

**Addendum # 1**

New Jersey Schools Development Authority
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Date: August 6, 2015

PROJECT #: NT-0014-C03
Garfield James Madison Elementary School #10
Garfield Public Schools

DESCRIPTION: Addendum # 1

This addendum shall be considered part of the Bid Documents issued in connection with the referenced project. Should information contained in this Addendum conflict with the Bid Documents, this Addendum shall supersede the relevant information in the Bid Documents.

A. CHANGES TO THE PROCUREMENT PROCESS

1. Not applicable.

B. CHANGES TO THE PROJECT MANUAL

NOTE that modifications to the following items will be shown as follows: additions in **bold and underlined** text; deletions in ~~strikethrough and italics~~.

1. Volume 2 Modifications to PROJECT SPECIFICATIONS & TECHNICAL REPORTS

- a. **DELETE:** ~~SGCME—SUPPLEMENTARY GENERAL CONDITIONS FOR MECHANICAL / ELECTRICAL WORK~~ it its entirety.

- b. **TABLE OF CONTENTS**

REVISE: **Table of Contents** as attached to this Addendum.



Under Division - 2 Site Work, **Change:** Section 02000 - ~~"Summary of Site Work"~~, to read **"Site Work"**.

Under Division - 2 Site Work, **Add:** the following new documents after Section 02000 which are attached to this Addendum:

Final Subsurface Investigation and Foundation Recommendations, Proposed James Madison School #10, as prepared by Schoor DePalma, dated 09/08/03 (25-pages).

Geotechnical Investigation Report, Proposed James Madison ES #10, as prepared by Sor Consulting Engineers, Inc., dated 10/31/13 (30-pages).

c. **DIVISION 2 - SECTION 02000 - SUMMARY OF SITE WORK**

Change: Title of Section 02000 - ~~"SUMMARY OF SITE WORK"~~, to read **"SITE WORK"**.

<u>Page</u>	<u>Paragraph</u>	
02000-2	1.4, A	In the second line, Insert: "previously" after the word "was" and Delete: "during Phase 2" .

Delete: the last two (2) sentences in their entirety.

After Section 02000, **Add:** the following documents:

Final Subsurface Investigation and Foundation Recommendations, Proposed James Madison School #10, as prepared by Schoor DePalma, dated 09/08/03 (25-pages).

Geotechnical Investigation Report, Proposed James Madison ES #10, as prepared by Sor Consulting Engineers, Inc., dated 10/31/13 (30-pages).



d. **DIVISION 2 - SECTION 02200 - EARTHWORK**

<u>Page</u>	<u>Paragraph</u>	
02200-8	3.60	Change: paragraph " 3.60 ", to read " <u>3.10</u> ".
	3.71	Change: paragraph " 3.71 ", to read " <u>3.11</u> ".

e. **DIVISION 2 - SECTION 02275 - GEOGRID SOIL REINFORCEMENT**

<u>Page</u>	<u>Paragraph</u>	
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02275-1	1.2, E	Change: "Ornamental Metal Fence", to read " <u>Ornamental Metal Fencing & Gates</u> "
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02275-3	2.3, A	Add: the following subparagraph: <u>1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:</u> <u>a. US Fabrics, Inc.;</u> <u>b. IWT / Cargo-Guard;</u> <u>c. SRW Products;</u> <u>d. Mirafi;</u> <u>e. or approved equal.</u>
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f. **DIVISION 2 - SECTION 02276 - MODULAR BLOCK RETAINING WALL**

<u>Page</u>	<u>Paragraph</u>	
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02276-3	2.01, A	Add: the following after "Allan Block", " <u>Rockwood Retaining Walls</u> ".
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g. **DIVISION 2 - SECTION 02360 - STORM DRAINAGE**

<u>Page</u>	<u>Paragraph</u>	
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02360-2	2.02, A	Add: the following sentence " <u>Acceptable products are manufactured by CertainTeed Corp, Charlotte Pipe, JM Eagle, or approved equal.</u> "
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02360-2	2.02, B	Add: the following sentence " <u>Acceptable products are manufactured by Vianini Pipe Co., Oldcastle Precast, Modern Concrete, or approved equal.</u> "
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02360-2	2.02, C	Revise: the first sentence to read " <u>Polyethylene Pipe (PEP): ASTM D3350, AASHTO M294. Acceptable manufacturers include Hancor "Hi-Q", ADS "N-12", smooth interior lined pipe, or approved equal.</u> "
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- 02360-2 2.04, B **Add:** the following sentence to this paragraph **“Acceptable products are manufactured by Campbell Foundry, Neenah Foundry, or approved equal.”**
- 02360-3 2.04 **Add:** the following paragraph:
C. Acceptable manufacturers of pre-cast units include Modern Concrete, Oldcastle Precast, Flemington Precast & Supply, or approved equal.
- 02360-2 2.05, B **Add:** the following sentence to this paragraph **“Acceptable products are manufactured by Campbell Foundry, Neenah Foundry, or approved equal.”**
- 02360-3 2.05 **Add:** the following paragraph:
C. Acceptable manufacturers of pre-cast units include Modern Concrete, Oldcastle Precast, Flemington Precast & Supply, or approved equal.”
- 02360-6 3.03, C.4 **Inert:** the word **“approved”** after “or”.
- 02360-7 3.9 **Change:** paragraph “~~3.9~~”, to read **“3.10”**.

h. **DIVISION 2 - SECTION - 02415 - UNIT PAVERS**

- | <u>Page</u> | <u>Paragraph</u> | |
|-------------|------------------|---|
| 02415-1 | 2.01, A.1 | In the first line, Add: <u>“Pine Hall Brick, Redland Brick, or approved equal”</u> after “(Basis of Design):”. |
| | 2.01, D.1 | In the second line, Add: <u>“Quikrete Powerloc, or approved equal”</u> after “brand,” |
| 02415-2 | 3.01 B.1 | Revise: this sentence to read <u>“Construct reinforced concrete base, 4" thick, per plan and specifications.”</u> |

i. **DIVISION 2 - SECTION - 02420 - ALL WEATHER PLAYGROUND SURFACING**

- | <u>Page</u> | <u>Paragraph</u> | |
|-------------|------------------|--|
| 02420-4 | 2.01, A | Delete: subparagraph 1 in its entirety and
Substitute: the following: |

**1. Manufacturer: Surface America, Inc.**

- a. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:**
1) Aliphatic Surfacing" by Game Time.
2) or approved equal.

2.02 **Delete:** paragraph 2.02 in its entirety.

j. **DIVISION 2 - SECTION 02510 - WATER DISTRIBUTION**

<u>Page</u>	<u>Paragraph</u>	
02510-3	2.02, A.1	Add: the following subparagraph: <u>d. or approved equal.</u>
	2.02, A.2	Add: the following subparagraph: <u>h. or approved equal.</u>
02510-4	2.02, A.3	Add: the following subparagraph: <u>g. or approved equal.</u>
	2.02, A.4	Add: the following subparagraph: <u>p. or approved equal.</u>
	2.02, A.5	Add: the following subparagraph: <u>f. or approved equal.</u>
	2.02, A.6	Add: the following subparagraph: <u>d. or approved equal.</u>
02510-5	2.02, A.7	Add: the following subparagraph: <u>d. or approved equal.</u>
	2.02, A.8	Add: the following subparagraph: <u>h. or approved equal.</u>
02510-5	2.02, A	Add: the following paragraph: <u>9. Pipe</u> <u>a. Charlotte Pipe Co.</u> <u>b. American Cast Iron Pipe Co.</u> <u>c. CertainTeed</u> <u>d. US Pipe Co.</u>



- e. JM Eagle Co.
 f. Dura Line, Co.
 g. Cresline Co.
 h. Or approved equal.

k. **DIVISION 2 - SECTION 02530 - SANITARY SEWER**

<u>Page</u>	<u>Paragraph</u>	
02530-2	0.08	Change: subparagraph " 0.08 ", to read " <u>1.08</u> ".
02530-2	2.01, A	Add: the following: <u>1. Charlotte Pipe</u> <u>2. CertainTeed</u> <u>3. JM Eagle</u> <u>4. Cresline</u> <u>5. or approved equal.</u>
02530-2	2.04,C	Add: the following sentence to the end of this paragraph: <u>"Acceptable products are manufactured by Campbell Foundry, Neenah Foundry, or approved equal."</u>
02530-5	2.05	Add: the following paragraph: <u>E. Acceptable products are manufactured by Modern Concrete, Oldcastle Precast, Flemington Precast & Supply, or approved equal.</u>

l. **DIVISION 2 - SECTION 02751 - CEMENT CONCRETE PAVEMENT**

<u>Page</u>	<u>Paragraph</u>	
02751-1	1.01, A	Delete: subparagraphs 1 and 2 in their entirety.
02751-5	2.04, C	In the third line after "Corporation", Add: <u>"or approved equal"</u> .
02751-6	2.04, D	Add: the following subparagraph: <u>1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:</u>



- a. Accelguard80 by Euclid
- b. Plastocrete 161FL, by Sika
- c. or approved equal.

- 2.04, E Add: the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
 - a. "Darex AEA" by WR Grace Co.
 - b. "Eucon Air Mix 250", by Euclid
 - c. or approved equal.

- 2.04, J Add: the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
 - a. "Lithochrome, by L.M Scofield
 - b. "Color Hardener" by Brickform
 - c. or approved equal.

- 2.04, K Add: the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
 - a. "Chromix" by L.M. Scofield
 - b. "Davis Colors" by Huntsman Co.
 - c. or approved equal.

- 2.04, L Add: the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
 - a. "Lithochrome Antiquing Release" by LM Scofield
 - b. "Antique Release" by Brick Form Co.
 - c. or approved equal.



2.04, M **Add:** the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
a. "SLX 100" by Prosoco
b. "Chemstop WB" by Euclid Co.
c. or approved equal.

02751-7 2.05, J.1 **Add:** the following subparagraph:
p. or approved equal.

02751-8 2.05, J.2 **Add:** the following subparagraph:
p. or approved equal.

2.05, J.4 **Add:** the following subparagraph:
m. or approved equal.

02751-13 3.04 **Change:** paragraph "~~3.04~~", to read "**3.05**"

02751-14 3.05 **Change:** paragraph "~~3.05~~", to read "**3.06**"

3.06 **Change:** paragraph "~~3.06~~", to read "**3.07**"

02751-15 3.07 **Change:** paragraph "~~3.07~~", to read "**3.08**"

3.08 **Change:** paragraph "~~3.08~~", to read "**3.09**"

02751-17 3.09 **Change:** paragraph "~~3.09~~", to read "**3.10**"

3.10 **Change:** paragraph "~~3.10~~", to read "**3.11**"

02751-18 3.11 **Change:** paragraph "~~3.11~~", to read "**3.12**"

m. **DIVISION 2 - SECTION 02820 - CHAIN LINK FENCE**

Page Paragraph

02820-1 1.02, C In the first line, **Add:** "**by US Fabrics, SRW Products, Allan Block**", after "Sleeve-it".

1.02, C In the first line, **Add:** "**approved**" after the word "or".



02820-2 2.01,A.1,e **Delete:** subparagraph “e” in its entirety and
Substitute: with the following:
e. or approved equal.

n. **DIVISION 2 - SECTION 02825 - ORNAMENTAL METAL FENCING & GATES**

Page Paragraph

02825-1 1.4, A **Delete:** paragraph A in its entirety and substitute with:
A. Acceptable products include "Montage II Industrial Fencing" by Ameristar, "Titan Industrial Fencing" by Fortress Fence, or approved equal.

02825-2 2.1A **Add:** the following subparagraph:
1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
a. "Montage II Industrial Fencing" by Ameristar
b. "Titan Industrial Fencing" by Fortress Fence
c. or approved equal.

02825-3 3.2, C.1 In the second line, **Add:** “**by US Fabrics, SRW Products, Allan Block**”, after “Sleeve-it”.

3.2, C.1 In the second line, **Add:** “**approved**” after the word “or”.

o. **DIVISION 2 - SECTION 02840 - ALUMINUM FLAGPOLE**

Page Paragraph

02840-2 2.01, A **Delete:** “~~or equal~~”.

2.01A **Add:** the following subparagraph:
12. or approved equal.

02840-3 2.03, D.1 **Add:** “**approved**”, after the word “or”.

p. **DIVISION 2 - SECTION 02845 - REMOVABLE STEEL BOLLARDS**

Page Paragraph

02825-1 2.01A **Add:** the following subparagraph:



1. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:

- a. "Grove Removable Bollard" by Keystone**
b. "Security Bollard" by Calpipe
c. or approved equal.

q. **DIVISION 2 - SECTION 03121 - OFF-GASSING MITIGATION**

Page Paragraph

03121-3 2.1, A **Add: "Basis of Design:"** before the word "Fluid".

03121-4 2.1 **Delete:** subparagraph C in its entirety.

2.1, D In the first line, **Delete:** "~~Contact CETCO to insure Liquid Boot® 500 is appropriate for the project~~".

2.1, D **Delete:** subparagraph 2 in its entirety.

r. **DIVISION 2 - SECTION 03300 - CONCRETE WORK**

Page Paragraph

03300-2 2.3, D.1 In the second line, **Add: ", or approved equal"**, after the word "following".

03300-3 2.3, E.1 In the second line, **Add: ", or approved equal"**, after the word "following".

2.3, F.1 In the second line, **Add: ", or approved equal"**, after the word "following".

2.3, G.1 In the second line, **Add: ", or approved equal"**, after the word "following".

2.3, H.1 In the second line, **Add: ", or approved equal"**, after the word "following".

03300-4 2.4, A.1 **Add:** the following subparagraph:
(c) or approved equal.



2.4, B.3	Add: the following subparagraph: <u>(d) or approved equal.</u>
2.4, D	Add: the following subparagraph: <u>4. or approved equal.</u>
03300-11	Add: " <u>03300</u> " after "END OF SECTION".
s. <u>DIVISION 2 - SECTION 04200 - UNIT MASONRY</u>	
<u>Page</u>	<u>Paragraph</u>
04200-1 1.2, C.3	Change: " Cavity Insulation ", to read <u>"Building Cavity Insulation"</u>
04200-9 2.3, B.4	Add: " <u>Anchor Concrete Products Inc.</u> <u>and Trenwyth, an Oldcastle Co."</u> after "EP Henry Corp."
04200-12 2.6, N.1	Add: the following subparagraph: <u>1. Subject to compliance with requirements of the</u> <u>Contract Documents, manufacturers offering</u> <u>products which may be incorporated in work include</u> <u>the following:</u> <u>a. Euclid Chemical.</u> <u>b. Headwaters Construction Materials</u>
04200-13 2.7,C.4.a.1)	In the second line, Add: " <u>Heckman</u> <u>Building Products, Inc.</u> " after "Mesh".
2.7,C.4.b.1)	In the second line, Add: " <u>Heckman</u> <u>Building Products, Inc.</u> " after "Mesh".
2.7,C.4.c.1)	In the second line, Add: " <u>Heckman</u> <u>Building Products, Inc.</u> " after "Mesh".
04200-16 2.8, C.3	In the second line, Add: " <u>Polyguard</u> <u>Products Inc., Masonpro Inc., Mortar</u> Net USA Ltd." after "Inc."
04200-17 2.9, D.1	In the second line, Add: " <u>Heckman</u> <u>Building Products, Inc.</u> " after "Inc."



04200-17 2.9, E

In the second line, Add: "**Hohmann & Barnard, Inc.**" after "Ltd.".

04200-17 2.9, F

In the third line, Add: "**Hohmann & Barnard, Inc.**" after "Ltd.".

04200-19 2.12, A

In the third line, Add: "**Henry Company**" after "Co.".t. **DIVISION 2 - SECTION 05300 - METAL DECKING**Page Paragraph

05300-2 2.1, B.1

Add: "**Consolidated Systems, Inc., and or approved equal**" after "Inc.".

05300-2 2.1, B.2

Add: "**Consolidated Systems, Inc., and or approved equal**" after "Inc.".u. **DIVISION 2 - SECTION 05400 - MISCELLANEOUS STRUCTURAL STEEL**Page Paragraph

05400-8 2.3, D.1

In the second line, Add: "**Pacific Stair Corp., EeStairs**" after "Inc.".

2.3, D.1

In the second line, Add: "**approved**" after "or".v. **DIVISION 2 - SECTION 05500 - METAL FABRICATIONS**Page Paragraph

05500-8 2.3, D.1

In the second line, Add: "**SBC Industries**", after "Industries".

2.3, E.1

In the first line, Add: "**SBC Industries**", after "Industries".

05500-9 2.3, G

In the second line, Add: "**as manufactured by Avcon; Ameristar Perimeter Security, USA; Integrity Aluminum Products, LLC**", after the word "Construction".



05500-12 2.3, K.2

Add: "Innoplast; Uline, Global Industrial" after "Shield".**w. DIVISION 2 - SECTION 06100 - CARPENTRY**Page Paragraph

06100-4 2.5, A.2,a

Add: "YellaWood®, or approved equal"
after "Wood".**x. DIVISION 2 - SECTION 06400 - ARCHITECTURAL WOODWORK**Page Paragraph

06400-1 1.2, E.1

Add: "- Painting" after "09900".**y. DIVISION 2 - SECTION 07132 - BENTONITE WATERPROOFING**Page Paragraph

07132-3 2.2, A.1

In the first line, **Add: "as manufactured by CETCO"**; after "Swelltite".**z. DIVISION 2 - SECTION 07200 - BUILDING INSULATION**Page Paragraph

07200-1 1.2, A.3.b

Add: "- Unit Masonry" after "04200".

07200-3 2.1, B.3

In the second line, **Add: "CertainTeed Corp.; Johns Manville; Guardian Building Products, Inc.; Knauf Insulation"** after "Corporation".

07200-4 2.1, E.1

In the second line, **Add: "ICON; Omni Block"** after "Products".**aa. DIVISION 2 - SECTION 07530 - SINGLE PLY EPDM ROOFING MEMBRANE SYSTEM**Page Paragraph

07530-1 1.2, D.3

Change: "Roof Accessories", to read "Roof Specialties and Accessories".



07530-6 1.5, I.2

Add: “Basis of Design” before “Provide”.

07530-10 2.3

Delete: subparagraph A in its entirety.

2.3, B.1

Add: “Sure-Seal HP Recovery Board by Carlisle Syntec Inc.” before “Securerock”.

07530-11 2.4, A

In the second line, **Add: “Resista by Firestone; MP-H by Versico”** after “Inc.”**bb. DIVISION 2 - SECTION 07600 - FLASHING, SHEET METAL AND ROOF ACCESSORIES**Page Paragraph

07600-1 1.2, B.4

Change: “~~Sealant of Metal Flashing~~”, to read “**Joint Sealer Assemblies**”.

07600-5 2.6, A.1

In the first line, **Add: “Hickman: W.P. Hickman Co.; Keystone Flashing Company; Cheney Flashing Company”** after “Corp.”.

07600-6 2.7, A

Add: “Metal-Era; Xtreme Trim” after “Corp.”

07600-10 3.3, G.3

In the fourth line, **Change:** “~~Sealants~~”, to read “**Joint Sealer Assemblies**”**cc. DIVISION 2 - SECTION 08800 - GLASS AND GLAZING**Page Paragraph

08800-4 2.2, F.1

Add: “Guardian” after “L.P.”

08800-5 2.3, A & B

In the second line, **Add: “Pilkington, Libbey-Owens-Ford, (LOF); PPG Industries”** after “Corp.”.

08800-6 2.4, B.1

In the second line, **Add: “Safti First, a Division of O'Keeffe's Inc.; Vetrotech Saint Gobain North America; Anemostat Door Products, a Mestek Co.”** after “Products”.

dd. **DIVISION 2 - SECTION 08900 - GLAZED CURTAIN WALL**Page Paragraph

08900-8 2.4, A

In the first line, **Add: “Cap Industries, Inc.”**
after “Corporation”ee. **DIVISION 2 - SECTION 09250 - GYPSUM DRYWALL**Page Paragraph

09250-6 2.3

Add: “PERMABASE” cement board by National Gypsum, before “or approved equal”.

09250-6 2.6

Delete: subparagraph “C” in its entirety
and **Substitute:** with the following:**C. Basis of Design: Provide “Mullion-Mate I”, “Mullion-Mate II”, “Double Mullion-Mate I” and/or “Double Mullion-Mate II” (size as indicated on the drawings), as manufactured by Gordon Inc.****a. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:**

- 1) “QuietJoint® Mass-Loaded Acoustic Partition Closure” as manufactured by EMSEAL Joint Systems Ltd.**
- 2) or approved equal.**

ff. **DIVISION 2 - SECTION 09290 - ARCHITECTURAL COLUMN COVERS**Page Paragraph

09290-5 2.4, C.2

After “Dow Corning 795”, **Add:** the following: “**Liquid Nails, by PPG Architectural Coatings Co.; Loctite – PL400 or PL Premium**”.

gg. **DIVISION 2 - SECTION 09515 - ACOUSTICAL TECTUM CEILING PANELS**

Page Paragraph

09515-3 2.1, A

Add: the following subparagraph:

- 1. Subject to compliance with requirements of the Contract Documents, manufacturers offering alternate products which may be incorporated in work include the following:**
 - a. Sound Silencer, as manufactured by Acoustical Surfaces, Inc.**
 - b. or approved equal.**

hh. **DIVISION 2 - SECTION 09522 – ACOUSTICAL WALL PANELS**

Page Paragraph

09522-4 2.1, C.3

Add: the following subparagraph:

- a. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:**
 - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.**

ii. **DIVISION 2 - SECTION 09650 - RESILIENT FLOORING**

Page Paragraph

09650-4 2.1, A.2

Add: the following subparagraphs:

- c. Static Dissipative Tile SDT as manufactured by Armstrong World Industries;**
- d. Static Dissipative ESD as manufactured by Roppe;**

jj. **DIVISION 2 - SECTION 09682 - CARPET ENTRY MATS (CEM)**

Page Paragraph

09682-7 2.1

Add: the following subparagraph:

- B. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:**
 - 1. Foyer, as manufactured by Interface;**



2. Abrasive Action II 02578" Walk-Off System, as manufactured by Tandus Flooring;
3. Recoarse Liaison Collection, as manufactured by Mannington Commercial;
4. Beyond the Door - Paseo, as manufactured by Patcraft (Shaw - a Berkshire Hathaway Company);
5. or approved equal.

kk. DIVISION 2 - SECTION 09685 - CARPET TILE

Page Paragraph

09685-3 1.5 In the first line, **Delete:** ~~Guarantee~~ and **Substitute:** "Bonds".

09685-4 1.6 **Delete:** subparagraph "G" in its entirety.

ll. DIVISION 10 - SECTION 10350 – FLAGPOLES

Delete: the referenced Section in its entirety.

mm. DIVISION 2 - SECTION 10900 - MISCELLANEOUS EQUIPMENT AND FURNISHINGS

Page Paragraph

10900-8 2.8 **Add:** the following subparagraph:
B. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:
1. LSI Corp. of America;
2. Shain, by Diversified Woodcrafts;
3. or approved equal.

10900-9 2.9 **Add:** the following subparagraph:
B. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.

nn. **DIVISION 2 - SECTION 11000 – GENERAL REQUIREMENTS – CASEWORK AND EQUIPMENT WORK**

<u>Page</u>	<u>Paragraph</u>	
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11000-2	1.3, E.1	Delete: subparagraph “c” in its entirety.
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oo. **DIVISION 2 - SECTION 11050 – LIBRARY EQUIPMENT & FURNITURE**

<u>Page</u>	<u>Paragraph</u>	
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11050-2	1.4,C.2	In the second line, Change: “ other prime contractors ”, to read “ <u>all parties</u> ”.
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pp. **DIVISION 2 - SECTION 11400 - FOOD SERVICE EQUIPMENT**

<u>Page</u>	<u>Paragraph</u>	
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11400-1	1.02	Delete: subparagraph “B” in its entirety.
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11400-2	1.07	Delete: Paragraph “ 1.07 ” in its entirety.
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11400-9	1.30, H	In the fifth line, Add: “ <u>Ansul, RangeGuard</u> ”, after SimplexGrinnell.
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11400-9	1.30	Delete: Bureau of Facilities Planning and Substitute: with “ <u>NJ Department of Community Affairs (NJDCA)</u> ”.
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11400-19	3.02	Delete: Paragraph “ 3.02 ” in its entirety.
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qq. **DIVISION 2 - SECTION 12500 – WINDOW TREATMENT**

<u>Page</u>	<u>Paragraph</u>	
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12500-4	2.1, C.2 & 3	Add: the following subparagraph: <u>1. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:</u> <u>a. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.</u>
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rr. **DIVISION 2 - SECTION 14240 – HYDRAULIC ELEVATORS (HOLELESS)**

Page Paragraph

14240-5 2.1, D **Delete:** Subparagraph “2” in its entirety.

ss. **DIVISION 2 - SECTION 14400 - WHEELCHAIR LIFT**

Page Paragraph

14400-3 2.1

Add: the following subparagraph:

C. Subject to compliance with requirements of the Contract Documents, manufacturers offering products which may be incorporated in work include the following:

- 1. Garavanta Lift;**
- 2. or approved equal.**

tt. **DIVISION 4 - SECTION 13915 - FIRE-SUPPRESSION PIPING**

Delete: the referenced Section in its entirety and substitute with the enclosed revised document (22-pages).

Page Paragraph

13915-1 1.1

Add: The following subparagraph:

B. Related Sections:

- 1. Section 17300 – Vibration Isolation & Seismic Restraint for HVAC, Fire Protection, Electrical & Plumbing Components.**

uu. **DIVISION 4 - SECTION 13921 – ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS**

Page Paragraph

13921-1 1.4, C

Delete: ~~Division 15 Section "Mechanical Vibration and Seismic Controls."~~, and
Substitute with **"Section 17300 – Vibration Isolation & Seismic Restraint for HVAC, Fire Protection, Electrical & Plumbing Components.**

**vv. DIVISION 4 - SECTION 15194 - FUEL GAS PIPING**

Delete: the referenced Section in its entirety and substitute with the enclosed revised document (12-pages).

Page Paragraph

15194-1 1.1

Add: The following subparagraph:

B. Related Sections:

1. Section 16621 – Packaged Engine Generators

2. Section 15486 – Fuel Fired Domestic Water Heaters

3. Section 15518 - Boilers

15194-3 2.1, A.1

Add: the following subparagraph:

g. or approved equal.

15194-3 2.1, A.2

Add: the following subparagraph:

r. or approved equal

15194-3 2.1, A.3

Add: the following subparagraph:

f. or approved equal.

15194-4 2.1, A.4

Add: the following subparagraph:

j. or approved equal.

