps, a mechanical and chemical cleaning system, and a control system. The MP-HI UV lamps are enclosed in individual quartz sleeves for protection against dirt and breakage. Reactor chambers (open channels) hold the lamps in a horizontal configuration. The effluent weirs and level sensors are used to keep the lamps submerged under the effluent water. This submergence ensures that the lamps do not overheat, thereby preventing lamp life reduction or burnout.

The UV system is assumed to operate from March to November each year. During the winter months, the equipment would sit idle as the flow is bypassed around the LLPS and UV Disinfection Building. However, due to the size of the facility including twelve reactors and over 4000 lamps, maintenance activities would be conducted every working day from March to November and periodically during the winter months. It is reasonable to expect that the area would continue to experience normal weather patterns for the Chicago area including extreme weather during all four seasons. In order to protect the safety of the M&O staff, ensure operational and maintenance-related productivity, and protect the UV equipment from adverse weather common to the Chicago area including high winds, rain, lightning, snow, and extreme temperatures, the UV system would be enclosed in a building.

4.2.1 Proposed Design Criteria for UV Disinfection Equipment

Based on a review of the information provided by the UV equipment manufacturers and the experience of five other facilities, it is observed that Trojan Technologies provides a widely-used low-maintenance solution for final effluent disinfection. The design of the MP-HI UV disinfection system for the SWRP is based on the Trojan UV4000™Plus equipment provided by Trojan Technologies.

4.2.2 Proposed Layout

Flow would enter the UV disinfection facilities at the north end of the influent chamber, where it would be directed east and west through 72-inch gates through two (2) banks of six (6) UV channels arranged on either side of the influent chamber. The effluent channels combine the flow to the south of the UV building and direct it to a new outfall. This layout provides for a compact site footprint and the enables the building size to be minimized.

The conceptual layout provides for a new effluent outfall to the SSC, rather than directing the disinfected effluent back to the existing outfall. However, it is likely that the construction of a new outfall would require permitting and an environmental impact assessment which may eliminate this option and necessitate the existing outfall being used during final design.

4.2.3 Proposed Basis of Design Criteria

The basis of design is given in **Table 3**.

Table 3 – Design Parameters for UV Disinfection Unit at NSWRP

Parameter	Design Value
Capacity and Water Quality	
Design flow, mgd	1,440
Average flow, mgd	1,250
Maximum TSS[a], mg/L	15
Pre-Disinfection Effluent E.Coli Count[b], cfu/100 mL, maximum (Assumed)	200,000
Post-Disinfection Effluent E.Coli Count Target[c], cfu/100 mL	400
Effluent Hardness[d], mg/L as $CaCO_3$	270
Dosage	
UV transmittance, minimum, %	65
UV intensity[e], W/lamp	4,000
Lamp Life, hours	5,000
Fouling factor, %	90
Lamp aging factor, %	89
UV dose, mW-s/cm^2	40
Physical Characteristics	
Channel dimensions, WxD	106" x 172"
Number of channels	12 (11 plus 1 standby)
Number of reactors per channel	1
Number of banks per reactor	2
Number of modules per bank	7
Number of lamps per module	24
Total number of lamps	4,032
Total power requirement, kW	11,827
Average power requirement, kW	9,225
Hydraulics	
Headloss, UV reactor only	9"
Velocity in each channel, V, ft/s	1.87
Liquid level control in channel	Motorized Weir Gate

[a] Monthly permit limit 12 mg/L
[b] Annual average
[c] Future requirement (monthly geometric average)
[d] Mean value
[e] 100% intensity at 100 hours of lamp use

The above design criteria are assumed based on available information and the current state of ultraviolet disinfection technology. A more extensive technology evaluation should be conducted prior to final design of the facility. Due to the extraordinary scale of this facility, CTE recommends the District undertake the following design process for selection and design of the UV disinfection equipment if final design is initiated:

1. Request and evaluate independent, full-scale validation data (also known as biodosimetry data) from manufacturers of candidate disinfection systems for similarly sized units or the largest size for which the manufacturer has data available. This evaluation would provide an initial level-of-confidence that the candidate systems can achieve the target disinfection levels. Data should be from systems using the same bulb, ballast, and control technology as proposed for the full-scale system.

2. Conduct a collimated beam testing program. This program would use site specific effluent and bacteria to determine the sensitivity of the site specific bacteria and pathogens to UV disinfection. The data would be used to size the UV lamps and reactors.

3. Increase frequency of UV transmittance testing at each plant to at least once per day for a period of one year or more to collect data on seasonal variability, daily variability, diurnal variability, and to capture the frequency of events that might reduce transmissivity such as wet weather and infrequent industrial discharges.

4. Conduct a more detailed life cycle cost analysis of the candidate disinfection systems based on the data collected during steps 1 through 3 above.

5. Construct a pilot testing facility designed to match lamp spacing, velocity profile and other design parameters of the proposed full scale units. The pilot testing facility would be used to determine:

    a. Appropriate control sequences and optimization for the UV disinfection equipment, including appropriate sensing equipment to allow advanced power management.

    b. In-situ disinfection performance including fouling rates of the lamps with and without ferric salt addition.

    c. Design life of lamps and other UV system parts.

    d. Actual M&O requirements in terms of labor and consumables as well as space requirements to complete required maintenance activities.

    e. Performance of alternate equipment manufacturers, if alternates are available at the time of piloting.

    f. Accuracy of life cycle cost analysis prior to final design of the full-scale system.

6. Conduct post-construction full-scale validation testing (biodosimetry testing) to confirm performance and determine operating parameters.

Using a program as described above, it may be possible to demonstrate the effective UV dosages to the regulators and optimize the equipment sizing criteria. For this study, reduction in the Illinois requirements for UV system sizing is not assumed based on the lack of data similar to that described above.

5 LOW LIFT PUMP STATION

This section will present the proposed arrangement and key characteristics of the proposed Low Lift Pump Station.

