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REPORT OF GEOPHYSICAL SURVEY
I-696 and Tunnel-Sewer Alignment
from Pumphouse to P.I. No. 3A
City of Southfield, Oakland County
Control Section 63102, Job Number 22141C



MATERIALS and TECHNOLOGY DIVISION

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City of Southfield, Oakland County
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Douglas N. Hart
Geologist

Testing Laboratory Section
Testing and Research Division

Michigan Transportation Commission
William C. Marshall, Chairman;
Lawrence C. Patrick, Jr., Vice-Chairman;
Hannes Meyers, Jr., Carl V. Pellonpaa,
Weston E. Vivian, Rodger D. Young
James P. Pitz, Director
May 11, 1984

This geophysical and boring survey was conducted by Geotechnical and Central Soils Unit personnel to determine subsurface conditions which would be encountered by a proposed tunnel-sewer alignment and the I-696 roadway.

Surface deposits in the survey area consist of lacustrine fine sand and silt. These deposits are underlain successively by lacustrine clays and a dense bed of very fine to medium sand.

The cross sections depicted on Figures 1 and 2 indicate that the tunnel-sewer bore from Station 96+50 to 118+00 will encounter compact to very compact sand deposits, which are partially saturated, and may contain occasional boulders. Natural gas was detected in these sand deposits in borings T-73 and T-74. The gas concentrations ranged up to 100% of the lower explosive limit in boring T-74. Tunnel-sewer bore from Station 118+00 to Station 124+00 will encounter firm to stiff clays. Tunnel-sewer construction work shafts P.I. 1A, 1 and 2 will encounter saturated conditions in the surface sand deposits.

Figures 3 and 4 depict subsurface conditions along construction center-line from Station 114+00 to Station 135+00. Excavation for the tunnel-sewer bore will encounter firm to stiff clays between the aforementioned stations. Excavations for tunnel-sewer work shafts P.I. 3 and 3A will encounter saturated conditions in the surface sand deposits.

Resistivity values obtained in the saturated surface sand deposits are abnormally low due, most probably, to accumulations of deicing salts. The clay resistivity values are in a normal range. Resistivity values observed in the deep sand deposits are variable, with the higher values indicating normal conditions, and the lower value zones indicating the presence of increased dissolved minerals in the soil moisture.

Included as part of this report is a Field Log of Borings, and Figures 1 through 4.

FIELD LOG OF BORINGS

D01-2, 180 Feet Left of Station 548+34 Eastbound I-696 Survey Centerline
Elevation 695.0 Feet

- 0 - 1.5 Feet Brown Loamy Sand
 - 1.5 - 7.0 Feet Moderately Compact Brown Fine Sand
 - 7.0 - 16.0 Feet Moderately Compact Gray Fine Sand (Saturated)
 - 16.0 - 38.0 Feet Firm Gray Clay, Occasional Pebbles
 - 38.0 - 62.0 Feet Very Compact Gray Fine to Medium Sand
 - 62.0 - 72.0 Feet Moderately Compact Gray Fine to Medium Sand
 - 72.0 - 83.0 Feet Compact Gray Fine sand
 - 83.0 - 86.0 Feet Moderately Compact Gray Fine Sand
- NOTE: Water Level 62' Below Ground Elevation on Completion (Auger in)

T-73, 105 Feet Left of Station 552+00 Eastbound I-696 Survey Centerline
Elevation 708.1 Feet

- 0 - 2.0 Feet Loose Brown Loamy Sand and Gravel, Trace of Clay
 - 2.0 - 4.0 Feet Plastic Brown-Gray Mottled Sandy Clay
 - 4.0 - 10.0 Feet Firm Brown-Gray Mottled Clay, Trace of Sand
 - 10.0 - 16.0 Feet Stiff Gray Sandy, Pebbly Clay
 - 16.0 - 22.0 Feet Moderately Compact Brown Fine and Medium Sand
 - 22.0 - 24.0 Feet Moderately Compact Gray Fine, Silty Sand
 - 24.0 - 37.0 Feet Firm Gray Silty Clay, Silt and Sand Lenses and Layers
 - 37.0 - 55.5 Feet Stiff Gray Silty Clay, Occasional Silt Lense, Trace of Pebbles
 - 55.5 - 57.0 Feet Hard Gray Clay, Trace of Pebbly Sand
 - 57.0 - 77.0 Feet Very Compact Gray Fine Sand
 - 77.0 - 81.0 Feet Moderately Compact Gray Fine Sand
- NOTE: Water Level 75' Below Ground Elevation on Completion (Auger in)

T-72, 95 Feet Left of Station 555+00 Eastbound I-696 Survey Centerline
Elevation 711.5 Feet

