



Geotechnical Engineering

Industry Mentors

Dan Johnson, P.E.

GEI Consultants, Inc.

dljohnson@geiconsultants.com

303-440-5234

Rich Tocher, P.E.

Tetra Tech

rich.tocher@tetrattech.com

303-772-5282

Hazards Below the Ground Surface

- **Low Strength Soils**
- **Swelling Soils/Bedrock**
- **Collapsing Soils/Bedrock**
- **Groundwater**
- **Chemical Reactive Soils**
- **Voids**
- **Deleterious Materials**

Site Observations

- **Overview**
- **Geology**
- **Geomorphology**
- **Prior Use**

Geotechnical Engineering

- **Preliminary Design (20%)**
- **Design Development (60%)**
- **Final Design (100%)**

Action Plan

- **Review Geotechnical Report**
- **Design Foundation and Floor Slab of Aerating Basin**
- **Design Foundation**

Other Design Considerations

- **Communication with Structural Designer/Hydraulics Engineer**
- **Construction Approach**
- **Specification Recommendations**
- **Construction Quality Control Recommendations**

Sampling



- **Split Spoon Sampler**
- **California Sampler**
- **Shelby Tube**
- **Bulk Samples**
- **Groundwater Level**

Laboratory Testing

- **Standard Properties of Soils and Bedrock**
- **Strength Properties**
- **Swell – Consolidation Properties**
- **Chemical Properties**

Analysis

- **Foundations**
- **Hydraulics**
- **Retaining/Foundation Walls**
- **Drains**
- **Earthwork/Excavations**
- **Fills**

Geotechnical Report

- **Data Presentation**
- **Site Issues**
- **Engineering Results**
- **Recommendations**
- **Limitations**

Consultation

- **Performance Prediction**
- **Construction Sequencing**
- **Excavation Requirements**
- **Specifications**
- **Problem Resolution**
- **Detailed Design**