5.1 Pump Type

Several pump types were considered for this application. Pump types considered included screw pumps, vertical turbine pumps, centrifugal pumps, and axial flow pumps. Screw pumps and axial flow pumps appear to have the best operating performance for this condition.

It is estimated that the low lift pumps would lift 1,440 MGD of secondary effluent approximately 22.3 feet (TDH) to the UV disinfection system influent, including estimated head to allow flow through the UV system. The static head equates to the difference in the estimated water surface elevation between the wet well and the discharge conduit plus an additional 2-ft of head added as a conservative factor to accommodate additional losses that may be identified during final design.

If tertiary filtration is constructed in the future, the TDH would most likely increase but the flow would remain the same. Screw pumps will not easily accommodate this change in head, without significant structural modifications to the pump station. However, axial pumps can be modified for future head conditions. Structural modifications to the pump station to accommodate these changes, if required, should be minimal. Therefore, axial flow, propeller type pumps are recommended.

Vertical axial flow pumps have been assumed here, but other configurations (including inclined or horizontal) could be considered in the future.

5.2 Basis of Design

Table 4 provides a summary of the basis of design for the Low Lift Pump Station.

Table 4 - Low Lift Pump Station Basis of Design

Flow, MGD	1,440
Pumps	
Type	Axial Flow
Number	8 total (N+1+1)
Pumping Rates, gpm/pump	166,670
Static Head, ft	15.8
Dynamic Head (inc. station losses), ft.	4.5
Total Dynamic Head, ft.[(1)]	22.3
Motor, hp [(2)]	1,500
Suction Head, ft	18.5
Wet Well	
Length, ft.	86
Width, ft.	114

(1) The static head equates to the difference in the estimated water surface elevation between the wet well and the discharge conduit plus an additional 2-ft of head added as a conservative factor to accommodate additional losses that may be identified during final design.

(2) A 1,350 hp motor could be provided, however this is a non-standard motor size and only standard motor sizes were assumed for this conceptual study.

5.3 Proposed Operational Description

The pump station would have a total of eight pumps, with six duty pumps, one standby and one out of service (N+1+1). Five pumps would be driven by constant speed motors, three would be variable speed driven. In order to provide operational flexibility, the pump station would be divided into two wet wells, each containing four pumps. Design average flow (1,250 MGD) would be handled by four constant speed and two variable speed pumps operating at reduced speed, leaving two pumps on standby. Peak flow (1,440 MGD) would be handled by six pumps operating at full speed, leaving two on standby.

The pumps would operate 24 hours a day, seven days per week. Typically, at least one variable speed pump would operate at all times, to handle fluctuations in flow. **Table 5** illustrates an example of pump operation at design average flow and peak flow:

Table 5 - Summary of Pump Operation

Flow, MGD	Pump Drive Type	Pump Flow, gpm
700	Constant speed	166,667
	Constant speed	166,667
	Variable speed	152,777
1250 (Design Average)	Constant speed	166,667
	Constant speed	166,667
	Constant speed	166,667
	Constant speed	166,667
	Variable speed	100,694
	Variable speed	100,694
1440 (Peak)	Constant speed	166,667
	Constant speed	166,667
	Constant speed	166,667
	Constant speed	166,667
	Constant speed	166,667
	Variable speed	166,667

In order to eliminate vortices, pumps require a minimum submergence as a function of pump suction bell diameter. For this flow condition, a 120-inch suction bell is required, which requires a minimum submergence of 16 feet. Submergence requirements should be verified by the pump manufacturer during final design.

Level sensors in the wet well would relay signals to turn pumps on and off. The level control would be automatic under normal conditions, with manual override possible. Other control inputs that need to be monitored include discharge pipe pressure, flap gate position, and motor alarms.

5.4 Proposed Layout

Flow would enter the pump station at the south end of the wet well, where it would be directed perpendicularly to the north through eight 96-inch slide gates. Pumps are located at the north end of the pump station. Site constraints and pump station size appear to make this flow pattern necessary. Due to the excessively large area needed to meet Hydraulic Institute (HI) Standards, there is insufficient area available to meet the suggested dimensions directly.

A rectangular wet well is shown in the plan and section. Design features, which have been shown to be effective in other installations, were incorporated in this design in order to meet HI standards. For example, perforated plates, curtain walls, and floor and back wall splitters have been incorporated into the conceptual design. (See Appendix C for a plan and section of the proposed layout). Sizing and details of these types of features are normally determined by physical scale modeling during detailed design.

6 SUMMARY

A review of TM-1WQ confirms that the disinfection facilities would consist of UV technology without requiring tertiary filters, although filtration could potentially reduce the size of the UV facility via reductions in TSS and BOD. Additionally, the disinfection facilities are recommended to be located in the southwest corner of the existing site, adjacent to the space reserved for the future tertiary filters. In order to direct flow to the proposed location, a new junction chamber would be constructed just upstream of the existing outfall to divert flow to the new disinfection facility. It would also permit bypassing of the disinfection facility during winter months when disinfection is not required.

A hydraulic basis of design was developed for a peak plant flow of 1,440 MGD. This preliminary evaluation indicated that additional pumping would be required to lift secondary effluent up approximately 16-ft in order to flow through the proposed UV system. Axial flow pumps are recommended for the LLPS due to the low head conditions and the need to modify the discharge head when tertiary filters are added in the future.

Hydraulics were estimated starting from the existing effluent aerator, through the LLPS and UV facilities, and ending at a new outfall to the SSC.

The proposed conceptual layout of the new UV facilities consists of the following:

a. Junction chamber with isolation gates within the existing plant effluent conduit and an conduit to the LLPS,

b. LLPS:
   i. Building housing a wet well and eight (8) axial flow pumps.
   ii. Influent and effluent conduits with isolation gates.
   iii. Support facilities such as an operator and storage rooms.

c. UV Facility
   i. Building housing twelve (12) UV reactor channels.
   ii. Influent and effluent channels with isolation and level control gates.
   iii. Support facilities such as an operator room, storage room and an electrical room housing the switchgear and transformers for both the LLPS and the UV facilities.

d. A new effluent outfall to the Ship and Sanitary Canal.