15194-4 2.1, A.6

Add: the following subparagraph:

j. or approved equal.

15194-4 2.1, A.7

Add: the following subparagraph:

f. or approved equal.

ww. DIVISION 4 - SECTION 15430 – PLUMBING SPECIALTIES

Page Paragraph

15430-8 2.7, A.1

Add: the following subparagraph:

k. or approved equal.

2.7, B.2

Add: the following subparagraphs:

b. MIFAB Manufacturing, Inc.

c. Zurn Industries, Inc.

d. or approved equal.



15430-9 2.9, A

Add: the following subparagraph:
5. or approved equal.

15430-9 2.10, A.1

Add: the following subparagraph:
e. or approved equal.

15430-10 2.10, D.1

Add: the following subparagraphs:
b. MIFAB Manufacturing, Inc.
c. Zurn Industries, Inc.
d. or approved equal.

15430-11 2.11, A

Add: the following subparagraphs:
b. Enpro Industries
c. Metraflex Co.
d. or approved equal.

15430-12 2.13, A.3

Add: the following subparagraph:
f. or approved equal.

15430-13 2.14, A.2

Add: the following subparagraph:
f. or approved equal.

15430-14 2.16, A.1

Add: the following subparagraph:
f. or approved equal.

15430-14 2.17, A.1

Add: the following subparagraph:
f. or approved equal.**xx. DIVISION 5 - SECTION 15050 – BASIC MECHANICAL MATERIALS AND METHODS**Page Paragraph

15050-1 1.1

Add: The following subparagraph:**B. Related Sections:**

- 1. Section 17300 – Vibration Isolation & Seismic Restraint for HVAC, Fire Protection, Electrical & Plumbing Components.**

15050-7 3.1, A

Add: **“Division 2 Section”** before Selective Demolition.

yy. **DIVISION 5 - SECTION 15185 – HYDRONIC PUMPS**Page Paragraph

15185-1 1.4, B

In the last line, Add: **“as indicated in Contract for Construction Services General Conditions - Substitutions”** before “Selective”.

zz. **DIVISION 5 - SECTION 15518 – BOILERS**Page Paragraph

15518-1 1.1, A

Delete: ~~(908) 241-4400 of Kenilworth, N.J.)~~

aaa. **DIVISION 5 - SECTION 15970 - HVAC CONTROLS**

Delete: the referenced Section in its entirety and substitute with the enclosed revised document (46-pages).

Page Paragraph

15970-2 1.3 A

Add: **“or approved equal”** to the end of the last sentence.

15970-5 1.7.B

Add: **“or approved equal”** at the end of the last sentence in the paragraph.

15970-5 1.7.E.1

Add: **“Honeywell”**, before “or approved equal”.

15970-5 1.7.E.3

Add: **“Honeywell”**, before “or approved equal”.

15970-6 1.7.E.10

Add: **“Honeywell”**, before “or approved equal”.

bbb. **DIVISION 6 - SECTION 16010 – ELECTRICAL SCOPE OF WORK**Page Paragraph

16010-1 1.1

Add: The following subparagraph:

B. Related Sections:

- 1. Section 17300 – Vibration Isolation & Seismic Restraint for HVAC, Fire Protection, Electrical & Plumbing Components.**

ccc. **DIVISION 6 - SECTION 16250 – MOLDED CASE CIRCUIT BREAKERS**

<u>Page</u>	<u>Paragraph</u>	
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16250-2	2.2	Delete: subparagraph “B”.
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ddd. **DIVISION 6 - SECTION 16452 – GROUNDING**

<u>Page</u>	<u>Paragraph</u>	
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16452-1	1.2, B.2	Delete: Switchgear and Substitute: with “ <u>Switchboard</u> ”.
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eee. **DIVISION 6 – SECTION 16462 – HIGH EFFICIENCY DRY TYPE TRANSFORMERS**

<u>Page</u>	<u>Paragraph</u>	
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16462-3	2.1 A.	Delete: the paragraph in its entirety and replace with the following: <u>A. Powersmiths International Corp., Eaton, Federal Pacific or approved equal.</u>
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fff. **DIVISION 6 - SECTION 16521 - EXTERIOR LIGHTING**

<u>Page</u>	<u>Paragraph</u>	
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16521-2	2.01,A.1	Add: the following after “Industries,” “ <u>KAD LED by Lithonia lighting</u> ”
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16521-2	2.01,A.1.e	Add: the following after or “ <u>approved</u> ”
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16521-3	2.02,A	Add: the following after XIG “ <u>Eagle Mountain, Model IGLED06</u> ”
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ggg. **DIVISION 6 - SECTION 16621 - PACKAGED ENGINE GENERATORS**

Delete: the referenced Section in its entirety and substitute with the enclosed revised document (15-pages).

<u>Page</u>	<u>Paragraph</u>	
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16621-1	1.2.A	Add: the following subparagraph: <u>4. “Division 15194 - Fuel Gas Piping”.</u>
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hhh. **DIVISION 6 - SECTION 16425 – SWITCHBOARDS****Page** **Paragraph**16425-1 1.2, B **Delete:** Subparagraph “5”, in its entirety.iii. **DIVISION 6 - SECTION 16995 – INTEGRATED AUDIO/VIDEO SYSTEMS****Page** **Paragraph**16995-2 1.7, A.3.a In the second line, **Delete:** “~~before bid award~~”.16995-13 2.3, A In the third line, **Delete:** “~~BEFORE RECEIPT OF BIDS~~”.16995-35 3.4, M **Add:** the following “**Or approved equal**”.jjj. **DIVISION 6 - SECTION 17010 – BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS****Change:** Footer on all pages from “~~17010~~”, to read “**6:17010**”**Page** **Paragraph**17010-1 1.2, C.8 **Change:** “~~Section 17080~~”, to read “**Section 07841**”.17010-4 1.5, C.2 **Delete:** the second sentence in its entirety.1.5, C **Delete:** Subparagraphs 3 and 7 in their entirety.17010-6 1.5, D **Delete:** Subparagraphs 4 and 5 in their entirety.17010-6 1.5, E, 8 **Add:** the following subparagraph:
c. or approved equal.17010-8 1.6, A **Delete:** Subparagraph 10 in its entirety.17010-9 1.6, B.1 **Delete:** Subparagraph 1 in its entirety and **Substitute:**
with “**Contractor’s Schedule of Values Form or other**
as required by NJ SDA”.17010-10 1.11 **Delete:** Subparagraph “€” in its entirety.17010-113.2, A **Change:** “~~16444~~” to read “**16440**” in both locations of



this paragraph.

17010-14 3.6, F

Delete: Subparagraph "2" in its entirety.

17010-16

Delete: "Telecommunications—Proof of Certification" form in its entirety.

kkk. **DIVISION 17 - SECTION 17050 - COMMUNICATIONS GROUNDING**

Change: Footer on all pages from "17050", to read "**6:17050**".

lll. **DIVISION 17 - SECTION 17110 - COMMUNICATIONS EQUIPMENT ROOMS**

Change: Footer on all pages from "17110", to read "**6:17110**"

Page Paragraph

17110-6 2.9, A, 4

Add: the following subparagraphs:

b. Amp

c. Uniprise

d. or approved equal.

17110-7 2.10, A, 4

Add: the following subparagraphs:

b. Amp

c. Uniprise

d. or approved equal.

mmm. **DIVISION 17 - SECTION 17130 - INTERIOR COMMUNICATION PATHWAYS**

Change: Footer on all pages from "17130", to read "**6:17130**"

nnn. **DIVISION 6 - SECTION 17150 – BACKBONE CABLING REQUIREMENTS**

Page Paragraph

17150-1 2.1

Delete: The second sentence in its entirety.

17150-2 2.2, C

Add: the following subparagraphs:

2. Amp

3. Uniprise

4. Corning

5. or approved equal.

2.3, A.5

Add: the following subparagraphs:



- b. General Cable**
- c. Mohawk Cable**
- d. or approved equal.**

17150-3 2.3, B.2

Add: the following subparagraph:
d. or approved equal.

ooo. **DIVISION 6 - SECTION 17160 – HORIZONTAL CABLING REQUIREMENTS**

Change: Footer on all pages from “17160”, to read “**6:17160**”

Page Paragraph

17160-2 2.1, A, 8

Add: the following subparagraphs:
b. Amp
c. Uniprise
d. or approved equal.

17160-3 2.2, A, 8

Add: the following subparagraphs:
b. Amp
c. Uniprise
d. Corning
e. or approved equal.

17160-4 2.2, B, 8

Add: the following paragraphs:
b. Amp
c. Uniprise
d. Corning
e. or approved equal.

17160-5 2.4, B

Add: the following subparagraph:
5. or approved equal.

ppp. **DIVISION 17 - SECTION 17170 - IDENTIFICATION AND ADMINISTRATION**

Change: Footer on all pages from “17170”, to read “**6:17170**”

qqq. **DIVISION 17 - SECTION 17171 - TESTING**

Change: Footer on all pages from “17171”, to read “**6:17171**”

rrr. **DIVISION 6 - SECTION 17190 – WARRANTY**

Change: Footer on all pages from “17190”, to read “**6:17190**”



Page Paragraph

17190-1 2.1, A

Delete: the second sentence in its entirety.

sss. **DIVISION 17 - SECTION 17210 - NETWORK SWITCHES AND ROUTERS**

Change: Footer on all pages from "~~17210~~", to read "**6:17210**"

ttt. **DIVISION 6 - SECTION 17300 – VIBRATION ISOLATION & SEISMIC RESTRAINT FOR HVAC, FIRE PROTECTION, ELECTRICAL & PLUMBING COMPONENTS**

Page Paragraph

17300-7 1.4, A

Change: ~~15010~~, to read "**15050**".

17300-12 2.1, A

Add: the following subparagraph to subparagraph 2:
1. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.

17300-35

On the second line, **Change:** ~~15000~~, to read "**17300**".

17300-36

On the second line, **Change:** ~~15000~~, to read "**17300**".

uuu. **DIVISION 6 - SECTION 17301 – TELEPHONE SYSTEM**

Change: Footer on all pages from "~~17301~~", to read "**6: 17301**"

Page Paragraph

17301-1 1.2, A

Delete: the subparagraph in its entirety.

17301-1 1.3, A

Delete: the subparagraph in its entirety.

17301-4 2.2

Add: the following paragraph:
2.2. Alternate Acceptable Manufacturers.
A. Avaya
B. Shoretel
C. or approved equal.



17301-5 3.2, A

Change: "~~Section 01-45-24~~", to read "**Section 01410.**"vvv. **DIVISION 17 - SECTION 17710 – CENTRAL CLOCK SYSTEM 17210 – NETWORK SWITCHES AND ROUTERS****Change:** Footer on all pages from "17710", to read "**6: 17710**"www. **DIVISION 17 - SECTION 17720 – DISTRIBUTED ANTENNA SYSTEM (DAS)****Change:** Footer on all pages from "17720", to read "**6: 17720**"Page Paragraph

17720-1 1.4, A.1

Delete: the paragraph in its entirety.

17720-4 1.9, E.3

Change: the first sentence to read as follows:
"Contractors shall state the assumed channel count for the PSN Frequency Bands identified above in Section 1.5 with submittal."

17720-4 1.9, E.5

Delete: the paragraph in its entirety.

17720-5 2.1

Change: "~~1.1 Manufacturers~~", to read "**2.1 Manufacturers**"

17720-5 2.1, B

Change: "~~Acceptable Manufacturers: As permitted in Section 1.05.~~", to read "**Acceptable Manufacturers: Motorola, Amphenol or approved equal.**"

17720-5 2.2, A.1

Delete: the subparagraphs in its entirety.

17720-5 2.2, A.2

Delete: the subparagraphs in its entirety.

17720-5 2.2, A.3

Delete: the subparagraphs in its entirety.

17720-5 2.2, A.4

Delete: the subparagraphs in its entirety.

17720-6 2.2, B.3

Change: subparagraph to the following:
3. Approved Manufacturers
a. Commscope Andrew DB498-PS
b. Amphenol
c. Motorola
d. or approved equal



17720-7 2.2, C.6

Change: subparagraph to the following:

6. Approved Manufacturers

- a. Commscope Andrew CELLMAX-O-CPUSE**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**

17720-8 2.2, D.6

Change: subparagraph to the following:

6. Approved Manufacturers

- a. Commscope Andrew CELLMAX-EXT-CPUSE**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**

17720-8 2.2, E.5

Change: subparagraph to the following:

5. Approved Manufacturers

- a. Commscope Andrew HL4RP-50A, AL4RPV-50A**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**

17720-9 2.2, F.6

Change: subparagraph to the following:

6. Approved Manufacturers

- a. Commscope Andrew LDF4-50A, FXL-540-NHR, or R FXL-780-NHR**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**

17720-9 2.2, G.1

Change: subparagraph to the following:

1. Approved Manufacturers

- a. Commscope Andrew**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**

17720-10 2.2, H.3

Change: subparagraph to the following:

3. Approved Manufacturers

- a. Commscope Andrew Node A**
- b. Ampthenal**
- c. Motorola**
- d. or approved equal**



17720-10 3.2, A

Change: "~~Section 17010~~", to read "**Section 17171.**"xxx. **DIVISION 17 - SECTION 17810 – VIDEO INTERCOM SYSTEM****Change:** Footer on all pages from "~~17810~~", to read "**6: 17810**"Page Paragraph

17810-1 1.1, A

Change: first sentence of the subparagraph to the following:**A. "Performance Statement: This specification section and the accompanying video intercom central clock specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system."**

17810-1 1.1, B

Change: first sentence of the subparagraph to the following:**A. "Performance Statement: This specification section and the accompanying video intercom specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system."**

17810-1 1.1, B

Change: subparagraph in its entirety to the following:**B. "Furnish and install complete with all accessories, a video intercom System. Furnish all materials, labor, tools, and system commissioning necessary to complete the installation of the system described in the Contract Documents"**

17810-1 1.1, B.1

Change: subparagraph in its entirety to the following:**1. "Complete video intercom system including but not limited to: central unit, intercom stations, master stations, door hardware integration, power, controls, and all other equipment necessary to provide a complete and operating system."**

17810-2 1.5, A

Change: subparagraph in its entirety to the following:



		<u>A. "Provide a one (1) year product and installation warranty."</u>
17810-2	1.6, D	Delete: subparagraph in its entirety.
17810-3	2.1, A	Change: the paragraph to the following: <u>A. Central Exchange Unit.</u>
17810-3	2.1, A.1	Delete: subparagraph in its entirety.
17810-3	2.1, A.16	Change: subparagraph to the following: <u>16. Approved Manufacturers</u> <u>a. Aiphone AX-084C.</u> <u>b. Adorne</u> <u>c. Siedle</u> <u>d. or approved equal</u>
17810-4	2.1, B	Change: subparagraph to the following: <u>B. Fixed Color Video Door Station</u>
17810-4	2.1, B.14	Change: the paragraph to the following: <u>14. Approved Manufacturers</u> <u>a. Aiphone AX-DVF.</u> <u>b. Adorne</u> <u>c. Siedle</u> <u>d. or approved equal</u>
17810-4	2.1, C	Change: subparagraph to the following: <u>C. Master Stations: Audio/Color Video.</u>
17810-5	2.1, C.25	Change: subparagraph to the following: <u>25. Outside Video Output: NTSC standard 1 Vpp</u> <u>(0.7 to 1.4 Vpp)"</u>
17810-5	2.1, C.26	Change: subparagraph to the following: <u>26. Approved Manufacturers</u> <u>a. Aiphone AX-8MV.</u> <u>b. Adorne</u> <u>c. Siedle</u> <u>d. Or approved equal</u>
17810-6	3.3, C.1	Change: " Section 17130 ", to read " <u>Section 17160.</u> "

yyy. **DIVISION 17 - SECTION 17820 – SOUND REINFORCEMENT SYSTEM**

Change: Footer on all pages from “17820”, to read “**6:17820**”

Page Paragraph

17820-3 2.1, A. 4 **Change:** subparagraph to the following:
4. or approved equal

17820-4 **Change:** “~~END OF SECTION 27-51-13~~”, to read “**END OF SECTION 17820**”

zzz. **DIVISION 17 - SECTION 17830 – ELECTRONIC ACCESS CONTROL**

Change: Footer on all pages from “17830”, to read “**6:17830**”

Page Paragraph

17830-1 1.2, B **Change:** “~~16111~~”, to read “**16440**”.

17830-1 1.2, D **Change:** “~~16721~~”, to read “**16724**”.

17830-1 1.5, A **Delete:** “~~in the Contractor's bid~~”

17830-5 1.10, G **Change:** “~~approval~~”, to read “written approval”.

17830-6 2.1, A **Change:** the paragraph to the following:
A. The School District's current system is manufactured by Software House. All new equipment shall be manufactured by Software House to integrate with existing. No substitutions.

17830-9 2.2, L **Change:** subparagraph to the following:
L. Approved Manufacturers:
1. Software House: iStar ex with I8 input board.
2. No substitutions

17830-10 2.3, A, 11 **Change:** subparagraph to the following:
11. Approved Manufacturers
a. HID Multiclass RMPK40.
b. Software House
c. or approved equal



17830-10 24, B

Change: the paragraph to the following:**B. Approved Manufacturers**

- 1. Assa Abloy**
- 2. No substitutions**

17830-10 2.5, D

Change: subparagraph to the following:**D. Approved Manufacturers**

- 1. GE 1078 series.**
- 2. Assa Abloy**
- 3. Tyco**
- 4. or approved equal**

aaaa. **DIVISION 17 - SECTION 17840 – VIDEO SURVEILLANCE****Change:** Footer on all pages from “17840”, to read “**6:17840**”Page Paragraph

17840-6 2.1, K

Delete: the paragraph in their entirety.

17840-12 2.6

Change: the paragraph to the following:**2.6 VIDEO SURVEILLANCE SYSTEM
MANUFACTURER”**

17840-12 2.6, A

Change: the subparagraph to the following:**A. Kratos Public Safety & Security Cameras”**

17840-12 2.6

ADD: subparagraph to the following:**B. No Substitutions**bbbb. **DIVISION 17 - SECTION 17845 – DETECTION AND ALARM****Change:** Footer on all pages from “17845”, to read “**6:17845**”Page Paragraph

17845-2 2.1, A.1

Change: subparagraph to the following:**1. The DACS control panel shall support the
following:”**

17845-8 2.1

ADD: subparagraph as follows:**I. Approved Manufacturers**

- 1. Bosch B5512**
- 2. Ademco**

**3. or approved equal**

17845-10 3.2, A

Change: “~~Section 17010~~”, to read “Section **17121.**”**CCCC. DIVISION 17 - SECTION 17850 – TELEVISION DISTRIBUTION SYSTEM****Change:** Footer on all pages from “~~17850~~”, to read “**6:17850**”

17850-2 2.1

ADD: subparagraph as follows:**B. Approved Manufacturers****a. Blonder Tongue - BIDA series.****b. PICO Digital****c. or approved equal**

17850-2 2.2, A.1

Delete: subparagraph in its entirety.

17850-2 2.2, A

ADD: subparagraph as follows:**10. Approved Manufacturers****a. Blonder Tongue - SXRS/SCVS series.****b. PICO Digital****c. or approved equal**

17850-2 2.3, A.1

Delete: subparagraph “~~b~~” in its entirety.

17850-2 2.3, A.1

Change: subparagraph “a” to the following:**a. Approved Manufacturers****1) Corning Gilbert – GF-UR-6.****2) Belden****3) or approved equal**

17850-3 2.3, A.2

Delete: subparagraph “~~b~~” in its entirety.**C. CHANGES TO THE PERFORMANCE SPECIFICATIONS:**

1. NOT APPLICABLE.

D. CHANGES TO THE DRAWINGS:1. **REVISE:** G-002, DRAWING INDEX, as follows:

A. **A-402 “ROOM LAYOUTS - SPEC. ED., S.G.I., 1ST, 2ND, 3RD, 4TH, 5TH GRADE CLASSROOMS”** in lieu of “~~ROOM LAYOUTS—SPECIAL EDUCATION, S.G.I., 1ST, 2ND, 3RD, 4TH, 5TH GRADE CLASSROOMS~~”.



- B. S-203 **"ROOF FLOOR FRAMING PLAN"** in lieu of **"ROOF FRAMING PLAN"**.
- C. P812 **"STORM AND DOM. WATER RISER DIAGRAMS"** in lieu of **"STORM AND DOMESTIC WATER DIAGRAMS"**.
- D. P911 **"STORM AND GAS RISER DIAGRAMS"** in lieu of **"PLUMBING DETAILS"**.
- E. AV-01 **"A/V SYSTEM INDEX, SYMBOL AND DEVICE LEGEND"** in lieu of **"A/V SYSTEM INDEX, SYMBOL & DEVICE LEGEND"**.
- F. AV-101 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS FIRST FLOOR, FLOOR LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—FIRST FLOOR, FLOOR LEVEL"**.
- G. AV-102 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS SECOND FLOOR, FLOOR LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—SECOND FLOOR, FLOOR LEVEL"**.
- H. AV-103 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS THIRD FLOOR, FLOOR LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—THIRD FLOOR, FLOOR LEVEL"**.
- I. AV-201 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS FIRST FLOOR, CEILING LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—FIRST FLOOR, CEILING LEVEL"**.
- J. AV-202 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS SECOND FLOOR, CEILING LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—SECOND FLOOR, CEILING LEVEL"**.
- K. AV-203 **"A/V SYSTEM EQUIPMENT & DEVICE LOCATIONS THIRD FLOOR, CEILING LEVEL"** in lieu of **"A/V SYSTEM DEVICE LAYOUT—THIRD FLOOR, CEILING LEVEL"**.
- L. AV-501 **"A/V SYSTEM CLASSROOMS TYPE A & B & CONFERENCE ROOM FUNCTIONAL"** in lieu of **"A/V SYSTEM CLASSROOMS TYPE A & B AND CONFERENCE ROOM FUNCTIONALS"**.
- M. AV-701 **"A/V SYSTEM PLATE & PANEL LAYOUTS - PAGE I"** in lieu of **"A/V SYSTEM PLATE AND PANEL LAYOUTS—PAGE I"**.



- N. **AV-702 “A/V SYSTEM PLATE & PANEL LAYOUTS - PAGE II”** in lieu of “~~A/V SYSTEM PLATE AND PANEL LAYOUTS – PAGE II~~”.
- O. **AV-703 “A/V SYSTEM PLATE & PANEL LAYOUTS - PAGE III”** in lieu of “~~A/V SYSTEM PLATE AND PANEL LAYOUTS – PAGE III~~”.

2. **REVISE:** SW-110, as indicated on drawing **AD1-SK1**, attached to this Addendum.
3. **REVISE:** SW-102, as indicated on drawing **AD2-SK1** attached to this Addendum.

REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

4. **REVISE:** SW-103, as indicated on drawing **AD2-SK2**, attached to this Addendum.

REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

5. **REVISE:** SW-105, as indicated on drawing **AD2-SK3**, attached to this addendum.

REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

E. BIDDER’S QUESTIONS, REQUESTS FOR INFORMATION AND RESPONSES:

1. Not applicable.

F ATTACHMENTS

1. Attachment 1 Final Subsurface Investigation and Foundation Recommendations, Proposed James Madison School #10, as prepared by Schoor DePalma, dated 09/08/03.
2. Attachment 2 Geotechnical Investigation Report, Proposed James Madison ES #10, as prepared by Sor Consulting Engineers, Inc., dated 10/31/13
3. Attachment 3 Topographic Survey as prepared by Mountain View Layout, dated 03/12/15.
4. Attachment 4 As-Built Drawing #AB-001, as prepared by Tricon Enterprises, dated 03/10/15.
5. Attachment 5 Table of Contents, Revised 8/6/15



6. Attachment 6 Specification Section 13915, dated 06/18/15.
7. Attachment 7 Specification Section 15194, dated 06/19/15.
8. Attachment 8 Specification Section 15970.
9. Attachment 9 Specification Section 16621.
10. Attachment 10 Addendum Sketch: AD1-SK1, dated 08/03/15.
11. Attachment 11 Addendum Sketch: AD2-SK1, dated 08/06/15.
12. Attachment 12 Addendum Sketch: AD2-SK2, dated 08/06/15.
13. Attachment 13 Addendum Sketch: AD2-SK3, dated 08/06/15.

G. SUPPLEMENTAL INFORMATION

1. Not applicable.

Any bidder attempting to contact government officials (elected or appointed), including NJSDA Board members, NJSDA Staff, and Selection Committee members in an effort to influence the selection process may be immediately disqualified.

End of Addendum No.1

Bak Ryan 8.6.15
NJSDA Director Date

**Addendum #1**

New Jersey Schools Development Authority
Office of Procurement
32 East Front Street
Trenton, NJ 08625
Phone: 609-858-2986
Fax: 609-656-7238

Date: August 06, 2015

PROJECT #: NT-0014-C03
Garfield James Madison Elementary School #10
Garfield Public Schools

DESCRIPTION: Addendum #1

Acknowledgement of Receipt of Addendum

Contractor hereby acknowledges the receipt of this Addendum by signing in the space provided below and returning via fax to (609-656-7238) or E-mail (NKathiari@njsda.gov). Signed acknowledgements must be received prior to the Bid Due Date. Acknowledgement of the Addendum must be made in Section E.6 of the Price Proposal Submission.