- 0 - 2.0 Feet Loose Brown Sand and Gravel
 - 2.0 - 9.0 Feet Plastic Gray-Brown Mottled Clay, Trace of Sand
 - 9.0 - 13.0 Feet Firm Gray-Brown Mottled Clay, Trace of Sand
 - 13.0 - 20.5 Feet Stiff Gray-Brown Mottled Clay, Trace of Sand, Trace of Pebbles
 - 20.5 - 21.5 Feet Moderately Compact Brown Silt
 - 21.5 - 27.0 Feet Moderately Compact Brown Fine Sand
 - 27.0 - 36.0 Feet Moderately Compact Gray Silt and Fine Sand, Clay Lenses
 - 36.0 - 44.0 Feet Firm Gray Silty Clay, Silt Lenses
 - 44.0 - 53.0 Feet Stiff Gray Silty Clay
 - 53.0 - 56.5 Feet Firm Gray Silty Clay
 - 56.5 - 65.0 Feet Very Hard Gray Sandy, Pebbly Clay
 - 65.0 - 76.0 Feet Very Compact Gray Fine Sand, Occasional Silt Lense
 - 76.0 - 86.0 Feet Compact Gray Fine, Silty Sand, Silt Lenses
- NOTE: Water Level 73' Below Ground Elevation on Completion (Auger in);
(Auger out)

T-75, 108 Feet Right of Station 557+00 Eastbound I-696 Survey Centerline
Elevation 696.9 Feet

- 0 - 2.0 Feet Topsoil
- 2.0 - 6.5 Feet Firm Gray Sandy Clay, Trace of Pebbles
- 6.5 - 15.0 Feet Moderately Compact Brown Fine to Very Fine Sand (Saturated)
- 15.0 - 25.5 Feet Moderately Compact Gray Fine Sand (Saturated)
- 25.5 - 38.0 Feet Firm Gray Clay, Trace of Silt
- 38.0 - 50.0 Feet Stiff Gray Sandy Clay, Trace of Pebbles, Occasional Sand Seams
- 50.0 - 63.0 Feet Very Compact Gray Very Fine to Medium Sand, Trace of Silt
- 63.0 - 68.0 Feet Compact Gray Silt and Fine Sand
- 68.0 - 71.0 Feet Compact Gray Medium Sand

NOTE: Water Level 59' Below Ground Elevation on Completion (Auger in)

T-76, 110 Feet Right of Station 561+90 Eastbound I-696 Survey Centerline
Elevation 691.2 Feet

- 0 - 0.5 Feet Topsoil
- 0.5 - 4.0 Feet Moderately Compact Brown Sand
- 4.0 - 11.0 Feet Moderately Compact Brown Fine Sand (Saturated)
- 11.0 - 21.0 Feet Moderately Compact Gray Fine Sand (Saturated)
- 21.0 - 34.0 Feet Firm Gray Clay, Trace of Silt
- 34.0 - 45.5 Feet Stiff Gray Clay
- 45.5 - 53.0 Feet Very Compact Gray Fine and Medium Sand
- 53.0 - 66.0 Feet Compact Gray Fine and Very Fine Sand

NOTE: Water Level 57' Below Ground Elevation on Completion (Auger in)

T-77, 79 Feet Right of Station 566+10 Eastbound I-696 Survey Centerline
Elevation 694.6 Feet

- 0 - 0.5 Feet Topsoil
- 0.5 - 2.0 Feet Brown Loamy Sand
- 2.0 - 12.0 Feet Moderately Compact Brown Medium Sand (Saturated below 5')
- 12.0 - 25.5 Feet Moderately Compact Gray Fine Sand (Saturated)
- 25.5 - 38.0 Feet Firm Gray Clay, Occasional Sand Seam
- 38.0 - 52.0 Feet Stiff Gray Clay
- 52.0 - 61.0 Feet Very Compact Gray Fine Sand
- 61.0 - Refusal Hard Boulder

NOTE: Water Level 56' Below Ground Elevation on Completion (Auger in)

T-74, 95 Feet Right of Station 568+00 Eastbound I-696 Survey Centerline
Elevation 691.6 Feet

- 0 - 1.0 Feet Topsoil
- 1.0 - 4.0 Feet Loose Brown Fine Sand
- 4.0 - 6.0 Feet Loose Dark Mucky Sand
- 6.0 - 13.0 Feet Moderately Compact Brown Fine Sand
- 13.0 - 24.0 Feet Compact Gray Very Fine Sand
- 24.0 - 41.0 Feet Moderately Compact Gray Fine Sand
- 41.0 - 54.0 Feet Stiff Gray Clay, Trace of Pebbles, Sand Lenses and Layers
- 54.0 - 71.0 Feet Very Compact Gray Fine to Medium Sand