The location and arrangement of these facilities was determined to accommodate future facilities as well as have functionality up to the 100-year flood elevation. A new effluent outfall is proposed, however permitting requirements may require this options to be reevaluated during final design

In conclusion, this review has confirmed the primary assumptions of the TM-1WQ in regards to the need for a low lift pump station, location of the facilities and arrangement of the facilities to accommodate future facilities.

APPENDIX A
Site Plan from the SWRP Master Plan

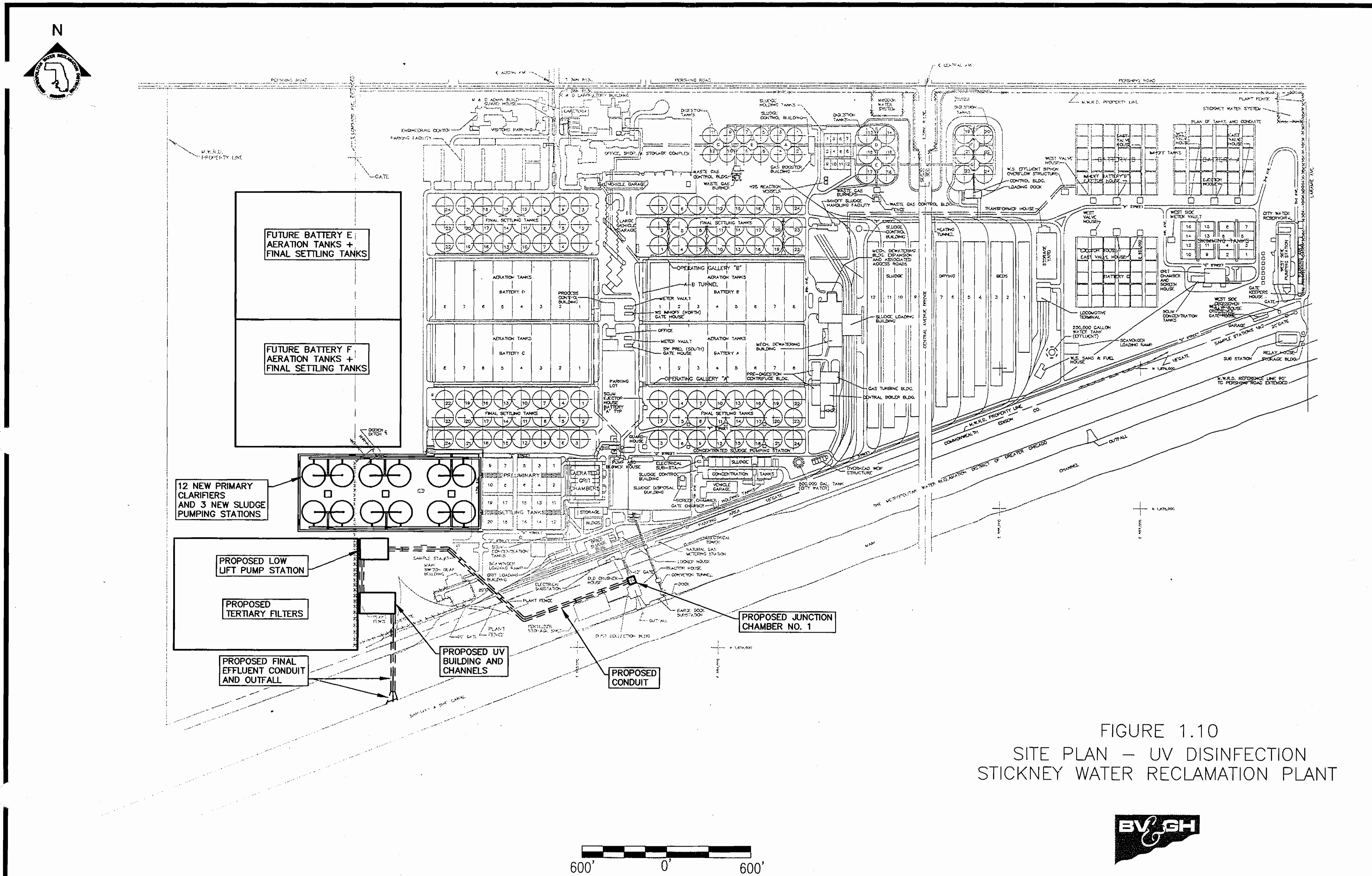


FIGURE 1.10
SITE PLAN – UV DISINFECTION
STICKNEY WATER RECLAMATION PLANT

APPENDIX B
Selected Pages from USACE CUP DDR

US Army Corps
of Engineers®
CHICAGO DISTRICT

DESIGN DOCUMENTATION REPORT

CHICAGOLAND UNDERFLOW PLAN
McCOOK RESERVOIR, ILLINOIS

Volume I of VIII

NOVEMBER 1999

Table A-11. Canal System Observed and Modeled Maximum Water Surface Elevations

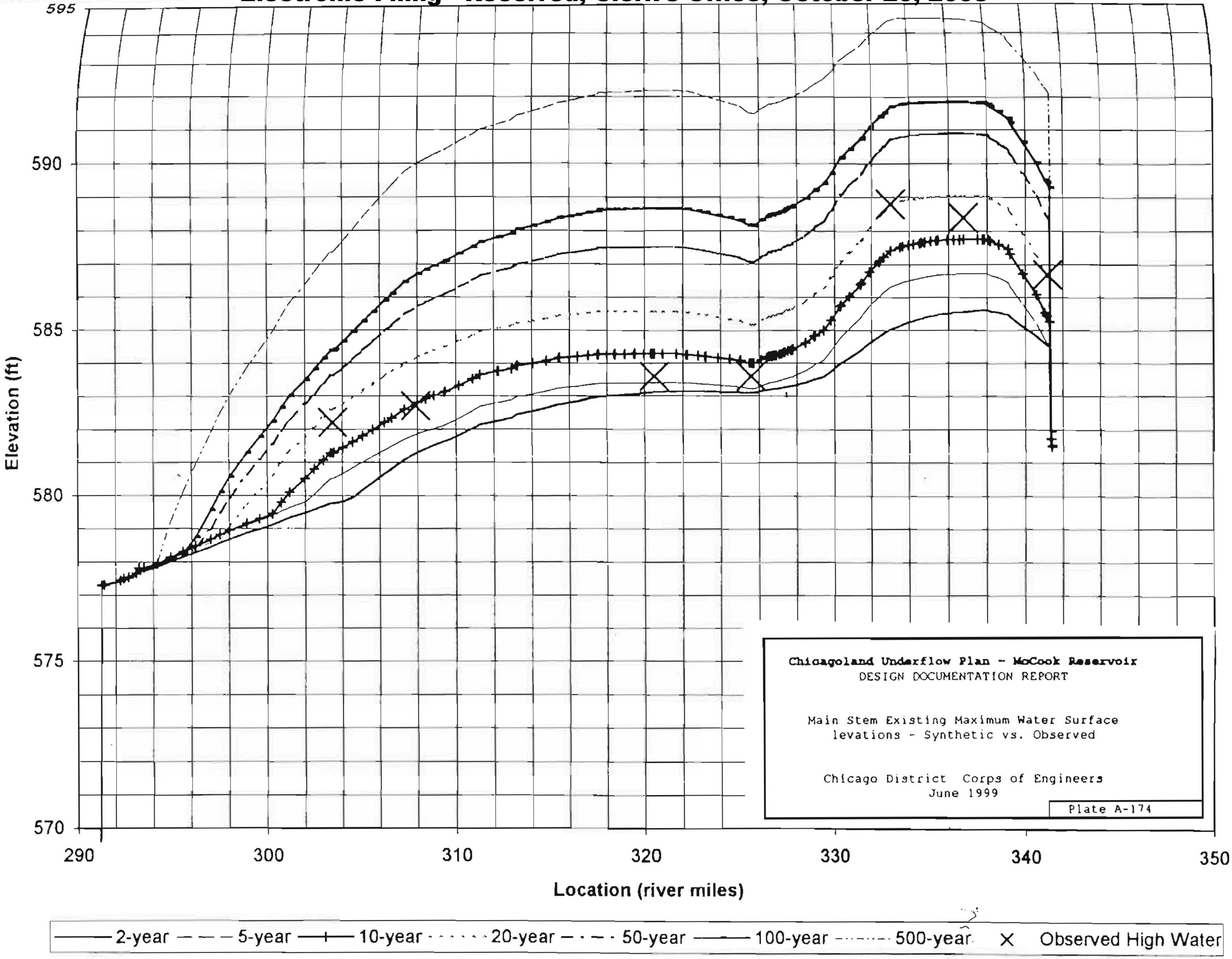
		Maximum Water Surface Elevation (ft NGVD)						
			Modeled for Water Years 1951-1988			*Modeled 1% Chance Exceedance Event*		
Location	**Approx. River Mile**	**Observed, 1965 to present (Date)**	**Existing (Date)**	**Stage 1 Project (Date)**	**Stage 2 Project (Date)**	**Existing**	**Stage 1 Project**	**Stage 2 Project**