Signature

Print Name

Company Name

Date



SCHOOR DEPALMA
Engineers and Consultants

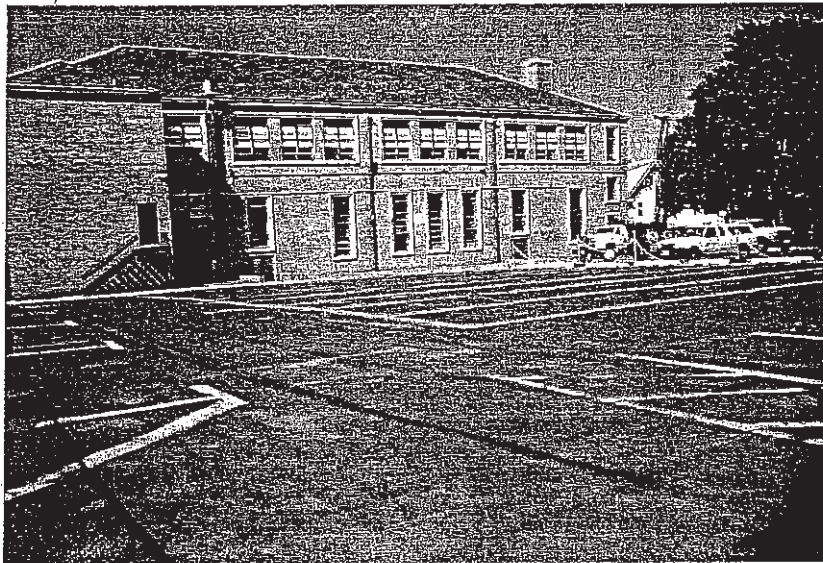
FINAL SUBSURFACE INVESTIGATION

AND

FOUNDATION RECOMMENDATIONS

PROPOSED JAMES MADISON SCHOOL #10
(NJSCC CONTRACT NO. NT-0014-A01)
(Formerly known as Most Holy Name Elementary School)

Garfield, Bergen County, New Jersey



SUBMITTED TO:

Faridy, Veisz, Fraytak, P.C.
Architects-Planners
1515 Lower Ferry Road,
P.O. Box: 7371
Trenton, NJ 08628

September 8, 2003

03.02629.01

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SCHOOR DEPALMA
Engineers and Consultants

September 8, 2003

Gary A. Rostron, AIA, Associates
Faridy, Veisz, Fraytak, P.C.
Architects - Planners
1515 Lower Ferry Road, PO Box 7371
Trenton, NJ 08628

RE: Final Report
Subsurface investigation and Foundation Recommendations
Proposed James Madison School #10
Garfield, Bergen County, New Jersey
Schoor DePalma's Project Number 03.02629.01

Dear Mr. Rostron:

Pursuant to your request, Schoor DePalma has completed a subsurface investigation program for the proposed James Madison School #10 to be constructed in the City of Garfield, Bergen County, New Jersey. This report presents the results of our subsurface investigation and foundation recommendation for the proposed structure.

Please contact our office should you have any questions or if we can be of further assistance.

Very truly yours,

SCHOOR DEPALMA, INC.

Khalid F. Hussein, E.I.T.
Senior Project Engineer

Moustafa A. Gouda, P.E., F. ASCE
Senior Vice President

KFH/MAG:tag

n:\project\2003\0302629\01\geotech\report\most holy name elementary school-9-4-03.doc

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- Grain Size Analyses
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- Engineering Rock Classification and Core Description Chart

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- Limitations



INTRODUCTION

This report presents the results of a geotechnical subsurface investigation conducted by Schoor DePalma for the proposed James Madison School #10, located in the City of Garfield, Bergen County, New Jersey. The purpose of this study was to determine the subsurface soil conditions beneath the site of the proposed structure, and to provide recommendations for the design and construction of its foundations.

SITE LOCATION AND PROJECT DESCRIPTION

The site of the proposed structure is located at 98 Marsellus Place in the City of Garfield, Bergen County, New Jersey. The site is bordered by Lincoln Place to the east, Marsellus Place to the west, residential dwellings to the north and Passaic Street to the south. The site is further depicted on the Site Location Map, Figure 1.

Based on the available topographic information, the site's existing elevations were observed to range from El. 62.0 to El. 52¹.0 feet. Generally, the site drains from east to west. Currently, the site is utilized as a parking area for an existing multi-story brick/block building with a partial basement, referred to as the Church of the Most Holy Name.

Site information was derived from a conceptual site plan, dated 8/21/03, prepared by Schoor DePalma, as well as our site reconnaissance.

At this time, two schemes, #1A and 4A, are being considered for the proposed structure. Scheme #1A entails a two-story addition to the existing building, approximately 11,200 square feet in plan area, with a 1,700 square foot partial basement. Scheme #4A entails a multi-story new building, approximately 18,200 square feet in plan area, with no below grade basement level. The proposed structure, in both schemes, will utilize a steel frame and/or masonry bearing walls. The maximum combined column dead and live loads are expected to be on the order of 200 kips. At the time of this writing, the Finished Floor Elevation (FFE) has not been established; however, it is expected to be similar to that of the existing grades. Consequently, fills and cuts of up to 5 feet will be required to attain the planned elevations.

OBJECTIVES AND SCOPE OF SERVICES

The objectives of this investigation were to determine the subsurface conditions within the site of the proposed construction, and to provide geotechnical recommendations for the design and construction of its foundations. In order to achieve these objectives, the following scope of services was performed:

1. Performed a subsurface investigation program consisting of four (4) test borings;
2. Provided full-time inspection of the explorations and prepared field logs of the borings;
3. Analyzed the data from the explorations, performed engineering evaluations, and prepared this report that includes the following:
 - a) Description of the test boring procedures;
 - b) Drawing showing the approximate location of the test borings;

¹ All elevations in this report are in feet and are referenced to the project topographical datum.



- c) Descriptions of subsurface soil conditions encountered during the subsurface investigation program, including groundwater level measurements;
- d) Overview of the general site and geologic conditions;
- e) Typed logs of the test borings;
- f) Results of engineering evaluations regarding the foundation design, including:
 - Foundation bearing pressure at the proposed foundation subgrade elevations;
 - Estimated settlements of the foundations;
 - Geotechnical earthquake engineering considerations including soil profile type;
 - Lateral earth pressures for design of permanent below-grade walls;
 - Permanent groundwater control considerations including subsurface drainage and waterproofing;
 - Use of on-site soils for controlled backfill.
- g) Results of engineering evaluations and recommendations regarding the construction of the foundations including:
 - Site preparation procedures;
 - Lateral support of temporary and permanent excavations;
 - Earthquake considerations;
 - Construction monitoring considerations.

SUBSURFACE INVESTIGATION PROGRAM

The subsurface investigation consisted of drilling four (4) test borings to depths ranging from approximately 17.5 to 26.5 feet below the existing surface grades. The approximate locations of the test borings are shown in Figure 2 for Scheme 1A and Figure 2A for Scheme 4A. On August 25 and 26, 2003, Site-Blauvelt of Mount Laurel, New Jersey performed the subsurface investigation. The test borings were advanced using a truck mounted Mobile B 59 hydraulic hollow stem drill rig. Soil samples were obtained using Standard Penetration Tests (SPT) techniques and equipment, in general accordance with American Society for Testing and Materials (ASTM) Standard Specification D1586. The SPT records the resistance to penetration of a 2 inch O.D. split spoon sampler driven into the soil by a 140-lb hammer falling freely a distance of 30 inches. The SPT N-value is defined as the number of hammer blows required to advance the sampler the last 12 inches of an 18 inch sampling interval. When a 24 inch sampling interval is used, the middle 12 inches of penetration is used to determine the N-value. SPT samples were obtained at regular intervals not exceeding 5 feet. When the top of the bedrock was encountered, rock coring was performed using a 5 foot long NX (2-1/8 inch O.D.) double tube core barrel. The top of the bedrock was determined based on the drilling operations (e.g., excessive rig chatter, difficult penetration) and refusal (i.e., blow counts greater than 100 for a 6 inch interval) to the split spoon sampler. Generally, five-foot long rock cores were obtained. The purpose of this coring was to verify the presence of bedrock (instead of intercepting a boulder), and to assess the relative quality of the bedrock encountered. In addition, the Core Recovery and Rock Quality Designation (RQD) were determined for each core run. The Core Recovery is defined as the ratio (expressed as a percentage) of the total length of recovered core to the total length cored. The RQD is defined as the ratio (expressed as a percentage) of the total length of recovered core samples having a length of at least twice the core diameter (i.e., about 4 inches for NX-core) to the total length recovered.



The soil samples and rock cores obtained from the test borings were visually classified in accordance with the procedures of the Modified Method of Identification of Soils (Modified Burmister) and the Unified Soil Classification Systems (USCS) by the Schoor DePalma field engineer and placed in protective glass sample jars or rock cores boxes, respectively. The Modified Burmister and the Unified Soil Classification System (USCS) are described in Appendix A. The correlation between soil conditions and the standard penetration test is presented below in Table I-1. The test boring logs are included in Appendix A.

**Table I-1 Correlation Between Soil Conditions and
Standard Penetration Test**

Soil Type	Designation	Blows/Ft
Non-cohesive Soils: Sand/Gravel Soils	Loose	0-10
	Medium Dense	10-30
	Dense	30-50
	Very Dense	51+
Cohesive Soils: Clays/Silts	Very Soft	0-2
	Soft	2-4
	Medium	4-8
	Stiff	8-16
	Very Stiff	16-32
	Hard	33+

SOILS LABORATORY TESTING PROGRAM

The soil sample jars and the rock core boxes were transported to our soils laboratory facility in Marlboro, New Jersey, where they were further examined and subjected to appropriate laboratory testing. The laboratory-testing program consisted of moisture content determinations and grain size analyses. Summaries of the test results along with graphic presentations of gradation analysis are presented in Appendix A. The results of our field and laboratory programs have provided the basis for our engineering analyses and design recommendations.

GENERAL SITE GEOLOGY

The general site geology information was obtained from the "Engineering Soil Survey, report number 4, Bergen and Hudson Counties", prepared by the State University of Rutgers, January 1953.

The parent formation of the natural soils at the proposed site is geologically identified as glacial ground moraine, composed of non-residual, unstratified materials deposited during the Wisconsin glaciation. The underlying formations are gneiss and basalt in the western part of Bergen County; sandstone with some shale throughout most of the remaining area of Bergen County; diabase along the eastern edge of Bergen and Hudson Counties.



SUBSURFACE SOIL CONDITIONS

The test borings performed for this study indicated that a surficial layer of a concrete bituminous pavement section blankets the site. The pavement section consists of a layer of asphalt, approximately 2 to 6 inches in thickness, over 2 to 6 inches of crushed stone subbase material. Site stratigraphy is characterized by fill underlain by glacial deposits consisting of red-brown medium dense to dense silty sand with varying percentages of gravel, further underlain by decomposed bedrock derived from the decomposition of the underlying parent sandstone bedrock.

The following general descriptions of the subsurface soil strata are based on our interpretations of the test boring data and our understanding of the general site geology. A general description of the strata is provided as follows:

Stratum F: Fill. Fill was encountered in three (3) of the four (4) test borings performed for this study directly beneath the surface cover. It extends to approximately 5 to 8 feet below the existing surface grade elevations. Fill encountered can be described as brown medium dense to very dense sand with varying percentages of silt and gravel. The N-values from the SPT tests ranged from 16 to 45 blows per foot (bpf).

Stratum G: Glacial Deposits. This stratum was encountered below the fill layer and/or beneath the surface cover in all the test borings. It consists of red-brown medium dense to dense silty sand with varying percentages of gravel. The SPT N-values ranged from 17 to 46 bpf.

Stratum DR: Decomposed Bedrock. Red-brown decomposed sandstone bedrock was encountered in all the borings beneath the glacial deposits. Refusal to further penetration of the split-spoon sampler (i.e., more than 100 blows per 6 inch) was typically encountered within this stratum.

Stratum R: Sandstone Bedrock. Bedrock was encountered at depths ranging from approximately 13 to 23.75 feet below the existing surface grade elevations. This stratum can be described as red-brown sandstone with occasional inclusions of shale. Rock core recoveries from two 5-foot runs ranged from 60 to 84 percent. The RQD values were determined to be 46.0 to 48.0 percent.

Based on the rock core recoveries and the RQD values, the uppermost 5 feet of rock would be classified as "poor" with close joint spacing. The Engineering Rock Classification and Core Description Chart are described in Appendix A.

GROUNDWATER CONDITIONS

Groundwater was encountered in two (2) test borings, B-1 and B-4, at depths ranging from 18 to 19 feet below the existing surface grade elevations at the time of the exploration. It should be noted that groundwater elevations are expected to fluctuate in response to seasonal variations in rainfall, temperature, surface runoff, and other factors.



FOUNDATION RECOMMENDATIONS

Foundation Type

Considering the loads anticipated for this project, the proposed structure may be supported on a conventional shallow foundation system bearing on the glacial deposits encountered within the proposed construction area and/or controlled compacted fill required to attain the proposed grade elevations.

Footing Bearing Capacity

Footing bearing on the site's natural glacial deposits and/or controlled compacted fill may be designed to impose maximum allowable net bearing pressures of up to 2 tons per square foot (tsf). This allowable soil bearing pressure provides a factor of safety of at least 3 against general shear failure.

Wall and column footings should not be less than 1.5 and 3.0 feet wide, respectively, or less than applicable code requirements. Exterior foundations should be a minimum of 3 feet below the proposed adjacent exterior grades, or deeper if required by local ordinances, to provide protection from frost penetration. Interior foundations located in permanently heated portions of the structure may be established at convenient depths below the ground floor slab provided that the bottom of the floor slab and top of the concrete footings are separated by a minimum 4 inch thick layer of clean structural fill. New foundations must not be constructed within the influence of existing foundations and should be established at elevations similar to that of the adjacent existing foundations. Footings may be stepped up or down at 2 horizontal to 1 vertical (2H: 1V) to achieve any necessary grade changes.

All footing subgrades should be inspected and approved by a geotechnical engineer prior to placement of forms and pouring of concrete.

Settlement

We estimate that maximum post construction settlements for structures supported on structural fill or on the site's natural soils, which are constructed in accordance with our recommendations, will be in the order of 1 inch or less, and maximum post construction differential settlement will be less than 1/2 inch.

Partial Basement and at-Grade Floor Slabs

The proposed partial basement and the at-grade floor slabs may be supported on the site's natural glacial deposits and/or compacted structural fill required to attain the planned floor subgrade levels. The floor slabs may be constructed using a modulus of subgrade reaction (kv) of 200 pounds per cubic inch (PCI) for slab subgrades prepared utilizing the materials and methods described herein. Based on the existing surface grades, we believe that moisture control systems will be required for the partial basement floor. The use of a polyethylene vapor barrier is warranted for the partial basement floor. Floor slabs should be isolated from all other structural components of the building to allow for independent movement. Saw joints or construction joints should isolate each bay to control shrinkage cracks.

Floor slabs designed and constructed in accordance with our recommendations should experience negligible post-construction settlements.



SITE DEVELOPMENT CONSIDERATIONS

Site Drainage and Surface Water Control

Adequate temporary and permanent control of surface water runoff will be required in order to allow site access, grading, and construction of underground utilities to proceed. Excavation, filling, subgrade and grade preparation should be performed in a manner and sequence that will provide drainage at all times as well as proper control of erosion. Surface water shall be pumped or drained to provide a suitable working platform. Any water accumulating in the open excavation shall be removed within 24 hours.

Existing Utilities

All existing underground utilities should be located within the proposed construction area. Those utilities, which are not reused, should be capped and removed from within and 5 feet beyond the proposed construction area. The utility trenches that are in the influence zone of new construction should be backfilled with compacted structural fill. A structural engineer should evaluate underground utilities, which are to be reused. A geotechnical engineer should evaluate the suitability of the utility backfill for support of the planned construction. Existing utilities, that are to be preserved, shall require grading operations to be performed in a manner so as not to disturb or damage the existing utility.

Structural Fill

Controlled fill should consist of inorganic, readily compactable, predominantly well-graded granular soils with no more than 15% fines (material passing the No. 200 sieve). It is recommended that fragments having a maximum dimension greater than 3 inches be excluded from the fill. The moisture content of the fill materials should be controlled to within 3% of the optimum by wetting, aeration or blending to facilitate compaction.

All load-bearing fill should be controlled fill. Controlled fill should be placed in loose horizontal lifts with a maximum thickness of 9 inches. It is recommended that controlled fill within the construction area be compacted to at least 95% of the maximum dry density as determined by the Modified Proctor Test (ASTM D 1557). In addition, it is recommended that all fills be stable without significant movement under construction traffic, as judged by the geotechnical engineer. Quality control testing of in-place fill densities should be conducted throughout the entire earthwork operation.

Site Preparation Procedures

1. Strip the existing bituminous concrete pavement from within and at least 5 feet beyond the limits of the proposed construction. The bituminous concrete pavement will not be suitable for reuse as controlled compacted fill or backfill, and should be disposed of in a suitable manner.
2. Excavate to proposed subgrade elevations where required. On-site materials generated as a result of grading operations and/or foundation installation will be comprised primarily of silty sand with varying percentages of clay and gravel. Due to the relatively high percentage of fines (materials passing sieve # 4), these soils are considered marginal, at best, for reuse as controlled compacted fill. Unless these materials are maintained at moisture contents suitable for compaction we do not believe that they will be suitable for reuse as controlled compacted fill and backfill.



3. Proofroll and compact the exposed subgrades with a heavy-duty 10-ton vibratory roller. Any areas, which exhibit signs of instability under the proofrolling operations, should be selectively over excavated to suitable bearing material and backfilled with controlled compacted fill. No proofrolling will be required if the subgrade consists of bedrock.
4. Raise the site to proposed subgrade elevations, where required, with controlled compacted fill placed in layers as outlined in the Structural Fill section of this report.

EXCAVATION

Permanent Lateral Earth Pressures

The following soil parameters can be used in the design of retaining walls and/or below grade foundation walls (if any). For restrained walls, we recommend the use of the at-rest earth pressure (K_o) in the design.

Soil Parameters
Total unit weight $\gamma_T = 125$ pcf
Angle of internal friction $\phi = 32^\circ$
Active earth pressure $K_a = 0.31$
Passive earth pressure $K_p = 1.6$ *
At rest earth pressure $K_o = 0.47$
Base friction coefficient = 0.30

Note; * with a factor of safety equal to 2.0

Base friction can be increased to 0.4 if a layer of 6 inch crushed stone is placed between the concrete footing and soil subgrade.

The geotechnical engineer predicates the use of the above parameters upon the assumption that backfilling within 5 feet of the wall will be done utilizing structural type fill and/or granular on-site material as approved. Fill placed within this 5-foot zone should be compacted with hand tampers. No heavy rollers should be allowed within 5 feet of any structure.

The recommended lateral pressure does not include hydrostatic pressure since it is considered that subdrainage will be provided as outlined below. A permanent subdrain should be provided around the exterior perimeter of below grade walls to drain any water, which develops behind the walls. The drain should consist of drainage panels and a 4 inch diameter slotted corrugated polyethylene pipe surrounded on the top and outer side by a minimum 4 inch thick AASHTO Size No. 57 aggregate filter. This filter should be enclosed in Mirafi 140N or equivalent drainage-type filter fabric. The pipes may drain by gravity to tie into a drainage system or to a sump pit/pump connecting to an adjacent storm sewer, or an off-site drainage system.

All building walls below grade shall be waterproofed. Drainage panels are not required where open graded crushed stone is utilized as backfill.



Further, no surcharge loads adjacent to the walls or at the ground surface were considered in the recommended lateral pressures above. We recommend adding a uniform (i.e., rectangular) lateral pressure distribution of 0.40 times the surcharge to the lateral earth pressure distribution. The factor of 0.40 takes into account the increase in lateral force due to dynamic loading. The structural engineer should determine the magnitude of the surcharge loads (i.e., live loads).

Slope Stability (Temporary)

Where space limitations may preclude performance of open trenching operations, it may be necessary to perform the required excavations via extraordinary earth support provisions such as sheeting and bracing. Areas that are not restricted by space constraints may, in all likelihood, be performed within open excavations utilizing temporary side slopes of one horizontal to one vertical above the ground water level. Excavations that extend below the observed water table will require significantly flatter slopes.

It should be noted that any sluffing of the trench walls adjacent to the excavations could undermine adjacent pavement, curbs, sidewalks, or utility lines. Consequently, costly repairs to existing improvements could result. It should be explicitly stated in the contract document that the contractor is responsible for maintaining the integrity of the existing above-grade and below-grade structures and/or dewatering operations. All construction excavations should be performed in conformance with applicable local, state and federal OSHA safety regulations.

Construction traffic and excavated material stockpiles should be kept away from excavations by a minimum distance equal to the fill depth of the excavation, unless the resulting surcharge loads are accounted for in the design of the lateral bracing system. A qualified engineer prior to allowing the contractor to commence work should review the contractor's proposed excavation, support systems, and sequence of construction. Permanent side slope, by Code, should not be steeper than 2H:IV.

If the temporary excavation support consists of soldier piles and lagging and the soldier piles are driven, measurements of vibration levels should be made in selected adjacent structures. Maximum peak particle velocity readings at the lowest level of any adjacent building should be kept below 2 in/sec.

The design of all temporary excavation support systems should be the responsibility of a licensed New Jersey Professional Engineer retained by the foundation contractor. All excavations of temporary support systems should conform to pertinent OSHA and local safety regulations. The owner's geotechnical engineer prior to construction of the temporary support structures should review the design of soil loads.

Slope Stability (Permanent)

For cuts and fills that will produce permanent slopes, we recommend that these side slopes should not be steeper than 2 horizontal on 1 vertical. If space constraints or site conditions warrant steeper slopes, a slope stability analysis should be performed prior to construction.



Rock Excavation

Sandstone bedrock was encountered at depths ranging from approximately 13 to 23.75 feet below the existing surface grade elevations. Considering the depth of excavation required to accommodate the proposed structure, rock excavation may be required to accommodate the proposed basement at 13'-4" below the first floor elevation. We believe that a "hoe-ram" could be used to excavate the rock due to the relatively small amount of rock to be excavated.

Groundwater Control

Groundwater was encountered in two borings, B-1 and B-4, at depths ranging from 18 to 19 feet below the existing surface grade elevations. It should be noted that groundwater elevations are expected to fluctuate in response to seasonal variations in rainfall, temperature, surface runoff, and other factors.

Considering the depth of excavation required to accommodate the proposed construction, we believe that groundwater-related problems are expected to be slight during and following construction. However, we strongly recommend that an under-slab drain be incorporated in the building design for the partial basement floor area. The proposed drain system should consist of 4 inch perforated pipes surrounded by a minimum of 6 inches of clean crushed stone and wrapped with a geotextile. The perforated pipes should be drained by gravity or through a mechanical sump. The pipe's invert should be installed at foundation level. The proposed elevator pit floor slab should be placed over a layer of clean crushed stone, 6 inches in thickness.

SEISMIC COEFFICIENTS

In accordance with the provisions of the 2000 International Building Code, Table 1615.1.1 (Site Class Definitions), the site can be classified as class D, stiff soil profile. Furthermore, the Standard Penetration Resistance, N-values, in the soils below the water table ranged from 18 to over 100 blows per foot. Based on our evaluation of the subsurface soil conditions at the site, the potential for liquefaction below the water table is unlikely and does not pose any concerns.

OBSERVATION AND TESTING

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions between test borings may be different from those encountered at the test borings locations, that conditions are not as anticipated by the designers, or that the construction process has altered the subsurface conditions. Therefore, geotechnical engineering construction observation should be performed under the supervision of a Geotechnical Engineer from our office who is familiar with the intent of the recommendations presented herein. This observation is recommended to evaluate whether the conditions anticipated in the design actually exist or whether the recommendations presented herein should be modified where necessary. Our firm should also provide observation and testing of compacted structural fill and backfill. We recommend that we be on-site on a full time basis during foundation installations and earthwork construction.



SCHOOR DEPALMA
Engineers and Consultants

Subsurface investigation and Foundation Recommendations
Proposed James Madison School # 10
NJSCC Contract No. NT-0014-A01
Garfield, Bergen County, New Jersey
03.02629.01

GENERAL

The conclusions and recommendations of this report are based on the information revealed by this exploration. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. An allowance should be established to account for possible additional costs that may be required to construct foundations and earthwork as recommended herein. Additional costs may be incurred for various reasons including undercutting of unsuitable soils, inability to use on-site soils during the period earthwork proceeds, and variation of soil between test borings.

This study should be made available to prospective bidders for informational purposes. We recommend that the project specifications contain the following statement:

"A geotechnical engineering report has been prepared for this project by Schoor DePalma inc. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Engineer and represent his interpretation of the subsoil conditions, tests, and the results of analyses, which he has conducted. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, prior to bidding, his own investigation, tests and analyses at his own cost. This report may be examined by bidders."

It is strongly advised that the Subsurface Exploration Data of Appendix A should be included in the contract documents.