T-78, Station 570+00 Eastbound I-696 Survey Centerline

Elevation 692.3 Feet

- 0 - 2.5 Feet Road Gravel
- 2.5 - 5.0 Feet Firm Brown Sandy Clay
- 5.0 - 13.0 Feet Moderately Compact Brown Fine Sand (Saturated)
- 13.0 - 27.0 Feet Moderately Compact Gray Very Fine Sand, (Saturated)
- 27.0 - 42.0 Feet Firm Gray Clay, Trace of Silt
- 42.0 - 56.0 Feet Stiff Gray Sandy Clay, Sand Partings, Occasional Pebbles
- 56.0 - 66.0 Feet Very Compact Gray Fine Sand

NOTE: Water Level 56' Below Ground Elevation on Completion (Auger in)

T-54, 40' Right of Station 115+50 I-696 Construction Centerline

Elevation 689.8 Feet

- 0 - 1.0 Feet Loose Brown Loamy Sand and Gravel
- 1.0 - 2.5 Feet Moderately Compact Yellow-Brown Fine Sand
- 2.5 - 9.0 Feet Compact Brown Fine Sand (Saturated at 7')
- 9.0 - 14.0 Feet Compact Gray-Brown Fine Sand, Occasional Silt Lenses
- 14.0 - 17.0 Feet Compact Gray Fine Silty Sand, Silt Lenses (Saturated)
- 17.0 - 24.5 Feet Moderately Compact Gray Silt and Fine Sand, Silt lenses (Saturated)
- 24.5 - 38.0 Feet Firm Gray Silty Clay, Silt Partings
- 38.0 - 48.0 Feet Firm Gray Clay, Slight Trace of Sand, Occasional pebbles
- 48.0 - 53.0 Feet Stiff Gray Clay, Occasional Heavy Trace of Pebbly Sand, Sand Lenses
- 53.0 - 60.5 Feet Stiff Gray Sandy, Pebbly Clay, Sand Lenses and Layers

NOTE: Water Level 7' Below Ground Elevation on Completion (Auger in);
(Auger out)

S03-1, 110 Feet Right of Station 119+38 I-696 Construction Centerline

Elevation 693.8 Feet

- 0 - 1.0 Feet Loose Brown Loamy Sandy, Heavy Trace of Gravel
- 1.0 - 7.0 Feet Loose Brown Loamy Sand, Trace of Gravel and Topsoil
- 7.0 - 9.0 Feet Loose Brown Fine Sand (Saturated)
- 9.0 - 13.5 Feet Moderately Compact Brown Mottled Silt and Very Fine Sand (Saturated)
- 13.5 - 20.0 Feet Compact Gray Fine Sand (Saturated)
- 20.0 - 22.0 Feet Stiff Gray Silty Clay
- 22.0 - 27.0 Feet Moderately Compact Gray Silt and Very Fine Sand
- 27.0 - 34.0 Feet Compact Gray Silt
- 34.0 - 36.0 Feet Stiff Gray Silty Clay, Silt Partings and Lenses
- 36.0 - 42.0 Feet Moderately Compact Gray Silt and Fine Sand, Clay Lenses and Layers
- 42.0 - 46.0 Feet Stiff Gray Silty Clay

NOTE: Water Level 2.5' Below Ground Elevation on Completion (Auger in);
(Auger out)

S03-3, 64 Feet Left of Station 119+35 I-696 Construction Centerline

Elevation 695.4 Feet

- 0 - 3.0 Feet Loose Brown Loamy Sand, Trace of Topsoil
- 3.0 - 6.0 Feet Moderately Compact Brown Loamy Sand
- 6.0 - 7.0 Feet Loose Gray Fine Sand
- 7.0 - 14.0 Feet Moderately Compact Brown-Gray Mottled Silt and Fine Sand (Saturated)
- 14.0 - 17.0 Feet Compact Gray Fine Sand (Saturated)
- 17.0 - 33.0 Feet Very Compact Gray Fine Sand, Occasional Silt Lenses (Saturated)
- 33.0 - 43.0 Feet Firm Gray Silty Clay
- 43.0 - 48.0 Feet Stiff Gray Clay
- 48.0 - 51.0 Feet Firm Gray Clay

NOTE: Water Level 3' Below Ground Elevation on Completion (Auger in)
Water Level 5' Below Ground Elevation on Completion (Auger out)

S03-2, Station 120+40 I-696 Construction Centerline

Elevation 694.2 Feet

- 0 - 5.0 Feet Loose Brown Loamy Sand and Topsoil
- 5.0 - 7.0 Feet Loose Brown Medium Sand (Saturated)
- 7.0 - 13.0 Feet Loose Brown Mottled Fine Sand, Silt Lenses (Saturated)
- 13.0 - 18.0 Feet Compact Gray Fine Sand, Trace of Silt, Silt Lenses
- 18.0 - 23.0 Feet Moderately Compact Gray Silt and Fine Sand, Silt Lenses (Saturated)
- 23.0 - 28.0 Feet Moderately Compact Gray Fine Sand (Saturated), Occasional Silt Lense
- 28.0 - 33.0 Feet Moderately Compact Gray Silt, Heavy Trace of Clay, Clay Lenses
- 33.0 - 51.0 Feet Firm Gray Silty Clay, Silt Partings and Lenses