Construction Phase Services

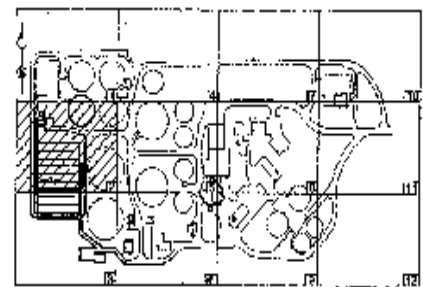
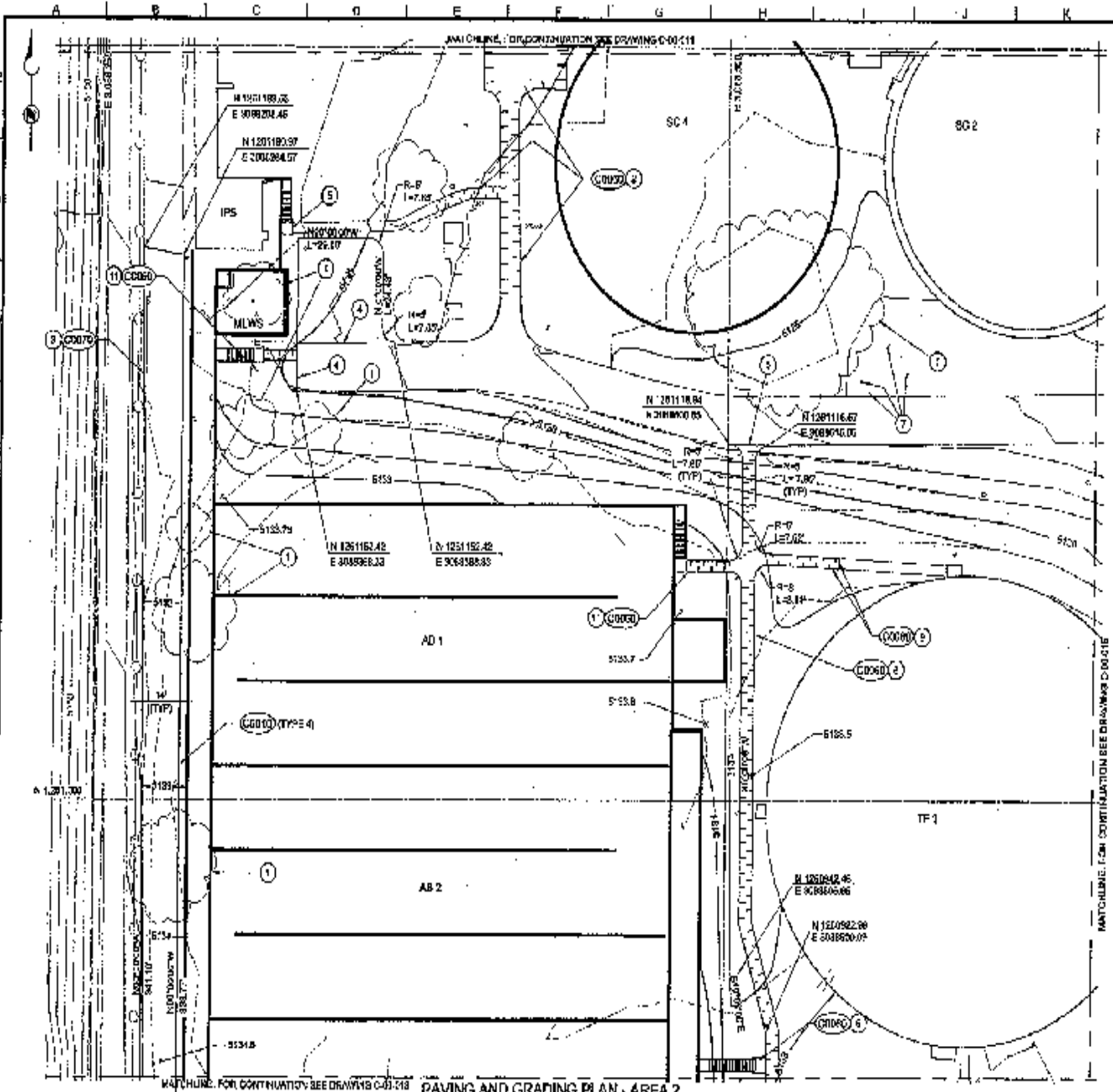
- **Observation – final geotechnical investigation**
- **Conformance to P&S/Design Intent**
- **Materials Testing**
- **Redesign**

PAVING AND GRADING GENERAL NOTES:

- A. EXISTING LANDSCAPE, ROADS, WALKWAYS, ETC. WHICH ARE DAMAGED OR DESTROYED BY NEW CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO MATCH EXISTING CONDITIONS.
- B. FOR CLARITY, NO NEW PLANTINGS OR LANDSCAPE ARCHITECTURAL ELEMENTS UNLESS SHOWN HERE, SEE LANDSCAPE AND IRRIGATION DRAWINGS.

KEY NOTES:

- ① REMOVE EXISTING TREES AND SHRUBS PER LANDSCAPE PLANS.
- ② REPLACE WALKWAY AFTER YARD PIPING INSTALLATION AND SC 4 CONSTRUCTION. WIDTHS TO MATCH EXISTING.
- ③ CONTINUE EXISTING ROADWAY ALONG WEST SIDE OF NEW YARD LOT BASINS.
- ④ TERMINATE EXISTING ROADWAY AND ADD PARKING AND TURNAROUND AREA TO ACCESS MIXED LIQUOR AREATING STATION.
- ⑤ SCHEDULE AND ILLUMINATE EXISTING WALKWAY AT BASE OF RELOCATED STAIRS.
- ⑥ PROVIDE 4' WIDE PAVED WALKWAY AS SHOWN.
- ⑦ PROTECT EXISTING VALVES AND CLEANOUTS DURING CONSTRUCTION AND KEEP IN SERVICE AT ALL TIMES.
- ⑧ TRANSITION NEW SIDEWALK TO EXISTING CURB AND GUTTER.
- ⑨ TRANSITION NEW SIDEWALK TO EXISTING MATCH EXISTING WALKWAY WIDTH.
- ⑩ TRANSITION NEW PAVEMENT TO EXISTING.
- ⑪ PROVIDE NEW 4' WIDE PAVED WALKWAY.