Wilmette - NSC @ Sheridan Rd.	341.2	586.7 (4/18/75)	592.6 (7/57)	591.3 (7/57)	590.5 (7/57)	589.4	589.1	587.6
North Side SW - NSC @ Howard St.	336.8	588.4 (8/14/87)	594.9 (7/57)	593.1 (7/57)	592.6 (7/57)	591.8	590.9	589.5
North Branch PS - NSC @ Lawrence St.	333.0	588.8 (8/16/97)	594.6 (7/57)	592.2 (7/57)	592.2 (7/57)	591.7	589.8	588.4
Chicago River Controlling Works - Chicago River @ Lk Michigan*	325.6	583.6 (8/16/97)	589.1 (7/57)	585.3 (10/54)	583.9 (10/54)	588.2	585.0	583.2
31st & Western - CS&SC @ Willow Springs Rd.	320.5	583.6 (6/30/77)	589.6 (7/57)	585.4 (10/54)	583.9 (10/54)	588.7	585.1	583.0
Willow Springs - CS&SC @ Willow Springs Rd.	307.9	582.7 (7/18/96)	587.2 (7/57)	584.0 (10/54)	583.0 (10/54)	586.7	584.1	582.4
Sag Junction - Confluence of CS&SC and CSC	304.2	582.2 (7/18/96)	585.0 (7/57)	582.6 (10/54)	581.9 (10/54)	584.7	582.8	581.6
O'Brien Lock - Calumet River Downstream (south) of O'Brien Lock	325.8	583.8 (7/18/96)	585.0 (7/57)	584.6 (7/57)	584.6 (7/57)	584.7	584.0	583.8
Southwest Highway - CSC @ Southwest Hwy	310.8	583.7 (7/18/96)	585.0 (7/57)	584.3 (10/54)	584.3 (10/54)	585.0	583.5	583.1

*The approximated river mile is for the junction of the Chicago River and its North and South Branch.