NOTE: Water Level 5' Below Ground Elevation on Completion (Auger in)

T-55, 80 Feet Right of Station 124+75 I-696 Construction Centerline

Elevation 689.5 Feet

- 0 - 1.0 Feet Topsoil
- 1.0 - 2.5 Feet Moderately Compact Brown Loamy Sand, Trace of Gravel
- 2.5 - 6.0 Feet Moderately Compact Yellow-Brown Mottled Fine Sand, Trace of Gravel
- 6.0 - 9.0 Feet Moderately Compact Gray Silt and Fine Sand (Saturated at 8')
- 9.0 - 22.0 Feet Compact Gray Fine, Silty Sand, Silt Partings (Saturated)
- 22.0 - 27.0 Feet Very Compact Gray Fine Sand (Saturated)
- 27.0 - 31.0 Feet Moderately Compact Gray Fine, Silty Sand, Silt and Clay Lenses
- 31.0 - 34.0 Feet Compact Gray Silt Clay Lenses
- 34.0 - 61.0 Feet Firm Gray Silty Clay, Silt Partings and Lenses

NOTE: Water Level 8' Below Ground Elevation on Completion (Auger in);
(Auger out)

T-56, 15 Feet Right of Station 127+60 I-696 Construction Centerline
Elevation 689.5 Feet

- 0 - 1.0 Feet Topsoil
- 1.0 - 3.0 Feet Brown Sand and Gravel
- 3.0 - 5.0 Feet Brown Loamy Sand
- 5.0 - 7.0 Feet Moderately Compact Gray Sand and Silt (Saturated)
- 7.0 - 12.0 Feet Very Compact Silt and Fine Sand
- 12.0 - 17.5 Feet Very Compact Gray Sand and Silt
- 17.5 - 27.0 Feet Compact Gray Fine Sand
- 27.0 - 29.5 Feet Moderately Compact Gray Sand and Silt
- 29.5 - 37.0 Feet Firm Gray Clay, Silt Lenses
- 37.0 - 48.0 Feet Firm Silty Gray Clay, Silt Lenses
- 48.0 - 60.0 Feet Stiff Gray Clay, Trace of Silt and Pebbles

NOTE: Water Level 9' Below Ground Elevation on Completion (Auger in);
(Auger out)

S32-3, Station 129+04 I-696 Construction Centerline
Elevation 689.3 Feet

- 0 - 0.5 Feet Gravel
- 0.5 - 3.5 Feet Soft Brown Sandy Clay
- 3.5 - 7.0 Feet Coarse Brown Sand (Saturated)
- 7.0 - 11.0 Feet Compact Gray Fine Sand
- 11.0 - 18.0 Feet Very Compact Gray Fine Sand
- 18.0 - 23.0 Feet Compact Gray Silt and Fine Sand
- 23.0 - 32.0 Feet Firm Gray Silty Clay, Lenses of Silt
- 32.0 - 50.0 Feet Firm Gray Clay, Trace of Silt

NOTE: Water Level 2' Below Ground Elevation on Completion (Auger in)