PAVING AND GRADING PLAN - AREA 2

BEHN & ASSOCIATES
 1800 130th Street
 Boulder, CO 80501
 303.440.1400
 www.behnandassociates.com

DESIGNED BY: *Behn*
 DATE: _____
 APPROVED BY: *[Signature]*
 DATE: _____

LEVEL 1 DESIGN	DATE	BY	CHKD BY
AT FULL COST			
APPROX. BIDDING COST			
CONSTRUCTION			
OPERATION			
MAINTENANCE			
REPAIRS			
REPLACEMENT			
RECONSTRUCTION			
RENOVATION			
RESTORATION			
REPAIRS			
REPLACEMENT			
RECONSTRUCTION			
RENOVATION			
RESTORATION			



REVISIONS			
NO.	DATE	DESCRIPTION	BY

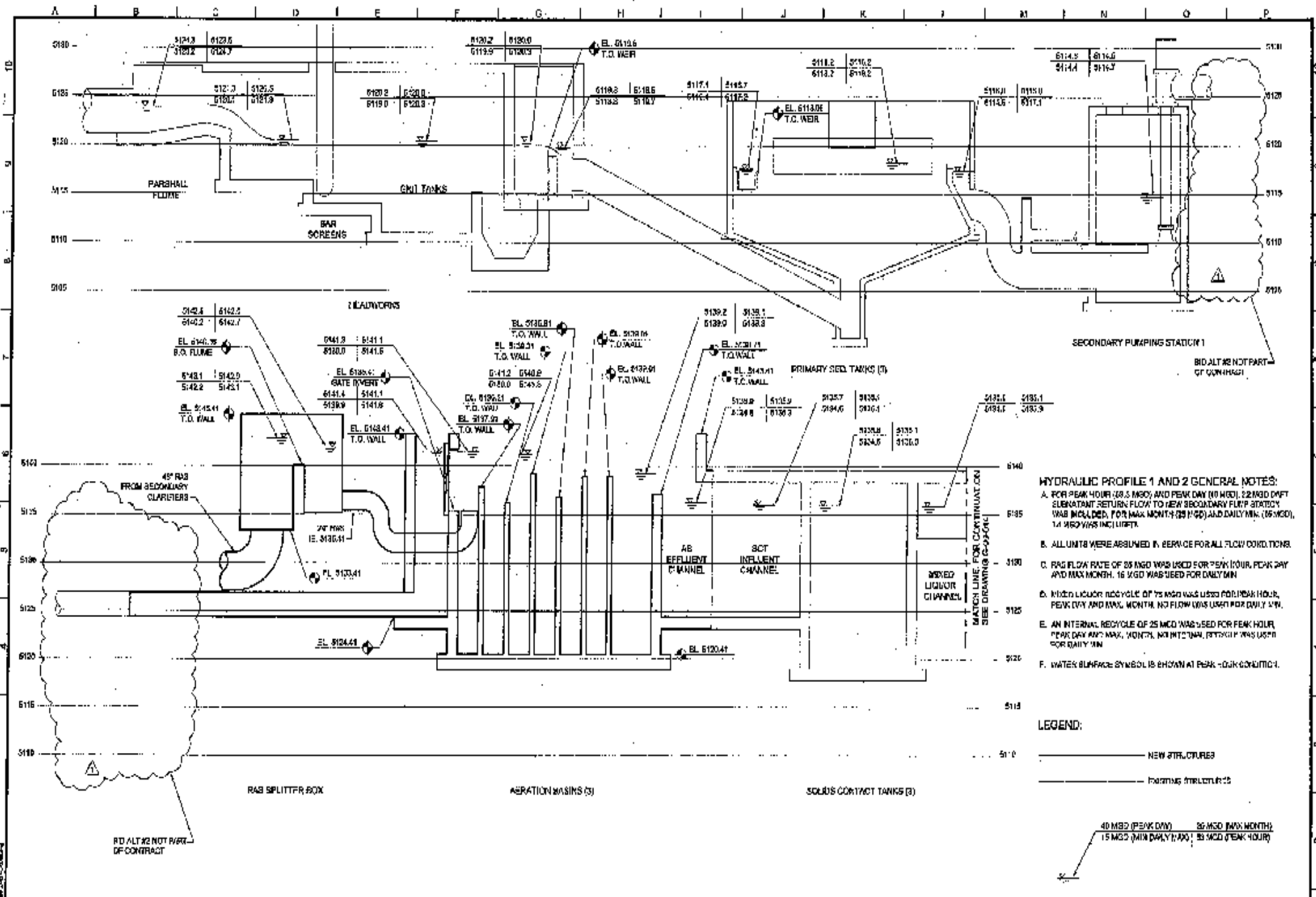
CITY OF BOULDER

75TH STREET
 WASTEWATER TREATMENT PLANT

UPGRADES PROJECT
 75TH STREET
 WASTEWATER TREATMENT PLANT

RFI-03-21

PLANNING
 20107
 03-03-2021
 G-00-012



- HYDRAULIC PROFILE 1 AND 2 GENERAL NOTES:**
- A. FOR PEAK HOUR (45 MGD) AND PEAK DAY (60 MGD), 22 MGD DIFT ELEMENTARY RETURN FLOW TO HEAD SECONDARY FLUM FLIP STATION WAS INCLUDED FOR MAX MONTHLY (15 MGD) AND DAILY MAX (15 MGD), 14 MGD WAS INCLUDED.
 - B. ALL UNITS WERE ASSUMED IN SERVICE FOR ALL FLOW CONDITIONS.