NSC = North Shore Channel
CS&SC = Chicago Sanitary and Ship Canal
CSC = Calumet Sag Channel

Table A-12. Index of Major Bridges and Confluences for Chicago Canal Model

Reach Scheme (Canal Model)	Tributary Stream	Bridge Name	River Mile
2	North Shore Channel	Sheridan Road Lock	341.2 1/
2	"	Central Street	340.4
2	"	Green Bay Road	339.8
2	"	Church Street	338.7
2	"	Dempster, Il 58	338.2
2	"	Oakton Street	337.2
2	"	Touhy Avenue	336.2
2	"	Devon Avenue	335.2
2	"	Peterson, US 14	334.7
2	"	Foster Avenue	333.6
2	"	Jct. North Branch	333.5
1	North Branch	Touhy	51.4 2/
1		(05536000 gage)	
1	"	Devon Avenue	49.2
1	"	Edens Expwy.	46.2
1	"	Cicero Avenue	46.1
1	"	Foster Avenue	44.5
1	"	Kimball Avenue	43.9
1	"	Kedzie Avenue	43.6
1	"	Jct. North Shore Channel	43.3
3	"	Jct. North Shore Channel	333.5
3	"	Lawrence Ave.	333.1
3	"	Montrose Ave.	332.5
3	"	Irving Park Rd.	332.0
3	"	Addison Street	331.4
3	"	Belmont Ave.	330.9
3	"	Western Ave.	330.6
3	"	Diversy Ave.	330.2
3	"	Damen Ave.	329.9
3	"	Fullerton Ave.	329.5
3	"	Ashland Ave.	329.1
3	"	Cortland Street	328.6
3	"	North Ave.	327.9
4	North Br. (Goose Island West)	Division Street	327.4
4	"	Ogden Ave.	326.9
4	"	Halsted Street	326.6
5	North Br. (Goose Island East)	Division Street	327.0
5	"	Ogden Ave.	326.9
5	"	Halsted Street	326.85
6	North Branch	Chicago Ave.	326.4
6	"	Ohio/Kennedy Expwy.	326.1
6	"	Grand Ave.	326.0
6	"	Kinzie Street	325.8
6	"	Jct. South Branch	325.6
7	Chicago River	Franklin Street	325.65
7	"	Wells Street	325.7
7	"	LaSalle Street	325.8
7	"	Clark Street	325.9
7	"	Dearborn Street	326.0
7	"	State Street	326.1
7	"	Wabash Ave.	326.3
7	"	Michigan Ave.	326.4