CROSS SECTION INFERRED FROM RESISTIVITY AND BORING DATA

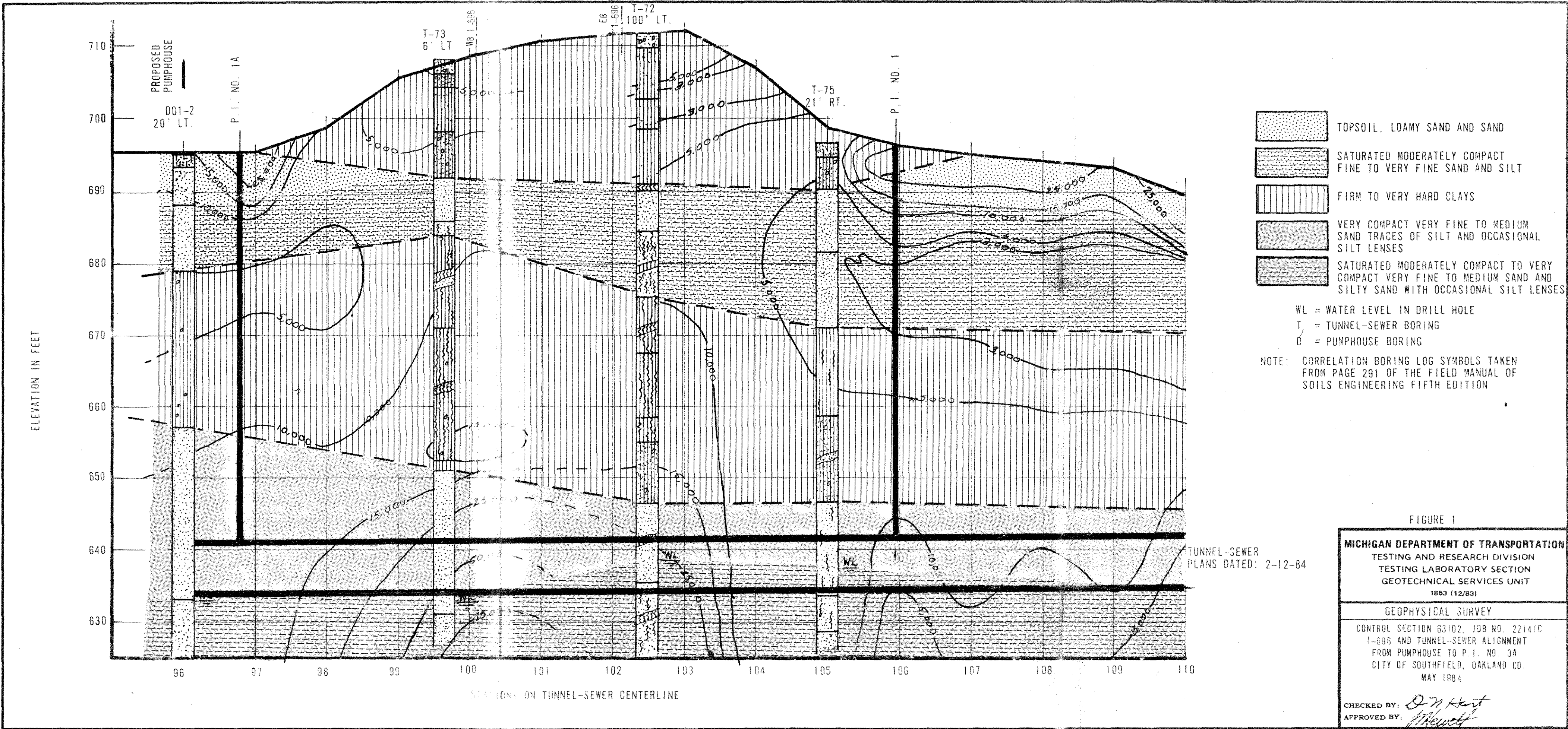


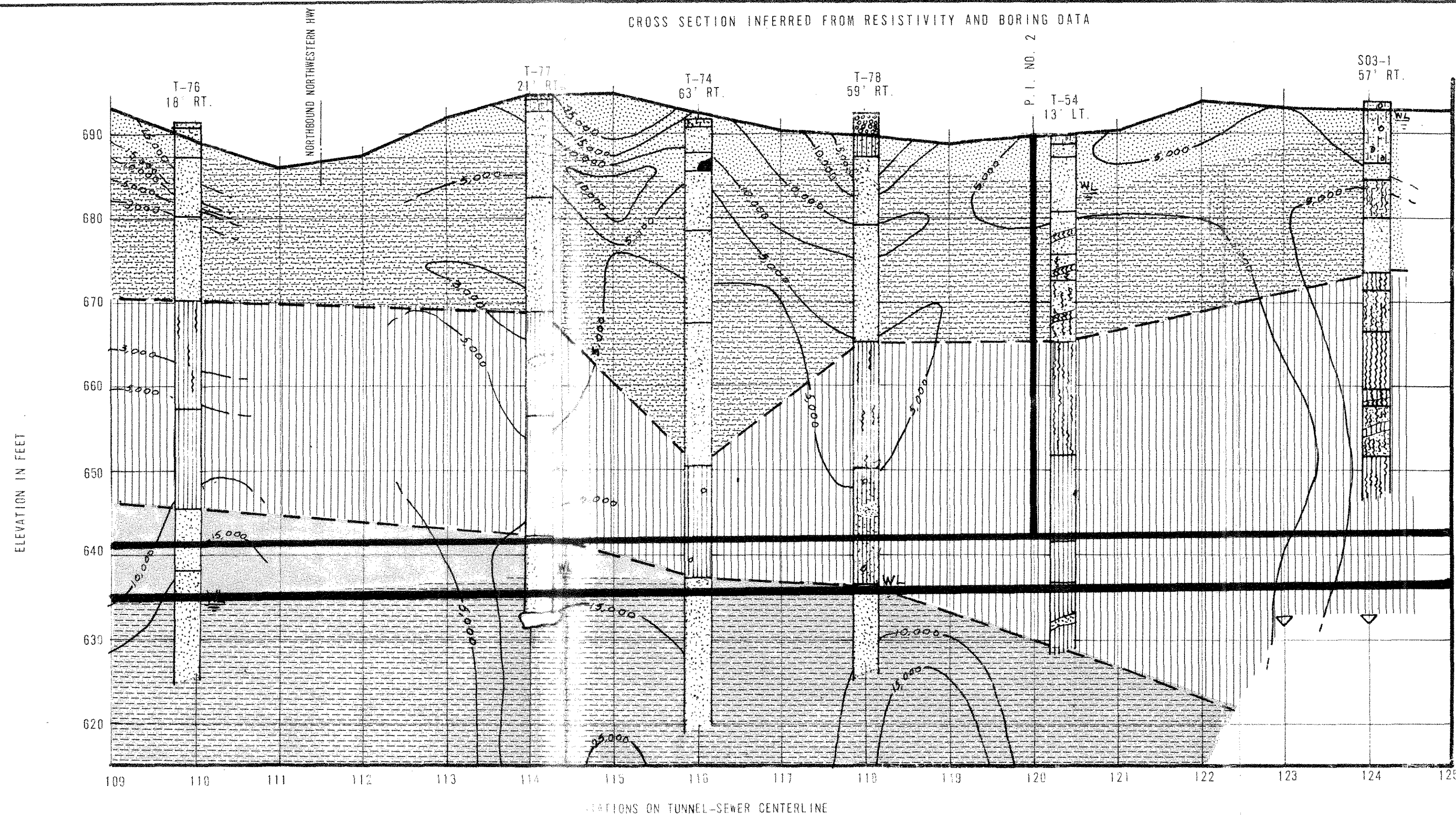
FIGURE 1

MICHIGAN DEPARTMENT OF TRANSPORTATION
 TESTING AND RESEARCH DIVISION
 TESTING LABORATORY SECTION
 GEOTECHNICAL SERVICES UNIT
 1853 (12/83)

GEOPHYSICAL SURVEY
 CONTROL SECTION 63102, JOB NO. 22141C
 I-995 AND TUNNEL-SEWER ALIGNMENT
 FROM PUMPHOUSE TO P.I. NO. 3A
 CITY OF SOUTHFIELD, OAKLAND CO.
 MAY 1984

CHECKED BY: *D. N. Hart*
 APPROVED BY: *M. Hewitt*

CROSS SECTION INFERRED FROM RESISTIVITY AND BORING DATA



- TOPSOIL, LOAMY SAND, SAND, GRAVEL AND CLAY
- SATURATED LOOSE TO COMPACT VERY FINE TO MEDIUM SAND AND SILTY SAND
- FIRM TO STIFF CLAYS WITH SAND AND SILT LENSES
- COMPACT TO VERY COMPACT VERY FINE TO MEDIUM SAND
- SATURATED COMPACT TO VERY COMPACT VERY FINE TO FINE SAND WITH OCCASIONAL BOULDERS
- = DEPTH OF RHO SOUNDING
- = TUNNEL-SEWER BORING
- = STRUCTURE BORING
- = WATER LEVEL IN DRILL HOLE