 - C. RAG FLOW RATE OF 25 MGD WAS USED FOR PEAK HOUR, PEAK DAY AND MAX MONTH, 16 MGD WAS USED FOR DAILY MAX.
 - D. MIXED LIQUOR RECYCLE OF 75 MGD WAS USED FOR PEAK HOUR, PEAK DAY AND MAX MONTH, NO FLOW WAS USED FOR DAILY MAX.
 - E. AN INTERNAL RECYCLE OF 25 MGD WAS USED FOR PEAK HOUR, PEAK DAY AND MAX MONTH, NO FLOW WAS USED FOR DAILY MAX.
 - F. WATER SURFACE SYMBOL IS SHOWN AT PEAK FLOW CONDITIONS.

- LEGEND:**
- NEW STRUCTURES
 - - - EXISTING STRUCTURES
- 40 MGD (PEAK HOUR) 60 MGD (PEAK DAY)
 15 MGD (MAX MONTHLY) 22 MGD (PEAK HOUR)

BRON & CALDWELL
 1745 W. 9th St. Ste. 200
 Boulder, CO 80502
 (303) 440-0100
 www.bronandcaldwell.com

DATE: _____
 APPROVED: _____ DATE: _____

LINE SIZE 18 INCHES	INTERNAL REVISIONS FILED SUBMITTAL
DATE 10/14/03	DATE 10/14/03
PROJECT NO. 000000000000	DATE 10/14/03

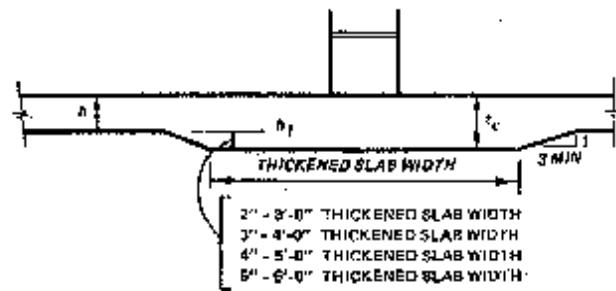


NO.	DATE	DESCRIPTION	BY	CHKD	APP'D
1	10/14/03	PRELIMINARY DESIGN			
2	10/14/03	FINAL DESIGN			

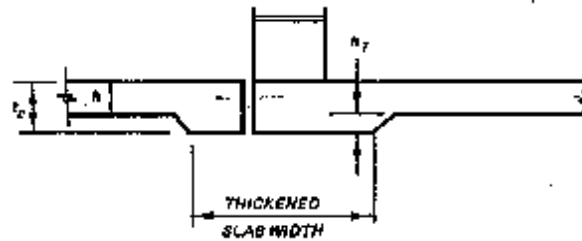
CITY OF BOULDER
 75TH STREET
 WASTEWATER TREATMENT PLANT