7	"	Lake Shore Drive	326.9
8	South Branch	Lake Street	325.6
8	"	Randolph Street	325.5
8	"	Washington Street	325.4
8	"	Madison Street	325.3
8	"	Monroe Street	325.1
8	"	Adams Street	325.0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Elevation (ft)
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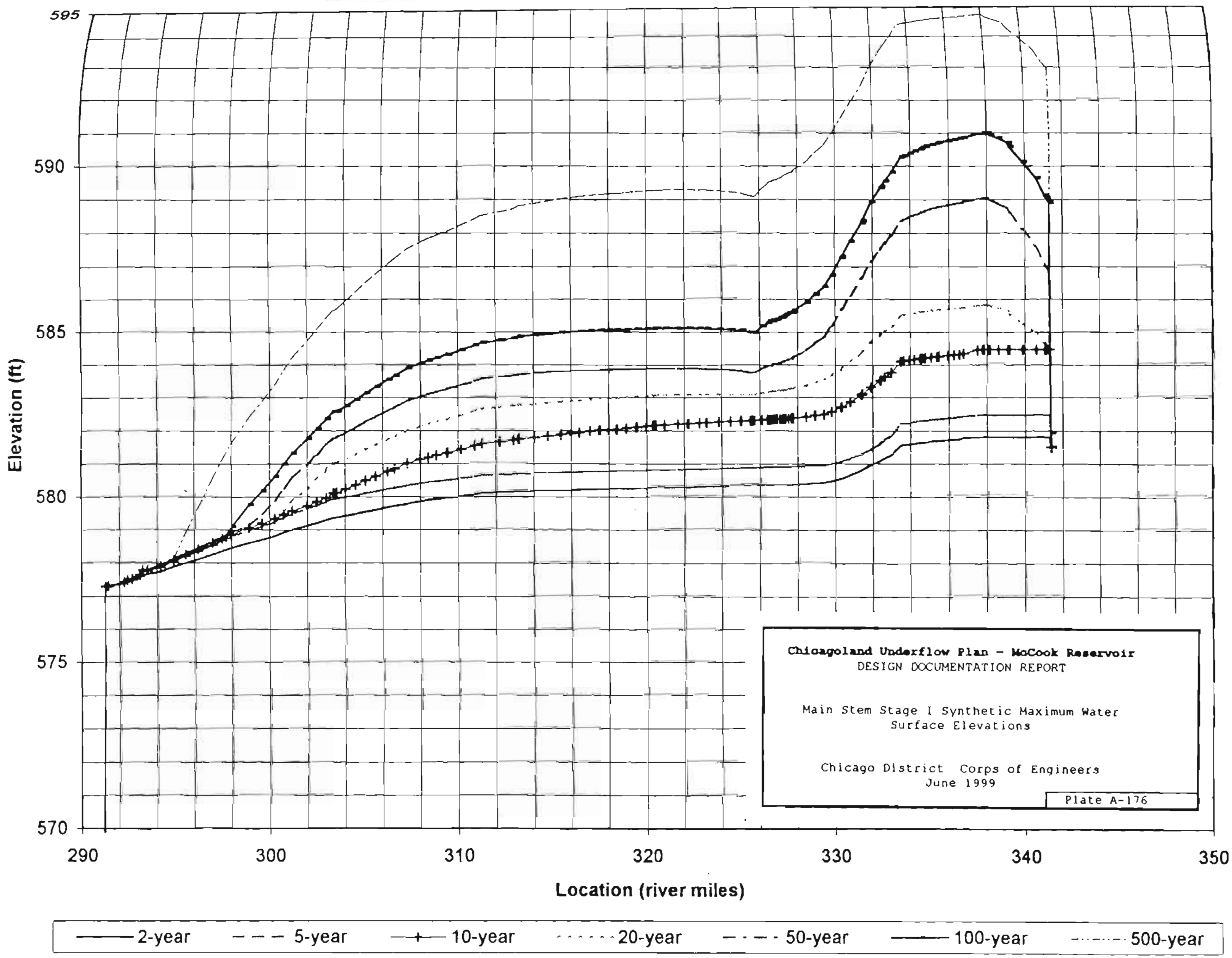
320
330
340
350
Location (river miles)
Chicagoland Underflow Plan - McCook Reservoir
DESIGN DOCUMENTATION REPORT
Main Stem Existing Maximum Water Surface
levations - Synthetic vs. Observed
Chicago District Corps of Engineers
June 1999
Plate A-174
2-year
5-year
10-year
20-year
50-year
100-year
500-year
Observed High Water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Elevation (ft)
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Location (river miles)
Chicagoland Underflow Plan - McCook Reservoir
DESIGN DOCUMENTATION REPORT
Main Stem Stage I Synthetic Maximum Water Surface Elevations
Chicago District Corps of Engineers
June 1999
Plate A-176
2-year
5-year
10-year
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50-year
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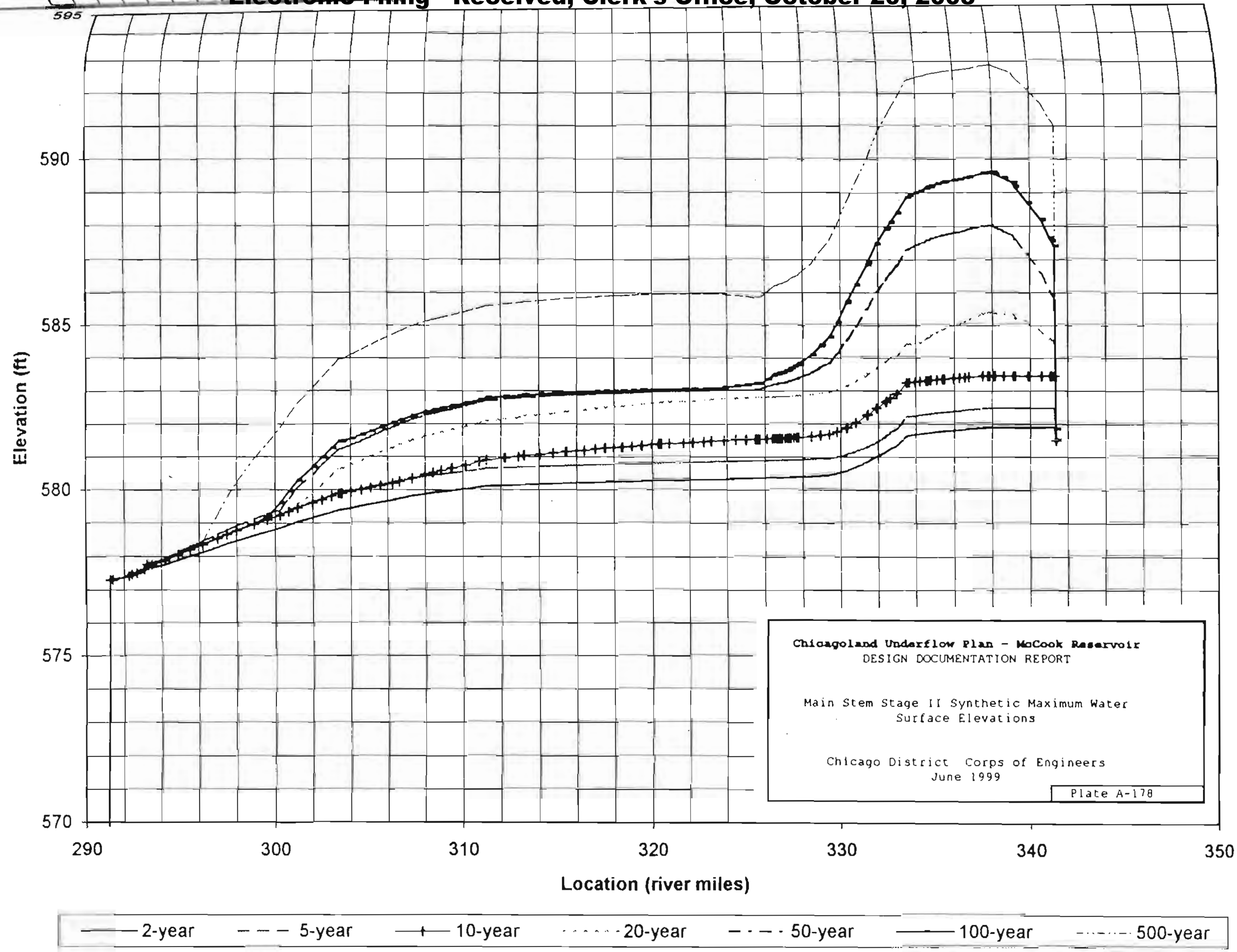
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Elevation (ft)
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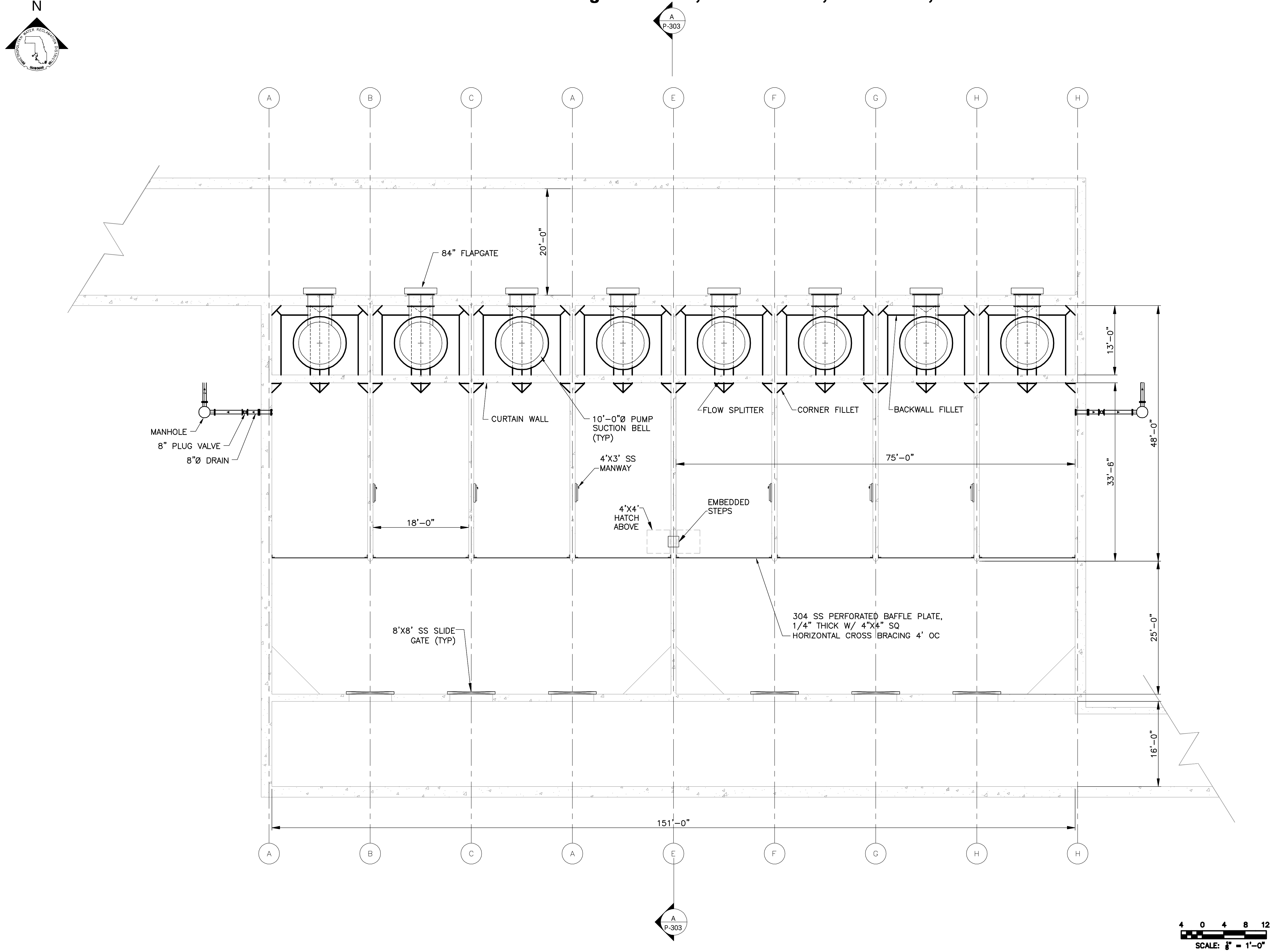
Location (river miles)
Chicagoland Underflow Plan - McCook Reservoir
DESIGN DOCUMENTATION REPORT
Main Stem Stage II Synthetic Maximum Water Surface Elevations
Chicago District Corps of Engineers
June 1999
Plate A-178
2-year
5-year
10-year
20-year
50-year
100-year
500-year