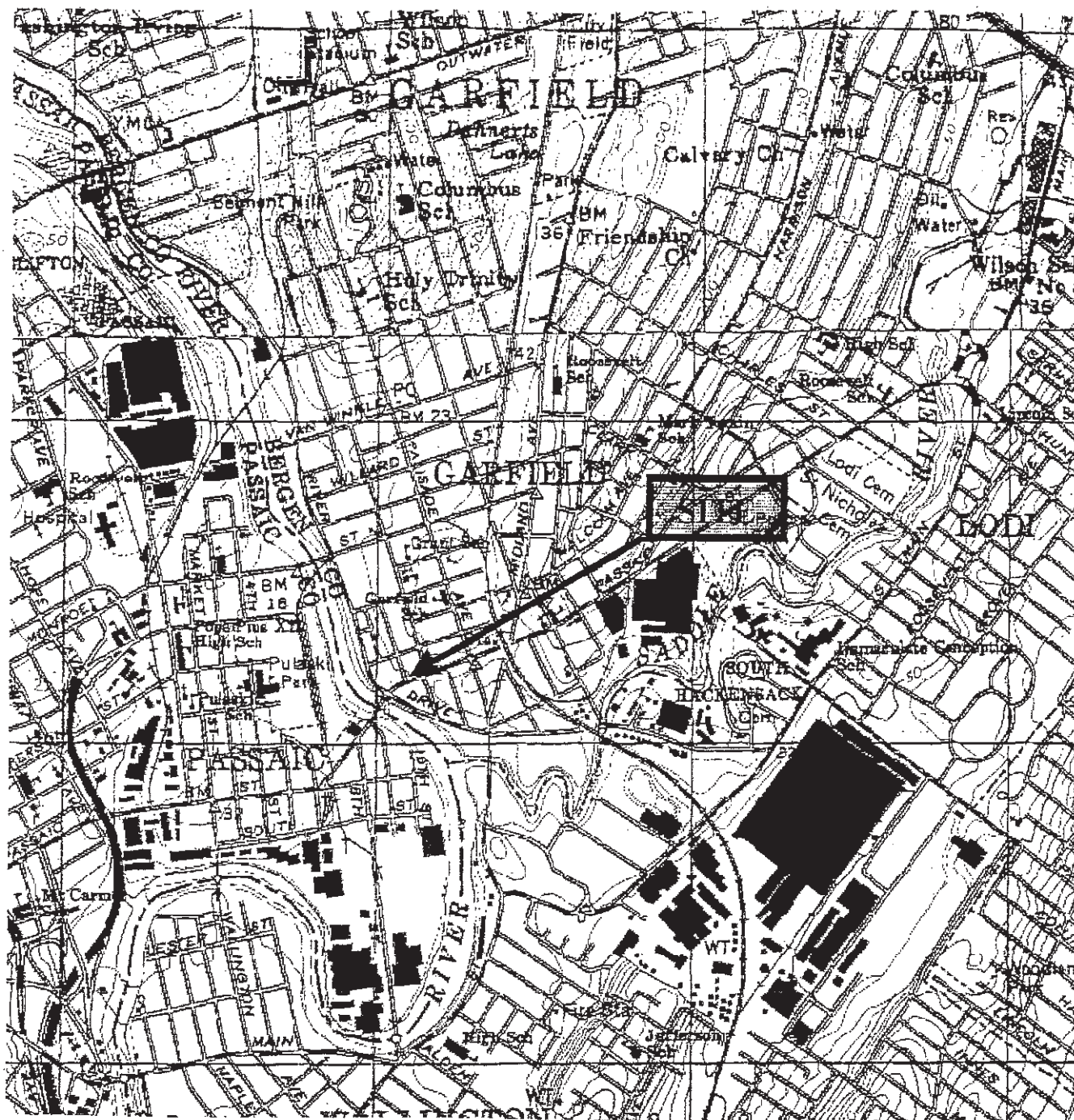


FIGURE 1

SITE LOCATION MAP

Map Source: www.topozone.com



PROPOSED JAMES
MADISON SCHOOL # 10

Garfield, Bergen Co., New Jersey



SCHOOR DEPALMA
Engineers and Consultants

200 STATE HIGHWAY NINE
P.O. BOX 900
MANALAPAN, NJ 07726-0900
TEL. (732) 577-9000 FAX (732) 577-9888

SCALE
1 = 50,000

DATE
9/2/03

DRAWN BY
kh

PROJECT NO.
030262901

TEST BORING LOG

Boring Contractor: Site-Blauvelt
 Boring Foreman: Robert Moyer
 Drilling Method: Hollow Stem Auger
 Drilling Equipment: Mobile B 58
 ID Representative: Khalid Hussein
 Dates: Started: 8/25/2003 Finished: 8/25/2003
 Ground Surface Elevation:



SCHOOR DEPALMA
 Engineers and Consultants

Project: James Madison School #10
 Project Location: Garfield, New Jersey
 Project Number: 03.02629.01
 Boring Log: B-1

GROUNDWATER OBSERVATIONS

Encountered:

Depth

Completion:

18 ft

Location: SEE TEST BORING LOCATION PLAN

Page 1 of 1

SAMPLING DATA			STRATUM	DEPTH	CLASS	STRATA DESCRIPTION		% W	REMARKS
S-1		11-11-11-13	F	-0	Fill	4" Asphalt, 6" crushed stone		10	Hard drilling @ 5'.
				-		Brown medium to fine SAND, little Silt, little fine Gravel			
S-2		21-18-27-20	G	-					
				-5					
S-3		68-27-11-10	G	-	SM	Red-brown medium to fine SAND, some Silt, some fine Gravel (medium dense)			
				-					
S-4		9-11-6-3	G	-					
				-					
S-5		4-4-8-16	G	-10					
				-					
S-6		18-16-14-15	G	-		Red-brown medium to fine SAND, some Silt, trace fine Gravel (dense)			
				-15					
S-7		6-8-10-11	G	-		Red-brown medium to fine SAND, some Silt, some coarse to fine Gravel (medium dense)			
				-20					
S-8		16-100/3"	DR	-		- Contains rock fragments @ 23'.			Auger refusal @ 23.75'
				-		End of Boring B-1 @ 23.75'.			
				-25					
				-					
				-					
				-					
				-					
				-					
				-30					
				-					
				-					
				-					
				-35					
				-					
				-					
				-					
				-40					
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(P.P.M.)									

TEST BORING LOG

Boring Contractor: Site-Blauvelt



SCHOOR DEPALMA
Engineers and Consultants

Project: James Madison School #10
Project Location: Garfield, New Jersey
Project Number: 03.02629.01
Boring Log: B-2

Boring Foreman: Wayne Reagle
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B 59
Representative: Khalid Hussein

Dates: Started: 8/26/2003 Finished: 8/26/2003

Ground Surface Elevation:

GROUNDWATER OBSERVATIONS

Encountered:

Depth

not encountered

Completion:

Location: SEE TEST BORING LOCATION PLAN

Page 1 of 1

SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS
S-1	14-15-15:16	F	-0	Fill	3" Asphalt, 4" crushed stone		
			-				
			-		Brown medium to fine SAND, some Silt, little coarse to fine Gravel		
			-				
S-2	11-15-17:31		-				
			-				
S-3	21-11-12:20	G	-5	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel		
			-		(medium dense)		
S-4	25-29-17:21		-		- contains rock fragments @ 8'. (dense)		
			-				
S-5	10-16-15:24		-10				
			-				
S-6	50/0"	DR	-				Auger refusal @ 13'
			-				
		R	-15		Core Run # 1		
			-		Rec. = 3.0' (60%)		
			-		RQD = 2.4' (48%)		
			-				
			-		Red-Brown Sandstone Bedrock		
			-				
			-20		End of Boring B-2 @ 18.0'		
			-				
			-				
			-				
			-				
			-				
			-25				
			-				
			-				
			-				
			-				
			-				
			-30				
			-				
			-				
			-				
			-				
			-				
			-35				
			-				
			-				
			-				
			-40				
			-				

ne							
Reading							
(P.M.)							

TEST BORING LOG

Boring Contractor: Site-Blauvelt		 SCHOOR DEPALMA Engineers and Consultants	Project: James Madison School #10	
Boring Foreman: Robert Moyer			Project Location: Garfield, New Jersey	
Drilling Method: Hollow Stem Auger		Project Number: 03.02629.01		
Drilling Equipment: Mobile B 59		Boring Log: B-3		
Dr Representative: Khalid Hussein				
Dates: Started: 8/25/2003 Finished: 8/25/2003				
Ground Surface Elevation:				

SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS
			-0		6" Asphalt, 6" crushed stone		
S-1	5-8-9-17	G	-	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel (medium dense)		
S-2	24-21-20-18		-		Red-brown medium to fine SAND, some clayey Silt, some fine Gravel (dense)	7	
S-3	14-15-16-18		-5				
S-4	21-13-14-11		-		- medium dense @ 8'.		
S-5	16-15-15-10		-10		- contains rock fragments @ 10' (dense)	9	
S-6	11-13-16-15		-		- medium dense @ 14'.		
		DR	-15				
			-		End of Boring B-3 @ 17.5'		Auger refusal @ 17.5'
			-20				
			-				
			-				
			-				
			-25				
			-				
			-				
			-				
			-30				
			-				
			-				
			-				
			-35				
			-				
			-				
			-40				

me						
Reading (P.M.)						

TEST BORING LOG

Boring Contractor: Site-Blauvelt



SCHOOR DEPALMA
Engineers and Consultants

Project: James Madison School #10
Project Location: Garfield, New Jersey
Project Number: 03.02629.01
Boring Log: B-4

Boring Foreman: Wayne Reagle
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B 59
Representative: Khalid Hussein

Dates: Started: 8/26/2003 Finished: 8/26/2003

Ground Surface Elevation:

GROUNDWATER OBSERVATIONS

Encountered:

Depth

19 ft

Completion:

Location: SEE TEST BORING LOCATION PLAN

Page 1 of 1

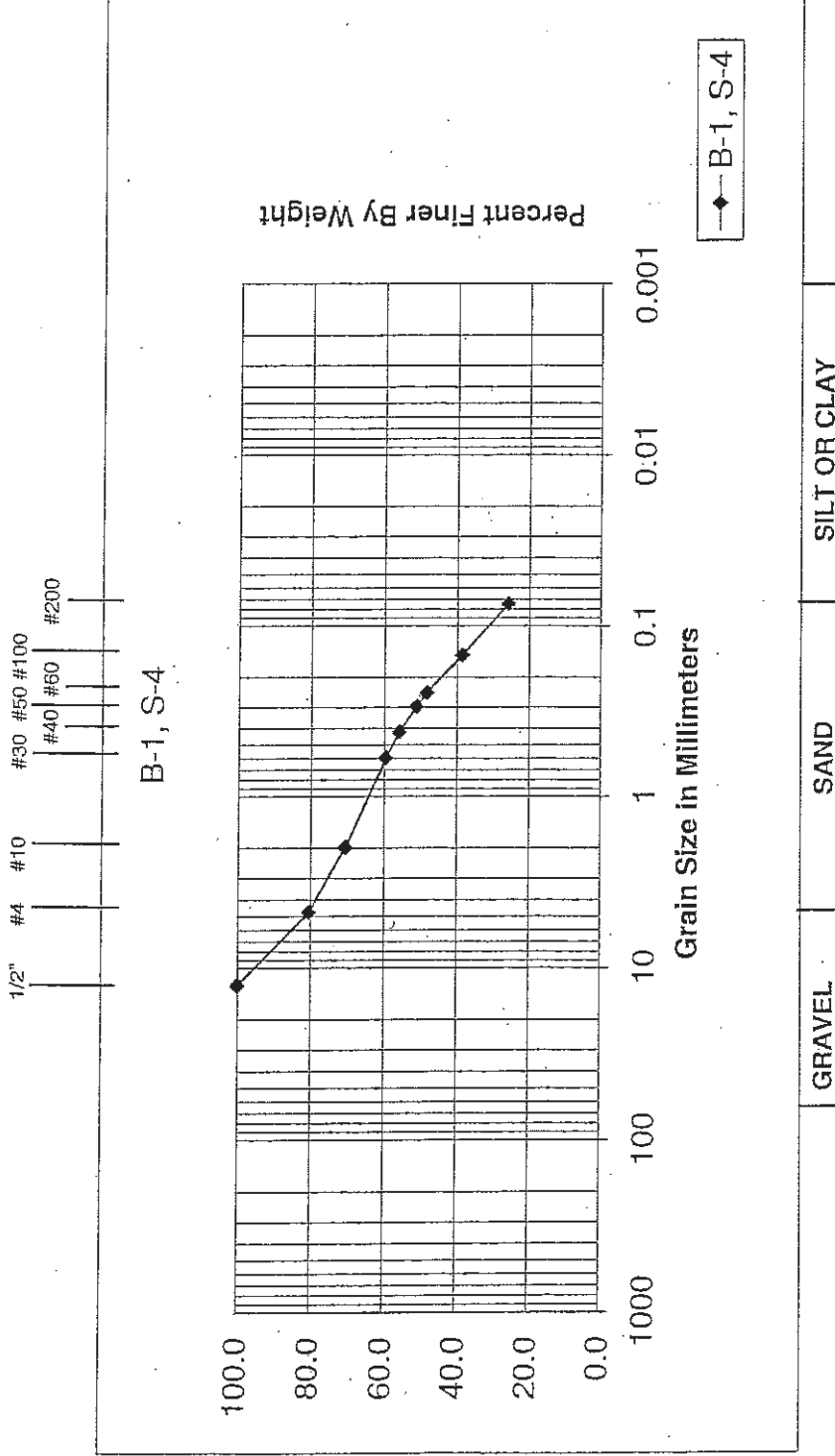
SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS
			-0		2" Asphalt, 2" crushed stone		
			-				
S-1	10-12-10-6	F	-	Fill	Brown medium to fine SAND, little Silt, little coarse to fine Gravel		
			-				
S-2	6-12-6-4		-				
			-5				
S-3	6-6-10-12		-		Brown medium to fine SAND, trace Silt, trace fine Gravel		
			-				
S-4	10-10-12-14	G	-				
			-				
S-5	12-13-14-15		-10	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel (medium dense)		
			-				
			-				
S-6	14-15-22-21		-		- dense @ 14'.		
			-15				
			-				
			-				
S-7	12-12-18-20		-		- contains rock fragments @ 19'.		
			-20				
		DR	-				Auger refusal @ 21.5'
			-				
		R	-		Core Run # 1		
			-		Rec. = 4.2' (84%)		
			-25		RQD = 2.3' (46%)		
			-				
			-		Red-brown Sandstone Bedrock		
			-		End of Boring B-4 @ 26.5'		
			-				
			-30				
			-				
			-				
			-				
			-				
			-35				
			-				
			-				
			-				
			-40				

me							
Reading							
(P.M.)							

PROJECT NO: 030262901
DATE: 9/2/03

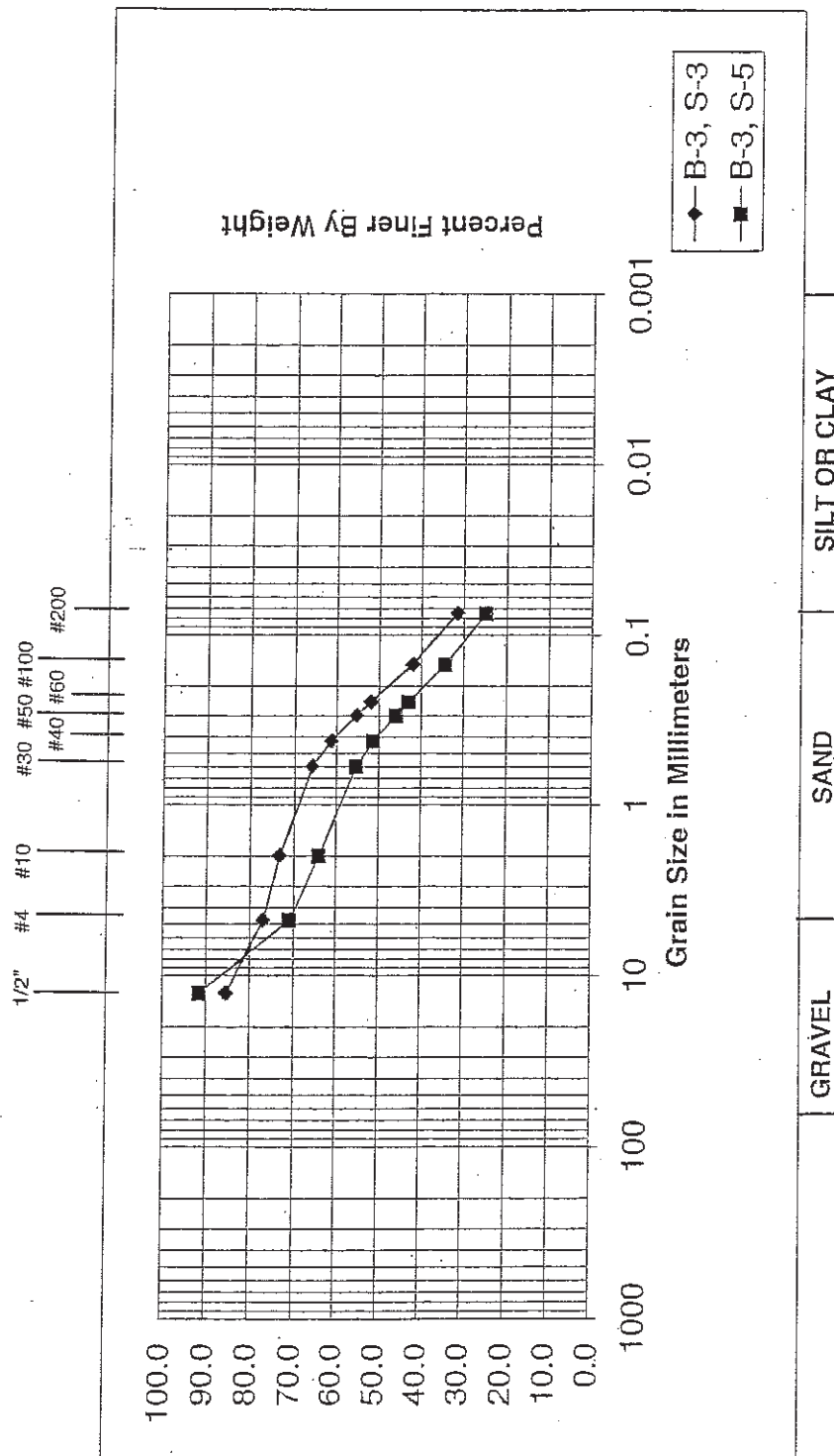


SCHOOR DEPALMA
Engineers and Consultants



BORING NO:	Sample	Depth	SOIL CLASSIFICATION	%Moisture content
B-1	S-4	7'-9'	Red-brown, m-f SAND, some Silt, some f. Gravel (SM)	10.0

GRAIN SIZE ANALYSES



BORING NO:	Sample	Depth	SOIL CLASSIFICATION	% Moisture content
B-3	S-3	5'-7'	Red-brown c-f SAND, some clayey SILT, some f. Gravel (SM)	7.0
B-3	S-5	9'-11'	Red-brown c-f SAND, some clayey SILT, some f. Gravel (SM)	9.0

GRAIN SIZE ANALYSES



MODIFIED METHOD
FOR
IDENTIFICATION OF SOILS
AFTER
DR. D.M. BURMISTER

Soil Component	Descriptive Terms As Written on Log	Range of Proportions
PRINCIPAL COMPONENT (All Letters Capitalized)	--	35% of more
MINOR COMPONENTS (First Letter Capitalized)	and (a.) some (s.) little (l.) trace (tr.)	35% to 50% 20% to 35% 10% to 20% 1% to 10%

Coarse Grained Soils – Gradation of Components

Coarse to fine	Coarse to fine	cf	All sizes
Coarse to medium	Coarse to medium	cm	Less than 10% fine
Medium to fine	Medium to fine	mf	Less than 10% coarse
Coarse	Coarse	c	Less than 10% medium & fine
Medium	Medium	m	Less than 10% coarse & fine
Fine	Fine	f	Less than 10% coarse & medium

Component	Symbol	Sieve Range
Boulders		9" and larger
Cobbles		3" to 9"
Gravel	G	
Coarse		3/4" to 3"
Fine		#4 to 3/4"
Sand	S	
Coarse		#4 to #10
Medium		#10 to #40
Fine		#40 to #200

Fine Grained Soils-Plasticity of Components

Component	Symbol	Overall Plasticity	Plasticity Index
SILT	S	Non-Plastic	0
Clayey Silt	CyS	Slight	1 to 5
SILT & CLAY	S & C	Low	5 to 10
CLAY & SILT	C & S	Medium	10 to 20
Silty Clay	SyC	High	20 to 40
CLAY	C	Very High	Over 40



MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FILES.	
		MORE THAN 50% OF COURSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		MORE THAN 50% OF COURSE FRACTION <u>PASSING</u> NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT <u>LESS</u> THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDS CLAYS, SILTY CLAYS, LEAN CLAYS	
			OL	ORGANIC SILTS AND ORANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS	LIQUID LIMIT <u>GREATER</u> THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
			HIGH ORGANIC SOILS		PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

GRADUATION*

COMPACTNESS*
SAND AND/OR GRAVEL

CONSISTENCY*
CLAY AND/OR SILT

% FINER BY WEIGHT

RELATIVE
DENSITY

RANGE OF SHEARING
STRENGTH
IN POUNDS PER SQUARE FOOT

TRACE.....0% TO 10%
LITTLE.....10% TO 20%
SOME.....20% TO 35%
AND.....35% TO 50%

LOOSE.....0% TO 40%
MEDIUM DENSE.....40% TO 70%
DENSE.....70% TO 90%
VERY DENSE.....90% TO 100%

VERY SOFT.....LESS THAN 250
SOFT.....250 TO 500
MEDIUM.....500 TO 1000
STIFF.....1000 TO 2000
VERY STIFF.....2000 TO 4000
HARD.....GREATER THAN 4000

* VALUES ARE FROM LABORATORY OR FILED TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

ENGINEERING ROCK CLASSIFICATION AND CORE DESCRIPTION CHART ⁽¹⁾

DESCRIPTION TERMINOLOGY FOR JOINT SPACING:

<u>DESCRIPTIVE TERM</u>	<u>SPACING OF JOINTS</u>
VERY CLOSE	LESS THAN 2 1/2 INCHES
CLOSE	2 1/2 TO 8 INCHES
MEDIUM	8 TO 24 INCHES
WIDE	2 TO 6 FEET
VERY WIDE	GREATER THAN 6 FEET

RELATIONSHIP OF RQD AND ROCK QUALITY:

<u>ROCK QUALITY DESIGNATION (RQD)⁽²⁾</u>	<u>DESCRIPTION OF ROCK QUALITY</u>
0 - 25	VERY POOR
25 - 50	POOR
50 - 75	FAIR
75 - 90	GOOD
90 - 100	EXCELLENT

(1) Core description system is based on a suggested system in the *Design Manual 7.1 - Soil Mechanics*, Department of the Navy, Navy Facilities Engineering Command, May 1982

(2) "Rock Quality Designation" is defined as a modified core recovery ratio that considers only pieces of the core that are at least 4 inches long. Obvious fractures by drilling are ignored in this system.

RQD



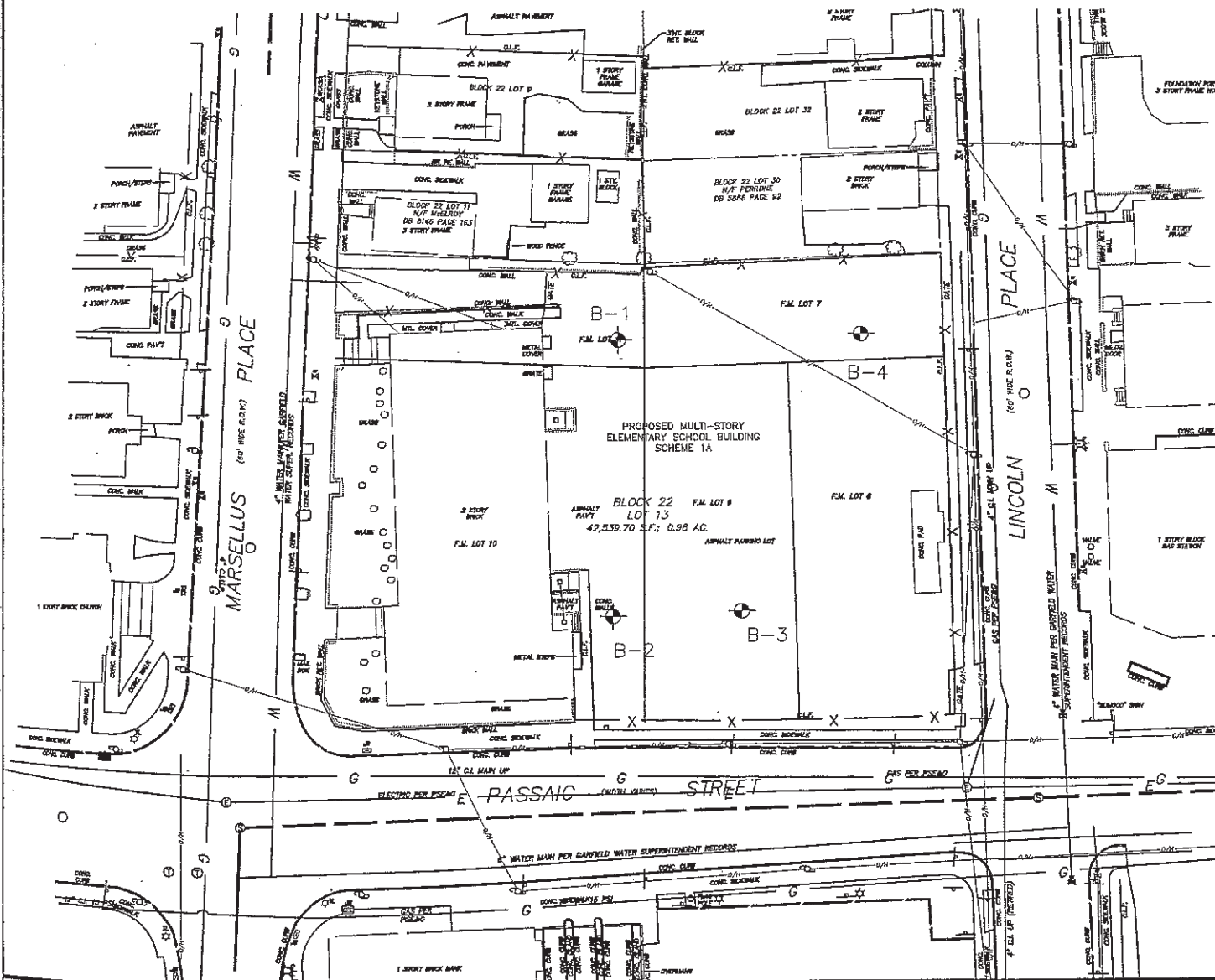
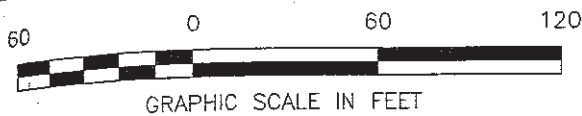
LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical design practices for specific application to this project. This report has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project Architect, Structural Engineer, and/or Civil Engineer. This report has been based on assumed conditions and characteristics of the proposed development where specific information was not available. Available project information at the time of this report preparation included a site plan, no proposed footing depths or ground floor slab details were available.

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. The validity of the projections, conclusions, and recommendations contained in this report is necessarily limited by the scope of field investigation and by the number of borings that were made. Should conditions arise which differ from those described in this report, Schoor DePalma should be notified immediately and provided with all information when available regarding subsurface conditions.

Our recommendations are based upon the assumption that the services of a qualified geotechnical engineer will be retained for the observation of stripping operations, proofrolling, structural fill placement, footing installation, and all critical earthwork operations.

The scope of this investigation was limited to the evaluation of the load-carrying capabilities and load stability of the subsurface soils. Oil, hazardous/contaminated waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this study. Their presence and/or absence are not implied, inferred or suggested by this report or results of this study.



PROPOSED JAMES MADISON SCHOOL #10
NJSCC CONTRACT NO. NT-0014-A0

CITY OF GARFIELD BLOCK 22 - LOT 13 BERGEN COUNTY NEW JERSEY

-NOTICE-

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TEST BORING LOCATION MAP



SCHOOR DEPALMA
Engineers and Consultants

Cert. Of Authorization 24GA27926200
160 LITTLETON RD.

P.O. BOX 5245 PARSIPPANY, NJ 07054
TEL (973)299-7970 FAX (973)334-5588

SCALE	DATE	DRAWN BY	DES. BY	FILE NO.	CHECKED BY
1" = 60'	8/21/03				

DATE	REVISIONS	ORDER NO.

SOR CONSULTING ENGINEERS, INC.

Geotechnical Engineering - Materials Testing - Forensic Studies

98 Sand Park Rd., Cedar Grove, NJ 07009
(973) 239-6001 Fax (973) 239-8380

GEOTECHNICAL INVESTIGATION REPORT PROPOSED JAMES MADISON ES #10 GARFIELD, NEW JERSEY

FOR

**FVHD ARCHITECTS
TRENTON, NEW JERSEY**

**Prepared by: Sor Consulting Engineers, Inc.
98 Sand Park Road
Cedar Grove, New Jersey 07009**

**Job No.: 13-C-66
Report No.: 13-C-140
October 31, 2013**

SOR CONSULTING ENGINEERS, INC.