UPGRADES PROJECT
 GENERAL
HYDRAULIC PROFILE 1

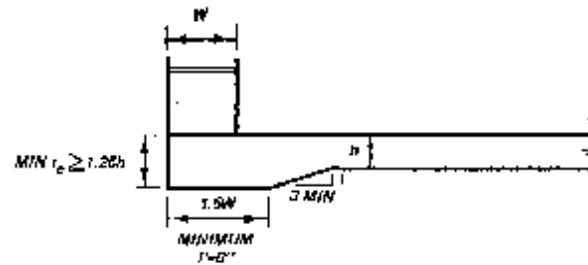
PROJECT NO. 000000000000
 SHEET NO. 11 OF 11
G-08-013



a) SLABS LOADED NEAR THE CENTER



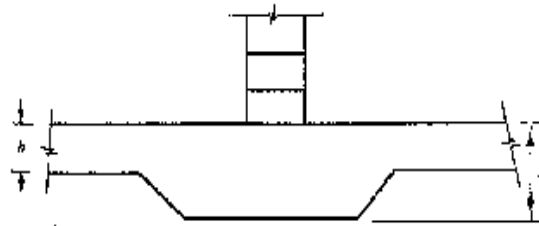
b) SLABS LOADED NEAR A KEYED OR DOWELED JOINT



c) SLABS LOADED NEAR A FREE EDGE

Figure 3-7. Widths of thickened slabs and slab edge conditions under wall loads.

Table 3-3. Minimum thickness of thickened floor slab for wall joint near center of slab or near keyed or sloped joint