APPENDIX C
LLPS Proposed Layout



Rev.	Description	Appr.	Date

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Approved: MWRD Assistant Chief Engineer

Correct: ANTHONY BOUCHARD

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Designed by: CMB | Checked by: XX | Drawn by: MB | Reviewed by: EPC | Date: 1/2008 | Scale: 1/8"=1'-0"

CONTRACT 07-026-2P
STICKNEY WATER RECLAMATION PLANT
ULTRAVIOLET DISINFECTION FACILITIES

LOW LIFT PUMP STATION
LOWER LEVEL PLAN

Seal

Sheet Number: P-301

Page Number:

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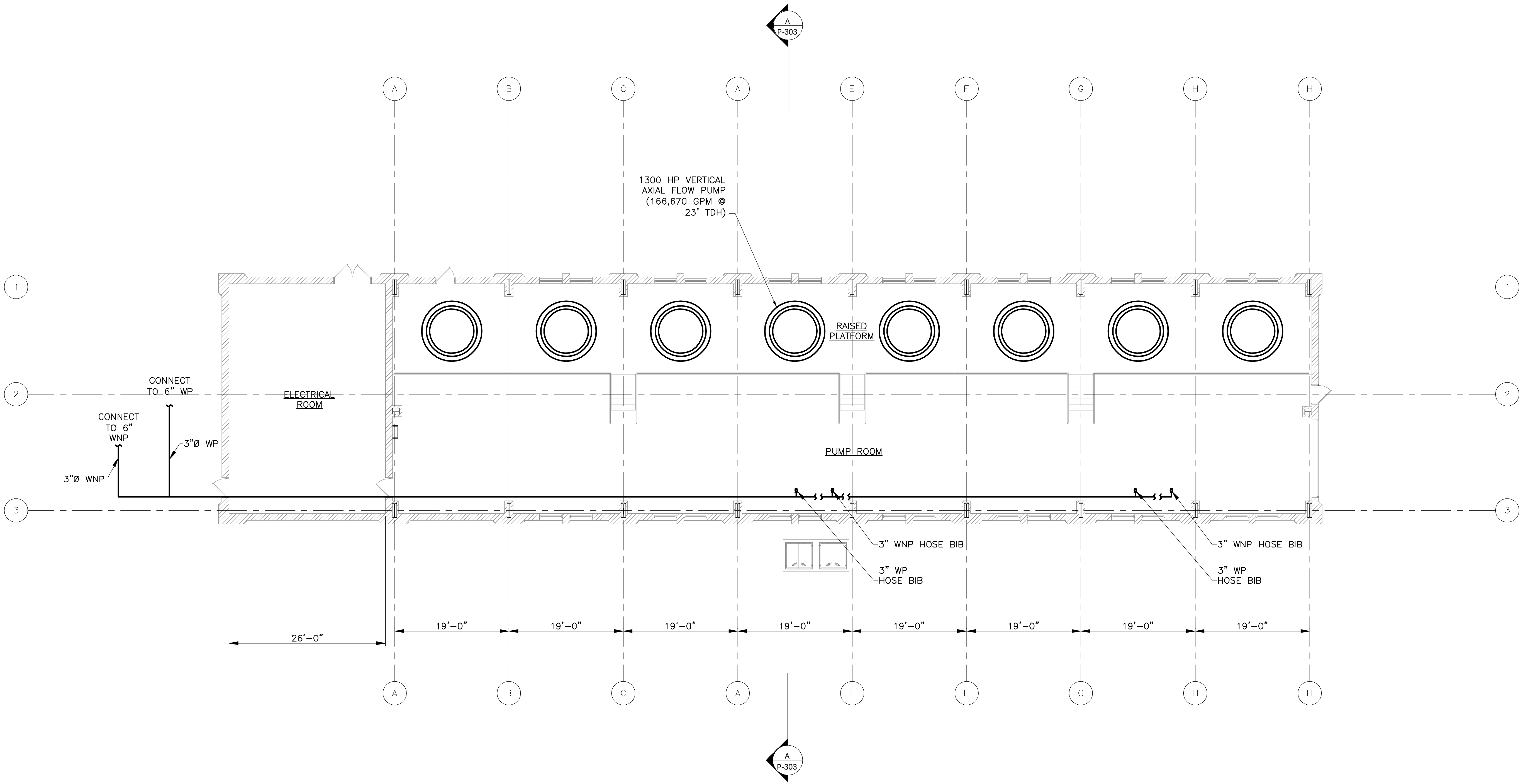