Geotechnical Engineering - Materials Testing - Forensic Studies

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Kamil Sor, Ph.D.
Orhun Sor, P.E.
Kenneth Rowbotham, P.E.
Atilla Sencar, P.E.

October 31, 2013
Job No.: 13-C-66
Report No.: 13-C-140

FVHD Architects
P.O. Box 7371
Trenton, NJ 08628

Attention: Gary A. Rostron, AIA
Email: grostron@fvhdpc.com

Re: Geotechnical Investigation Report
Proposed James Madison ES #10
Garfield, New Jersey

INTRODUCTION

This report presents the results of a geotechnical investigation performed for the proposed new James Madison Elementary school to be constructed on an approximate 1 acre site in Garfield, New Jersey. The subject site is located at 98 Marsellus Place and is bounded by Passaic Street to the south, Lincoln Place to the east and Marsellus Place to the west.

PROPOSED CONSTRUCTION

Based on a Site and Demolition Plan dated July 16, 2009 prepared by FVHD Architects, the new school will occupy the eastern portion of the site which is currently a paved parking lot. The building is estimated to occupy a footprint area of approximately 20,000 square feet. The building will not contain a basement. A paved parking area and multi-purposed playground will occupy the western portion of the site which is currently occupied by an abandoned school building that is to be demolished. The

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FVHD Architects
Proposed James Madison ES #10
Garfield, New Jersey

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foundation drawings provided to us indicate that the finished first floor elevation of the proposed building will be at Elevation +58.85 feet except the southeast section of the building where the finished first floor elevation will be at Elevation +62.18 feet.

AVAILABLE SITE DATA

A Final Subsurface Investigation and Foundation Recommendations Report dated September 8, 2003 had been prepared for this site by Schoor DePalma. As part of their study, four soil borings were performed. Four additional borings have been requested. The Schoor DePalma report recommended that the building be supported by conventional spread foundations founded on the natural soils designed to impose a maximum allowable bearing pressure of up to 2 tons per square foot.

PURPOSE AND SCOPE OF WORK

The purpose of this study was to:

- further explore the subsurface conditions within the proposed building area;
- estimate the geotechnical engineering properties of the encountered subsurface materials;
- evaluate the foundation requirements for the building considering the anticipated structural loads and encountered subsurface conditions;
- recommend an appropriate type of foundation for support of the proposed building;
- present recommendations relative to the support and subdrainage of slabs to be constructed on-grade;
- estimate the post-construction performance of the recommended floor and foundation systems;
- recommend appropriate pavement sections for the proposed parking and roadway facilities; and

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Proposed James Madison ES #10
Garfield, New Jersey

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- discuss appropriate earthwork operations or considerations consistent with the proposed construction and encountered subsurface conditions.

To accomplish this, a subsurface exploration program consisting of four test borings was conducted on the site on October 21, 2013. The borings were advanced using truck mounted hollow stem auger drilling equipment and extended to a maximum depth of 19 feet beneath the existing ground surface. Soil samples suitable for identification and laboratory testing purposes were extracted from the borings in accordance with the procedures of the Standard Penetration Test. Upon completion, the explorations were backfilled so as not to leave any open holes and the surface was filled with cold patch asphalt.

The borings were performed by Environmental Technical Drilling, Inc. under the direct technical observation of a licensed geotechnical engineer from Sor Consulting Engineers, Inc. Our representative located the borings at the site, prepared logs of the explorations as the drilling proceeded and supervised the soil sampling operations so as to obtain the appropriate subsurface information. The locations of the explorations are shown relative to the existing site features on the Boring Location Plan contained in Appendix I of this report. Detailed descriptions of the encountered subsurface conditions are presented on the individual boring logs included in Appendix II. The soils were visually classified in accordance with the Burmeister Soil Classification System also included in Appendix II. The group symbol based on the Unified Soil Classification System is also included on the boring logs. Ground surface elevations at the boring locations were determined by interpolation between existing ground contours depicted on the site plan.

All soil samples were brought to our office where they were further examined in our soil mechanics laboratory. Moisture content and mechanical grain size distribution tests were performed on selected samples to assist in our evaluation of their engineering soil properties. Laboratory test results are presented in Appendix III.

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FVHD Architects
Proposed James Madison ES #10
Garfield, New Jersey

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The results of the subsurface exploration and laboratory testing programs have provided the basis for our engineering analyses and geotechnical recommendations. The following discussions of our findings and conclusions are subject to the limitations contained in Appendix IV of this report.

SITE CONDITIONS

Surface Features: Currently, the site is utilized as a paved parking lot for an existing (abandoned) multi-story brick/block building with a partial basement. Based on the available topographic information, the site's existing ground surface elevations range from Elevation +62 to +52 feet. The surface grades slope down from east to west.

Subsurface Conditions: The subsurface conditions encountered in the borings performed for the Schoor DePalma investigation as well as this study were relatively uniform and consisted of the following generalized strata in order of increasing depth:

- 1) Surface Material: Surface cover consisted of 2 to 6 inches of bituminous concrete over 2 to 6 inches of aggregate base.
- 2) Fill: Fill was encountered in six of the eight test borings performed for the two investigations directly beneath the surface cover. The fill extends to approximately 3 to 8 feet below the existing surface elevations. The fill can be described as brown loose to medium compact silty sand with varying quantities of gravel. N-values obtained from the Standard Penetration Tests ranged from 4 to 45 blows per foot.
- 3) Glacial Deposits: This stratum was encountered below the fill layer and/or beneath the surface cover in all of the test borings. The glacial deposits consist of brown to reddish brown medium dense silty sand with varying amounts of gravel/rock fragments. The majority of the borings were terminated in this stratum when refusal to further penetration of the drilling and sampling equipment was encountered.

- 4) Sandstone Bedrock: At School DePalma Borings 2 and 4 sandstone bedrock was encountered at depths of 13 and 21.5 feet below the existing surface grade. The rock was core drilled and rock core recoveries ranged from 60 to 84 percent. The RQD values, a measure of rock quality, were determined to be 46 to 48 percent. Based on these recovery and RQD values, the upper most 5 feet of rock is classified as weathered/fractured sandstone.

Groundwater was encountered in three test borings, B-1, B-4 and B-6, at depths ranging from 17 to 19 feet below the existing surface grade at the time of the explorations. It should be noted that groundwater elevations at this site may fluctuate due to seasonal variations in rainfall and temperature, runoff from the existing building and other factors.

CONCLUSIONS AND RECOMMENDATIONS

General: Based on our evaluation of the subsurface conditions encountered in the borings performed for the School DePalma investigation and for this study, the existing fill varies in relative density from loose to medium compact and as such is unsuitable for support of new foundations due to the potential for excessive and detrimental settlements. New conventional spread footing foundations should extend through the fill and derive their support from the competent natural glacial deposits or new controlled compacted crushed stone placed over these materials. Floor slabs may be supported on-grade with proper subgrade densification and preparation as described in subsequent sections of this report. Detailed discussions of geotechnical design and construction items considered relevant to construction of the proposed new school building are presented in the following sections of this report.

Site Preparation and Earthwork: Site preparation procedures should initially consist of demolishing the existing structure and removing and legally disposing of the demolition debris. Existing utilities should also be removed and/or relocated at this

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FVHD Architects
Proposed James Madison ES #10
Garfield, New Jersey

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time. Any existing topsoil and/or pavements, sidewalks, slabs, etc. should also be stripped from within and at least 5 feet beyond the proposed building limits. The existing asphalt may be milled and stockpiled on-site for future use as either subbase or controlled fill in pavement areas.

After removal of the existing structures, utilities, demolition debris and surface features and prior to backfilling of excavations or placing any fill in areas to be raised, the exposed soils should be thoroughly proofrolled and compacted to a dense and unyielding condition by numerous passes of a vibratory steel drum compactor (Dynapac CA-150 or equivalent). In confined or limited access areas proofrolling and compaction should be accomplished with a smaller, double drum vibratory steel drum compactor (Wacker Neuson RD-7H-ES or equivalent). The compactor should be operated in static mode within 5 feet of adjacent structures or utilities to remain. Any localized areas that cannot be compacted to a dense and unyielding condition or are detected to contain significant concentrations of deleterious materials should be excavated to expose suitable subsoils and the areas subsequently backfilled with controlled fill. We strongly recommend that the proofrolling and compaction operations as well as any subsequent placement of controlled fill or backfill be performed under the direct technical observation of a qualified geotechnical engineer.

Upon completion of the proofrolling and densification operations, controlled compacted fill and backfill may be installed as required to reach the proposed floor slab and pavement subgrade levels. All mass fill placed within the building and pavement areas should be spread in horizontal layers on the order of 10 to 12 inches in loose thickness. Backfill placed in confined areas, such as foundation and utility trench excavations, should be spread in layers on the order of 6 to 8 inches in loose thickness. Each layer of fill and backfill should be compacted to at least 95 percent of maximum dry density as determined by the modified Proctor moisture-density test procedure (ASTM D1557).

Controlled fill and/or backfill imported to the site should consist of a relatively well-graded granular material containing less than 15 percent by weight passing a U.S.

SOR CONSULTING ENGINEERS, INC.

FVHD Architects
Proposed James Madison ES #10
Garfield, New Jersey

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Standard No. 200 sieve and having a maximum particle size of 2 inches. Imported fill materials should be certified as environmentally clean fill and should meet the NJDEP requirements for the intended use. The on-site fill and natural glacial deposit materials may be reused as controlled fill or backfill provided they are free of deleterious materials, are less than 2 inches in nominal maximum size, and are at a moisture content that will permit compaction to the required densities. The on-site materials are sensitive to slight changes in moisture content and, if they become wet either prior to or during placement as controlled fill or backfill, will be difficult to compact. In addition, these materials are difficult to dry if they become wet and may require removal and replacement to facilitate fill placement and compaction.

Groundwater was observed in three of the borings at depths of 17 to 19 feet below the existing surface. Therefore, groundwater is not expected to present problems during the site preparation and earthwork operations. However, minor amounts of trapped water could be encountered within zones or layers of more permeable soils or adjacent to the existing structure. We recommend that surface grades be maintained during construction to prevent the inundation of the subgrade soils from surface water runoff. Any water seepage that may occur should be collected and removed from the construction excavations by pumping from sumps established within or immediately adjacent to the excavations.

All excavations should be in accordance with OSHA requirements. For this site, the soils are considered to be Type C which limits excavation sides to 1 vertical to 1.5 horizontal. Steeper slopes should be adequately protected with sheeting, shoring or bracing.

Foundation Design Criteria: The proposed building may be supported on conventional spread foundations. All foundation excavations should extend through the surficial existing fill to expose the natural glacial deposit soils. New foundations may be established directly on the competent bearing natural soils or the foundation excavations may be backfilled to convenient depths with clean compacted crushed stone. Foundations established on the natural glacial deposits or new controlled

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FVHD Architects
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compacted 3/4-inch size crushed stone placed over the natural materials may be proportioned to impose a maximum allowable net bearing pressure of up to 2 tons per square foot. However, wall foundations should be at least 18 inches in width and column foundations at least 2 feet by 2 feet in plan dimension. The bottoms of all exterior foundations should be established at least 3 feet below the adjacent exterior grades to provide protection from frost penetration. Interior foundations in permanently heated portions of the building may be established at convenient depths beneath the floor slab provided they are supported on the intended bearing materials. Consideration should be given to protecting the foundation subgrade materials from disturbance during construction and subsequent loss of strength. It may be advantageous to provide a 3 to 4 inch thick layer of lean concrete or 3/4-inch crushed stone over the subgrade materials to facilitate construction and minimize disturbance and potential over excavation. The need for foundation subgrade protection measures is partially a function of the contractor's methods and procedures and should be determined in the field at the time of construction.

We estimate that foundations designed and installed in accordance with our recommendations would experience total settlements of less than 1/2 of 1 inch and that post-construction differential settlements would be less than 1/4 of 1 inch.

Slab-On-Grade Design Criteria: We recommend that immediately prior to slab construction, the exposed subgrade soils be recompacted and proofrolled to a dense and unyielding condition using a vibratory steel drum compactor. Any localized areas that cannot be recompacted to a dense and unyielding condition should be removed to expose suitable subsoils and the excavations backfilled with controlled compacted backfill. Following the recompaction and proofrolling operations, slabs may be designed using a vertical modulus of subgrade reaction (K_v) of 200 pounds per cubic inch. We recommend that slabs be underlain by a minimum 4-inch thick layer of clean 3/4-inch size crushed stone to provide a capillary break as well as a porous drainage layer beneath the slab.

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We estimate that post-construction settlements of slabs designed and supported on material prepared in accordance with our recommendations would be negligible.

Below Grade and Site Retaining Wall Design Criteria: Below grade walls and walls required to accommodate grade changes should be designed to resist lateral earth pressures and consider appropriate surcharge loads. Assuming the walls are backfilled in accordance with our previous recommendations for controlled fill and are fully drained, the walls may be designed using the following parameters:

Total Unit Weight of Soil (Moist)	=	125 pcf
Angle of Internal Friction	=	32°
Coefficient of Active Earth Pressure (Ka)	=	0.33
Coefficient of Passive Earth Pressure (Kp)	=	3.25
Coefficient of At-Rest Earth Pressure (Ko)	=	0.50
Friction Factor between Soil and Concrete	=	0.40

Pavement Design Criteria: Subgrade preparation procedures within proposed pavement areas should consist of demolishing and removing the existing structure and any existing asphalt pavement, sidewalks, slabs or otherwise deleterious materials from within the pavement limits. Following general grading and after cutting to grade in high areas but prior to placing any fill in areas to be raised, the surface should be thoroughly proofrolled and compacted to a dense and unyielding condition by numerous passes of a heavy vibratory drum compactor. Localized areas that cannot be compacted to a dense and unyielding condition should be excavated to expose suitable subsoils and the excavations backfilled with controlled compacted fill. New fill required to raise grade should be placed and compacted in accordance with the recommendations for controlled compacted fill previously presented in this report.

Assuming that the pavement subgrade soils are recompacted to a dense and unyielding condition immediately prior to construction, these materials would generally provide a "fair" to "good" subgrade support condition for pavements. Based on the subgrade support conditions and the anticipated light traffic volume and loading

SOR CONSULTING ENGINEERS, INC.

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Proposed James Madison ES #10
Garfield, New Jersey

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associated with a facility such as an elementary school, the following minimum flexible pavement sections are recommended:

	Access Roads	Automobile Parking
Bituminous Concrete Surface Course	2 inches	1 ½ inches
Bituminous Concrete Base Course	4 inches	2 ½ inches
Dense Graded Aggregate Subbase or Milled Existing Asphalt Pavement	6 inches	6 inches
Total Section Thickness	12 inches	10 inches

For rigid pavements, a modulus of subgrade reaction of 200 pounds per cubic inch may be used. The recommended minimum pavement design sections are subject to the approval of the municipal engineer.

Seismic Design Considerations: Structures must be designed in conformance with the applicable seismic design criteria of the New Jersey Edition of the 2009 International Building Code. In accordance with Section 1613 of the Code, the subsurface information obtained from the borings and the known geologic conditions in this area, the site is considered to have a soil profile identified as "Very Dense Soil and Soft Rock" which corresponds to a site class "C".

RECOMMENDED SERVICES

It is recommended that Sor Consulting Engineers be provided the opportunity for a general review of the final design and specifications to assure that the foundation and earthwork recommendations are properly interpreted and implemented in the construction documents.

We also recommend that Sor Consulting Engineers be retained to provide continuous on-site observation services during the earthwork operations, subgrade preparation and foundation construction phases of the project. This is to assure compliance with the project specifications and to identify and address field conditions that may affect the design in the event that the subsurface conditions differ significantly from those encountered in the explorations performed for this study.

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Proposed James Madison ES #10
Garfield, New Jersey

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Sor Consulting Engineers appreciates the opportunity to be of assistance with this project. Should there be any questions concerning the information contained herein, please do not hesitate to call. The following appendices are attached and complete this report:

- Appendix I: Boring Location Plan
- Appendix II: Boring Logs 1 through 4 (performed previously by others)
Boring Logs 5 through 8 (performed by SCE)
Burmeister Soil Classification System
- Appendix III: Laboratory Soil Test Results
- Appendix IV: Limitations

Respectfully submitted,
SOR CONSULTING ENGINEERS, INC.

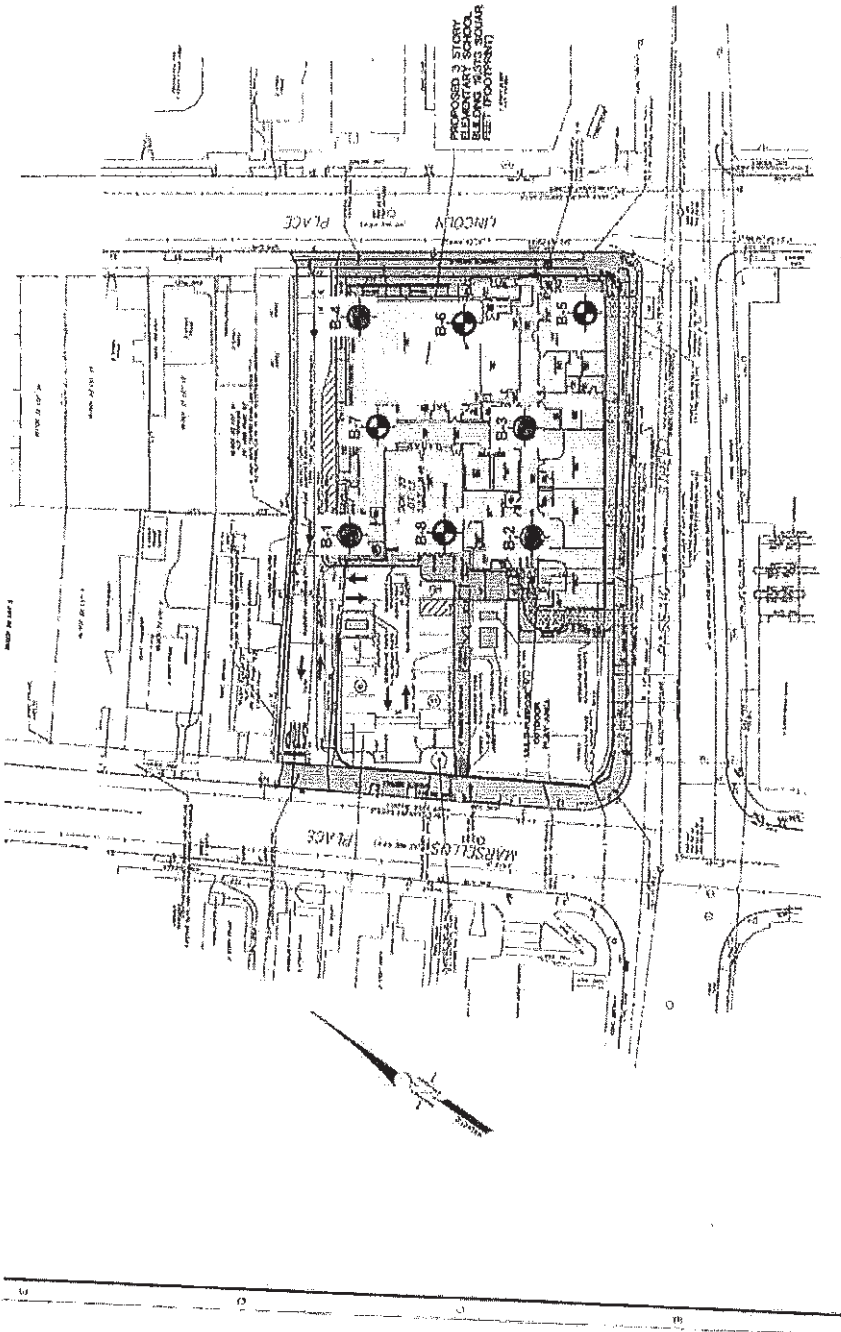
Atilla Sencar, P.E.
Senior Engineer

Kenneth J. Rowbotham, P.E.
Senior Engineer

AS/KJR/jh

APPENDIX I

BORING LOCATION PLAN



LEGEND

B-5

Number and approximate location of geotechnical boring performed by SCE for this study.

B-1

Number and approximate location of boring performed previously by others.

NOTES

1. This drawing is part of Sor Consulting Engineers, Inc. Report No. 13-C-140 and should be read together with the report for complete evaluation.
2. General Layout was obtained from a plan provided by the Client.

BORING LOCATION PLAN

FVHD ARCHITECTS
NEW JAMES MADISON ELEMENTARY SCHOOL NO.10
GARFIELD, NEW JERSEY

SOR CONSULTING ENGINEERS, INC.

Geotechnical Engineering – Materials Testing – Forensic Studies
98 Sand Park Road, Cedar Grove, New Jersey 07009

Prepared By : A.S.	Approved By : K.J.R.	DRAWING NO.
Date : 10/25/2013	Date : 10/29/2013	13-C-56-1
Scale : NTS	Report No. : 13-C-140	Sheet No. 1 of 1

APPENDIX II

**BORING LOGS 1 THROUGH 4
(previously by others)**

**BORING LOGS 5 THROUGH 8
(by SCE)**

BURMEISTER SOIL CLASSIFICATION SYSTEM

TEST BORING LOG									
Boring Contractor: Site-Blauvelt Boring Foreman: Robert Moyer Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B 59 ID Representative: Khalid Husseln Dates: Started: 8/25/2003 Finished: 8/25/2003 Ground Surface Elevation: +56.0'				SCHOOR DEPALMA Engineers and Consultants			Project: James Madison School #10 Project Location: Garfield, New Jersey Project Number: 03.02629.01 Boring Log: B-1		
GROUNDWATER OBSERVATIONS						Depth			
Encountered:						18 ft			
Completion:									
Location: SEE TEST BORING LOCATION PLAN						Page 1 of 1			
SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS		
S-1	11-11-11-13	F	-0	Fill	4" Asphalt, 6" crushed stone				
			-		Brown medium to fine SAND, little Silt, little fine Gravel				
			-						
S-2	21-16-27-20		-						
			-						
			-						
S-3	68-27-11-10	G	-5	SM	Red-brown medium to fine SAND, some Silt, some fine Gravel (medium dense)	10	Hard drilling @ 5'.		
			-						
			-						
S-4	9-11-6-3		-						
			-						
			-						
S-5	4-4-8-16		-10						
			-						
			-						
S-6	18-16-14-15		-		Red-brown medium to fine SAND, some Silt, trace fine Gravel (dense)				
			-15						
			-						
S-7	6-8-10-11		-		Red-brown medium to fine SAND, some Silt, some coarse to fine Gravel (medium dense)				
			-20						
			-						
S-8	16-100/8"	DR	-		- Contains rock fragments @ 23'.		Auger refusal @ 23.75'		
			-25						
			-						
			-		End of Boring B-1 @ 23.75'.				
			-30						
			-35						
			-						
			-						
			-40						

me
lr
Reading
(P.P.M.)

TEST BORING LOG

Boring Contractor: Site-Blauvelt		 SCHOOR DEPALMA Engineers and Consultants	Project: James Madison School #10	
Boring Foreman: Wayne Reagle			Project Location: Garfield, New Jersey	
Drilling Method: Hollow Stem Auger		Project Number: 03.02629.01		
Drilling Equipment: Mobile B 59		Boring Log: B-2		
Representative: Khalid Hussein				
Dates: Started: 8/26/2003 Finished: 8/26/2003				
Ground Surface Elevation: +57.0'				

SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS
J-1	14-15-15-16	F	-0	Fill	3" Asphalt, 4" crushed stone		
			-		Brown medium to fine SAND, some Silt, little coarse to fine Gravel		
J-2	11-15-17-31		-				
			-5				
S-3	21-11-12-20	G	-	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel (medium dense)		
J-4	25-29-17-21		-		- contains rock fragments @ 8' (dense)		
J-5	10-16-15-24		-10				
			-				
			-				
		DR	-				Auger refusal @ 13'
J-6	50/0'		-		Core Run # 1		
			-15		Rec. = 3.0' (60%)		
		R	-		RQD = 2.4' (48%)		
			-		Red-Brown Sandstone Bedrock		
			-		End of Boring B-2 @ 18.0'		
			-20				
			-				
			-				
			-				
			-25				
			-				
			-				
			-				
			-30				
			-				
			-				
			-				
			-35				
			-				
			-				
			-40				
ne							
Reading (P.M.)							

TEST BORING LOG

Boring Contractor: Sile-Blauvelt



SCHOOR DEPALMA
Engineers and Consultants

Project: James Madison School #10

Project Location: Garfield, New Jersey

Project Number: 03.02629.01

Boring Log: B-3

Boring Foreman: Robert Moyer

Drilling Method: Hollow Stem Auger

Drilling Equipment: Mobile B 59

Drilling Representative: Khalid Hussein

Dates: Started: 8/25/2003 Finished: 8/25/2003

Ground Surface Elevation: +59.5'

GROUNDWATER OBSERVATIONS

Encountered:

Completion:

Location: SEE TEST BORING LOCATION PLAN

Depth

not encountered

Page 1 of 1

SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% w	REMARKS
			-0		6" Asphalt, 6" crushed stone		
3-1	5-9-17	G	-	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel (medium dense)		
3-2	24-21-20-18		-		Red-brown medium to fine SAND, some clayey Silt, some fine Gravel (dense)	7	
3-3	14-15-16-18		-5				
3-4	21-13-14-11		-		- medium dense @ 8'		
3-5	16-18-15-10		-10		- contains rock fragments @ 10' (dense)	9	
3-6	11-13-16-15		-		- medium dense @ 14'		
		DR	-15				
			-		End of Boring B-3 @ 17.5'		Auger refusal @ 17.5'
			-20				
			-25				
			-30				
			-35				
			-40				
me							
Reading (P.M.)							

TEST BORING LOG

Boring Contractor: Site-Blauvett Boring Foreman: Wayne Reagle Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B 59 Representative: Khalid Hussein Dates: Started: 8/26/2003 Finished: 8/26/2003 Ground Surface Elevation: +61.5'		 SCHOOR DEPALMA Engineers and Consultants	Project: James Madison School #10 Project Location: Garfield, New Jersey Project Number: 03.02629.01 Boring Log: B-4
		GROUNDWATER OBSERVATIONS Encountered: _____ Depth: 19 ft Completion: _____ Location: SEE TEST BORING LOCATION PLAN	

SAMPLING DATA		STRATUM	DEPTH	CLASS	STRATA DESCRIPTION	% W	REMARKS
			-0		2' Asphalt, 2" crushed stone		
S-1	10-12-10-6	F	-	Fill	Brown medium to fine SAND, little Silt, little coarse to fine Gravel		
S-2	6-12-6-4		-				
S-3	6-6-10-12		-5		Brown medium to fine SAND, trace Silt, trace fine Gravel		
S-4	10-10-12-14	G	-	SM	Red-brown medium to fine SAND, some Silt, little fine Gravel (medium dense)		
S-5	12-13-14-15		-10				
S-6	14-15-22-21		-15		- dense @ 14'.		
S-7	12-12-18-20	DR	-20		- contains rock fragments @ 19'.		
		R	-25		Core Run # 1 Rec. = 4.2' (84%) RQD = 2.3' (46%) Red-brown Sandstone Bedrock		Auger refusal @ 21.5'
			-30		End of Boring B-4 @ 26.5'		
			-35				
			-40				

me						
Reading						
(P.M.)						