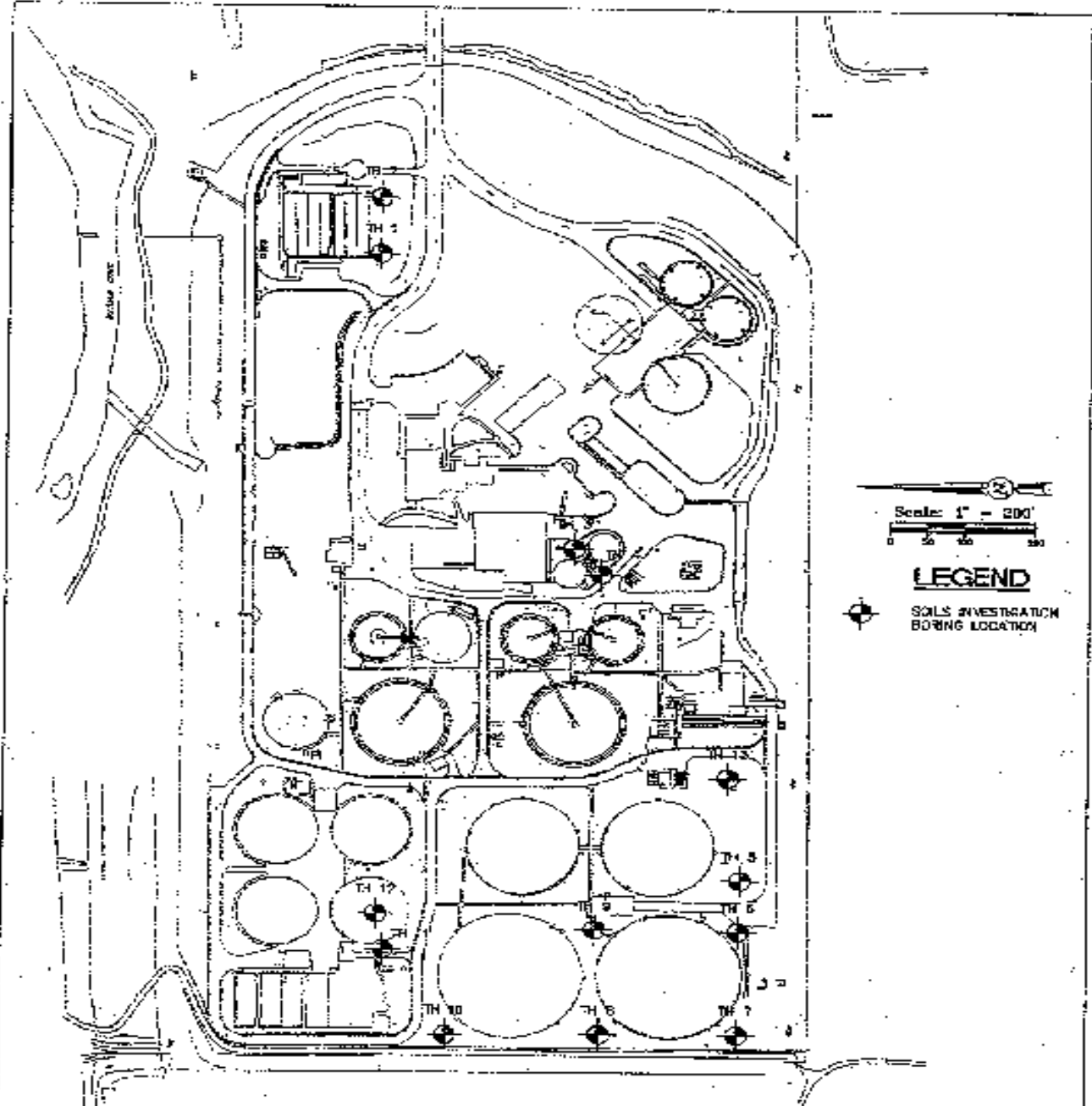
Thickness of Thickened Floor Slab, t , (inches)	Slab Unit Load Capacity, q (lb/in ²)			
	Flexural Strength of Concrete (lb/in ²)			
	550	600	650	700
4	425	465	485	510
5	505	550	575	605
6	610	665	695	730
7	740	810	845	890
8	1,015	1,090	1,135	1,185
9	1,175	1,265	1,320	1,380
10	1,340	1,440	1,500	1,605

NOTE: The allowable wall loads are based on a modulus of subgrade reaction (k) of 100 pounds per cubic inch. The thickness of the thickened slab will be computed by multiplying the above thicknesses by a constant factor. Constants for other subgrade moduli are tabulated below.

Modulus of Subgrade reaction k	25	50	100	200	300
Constant factor	1.3	1.1	1.0	0.9	0.8

For other modulus of subgrade reaction values the constant values may be found from $\sqrt{100/k}$.

For this application the flexural strength of concrete was assumed equal to $9\sqrt{f'_c}$ where f'_c is the specified compressive strength of concrete (lb/in²).



**FIGURE 1
BORING LOCATION MAP**


SCOTT, COX & ASSOCIATES, INC.
 consulting engineers • surveyors
 1520 55th Street • Boulder, Colorado 80303
 (303) 444-3665