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Designed by: CMB
Checked by: XX
Correct: ANTHONY BOUCHARD
Approved: MWRD Assistant Chief Engineer
Drawn by: MB
Reviewed by: EPC
Date: 1/2008
Scale: 1/8"=1'-0"

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CONTRACT 07-026-2P
STICKNEY WATER RECLAMATION PLANT
ULTRAVIOLET DISINFECTION FACILITIES

LOW LIFT PUMP STATION UPPER LEVEL PLAN

Seal

Sheet Number: P-302
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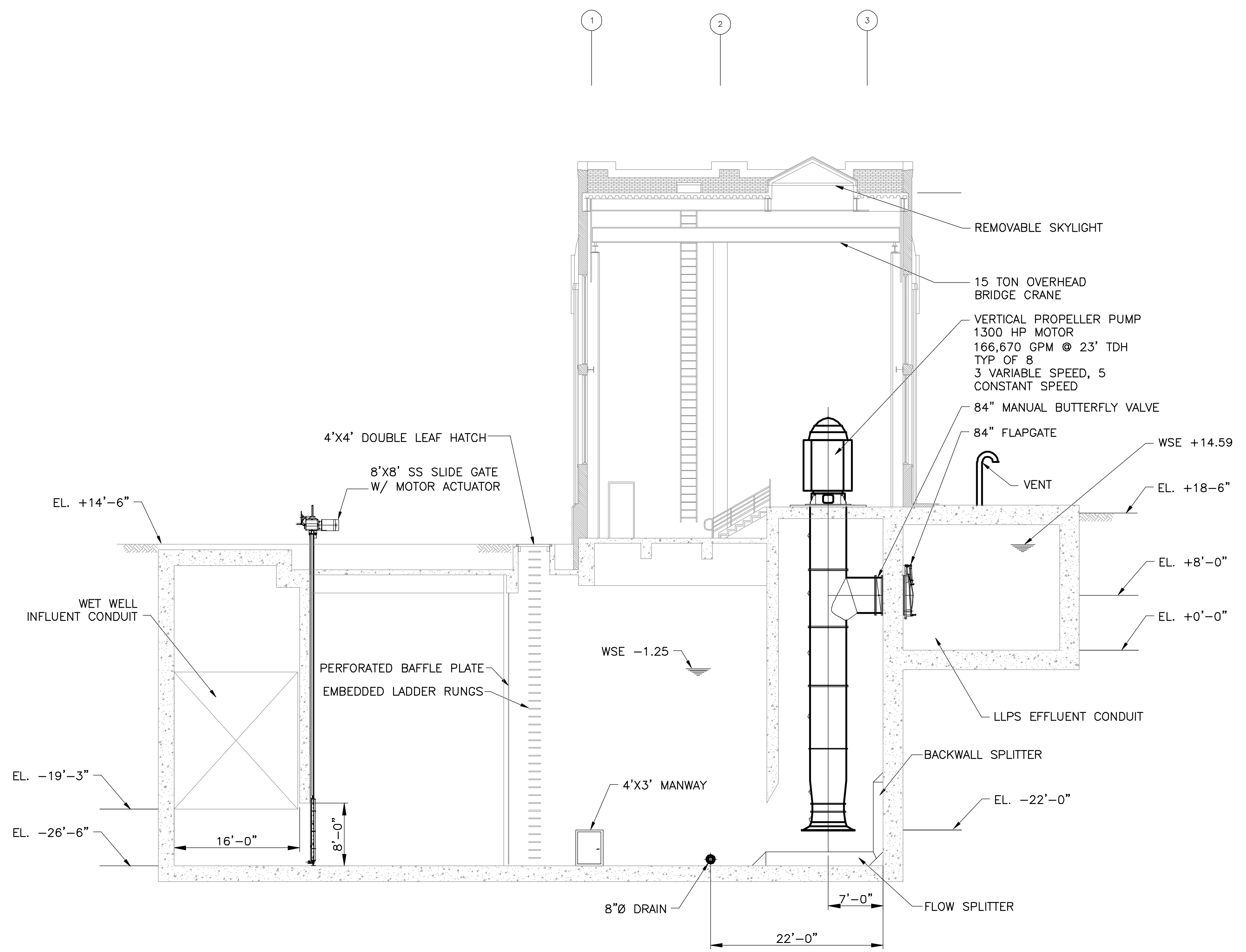

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STICKNEY WATER RECLAMATION PLANT
ULTRAVIOLET DISINFECTION FACILITIES

LOW LIFT PUMP STATION
SECTION

Sheet Number: P-303
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