SOR CONSULTING ENGINEERING, INC.				TEST BORING LOG				BORING 5	
CLIENT FVHD Architects								GSE	+61.5'
PROJECT New James Madison Elementary School #10								DATUM	Top of Pavement
LOCATION Garfield, New Jersey								DATE START	10/21/13
GROUND WATER				CAS.	SAMP.	CORE	TUBE	DATE FINISH	10/21/13
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS			
10/21/13		NE		DIA.	4-1/4"	2" OD			JOB NO. 13-C-66
				WT.		140 lbs			REPORT NO. 13-C-140
				FALL		30"			SHEET NO. 1 of 1
depth. ft	casing blows	sample type/no	depth	sampler blows per 6"	N value	DESCRIPTION			REMARKS
1						Asphalt 2"			
2		S-1	1' - 3'	5	35	Brown medium to fine Sand, some Silt, some medium to fine Gravel (SM)			Moist
3				17					
4				18					
5		S-2	3' - 4.4'	15	75/10"	Same w/rock fragments			
6				15					
7				25					
8		S-3	5' - 7'	50/4"	51	Brown coarse to fine SAND, little Silt, some coarse to fine Gravel/rock fragments (SM)			
9				18					
10				25					
11		S-4	10' - 10.4'	26	100/4"	Same			
12				50					
13									
14		S-5	13.5'			Test Boring completed at 13' 6"			
15				50/0"					
16									
17						(Auger and spoon refusal)			
18									
19									
20									
21									
22									
23									
24									
25									

S - SPLIT SPOON SAMPLER
 U - UNDISTURBED SAMPLE
 C - CORE DRILLED

DRILLING CONTRACTOR: ETD
 DRILLING EQUIPMENT: Truck Rig
 SCE REPRESENTATIVE: A. Sencar

SOR CONSULTING ENGINEERING, INC.					TEST BORING LOG					BORING 6	
CLIENT FVHD Architects					GSE +61.5'						
PROJECT New James Madison Elementary School #10					DATUM Top of Pavement						
LOCATION Garfield, New Jersey					DATE START 10/21/13						
GROUND WATER					CAS.	SAMP.	CORE	TUBE	DATE FINISH 10/21/13		
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS					
10/21/13		17'		DIA.	4-1/4"	2" OD			JOB NO.	13-C-66	
				WT.		140 lbs			REPORT NO.	13-C-140	
				FALL		30"			SHEET NO.	1 of 1	
depth, ft	casing blows	sample type/no	depth	sampler blows per 6"	N value	DESCRIPTION				REMARKS	
1		S-1	1' – 3'	2	5	Asphalt 2" and Gravel Base 2"				Moist	
2				3		Brown coarse to fine SAND, some Silt, trace fine Gravel (Fill)					
3				2							
4		S-2	3' – 5'	1	8	Brown medium to fine SAND, some Silt, little medium to fine Gravel (Fill)					
5				4							
6				4							
7		S-3	5' – 7'	6	18	5' 0"					
8				7							
9				9		Brown medium to fine SAND, some Silt (SM)					
10		S-4	7' – 9'	9	39						
11				13							
12				23		Brown medium to fine SAND, some Silt, little medium to fine Gravel (SM)					
13		S-5	10' - 12'	23	33						
14				16							
15				12							
16		S-6	12' – 14'	13	37						
17				15							
18				18		Same					
19		S-7	15' – 17'	20	42						
20				11							
21				19		Same					
22		S-8	18.5'	18							
23				21							
24				24							
25				30		Same w/rock fragments					
				12							
				17							

S - SPLIT SPOON SAMPLER
U - UNDISTURBED SAMPLE
C - CORE DRILLED

DRILLING CONTRACTOR: ETD

DRILLING EQUIPMENT: Truck Rig

SCE REPRESENTATIVE: A. Sencar

SOR CONSULTING ENGINEERING, INC.				TEST BORING LOG				BORING 7	
CLIENT FVHD Architects								GSE	+59.0'
PROJECT New James Madison Elementary School #10								DATUM	Top of Pavement
LOCATION Garfield, New Jersey								DATE START	10/21/13
GROUND WATER				CAS.	SAMP.	CORE	TUBE	DATE FINISH	10/21/13
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS			
10/21/13		NE		DIA.	4-1/4"	2" OD			JOB NO. 13-C-66
				WT.		140 lbs			REPORT NO. 13-C-140
				FALL		30"			SHEET NO. 1 of 1
depth, ft	casing blows	sample type/no	depth	sampler blows per 6"	N value	DESCRIPTION			REMARKS
1						Asphalt 2" and Stone Base 2"			
2		S-1	1' - 3'	3	6	Brown medium to fine SAND, some Silt, some coarse to fine Gravel (Fill)			Moist
3				3					
4		S-2	3' - 5'	8	17	Brown medium to fine Sand, some Silt, some coarse to fine Gravel/rock fragments (SM)			
5				45					
6		S-3	5' - 6.3'	30	100/9"	Brown rock fragments, some coarse to fine Sand, some Silt (SM) (cobbles/boulders)			
7				50					
8				50/3"					
9									
10		S-4	9' - 11'	10	35	Brown coarse to fine SAND, some Silt, little coarse to fine Gravel (SM)			
11				15					
12				20					
13				18					
14									
15									
16		S-5	15' - 17'	19	73	Same w/rock fragments			
17				28					
18				45					
19		S-6	19'	50					
20				50/0"		Test Boring completed at 19' 0"			
21						(Auger and split spoon refusal)			
22									
23									
24									
25									

S - SPLIT SPOON SAMPLER
 U - UNDISTURBED SAMPLE
 C - CORE DRILLED

DRILLING CONTRACTOR: ETD

DRILLING EQUIPMENT: Truck Rig

SCE REPRESENTATIVE: A. Sencar

SOR CONSULTING ENGINEERING, INC.				TEST BORING LOG					BORING 8	
CLIENT FVHD Architects									GSE +57.0'	
PROJECT New James Madison Elementary School #10									DATUM Top of Pavement	
LOCATION Garfield, New Jersey									DATE START 10/21/13	
GROUND WATER					CAS.	SAMP.	CORE	TUBE	DATE FINISH 10/21/13	
DATE	TIME	DEPTH	CASING	TYPE	HSA	SS				
10/21/13		NE		DIA.	4-1/4"	2" OD			JOB NO. 13-C-66	
				WT.		140 lbs			REPORT NO. 13-C-140	
				FALL		30"			SHEET NO. 1 of 1	
depth, ft	casing blows	sample type/no	depth	sampler blows per 6"	N value	DESCRIPTION				REMARKS
1						Asphalt 3" and Stone Base 3"				Moist
				5						
2		S-1	1' - 3'	6	9	Brown to yellow brown medium to fine SAND, some Silt, little medium to fine Gravel (Fill)				
				3						
3				3						
				3						
4		S-2	3' - 5'	2	4	Same (Fill)				
				2						
5				8		5' 0"				
				8						
6		S-3	5' - 7'	10	23	Brown coarse to fine SAND, some Silt, some coarse to fine Gravel (SM)				
				13						
7				10						
				11						
8		S-4	7' - 9'	11	27	Brown coarse to fine SAND, little Silt, and medium to fine Gravel (SM)				
				16						
9				22						
10				19						
				25						
11		S-5	10' - 12'	33	58	Same w/rock fragments				
				30						
12										
13										
14										
15										
				18						
16		S-6	15' - 17'	28	78	Same				
				50						
17				60						
18										
19		S-7	19'	50/0"						
20						Test Boring completed at 19' 0"				
21						(Auger and split spoon refusal)				
22										
23										
24										
25										

S - SPLIT SPOON SAMPLER
U - UNDISTURBED SAMPLE
C - CORE DRILLED

DRILLING CONTRACTOR: ETD
DRILLING EQUIPMENT: Truck Rig
SCE REPRESENTATIVE: A. Sencar

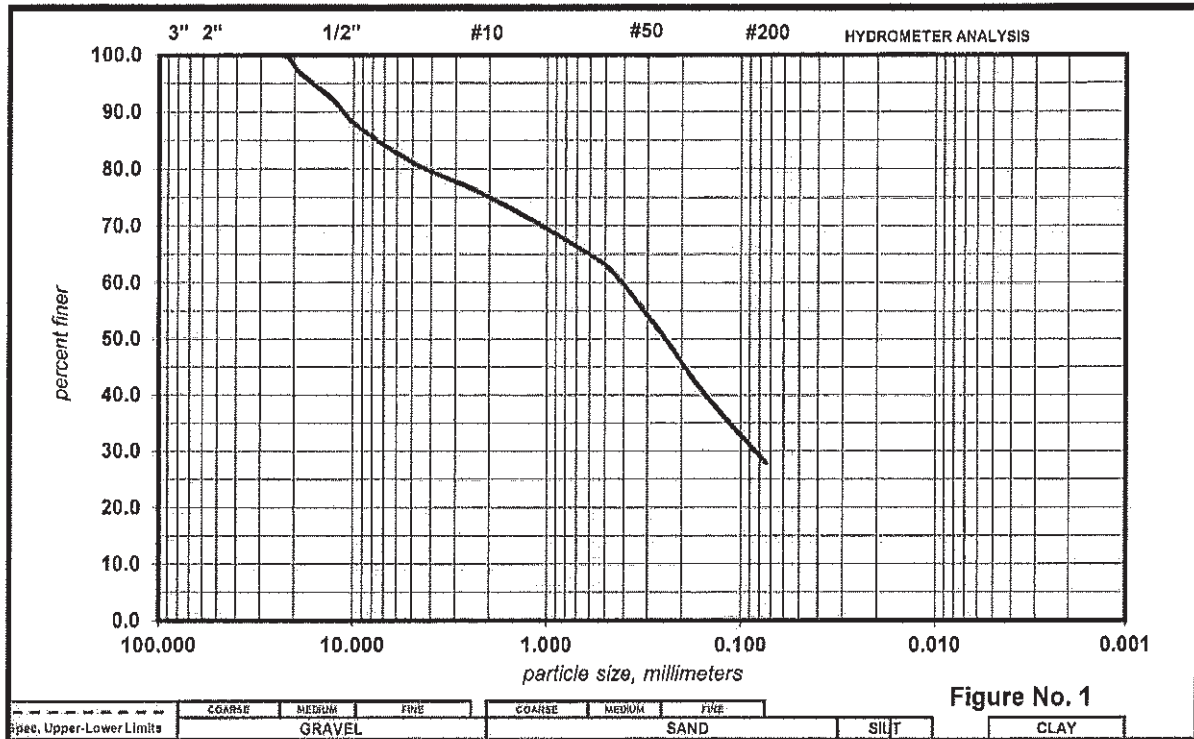
APPENDIX III

LABORATORY SOIL TEST RESULTS

SOR TESTING LABORATORIES, INC.

98 Sand Park Road - Cedar Grove, NJ 07009
Tel.: (973) 239-6001 Fax: (973) 239-8380 http://www.sorlabs.com

PARTICLE SIZE DISTRIBUTION TEST REPORT



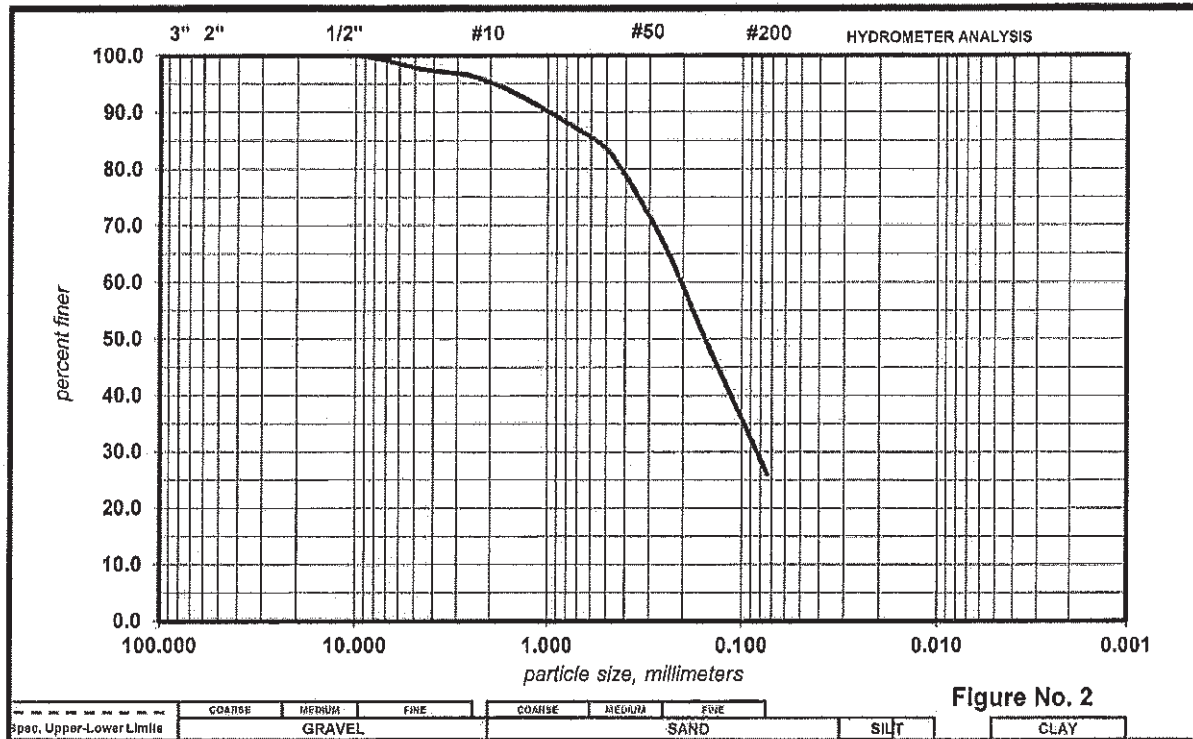
Specification*

Sieve Size	% Finer	Min.(%)	Max.(%)	Sample Identification		
3" (75 mm)				Sample No.:	B-5, S-1	
2 1/2" (63 mm)				Lab No.:	A13-209-01	
2" (50 mm)				Source/Location:	1'-3'	
1 1/2" (38.1 mm)				Description:	Dark Brown of Sand, some Silt, some mf Gravel	
1" (25 mm)	100.0					
3/4" (19 mm)	97.0					
5/8" (16 mm)				sample description in accordance with Burmister System		
1/2" (12.5 mm)	92.1			LL :	PL :	PI :
3/8" (9.5 mm)	87.5			As received Moisture Content: 10.5 %		
5/16" (8 mm)				Classification:		
1/4" (6.3 mm)						
#4 (4.75 mm)	80.8			USCS: [SM]		
#6 (3.35 mm)				AASHTO:		
#8 (2.36 mm)				Remarks:		
#10 (2 mm)	75.1					
#14 (1.4 mm)				Sample received in lab on October 23, 2013		
#16 (1.18 mm)				Client:		
#20 (850 µm)						
#30 (600 µm)	64.9			Project:		
#40 (425 µm)	60.5					
#50 (300 µm)				Location:		
#60 (250 µm)	50.6					
#100 (150 µm)	39.7			Date:		
#200 (75 µm)	27.9					
* -				Job No.:	13-C-66	Report No.: 13-C-140

SOR TESTING LABORATORIES, INC.

98 Sand Park Road - Cedar Grove, NJ 07009
Tel.: (973) 239-6001 Fax: (973) 239-8380 <http://www.sorlabs.com>

PARTICLE SIZE DISTRIBUTION TEST REPORT



Specification*				Sample Identification		
Sieve Size	% Finer	Min.(%)	Max.(%)	Sample No.:	B-6, S-1	
3" (75 mm)				Lab No.:	A13-209-02	
2 1/2" (63 mm)				Source/Location:	1'-3'	
2" (50 mm)				Description:	Dark Brown of SAND, some Silt, trace fine Gravel	
1 1/2" (38.1 mm)				sample description in accordance with Burmister System		
1" (25 mm)				LL :	PL :	PI :
3/4" (19 mm)				As received Moisture Content: 10.2 %		
5/8" (16 mm)	100.0			Classification:		
1/2" (12.5 mm)				USCS: [SC]		
3/8" (9.5 mm)				AASHTO:		
5/16" (8 mm)				Remarks:		
1/4" (6.3 mm)				Sample received in lab on October 23, 2013		
#4 (4.75 mm)	97.7			Client: FVHD Architects		
#6 (3.35 mm)				Project: New James Madison		
#8 (2.36 mm)				Elementary School #10		
#10 (2 mm)	95.3			Location: Garfield, New Jersey		
#14 (1.4 mm)				Date: 25-Oct-13		
#16 (1.18 mm)				Job No.: 13-C-66		
#20 (850 µm)				Report No.: 13-C-140		
#30 (600 µm)	85.5					
#40 (425 µm)	80.0					
#50 (300 µm)						
#60 (250 µm)	66.4					
#100 (150 µm)	49.0					
#200 (75 µm)	26.1					
* -						

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PARTICLE SIZE DISTRIBUTION TEST REPORT

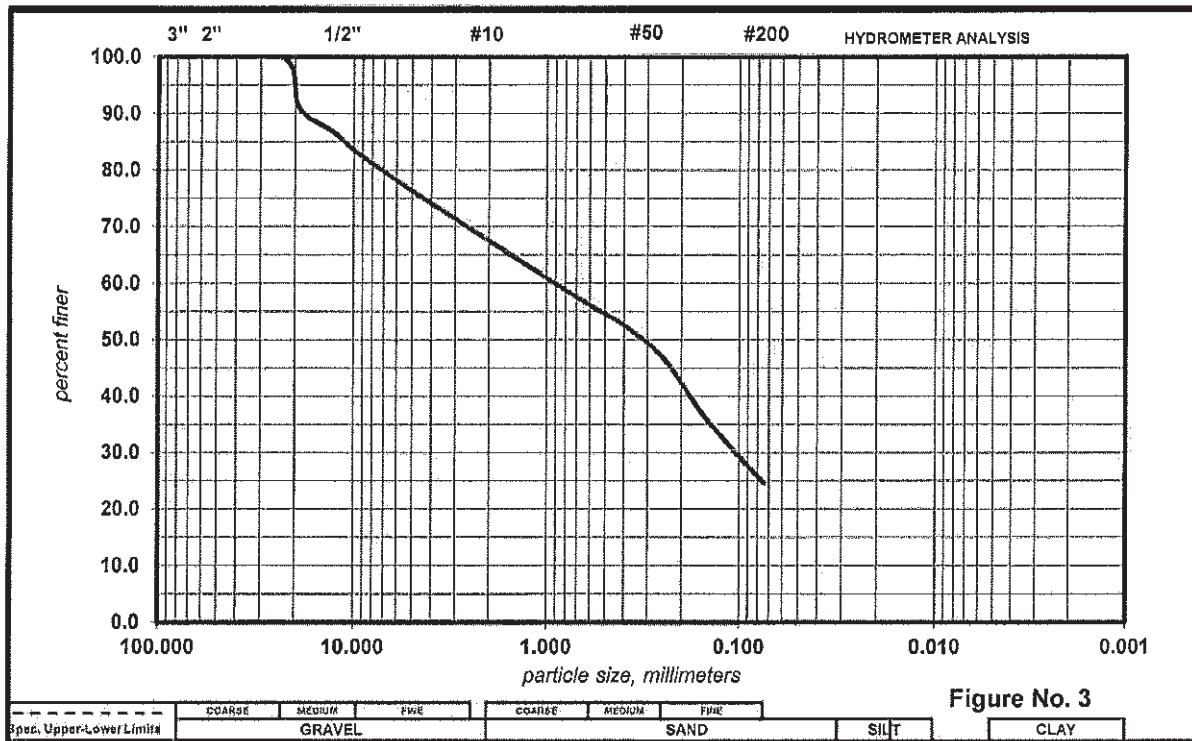


Figure No. 3

Specification*				Sample Identification		
Sieve Size	% Finer	Min.(%)	Max.(%)	Sample No.: B-7, S-2		
3" (75 mm)				Lab No.: A13-209-03		
2 1/2" (63 mm)				Source/Location: 3'-5'		
2" (50 mm)				Description:		
1 1/2" (38.1 mm)				Dark Brown of Sand, some Silt, some mf Gravel		
1" (25 mm)	100.0			sample description in accordance with Burmister System		
3/4" (19 mm)	90.9					
5/8" (16 mm)				LL :	PL :	PI :
1/2" (12.5 mm)	86.7			As received Moisture Content: 16.4 %		
3/8" (9.5 mm)	83.1			Classification:		
5/16" (8 mm)				USCS: [SM]		
1/4" (6.3 mm)				AASHTO:		
#4 (4.75 mm)	75.8			Remarks:		
#6 (3.35 mm)				Sample received in lab on October 23, 2013		
#8 (2.36 mm)				Client: FVHD Architects		
#10 (2 mm)	67.5					
#14 (1.4 mm)				Project: New James Madison		
#16 (1.18 mm)				Elementary School #10		
#20 (850 µm)				Location: Garfield, New Jersey		
#30 (600 µm)	56.0			Date: 25-Oct-13		
#40 (425 µm)	53.1			Job No.: 13-C-66		
#60 (250 µm)	46.9			Report No.: 13-C-140		
#100 (150 µm)	36.0					
#200 (75 µm)	24.6					

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PARTICLE SIZE DISTRIBUTION TEST REPORT

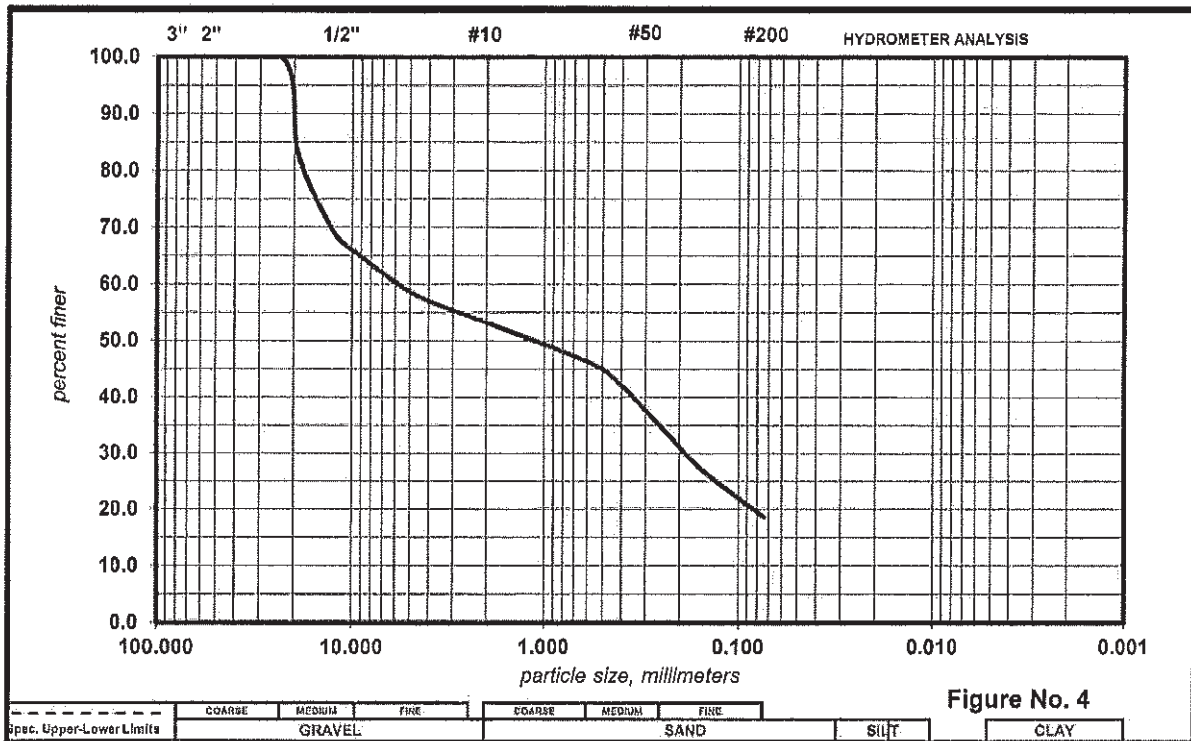


Figure No. 4

Specification*				Sample Identification		
Sieve Size	% Finer	Min.(%)	Max.(%)	Sample No.: B-8, S-4		
3" (75 mm)				Lab No.: A13-209-04		
2 1/2" (63 mm)				Source/Location: 7'-9'		
2" (50 mm)				Description:		
1 1/2" (38.1 mm)				D.Red.Br. of Sand, little Silt, and mf Gravel		
1" (25 mm)	100.0			sample description in accordance with Burmister System		
3/4" (19 mm)	82.5			LL :	PL :	PI :
5/8" (16 mm)				As received Moisture Content: 7.1 %		
1/2" (12.5 mm)	69.6			Classification:		
3/8" (9.5 mm)	65.5			USCS: [GM]		
5/16" (8 mm)				AASHTO:		
1/4" (6.3 mm)				Remarks:		
#4 (4.75 mm)	58.3			Sample received in lab on October 23, 2013		
#6 (3.35 mm)				Client: FVHD Architects		
#8 (2.36 mm)				Project: New James Madison		
#10 (2 mm)	53.2			Elementary School #10		
#14 (1.4 mm)				Location: Garfield, New Jersey		
#16 (1.18 mm)				Date: 25-Oct-13		
#20 (850 µm)				Job No.: 13-C-66		
#30 (600 µm)	46.3			Report No.: 13-C-140		
#40 (425 µm)	42.9					
#50 (300 µm)						
#60 (250 µm)	34.8					
#100 (150 µm)	26.7					
#200 (75 µm)	18.7					
*-						

APPENDIX IV

LIMITATIONS

SOR CONSULTING ENGINEERS, INC

LIMITATIONS

The conclusions and recommendations contained in this geotechnical report no. 13-C-140 are based upon the applicable standards of our profession at the time this report was prepared.