9/21/04

JOB NO. 04466

DRAWING NO. 04466

Graphic Boring Logs

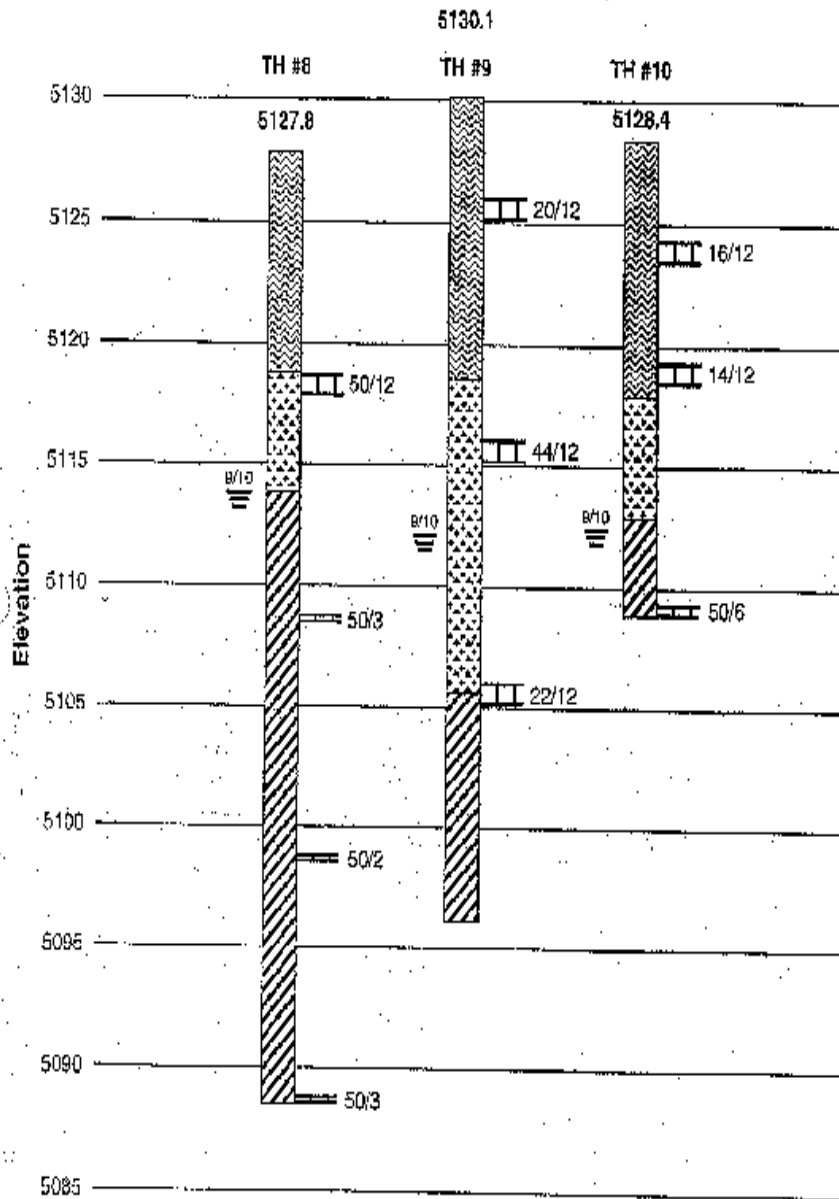


Figure 2
Page 3



SCOTT, COX & ASSOCIATES, INC. consulting engineers • surveyors

December 7, 2004

Brown and Caldwell
1697 Cole Boulevard, Suite 200
Golden, CO 80401

Attn: Mr. Boyd D. Hanson, P.E.

Project: 04466

Dear Mr. Hanson:

On December 6, 2004, Scott, Cox & Associates, Inc. attended a design meeting for the proposed new additions to the 75th Street Waste Water Treatment Plant in Boulder, Colorado. A number of topics were discussed, however, it was requested that we clarify the offset to bedrock since one of the design schemes involves raising and refiguring the aeration basins.

Our original report called for a minimum 4-foot offset above the potentially expansive bedrock in order to utilize a footing foundation system. Based upon the proposed elevations and the depths to claystone bedrock encountered in the borings, it appears that an offset of 1½ feet could be maintained on the west side of the new aeration basins to greater than 4 feet on the east side. Since the site has an existing groundwater table above the bedrock contact, the upper portions of the bedrock are essentially in a steady state/wetted condition. Therefore, provided the minimum 1½ foot offset is maintained, then the potential expansion of the claystone by wetting should be significantly minimized.

It should be noted that these elevations are based upon the borings drilled and that it is still possible that the bedrock is higher at some locations. Therefore, if bedrock is encountered during construction, the owner and appropriate parties should be contacted and the risks re-evaluated.

Questions