NOTE: CORRELATION BORING LOG SYMBOLS TAKEN FROM PAGE 291 OF THE FIELD MANUAL OF SOILS ENGINEERING FIFTH EDITION

TUNNEL-SEWER PLANS DATED: 2-12-84

FIGURE 2

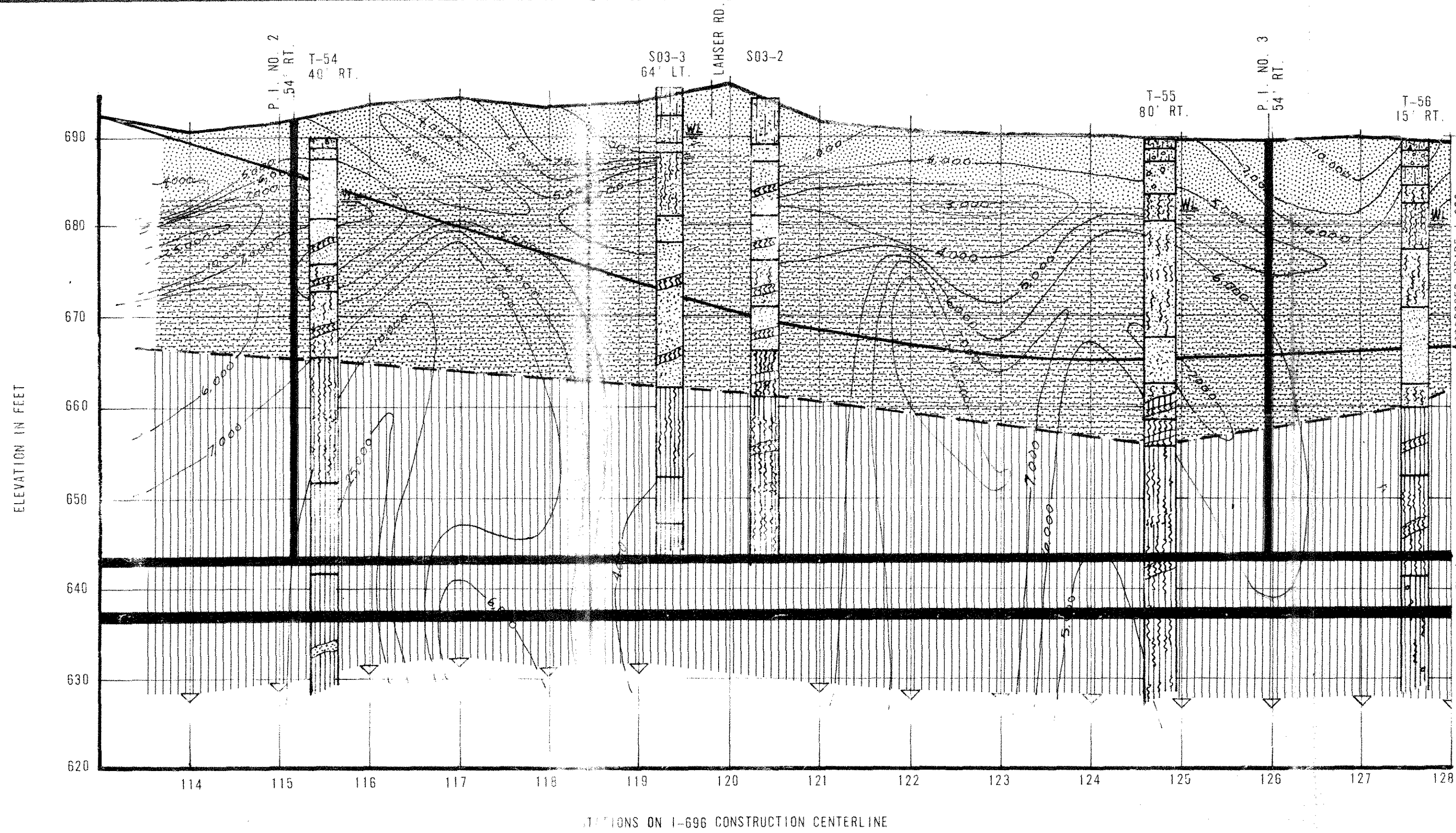
MICHIGAN DEPARTMENT OF TRANSPORTATION
 TESTING AND RESEARCH DIVISION
 TESTING LABORATORY SECTION
 GEOTECHNICAL SERVICES UNIT
 1853 (12/83)

GEOPHYSICAL SURVEY

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 MAY 1984

CHECKED BY: *D. M. Hart*
 APPROVED BY: *[Signature]*

CROSS SECTION INFERRED FROM RESISTIVITY AND BORING DATA



TOPSOIL, LOAMY SAND, SAND AND SILT
 SATURATED LOOSE TO VERY COMPACT FINE TO MEDIUM SAND AND SILTY SAND, WITH SILT AND CLAY LENSES
 FIRM TO STIFF CLAYS WITH OCCASIONAL SILT LENSES
 = DEPTH OF RHO SOUNDING
 WL = WATER LEVEL IN DRILL HOLE
 T = TUNNEL-SEWER BORING
 S = STRUCTURE BORING
 NOTE: CORRELATION BORING LOG SYMBOLS TAKEN FROM PAGE 291 OF THE FIELD MANUAL OF SOILS ENGINEERING FIFTH EDITION