The analyses and recommendations submitted in this report are based in part upon the data obtained from eight widely-spaced test borings. Four borings were performed previously by Schoor DePalma and four borings were performed by Sor Consulting Engineers, Inc. The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types. However, the transition between soil types may be gradual.

In our opinion, the number of explorations performed for this study are adequate for a general understanding of the site subsurface conditions. However, the nature and extent of variations between the explorations may not become evident until construction. If, during construction, variations become evident, it will be necessary to re-evaluate the recommendations of this report.

In the event that any changes in the nature, design or location of the proposed school building are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

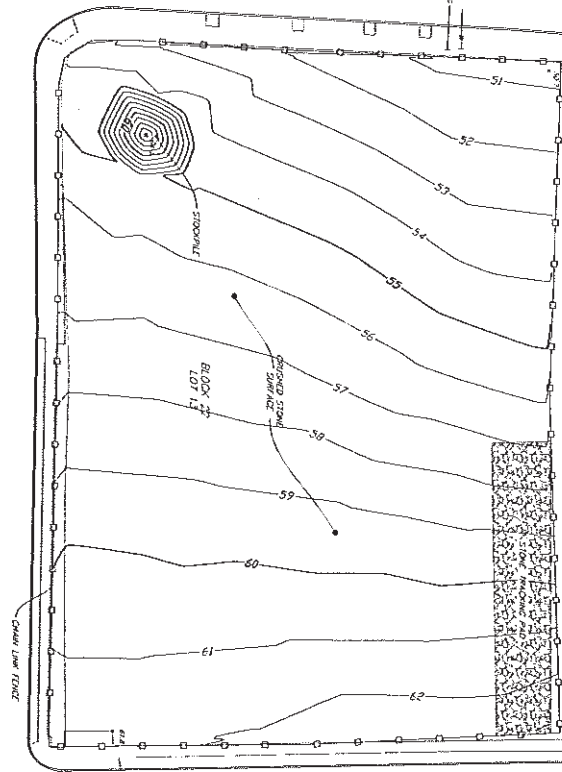
This report may be referred to or included in the project specifications for general information purposes only, but should not be solely used as the technical specifications for the work.

This geotechnical engineering report was prepared for the project by Sor Consulting Engineers, Inc. for design purposes only, and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope is limited to design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

This report has been prepared in accordance with generally accepted geotechnical engineering practices for the exclusive use of FVHD Architects and/or their authorized representatives for specific application to the design of the proposed new James Madison Elementary School to be located at 98 Marsellus Place in Garfield, New Jersey. No other warranty, expressed or implied, is made.

MARSELLUS PLACE

PASSIAC ST.



LINCOLN PLACE



NOTE:
1. VERTICAL DATUM NAD 83
2. UTILITY LOCATION APPROXIMATE, NO LONGER
VISIBLE IN THE FIELD

DATE
1/1/15
BY
J

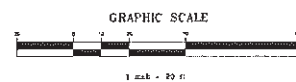
TOPOGRAPHIC SURVEY
BLOCK 22, LOT 13
CARFIELD
BERGEN COUNTY, NEW JERSEY

Mountain View Layout
Land Surveying & Construction, Inc.
www.MountainViewLayout.com
117 Morris Avenue - Rockaway, NJ 07866-0022

MARC J. GIFFONE
PROFESSIONAL LAND SURVEYOR

MARC J. GIFFONE N.J.P.L.S. L.C. NO. 0541329
DATE: 03/12/2015
BY: MJC
CHECKED: DCA
APPROVED: CWC

REVISIONS
1004 3/26/2015



SDA

STATE OF NEW JERSEY



EXHIBIT 1
EXHIBIT 2
EXHIBIT 3

PHASE 2
DEMOLITION OF EXISTING JAMES MADISON SCHOOL #10
CARTER SCHOOL DISTRICT
CARTER SCHOOL DISTRICT
CARTER SCHOOL DISTRICT

REV. R000
DATE 3/10/2015

DRAWING TITLE
As-Built Drawing

DRAWING NO.
AB-001



SCALE: 1"=20'

EXISTING CONDITIONS PLAN

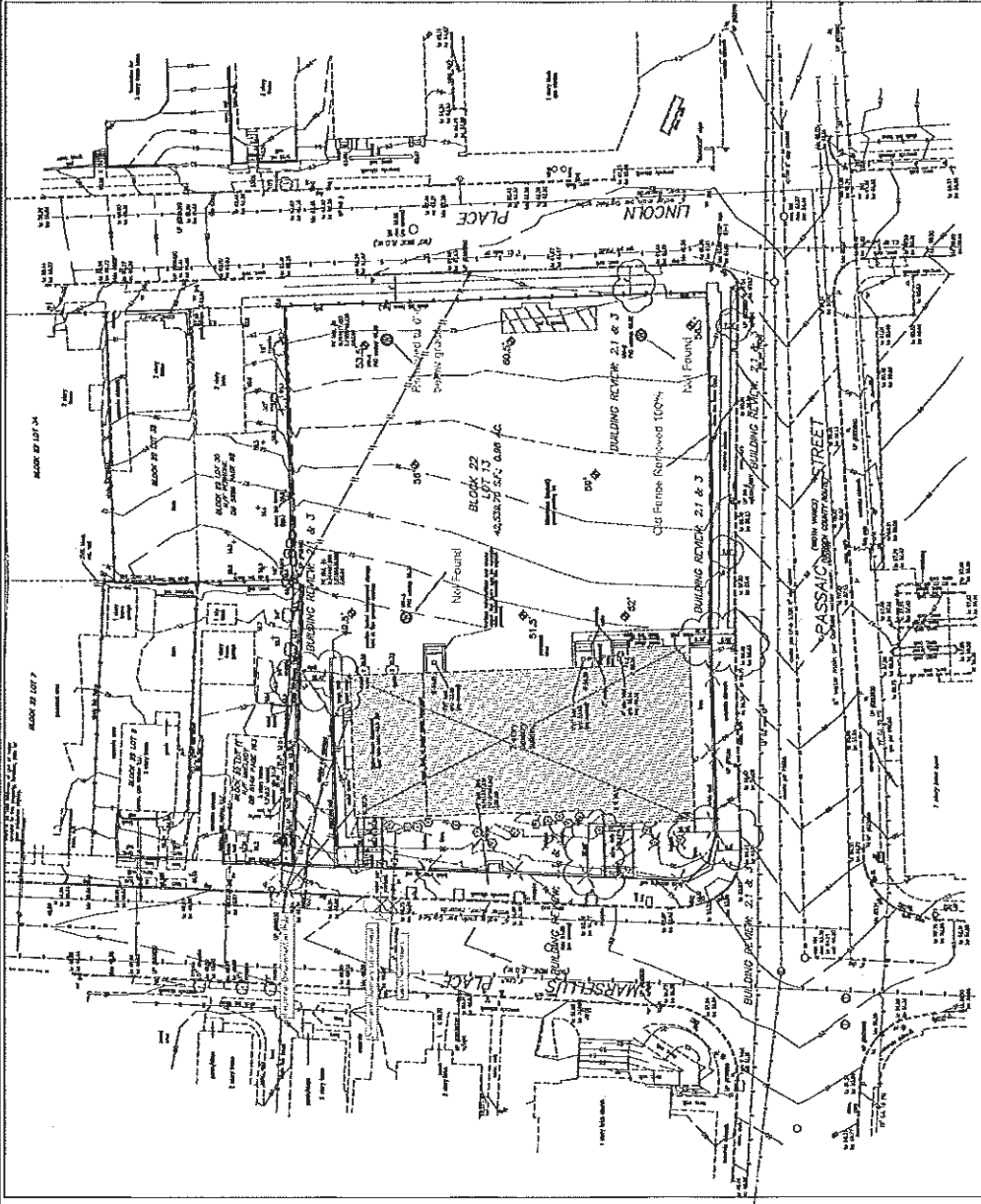


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SECTION 13915 - FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
 - 2. Automatic wet-type, Class I, fire-suppression standpipes and branches for sprinklers.
 - 3. **Preaction, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers operated by fire-detection system.**
- B. Related Sections include the following:
 - 1. Division 2 Section "Water Distribution" for piping outside the building.
 - 2. Division 16 Section 16724 "Fire Alarm System" for alarm devices not specified in this Section.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig (1200 kPa).
- D. PE: Polyethylene plastic.
- E. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).
- B. High-Pressure Piping System Component Working Pressure: Listed for 300 psig (2070 kPa).
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Libraries, Except Stack Areas: Light Hazard.
 - e. Library Stack Areas: Ordinary Hazard, Group 2.
 - f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - g. Office and Public Areas: Light Hazard.
 - h. Stage Area: Ordinary Hazard, Group 2.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. (4.1 L/min. per sq. m over 139 sq. m or 4.1 mm/min. over 139 sq. m).
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1500 sq. ft. (6.1 L/min. per sq. m over 139 sq. m or 6.1 mm/min. over 139 sq. m).
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft. (8.1 L/min. per sq. m over 139 sq. m or 8.1 mm/min. over 139 sq. m).
 - d. Special Occupancy Hazard: As determined by authorities having jurisdiction.
 - 4. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 225 sq. ft. (20.9 sq. m).
 - b. Storage Areas: 130 sq. ft. (12.1 sq. m).
 - c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
 - 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and Section 15 Seismic.

1.6 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials, including dielectric fittings and sprinkler specialty fittings.
 - 2. Pipe hangers and supports, including seismic restraints.
 - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 5. Hose connections, including size, type, and finish.
 - 6. Hose stations, including size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
 - 7. Monitors.
 - 8. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 - 9. Alarm devices, including electrical data.
 - 10. Air compressors. Include electrical data.**
 - 11. Preaction valves, cabinets and accessories.**
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Fire-hydrant flow test report.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Contractor performing fire protection equipment work shall have the appropriate certification issued by the NJ Division of Fire Safety.

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

- 2.1 All system components and hardware shall be in accordance with NFPA 13, 2002 chapter 6.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or approved equal.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

2.4 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Ductilic, Inc.
 - 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.
- D. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250).

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- E. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250); with factory- or field-formed, roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Ductilic, Inc.
 - 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

2.5 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Industries, Inc.; Wilkins Div.
- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig (1200-kPa) minimum working-pressure rating as required for piping system.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.

- d. Watts Industries, Inc.; Water Products Div.
- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products and Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
 - 1. Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.6 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.7 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig (1725-kPa) minimum working-pressure rating if fittings are components of high-pressure piping system.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufacturers:
 - a. Central Sprinkler Corp.

- b. Fire-End and Croker Corp.
 - c. Viking Corp.
 - d. Victaulic Co. of America.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Potter-Roemer; Fire-Protection Div.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Manufacturers:
 - a. AGF Manufacturing Co.
 - b. Central Sprinkler Corp.
 - c. G/J Innovations, Inc.
 - d. Triple R Specialty of Ajax, Inc.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
 - 1. Manufacturers:
 - a. CECA, LLC.
 - b. Merit.

2.8 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating. Valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
 - 1. NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - 2. NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 3. NPS 3 (DN 80): Ductile-iron body with grooved ends.
 - 4. Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.
- C. Butterfly Valves: UL 1091.

1. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Global Safety Products, Inc.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Mueller Company.
 - 5) NIBCO.
 - 6) Pratt, Henry Company.
 - 7) Victaulic Co. of America.
- D. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 1. Manufacturers:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Co.; Waterous Co.
 - c. Central Sprinkler Corp.
 - d. Clow Valve Co.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Firematic Sprinkler Devices, Inc.
 - h. Globe Fire Sprinkler Corporation.
 - i. Grinnell Fire Protection.
 - j. Hammond Valve.
 - k. Matco-Norca, Inc.
 - l. McWane, Inc.; Kennedy Valve Div.
 - m. Mueller Company.
 - n. NIBCO.
 - o. Potter-Roemer; Fire Protection Div.
 - p. Reliable Automatic Sprinkler Co., Inc.
 - q. Star Sprinkler Inc.
 - r. Stockham.
 - s. United Brass Works, Inc.
 - t. Venus Fire Protection, Ltd.
 - u. Victaulic Co. of America.
 - v. Watts Industries, Inc.; Water Products Div.
- E. Gate Valves: UL 262, OS&Y type.
 1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.

- 4) United Brass Works, Inc.

2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.

- a. Manufacturers:

- 1) Clow Valve Co.
- 2) Crane Co.; Crane Valve Group; Crane Valves.
- 3) Crane Co.; Crane Valve Group; Jenkins Valves.
- 4) Hammond Valve.
- 5) Milwaukee Valve Company.
- 6) Mueller Company.
- 7) NIBCO.
- 8) Red-White Valve Corp.
- 9) United Brass Works, Inc.

2.9 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.10 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating. Control valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

- a. AFAC Inc.
- b. Central Sprinkler Corp.
- c. Firematic Sprinkler Devices, Inc.
- d. Globe Fire Sprinkler Corporation.
- e. Grinnell Fire Protection.
- f. Reliable Automatic Sprinkler Co., Inc.
- g. Star Sprinkler Inc.

- h. Venus Fire Protection, Ltd.
 - i. Victaulic Co. of America.
 - j. Viking Corp.
2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- B. Dry-Pipe Preaction Valves: Pre-assembled fire protection valve package enclosed within a free-standing cabinet. System shall be a double interlock electric/pneumatic design. UL 260; differential type; 175-psig (1200-kPa) working pressure; with cast-iron flanged inlet and outlet, bronze seat with O-ring seals, and single-hinge pin and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.**
1. Option: Grooved-end connections for use with keyed couplings.
 2. Air-Pressure Maintenance Devices: To be included in pre-assembled cabinet. Automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) maximum inlet pressure.

Air Compressor: Fractional horsepower, 115-V ac, 60 Hz, single phase.
 3. Manufacturers
 - a. TYCO Inc.
 - b. Central Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Sprinkler Corporation.
 - e. Grinnell Fire Protection.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Star Sprinkler Inc.
 - h. Venus Fire Protection, Ltd.
 - i. Victaulic Co. of America.
 - j. Viking Corp.

2.11 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating. Sprinklers shall have 250-psig (1725-kPa) minimum pressure rating if sprinklers are components of high-pressure piping system.

- B. Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Firematic Sprinkler Devices, Inc.
 - 3. Globe Fire Sprinkler Corporation.
 - 4. Grinnell Fire Protection.
 - 5. Reliable Automatic Sprinkler Co., Inc.
 - 6. Star Sprinkler Inc.
 - 7. Victaulic Co. of America.
 - 8. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
 - 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Pendent sprinklers.
 - 3. Quick-response sprinklers.
 - 4. Sidewall sprinklers.
 - 5. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch (25-mm) vertical adjustment.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.12 HOSE CONNECTIONS

- A. Description: UL 668, 300-psig (2070-kPa) minimum pressure rating, brass, hose valve for connecting fire hose. Include 90-degree angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 2-1/2 (DN65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Pressure-regulating type.
 - 2. Finish: Rough brass.

2.13 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Elkhart Brass Mfg. Co., Inc.
 - 3. Fire-End and Croker Corp.
 - 4. Guardian Fire Equipment Incorporated.
 - 5. Potter-Roemer; Fire-Protection Div.
 - 6. Reliable Automatic Sprinkler Co., Inc.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig (1200-kPa) minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR."
 - 1. Type: Exposed, projecting, with two inlets and round escutcheon plate.
 - 2. Finish: Polished brass.

2.14 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- (250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN 20) inlet and NPS 1 (DN 25) drain connections.
 - 1. Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Globe Fire Sprinkler Corporation.
 - c. Grinnell Fire Protection.
 - d. Reliable Automatic Sprinkler Co., Inc.
 - e. Star Sprinkler Inc.
 - f. Viking Corp.
- C. Electrically Operated Alarm: UL 464, with 8-inch- (200-mm-) minimum-diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.
- D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. ITT McDonnell & Miller.
 - c. Potter Electric Signal Company.
 - d. System Sensor.
 - e. Viking Corp.
 - f. Watts Industries, Inc.; Water Products Div.
- E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.

2.15 PRESSURE GAGES

- A. Manufacturers:
 1. AMETEK, Inc.; U.S. Gauge.
 2. Brecco Corporation.
 3. Dresser Equipment Group; Instrument Div.
 4. Marsh Bellofram.
 5. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.
 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
- E. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.
- F. Standpipes: Use the following:
 - 1. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - 3. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
 - 4. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
 - 5. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 - 6. NPS 5 and NPS 6 (DN125 and DN150): Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:
 - 1. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. NPS 2 (DN 50): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
5. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
6. NPS 4 to NPS 6 (DN 100 to DN 150): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
7. NPS 4 to NPS 6 (DN 100 to DN 150): Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
8. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Dry-Pipe Preaction Sprinklers: Use the following:

1. NPS 1-1/2 (DN40) and Smaller: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 2. NPS 1-1/2 (DN40) and Smaller: Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
 3. NPS 1-1/2 (DN40) and Smaller: Type L (Type B) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
 4. NPS 1-1/2 (DN40) and Smaller: Type M (Type C) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
 5. NPS 2 (DN50): Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 6. NPS 2 (DN50): Galvanized, standard-weight steel pipe with plain ends; locking-lug fittings; and twist-locked joints.
 7. NPS 2 (DN50): Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 8. NPS 2 (DN50): Type L (Type B) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
 9. NPS 2 (DN50): Type M (Type C) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
 10. NPS 2 (DN50): Type L (Type B) copper tube with roll-grooved ends; copper, grooved-end fittings; copper, keyed couplings; and grooved joints or Type L (Type B) copper tube with expanded and roll-grooved ends; copper fittings with expanded and roll-grooved ends; steel, keyed couplings; and grooved joints.
 11. NPS 2-1/2 to NPS 4 (DN65 to DN100): Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 12. NPS 2-1/2 to NPS 4 (DN65 to DN100): Galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
 13. NPS 2-1/2 to NPS 4 (DN65 to DN100): Type L (Type B) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
 14. NPS 2-1/2 to NPS 4 (DN65 to DN100): Type M (Type C) copper tube with plain ends, cast- or wrought-copper fittings, and brazed joints.
- NPS 2-1/2 to NPS 4 (DN65 to DN100): Type L (Type B) copper tube with roll-grooved ends; copper fittings with grooved ends; copper, keyed couplings; and grooved joints or Type L (Type B) copper tube with expanded and roll-grooved

ends; copper fittings with expanded and roll-grooved ends; steel, keyed couplings; and grooved joints.

3.6 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.7 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
 - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - 1. NPS 2 (DN 50) and Smaller: Use dielectric unions, couplings, or nipples.
 - 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
 - 3. NPS 5 (DN 125) and Larger: Use dielectric flange insulation kits.

3.8 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.9 WATER-SUPPLY CONNECTION

- A. Connect fire-suppression piping to building's fire water distribution piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.10 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.

- I. Install sprinkler zone control valves, test assemblies, and drain risers in accessible locations.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping and to NFPA 14 for standpipes.
- M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- O. Fill wet-standpipe system piping with water.
- P. Fill wet-pipe sprinkler system piping with water.

3.11 VALVE INSTALLATION

- A. Refer to Division 15 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- D. Specialty Valves:
 - 1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
- E. **Dry-Pipe Preaction Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.**
 - 1. **Air-Pressure Maintenance Devices for Dry-Pipe Preaction Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.**

2. **Install air compressor and compressed-air supply piping.**
3. **Install compressed-air supply piping from building compressed-air piping system.**

3.12 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
 1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Pendent, dry sprinklers, Sidewall, dry sprinklers.
 5. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

3.13 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.14 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.15 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

- E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- F. Electrical Connections: Power wiring is specified in Division 16.
- G. Connect alarm devices to fire alarm.
- H. Ground equipment according to Division 16 Section "Grounding."
- I. Connect wiring according to Division 16 Section "Wires and Cables."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.16 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 15 Section "Mechanical Identification."

3.17 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 5. Coordinate with fire alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.18 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

3.19 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 13915

SECTION 15194 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This Section includes fuel gas piping, specialties, and accessories within the building.
- B. Related Sections include the following:
 - 1. Division 15 Section "Meters and Gages" for pressure gages.

1.3 PROJECT CONDITIONS

- A. Gas System Pressure: One pressure range. 0.25 psig (3.45 kPa) or less.
- B. Design values of fuel gas supplied for these systems are as follows:
 - 1. Nominal Heating Value: 1000 Btu/cu. ft. (37.3 MJ/cu. m).
 - 2. Nominal Specific Gravity: 0.6.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
- B. Shop Drawings: For fuel gas piping. Include plans and attachments to other Work. Retain subparagraph below if equipment includes wiring.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Maintenance Data: For natural gas specialties and accessories to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ANSI Standard: Comply with ANSI Z223.1, "National Fuel Gas Code."
- C. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.
- D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.
- E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.7 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufactures or approved equal:
 - 1. Appliance Connector Valves:
 - a. American Valve.
 - b. B&K Industries, Inc.
 - c. Brass Craft Manufacturing Co.

- d. Cimberio Valves, S. p. A.
 - e. Conbraco Industries, Inc.; Apollo Div.
 - f. E. M. Plastic and Electric Products, Ltd.; Neo Valve Div.
 - g. Frey: John M. Frey Co.
 - h. Jomar International, Ltd.
 - i. Key Gas Components, Inc.
 - j. Legend Valve and Fitting, Inc.
 - k. McDonald: A. Y. McDonald Mfg. Co.
 - l. Mueller Co.; Mueller Gas Products Div.
 - m. Newman Hattersley, Ltd.; Specialty Valve Div.
 - n. Robert Manufacturing Co.
 - o. State Metals, Inc.
 - p. Watts Industries, Inc.; Water Products Div.
2. Gas Valves, NPS 2 (DN 50) and Smaller:
- a. BMI Canada, Inc.
 - b. Crane Valves.
 - c. Dungs: Karl Dungs, Inc.
 - d. Flow Control Equipment, Inc.
 - e. Grinnell Corp.
 - f. Honeywell, Inc.
 - g. Jomar International, Ltd.
 - h. Kitz Corp. of America.
 - i. Legend Valve and Fitting, Inc.
 - j. Lyall: R. W. Lyall & Co., Inc.
 - k. McDonald: A. Y. McDonald Mfg. Co.
 - l. Milwaukee Valve Co., Inc.
 - m. Mueller Co.; Mueller Gas Products Div.
 - n. Nibco, Inc.
 - o. Red-White Valve Corp.
 - p. Velan Valve Corp.
 - q. Watts Industries, Inc.; Water Products Div.
3. Plug Valves, NPS 2-1/2 (DN 65) and Larger:
- a. Flow Control Equipment, Inc.
 - b. Milliken Valve Co., Inc.
 - c. Nordstrom Valves, Inc.
 - d. Olson Technologies, Inc.; Homestead Valve Div.
 - e. Walworth Co.
4. Automatic Gas Valves:
- a. ASCO General Controls.
 - b. ASCOLECTRIC, Ltd.
 - c. Automatic Switch Co.
 - d. Dungs: Karl Dungs, Inc.
 - e. Eaton Corp.; Controls Div.

- f. Eclipse Combustion, Inc.
 - g. GPS Gas Protection Systems, Inc.
 - h. Honeywell, Inc.
 - i. Johnson Controls, Inc.
- 5. Electrically Operated Gas Valves:
 - a. ASCO General Controls.
 - b. Atkomatic Valve Co., Inc.
 - c. Automatic Switch Co.
 - d. Dungs: Karl Dungs, Inc.
 - e. Eclipse Combustion Inc.
 - f. Goyen Valve Corp.
 - g. Magnatrol Valve Corp.
 - h. Parker Hannifin Corp.; Climate & Industrial Controls Group; Skinner Valve Div.
- 6. Line Pressure Regulators:
 - a. American Meter Co.
 - b. Donkin: Bryan Donkin RMG Canada, Ltd.
 - c. Eclipse Combustion, Inc.
 - d. Equimeter, Inc.
 - e. Fisher Controls International, Inc.
 - f. Maxitrol Co.
 - g. National Meter.
 - h. Richards Industries, Inc.; Jordan Valve Div.
 - i. Schlumberger Industries; Gas Div.
- 7. Appliance Pressure Regulators:
 - a. Canadian Meter Co., Inc.
 - b. Eaton Corp.; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Co.
 - e. SCP, Inc.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.

2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. PE Pipe: ASTM D 2513, SDR 11.

1. **PE Fittings:** ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. **PE Transition Fittings:** Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. **Anodeless Service-Line Risers:** Factory fabricated and leak tested.
 - a. **Underground Portion:** PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. **Casing:** Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. **Aboveground Portion:** PE transition fitting.
 - d. **Outlet shall be threaded or flanged or suitable for welded connection.**
 - e. **Tracer wire connection.**
 - f. **Ultraviolet shield.**
 - g. **Stake supports with factory finish to match steel pipe casing or carrier pipe.**
4. **Transition Service-Line Risers:** Factory fabricated and leak tested.
 - a. **Underground Portion:** PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. **Outlet shall be threaded or flanged or suitable for welded connection.**
 - c. **Bridging sleeve over mechanical coupling.**
 - d. **Factory-connected anode.**
 - e. **Tracer wire connection.**
 - f. **Ultraviolet shield.**
 - g. **Stake supports with factory finish to match steel pipe casing or carrier pipe.**
5. **Steel Mechanical Couplings:** Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - a. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) **Dresser Piping Specialties; Division of Dresser, Inc.**

2) Smith-Blair, Inc.

- b. Stainless-steel flanges and tube with epoxy finish.**
- c. Buna-nitrile seals.**
- d. Stainless-steel bolts, washers, and nuts.**
- e. Factory-installed anode for steel-body couplings installed underground.**

- C. Transition Fittings: Type, material, and end connections to match piping being joined.
- D. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.4 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere.

2.5 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.
- B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.6 SPECIALTY VALVES

- A. Valves, NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
- B. Valves, NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
- C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.
- D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig (13.8-kPa) minimum pressure rating.
- E. Gas Valves, NPS 2 (DN 50) and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig (860-kPa) pressure rating.
 - 1. Tamperproof Feature: Include design for locking.
- F. Plug Valves, NPS 2-1/2 (DN 65) and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig (860-kPa) pressure rating.