PROPOSED GRADE I-696
 PLANS DATED: 11-15-83

TUNNEL-SEWER
 PLANS DATED: 2-12-84

FIGURE 3

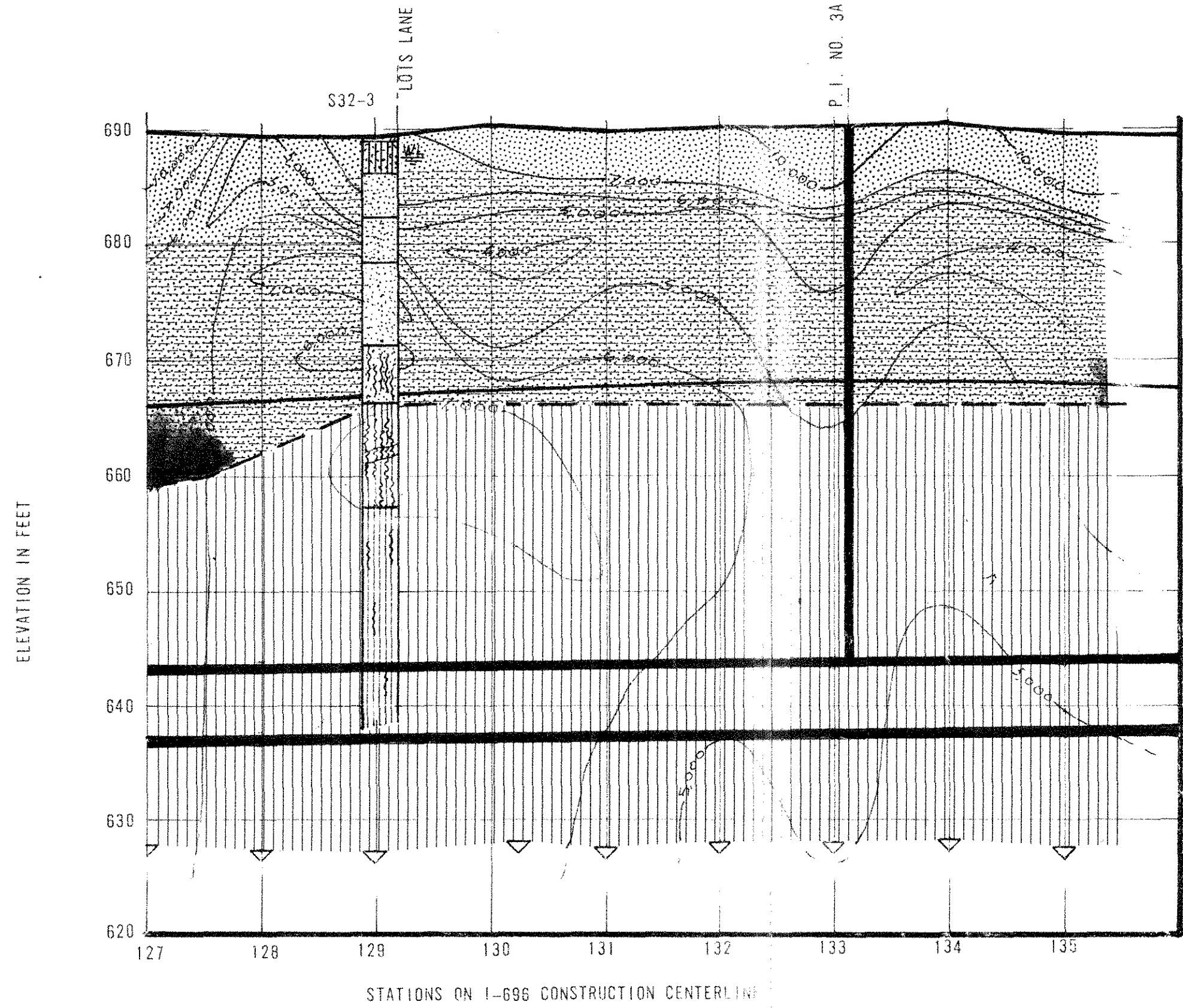
MICHIGAN DEPARTMENT OF TRANSPORTATION
 TESTING AND RESEARCH DIVISION
 TESTING LABORATORY SECTION
 GEOTECHNICAL SERVICES UNIT
 1853 (12/83)

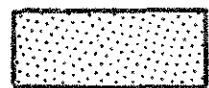


GEOPHYSICAL SURVEY


CONTROL SECTION 63102, JOB NO. 22141C
 I-696 AND TUNNEL-SEWER ALIGNMENT
 FROM PUMPHOUSE TO P.I. NO. 3A
 CITY OF SOUTHFIELD, OAKLAND CO.
 MAY 1984

CHECKED BY: *D. J. Hart*
 APPROVED BY: *[Signature]*

CROSS SECTION INFERRED FROM RESISTIVITY AND BORING DATA



-  TOPSOIL, LOAMY SAND, SAND, AND CLAY
-  SATURATED MODERATELY COMPACT TO VERY COMPACT FINE SAND AND SILT
-  FIRM TO STIFF CLAYS

-  = DEPTH OF RHO SOUNDING
- WL = WATER LEVEL IN DRILL HOLE
- S = STRUCTURE BORING

NOTE: CORRELATION BORING LOG SYMBOLS TAKEN FROM PAGE 291 OF THE FIELD MANUAL OF SOILS ENGINEERING FIFTH EDITION

PROPOSED GRADE I-696
PLANS DATED: 11-15-83

TUNNEL-SEWER GRADE
PLANS DATED: 2-12-84

FIGURE 4

MICHIGAN DEPARTMENT OF TRANSPORTATION
TESTING AND RESEARCH DIVISION
TESTING LABORATORY SECTION
GEOTECHNICAL SERVICES UNIT
1853 (12/83)

GEOPHYSICAL SURVEY

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APPROVED BY: *M. B. ...*