1. Tamperproof Feature: Include design for locking.
- G. General-Duty Valves, NPS 2-1/2 (DN 65) and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig (860-kPa) pressure rating.
 1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.
 2. Butterfly Valves: MSS SP-67, lug type with lever handle.
- H. Automatic Gas Valves: ANSI Z21.21, with electrical operator for actuation by appliance automatic shutoff device.
 1. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

2.7 PRESSURE REGULATORS

- A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
 1. NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 2. NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 3. Line Pressure Regulators: ANSI Z21.80 with 2-psig- (13.8-kPa-) minimum inlet pressure rating.
 4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
- B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

3.2 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code of NJ for installation and purging of natural-gas piping.**
- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 02221 Section "Trenching, Backfilling and Compaction."**
 - 1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.**
 - 2. Install underground, PE, natural-gas piping according to ASTM D 2774**

3.3 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.**
- B. Fuel Gas Piping, 0.5 psig (3.45 kPa) or Less: Use the following:**
 - 1. NPS 1/2 (DN 15) and Smaller: NPS 3/4 (DN 20) steel pipe, malleable-iron threaded fittings, and threaded joints.**
 - 2. NPS 3/4 and NPS 1 (DN 20 and DN 25): Steel pipe, malleable-iron threaded fittings, and threaded joints.**
 - 3. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): Steel pipe, malleable-iron threaded fittings, and threaded joints.**
 - 4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Steel pipe, steel welding fittings, and welded joints.**
 - 5. Larger Than NPS 4 (DN 100): Steel pipe, steel welding fittings, and welded joints.**
- C. Underground Fuel Gas Piping: Steel pipe, steel welding fittings, and welded joints. Encase in containment conduit.**
- D. Containment Conduits: Steel pipe, steel welding fittings, and welded joints.**
- E. Gas Service Piping at Meters and Regulators, Above 5 psig (34.5 kPa): Steel pipe, steel welding fittings, and welded joints.**

3.4 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig (3.45 kPa) or Less: Appliance connector valve or gas stop.**
- B. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.**
- C. Piping Line Valves, NPS 2-1/2 (DN 65) and Larger: Plug valve or general-duty valve.**
- D. Valves at Service Meter, NPS 2 (DN 50) and Smaller: Gas valve.**

- E. Valves at Service Meter, NPS 2-1/2 (DN 65) and Larger: Plug valve.

3.5 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
 - 2. In Floors: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in floors, subject to approval of authorities having jurisdiction. Surround piping cast in concrete slabs with minimum of 1-1/2 inches (40 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Gas piping may be installed in floor channels, subject to approval of authorities having jurisdiction. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - a. Exception: Tubing passing through partitions or walls.
 - 5. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
 - 6. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - a. Exception: Accessible above-ceiling space specified above.
- C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.

- E. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- G. Connect branch piping from top or side of horizontal piping.
- H. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- I. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
- J. Install pressure gage upstream and downstream from each line pressure regulator.
- K. Install flanges on valves, specialties, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- L. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- M. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches (100 mm) outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (16 mm).

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches (1800 mm) of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment.
 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
 2. Do not use gas pipe as grounding electrode.

3.9 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.
 1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 2. Refer to Division 15 Section "Mechanical Identification" for nameplates and signs.

3.10 PAINTING

- A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.
- B. Paint exterior service meters, pressure regulators, and specialty valves.
 1. Color: Gray.

3.11 FIELD QUALITY CONTROL

- A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

3.12 ADJUSTING

- A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 15194

SECTION 15970 – HVAC CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION

- A. The PC workstation and building management system provided under this contract shall communicate with the existing Siemens central PC workstation and building management system located in the Garfield Board of Education building.

The current Siemens district-wide building management system has a central graphic monitoring PC workstation at the Garfield Board of Education Building. This PC is connected to the school district's corporate network monitoring each of eight existing remote schools' respective Siemens BMS systems. The intent of this project is to have The Garfield Board of Education to use the existing Siemens PC Workstation as the central building management to communicate, monitor and command the new building management system in the James Madison School. Also as part of this contract, the new building management system shall send all information to the Garfield Board of Education's Siemens central PC over the school district's corporate network. This allows the user to have a single seat from which to perform daily operation and have central alarming capability.

The system shall be capable of BACnet communication according to ASHRAE standard SPC-135A/95. The system shall not be limited to only use open communication protocols, but also be able to integrate a wide variety of third-party devices and applications via existing vendor protocols and through the latest software standards. This contractor shall provide proof of experience with integration of the type outlined in this specification.

This contractor shall include all costs for joint commissioning with Siemens to ensuring full seamless integration between existing Siemens systems and new systems installed under this project. This contractor with Siemens shall test actual field operation of each control and sensing point. Compare the values read at the BACnet device with what is read at the existing Siemens PC workstation at the Board of Education.

1.3 CONTRACTOR QUALIFICATIONS

- A. Qualified Bidders: Basis of design are systems as manufactured by Siemens Building Technologies, Inc. alternate manufacturers include; Johnson Controls, Automated Logic and Andover.
- B. All automatic temperature control wiring; line voltage and low voltage shall be installed by a New Jersey licensed Electrical Contractor.
 - 1. The ATC Contractor shall submit a copy of the electrical permit at the time of submittal of the automatic temperature control equipment.
- C. All Microprocessor based digital controllers shall be provided with EEPROM non-volatile memory. Battery backed up memory shall be used only to maintain the time clock function in the controller. Any controller which does not have EEPROM memory shall be provide with a 12 hour UPS power supply for each controller.
- D. All controls must be provided by a direct factory sales office or a factory authorized sales representative. Distributors, dealers and wholesalers of control products or third party contractors whose primary business is not that of an Automatic Temperature Control Contractor are not acceptable.
- E. Longevity: The Facilities Management System Contractor shall have a minimum of ten years experience in manufacturing, installing, and servicing computerized Facilities Management Systems (FMS). All subcontractors utilized by the FMS contractor shall have a minimum of five years experience within their appropriate trades.
- F. Personnel, Coverage, and Response Capabilities: The FMS contractor shall have a minimum of three full time electronic service personnel within a 90 mile radius of the project location. One of the three full time electronic service personnel must work within a 60 mile radius of the project location.
 - 1. The FMS contractor shall have a designated engineering department composed of at least three full time engineers within a 90 mile radius of the project location.
 - 2. The FMS contractor shall have an established 24-hour emergency service organization. A dedicated telephone number shall be provided to the owner for requesting emergency service. A maximum of eight hour, electronic service technician on site response time shall be guaranteed by the FMS contractor.
- G. Past Projects: The FMS contractor shall have completed a minimum of five projects within the last five years which are at least equal in dollar and scope to this project.
- H. Engineered Drawings: All control drawings shall be generated using Computer Aided Drafting. All project drawings shall be supplied to the owner on an MS-DOS formatted diskette using the DXF file format upon

project completion. Further additions or changes to the FMS shall be reflected upon the CAD drawings.

1.4 WORK BY OTHERS

- A. Sheet Metal Subcontractor:
 - 1. Setting of automatic control dampers, smoke control dampers, and necessary blank off plates.
 - 2. Access doors where and as required.
- B. Heating Contractor:
 - 1. Installation of immersion wells and pressure taps.
 - 2. Installation of flow switches.
 - 3. Setting of automatic control valves.
 - 4. Installation of pressure taps and associated shut-off cocks.
- C. Electrical Subcontractor:
 - 1. All power wiring to the starters and control panels other than ATC panels.

1.5 ELECTRICAL WORK FOR CONTROLS (BY ATC)

- A. Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the electrical drawings shall be included in Division 15.
- B. Power wiring (120v) for the ATC System: control valve, damper actuators, DDC controllers, DDC control panels, shall be provided by the ATC Contractor. The Electrical Contractor, as part of his contract, shall provide 1P-20A circuit breakers in the power and lighting distribution panels. See electrical drawings for panelboard locations.
- C. Electrical work shall, in general, comply with the following:
 - 1. All low voltage wiring in finished rooms shall be concealed. If any wiring must be exposed in rooms it shall be installed in wiremold raceway.
 - 2. Electrical work may include both line voltage and low voltage wiring, as required.
 - 3. Conduit network for power systems may be used for running control high voltage wiring.
 - 4. All electrical work shall comply with the N.E.C. and local electrical codes.

5. All safety devices shall be wired through both hand and auto positions of motor starting device to insure 100% safety shut-off.
6. All magnetic starters furnished by Mechanical Contractor for control transformers, sized to handle the additional VA needed for the controls – pilots, EP valves, etc.
7. The motor starter supplier shall provide auxiliary contacts as required for interlock by FMS Contractor, the supplier shall estimate an allowance of at least one auxiliary contact per starter. All interlock and control wiring shown on the electrical prints or in the electrical specifications is by the electrical subcontractor.
8. Low voltage plenum rated wiring can be run exposed above accessible ceiling. Wiring shall be neatly tied to pipes, EMT, or other devices and not laid on ceiling tile. All control wiring in mechanical spaces shall be installed in EMT.
9. All ATC wiring – line voltage and low voltage shall be installed by a New Jersey licensed Electrical Contractor.

1.6 DRAWINGS AND LAYOUTS

- A. The FMS manufacturer shall submit description of operation and schematic drawings of the System to the Engineer for approval before starting work. At least eight sets of submittals shall be sent through channels. At least four sets of operator and maintenance manuals with "as built" drawings, parts lists, etc., shall be provided at job completion.

1.7 CONTROL EQUIPMENT AND DEVICES

- A. The control system shall include all necessary and specified control equipment properly installed in accordance with specifications and drawings, and shall include the automatic control of the following:
- B. Control Dampers: Dampers required in the temperature and smoke control functions of the automatic control system shall be factory fabricated and shall be manufactured by the ATC Systems Manufacturer. All dampers shall be sized as shown on drawings or as specified. All damper frames shall be constructed of 13 gauge galvanized sheet metal or extruded aluminum of 12 gauge thickness, and shall have a flange or duct mounting. The blades shall be parallel or opposed, as required, and suitable for the air velocities to be encountered in the system. Replaceable Butyl rubber seals are to be provided on damper blades and installed along with the top and bottom of the frame. Stainless steel damper blades and seals shall be installed inside the frame sides. Seals and bearings shall be able to withstand temperatures ranging from minus 40 degrees F to plus 200 degrees F. Dampers shall be leak rated for 3 CFM/foot squared at 1" WG and 10 CFM/foot squared at 4" WG or less in full closed position at 4" WG pressure differential across damper.

Damper blades shall not exceed 6" in width. All blades shall not exceed 6" in width. All blades are to be corrugated type construction, fabricated from two sheets of #22 gauge galvanized sheet steel, spot welded together. Blades are to be suitable for high velocity performance. Damper blades shall

be a maximum of 48" long. Longer units shall be fabricated in sections. Dampers shall be Ruskin CD-60 or Johnson Controls D-1300.

- C. **Control Valves:** Valves shall be sized by the control manufacturer to produce the required capacity at a pressure loss not exceeding the allowable pressure drop indicated on the drawing. Nominal body rating shall be not less than 125 PSI. However, the valve body and packing selected shall be sized to withstand the system static head plus the maximum pump head and the maximum temperature of the control medium, chilled water, steam, and/or hot water. Two-way modulating valves shall have close-off ratings exceeding the maximum pressure difference, at any load condition, between the outlet and inlet. Each valve shall be equipped with proper packing to assure there will be no leakage at the valve stem.
- D. **Operators:** All damper or valve operators shall be 0 to 10vdc electric and be provided for each automatic damper or valve and shall be of sufficient capacity to operate the damper or valve under all conditions and to guarantee tight close-off of valves, as specified, against system pressure encountered. Damper operators shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as indicated. Valve operators shall be spring return or DDC failsafe operated to fail to safe position if the associated fan system is off. Damper and valve operators are to be made out of diecast metal; no plastic or sheet metal bodies will be allowed.
- E. **Sensors and Controllers:**
 - 1. Differential Pressure Switch for water shall have a single-pole, single-throw (SPST) contact, adjustable set point, UL rated 6 amperes at 120 volts, 100 psig design, and shall be Johnson Controls P74 Series with automatic reset, or equal. Each switch shall be provided with isolation and drain valves.
 - 2. Differential Pressure Switch for air shall have a single-pole, single-throw (SPST) contact, adjustable set point, UL rated 9.8 amperes at 120 volts, and shall be Johnson Controls P32 Series or equal.
 - 3. Low Limit Thermostats shall be of manual reset type, with set point adjustment. The sensing element shall be 20 foot minimum and shall be installed completely across the coil. When any one-foot of the element senses a temperature as low as the set point, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms or as desired. Thermostat shall be Johnson Controls A70 or equal.
 - 4. Duct Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of $\pm$

1% over the full range. The output shall be compatible with the panel it serves.

5. Duct Averaging Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of $\pm 1\%$ over the full range. The output shall be compatible with the panel it serves. Transmitter shall be with 17 feet of sensor capillary.
6. Space Temperature Transmitter shall contain an RTD sensing element to monitor room air temperatures in the range of 30 degrees F to 90 degrees F, unless indicated otherwise. The transmitter shall be factory calibrated to an accuracy of $\pm 1\%$. The assembly shall be installed within a metal ventilated enclosure suitable for wall mounting. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
7. Pipe Temperature Transmitter shall contain an RTD sensing element to monitor water temperature. The Contractor shall provide brass wells of sufficient size for the pipe to be installed. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
8. Outdoor Air Temperature Transmitter shall contain an RTD sensing element mounting in an enclosure rated for outdoor use. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
9. Humidity Transmitter Duct shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 4\%$ over the range of 10 to 80% RH. The output shall be proportional VDC over a cable pair.
10. Humidity Transmitter Outside Air shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 2\%$ over the range 20 to 90% RH. The output shall be a 4 to 20 Ma signal over a shielded cable pair. Transmitter shall have outside weather enclosure. Transmitter shall be General Eastern RH-1 or equal.
11. Humidity Transmitter Space shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 3\%$ over the range of 20 to 60% RH. The output shall be proportional VDC over a cable pair.
12. Pressure Transducer shall be for steam service and have a stainless steel sensor. The device shall output a 4-20 milliamp signal, which is linear in relation to the sensed pressure. Accuracy shall be $\pm .05\%$ of the full scale. Power shall be from the controller and range from 22-26 volts DC. The unit shall have temperature compensation so that

thermal effects are no more than $\pm .05\%$ of the full scale from 0-175 DEGF. The unit shall be suitable for the media and pressure measured.

13. Differential Pressure Transducer shall be for air or water service. The device shall output a 4-20 milliamp signal, which is linear in relation to the sensed pressure. Accuracy shall be $\pm .01\%$ of full scale. The power shall be from the controller and shall be in the range of 22-26 volts DC. The unit shall have temperature compensation so that thermal effects are no more than $\pm .05\%$ of the full scale from 32-100 DEGF. The transducer shall be suitable for the media and pressure measured.

PART 2 - FACILITY MANAGEMENT SYSTEM

2.1 GENERAL PRODUCT DESCRIPTION

- A. The Facility Management System (FMS) shall be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.
- B. The FMS shall consist of the following:
 1. Metasys NAE Supervisory Controller with embedded web access.
 2. Standalone Application Specific Controllers (Application Specific Controllers)
 3. Operator's desk top computer workstation.

The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Application Specific Controllers, and operator devices.

- C. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
- D. The Facility Management System shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, fire management, access control, lighting control, information management, and historical data collection and archiving.
- E. The Facility Management System shall consist of the following:
 1. Standalone DDC panels
 2. Application specific controllers (HVAC etc.)
 3. Local Display Device capability
 4. Portable Operator's Terminal capability
 5. Personal Computer Operator Workstations

The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, standalone DDC panels, and operator devices.

- F. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
- G. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device, such as a central file server. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations, terminals, and printers without dependence upon a central processing device or File Server.

2.2 NETWORKING/COMMUNICATIONS

The design of the FMS shall be networked as shown on the attached system configuration drawing. Inherent in the system's design shall be the ability to expand or modify the network either via a local network, auto-dial telephone line modem connections, or a combination of the two networking schemes.

- A. Local Network
 - 1. Personal Computer/Panel Support: The Personal Computer and Metasys NAE panel shall directly oversee a local network such that communications may be executed directly to and between Application Specific Controllers. The NAE Supervisory Controller version shall be referred to as the "Digital Panel(s)" throughout this document.
 - 2. Data Access: All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all point status and application report data on the network. Access to system data shall not be restricted by the hardware configuration of the facility management system.
 - 3. Global Data Sharing: Global Data Sharing or global point broadcasting shall allow point data to be shared between Application Specific Controllers, when it would be inefficient or impractical to locate multiple sensors. Global data sharing between N30 Controllers and N2 devices shall have no predefined limits.
 - 4. General Network Design: Network design shall include the following provisions:

- a. Data transfer rates for alarm reporting and quick point status from multiple Application Specific Controllers. The minimum baud rate shall be 56 K baud.
 - b. Support of any combination of Application Specific Controllers. A minimum of 200 Application Specific Controllers shall be supported on a single local network. The bus shall be addressable for up to 320 Application Specific Controllers.
 - c. Detection of single or multiple failures of Application Specific Controllers or the network media.
 - d. Error detection, correction, and retransmission to guarantee data integrity.
 - e. Commonly available, multiple-sourced, networking components shall be used.
 - f. Use of an industry standard protocol, such as Optomux, and IEEE RS-485 communications interface.
- B. Dial-up Communications: Auto-dial/auto-answer communications shall be provided to allow Digital Panels to communicate with remote operator terminals on an occasional basis via telephone lines.
 - 1. Dial-up Digital Panels: Auto-Dial Digital Panels shall automatically place calls to remote terminals to report critical alarms.
 - a. Digital Panels shall analyze and prioritize all alarms to minimize the initiation of calls. Non-critical alarms shall be buffered in memory and reported as a group of alarms, or until an operator manually requests an upload of all alarms.
 - b. The auto-dial program shall include provisions for handling busy signals, "no-answers", and incomplete data transfers. Default devices shall be called when communications cannot be established with primary devices.
 - 2. Dial-up Remote Operator Terminals: Operators at dial-up remote operator terminals shall be able to perform all control functions, all report functions, and all data base generation and modification functions as described for local operator terminals connected via the RS-232 port. Routines shall be provided to automatically answer calls, and display information sent from remote Digital Panels. The fact that communication is taking place with remote control systems over telephone lines shall be completely transparent to an operator.
 - a. An operator shall be able to access remote buildings by selecting any facility by its logical name or associated telephone numbers.
 - b. Alarm and data file transfers handled via dial-up transactions shall not interfere with local network activity, nor shall local network activity keep the remote operator's terminal from handling incoming calls.
 - c. Both local and remote operators shall be able to access and perform functions with the Digital Panel simultaneously.

3. Modem Characteristics: Dial-up communications shall make use of zoom compatible 57,600-baud modems and voice grade telephone lines.
4. The design of the FMS shall network operator workstation and Standalone DDC Panels as shown on the attached system configuration drawing. Inherent in the system's design shall be the ability to expand or modify the network either via a local area network, or auto-dial telephone line modem connections, or via a combination of the two networking schemes.

2.3 DIGITAL PANELS

- A. General: Digital Panels shall be microprocessor-based, multi-tasking, multi-user, digital control processors.
- B. Memory: Each Digital Panel shall have sufficient memory to support its own operating system and data bases including:
 1. Control processes
 2. Energy Management Applications
 3. Alarm Management
 4. Trend Data
 5. Maintenance Support Applications
 6. Operator I/O
 7. Dial-Up Communications
 8. Manual Override Monitoring
- C. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.
- D. Serial Communication Ports: Digital Panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices, such as laptop computers, Personal Computers, and Video Display terminals.
- E. Hardware Override Monitoring: Digital Panels shall monitor the status of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited.
- F. Integrated On-Line Diagnostics: Each Digital Panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. Digital Panels shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each Digital Panel.

- G. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.
- H. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of the Digital Panel to prevent the loss of database or operating system software.

Flash based non-volatile memory for storage of database.

Upon restoration of normal power, the Digital Panel shall automatically resume full operation without manual intervention.

- I. Minimum Panel Configuration
 - 1. Support dial-in and dial-out at speeds up to 57,600 baud. (9600 baud no longer acceptable).
 - 2. Up to ten (10) Metasys Digital Panels shall be networked on existing Ethernet wide area networks (WANs).
 - 3. BAC NET on Ethernet peer to peer bus.
 - 4. PC workstation can be connected via Ethernet, dial-up, or direct connection.
 - 5. Three (3) configurable RS-232 ports.
 - 6. BAC NET compatible scheduling.
 - 7. UL listed for energy management (UL 916).
 - 8. Online-offline data base generation.
 - 9. Flexible alarm routing.
 - 10. Power-fail restart, built-in.
 - 11. Support the Internet Protocol (IP) implementation of BAC NET defined in Annex J of the ASHRAE standard.

2.4 STANDALONE DDC PANELS

- A. General: Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the attached point list.
- B. Memory: Each DDC panel shall have sufficient memory to support its own operating system and databases including:

1. Control processes
 2. Energy Management Applications
 3. Alarm Management
 4. Historical/Trend Data for all points
 5. Maintenance Support Applications
 6. Custom Processes
 7. Operator I/O
 8. Dial-Up Communications
 9. Manual Override Monitoring
- C. Point types: Each DDC panel shall support the following types of point inputs and outputs:
1. Digital Inputs for status/alarm contacts
 2. Digital Outputs for on/off equipment control
 3. Analog Inputs for temperature, pressure, humidity, flow, and position measurements
 4. Analog Outputs for valve and damper position control, and capacity control of primary equipment
 5. Pulse Inputs for pulsed contact monitoring
- D. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators.

The system architecture shall support 25% expansion capacity of all types of DDC panels, and all point types included in the initial installation.

- E. Serial Communication Ports: Standalone DDC panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard printers, laptop workstations, PC workstations, and panel mounted or portable DDC panel Operator's Terminals. Standalone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.
- F. Hardware Override Switches: As indicated in the point schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard hand/off/auto operator override switches for binary control points and gradual switches for analog control type points. These override switches shall be operable whether the panel is powered or not.

- G. Hardware Override Monitoring: DDC panels shall monitor the status or position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.
- H. Local Status Indicator Lamps: The DDC panel shall provide local status indication for each binary input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
- I. Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each DDC panel, and shall not require the connection of an operator I/O device.
- J. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980.
- K. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of all standalone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

Should DDC panel memory be lost for any reason, the panel will automatically receive a download via the local area network, phone lines, or connected computer. In addition, the user shall have the capability of reloading the DDC panel via the local area network, via the local RS-232C port, or via telephone line dial-in.

2.5 CONTROLLER SOFTWARE FEATURES

- A. General:
 - 1. All necessary software to form a complete operating control system, as described in this specification, shall be provided.
 - 2. The software programs specified in this section shall be provided as an integral part of the Digital Panel, and shall not be dependent upon any higher level computer for execution.
- B. Control Software Description:
 - 1. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

2. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- C. Energy Management Applications: Digital Panels shall have the ability to perform any or all of the following energy management routines:
1. Time of Day Scheduling
 2. Calendar Based Scheduling
 3. Holiday Scheduling
 4. Optimal Start
 5. Optimal Stop
 6. Demand Limiting
 7. Load Rolling
 8. Heating/Cooling Interlock

All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment described in the "Execution" portion of this specification.

- D. Programming Capability: Digital Panels shall be able to execute configured processes defined by the user to automatically perform calculations and control routines.
1. Process Inputs and Variables: It shall be possible to use any of the following in a configured process:
 - a. Any system-measured point data or status
 - b. Any calculated data
 - c. Any results from other processes
 - d. Boolean logic operators (and, or)
 2. Process Triggers: Configured processes may be triggered based on any combination of the following:
 - a. Time of day
 - b. Calendar Date
 - c. Other processes
 - d. Events (e.g., point alarms)
 3. Data Access: A single process shall be able to incorporate measured or calculated data from any and all other Application Specific Controllers.

In addition, a single process shall be able to issue commands to points in any and all other Application Specific Controllers on the local network.

- E. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each Digital Panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.

At no time shall the Digital Panel's ability to report alarms be affected by either operator activity at the local I/O device, or communications with other Application Specific Controllers on the network.

1. Point Change Report Description: All alarm or point change reports shall include the points' English language description, and the time and date of occurrence.
2. Prioritizing: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Users shall have the ability to manually inhibit alarm reporting for each point.

The user shall also be able to define conditions under which point changes need to be acknowledged by an operator, and/or logged for analysis at a later date.

3. Report Routing: Alarm reports and messages shall be directed to an operator device.
 4. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response. Each Digital Panel shall be capable of storing a library of at least 100 Alarm Messages. Each message must be capable of being assigned to any number of points in the panel.
 5. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until a manual request is received, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.
- F. Trend Analysis: A data collection utility shall be provided to automatically sample, store, and display system data.

Measured and calculated analog and binary data shall be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 24 hours, in one-minute or one-hour intervals, shall be provided. Each Digital Panel shall have a dedicated buffer for trend data, and shall be capable of storing 16 trend logs. Each trend log shall have up to four points trended at 48 data samples each. Data shall be sorted at the Digital Panel, and uploaded to floppy disk storage when archival is desired.

- G. Runtime Totalization: Digital Panels shall automatically accumulate and store runtime hours for binary input and output points specified in the "Execution" portion of this specification.
 - 1. The Totalization routine shall have a sampling resolution of one minute.
 - 2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.
- H. Pulse Totalization: Digital Panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
 - 1. Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g. KWH, gallons, KBTU, tons, etc.).
 - 2. The Totalization routine shall have a sampling resolution of one minute.
 - 3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
 - 4. The information available from the Pulse Totalization shall include, but not be limited to, the following:
 - a. Peak Demand, with date and time stamp
 - b. 24-hour Demand Log
 - c. Accumulated KWH for day
 - d. Sunday through Saturday KWH usage
 - e. Sunday through Saturday Demand KW
 - f. Demand KW annual history for past 12 periods
 - g. KWH annual history for past 12 periods
- I. Event Totalization: Digital Panels shall have the ability to count events, such as the number of times a pump or fan system is cycled on and off.
 - 1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
 - 2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.6 SYSTEM SOFTWARE FEATURES

- A. General
 - 1. All necessary software to form a complete operating system as described in this specification shall be provided.
 - 2. The software programs specified in this section shall be provided as an integral part of the DDC panel and shall not be dependent upon any higher level computer for execution.

B. Control Software Description:

1. Pre-Tested Control Algorithms: The DDC panels shall have the ability to perform the following pre-tested control algorithms:
 - a. Two Position Control
 - b. Proportional Control
 - c. Proportional plus Integral Control
 - d. Proportional, Integral, plus Derivative Control
 - e. Automatic Control Loop Tuning
2. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
3. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
4. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

C. Energy Management Applications:

1. DDC Panels shall have the ability to perform any or all of the following energy management routines:
 - a. Time of Day Scheduling
 - b. Calendar Based Scheduling
 - c. Holiday Scheduling
 - d. Temporary Schedule Overrides
 - e. Optimal Start
 - f. Optimal Stop
 - g. Night Setback Control
 - h. Enthalpy Switch Over (Economizer)
 - i. Peak Demand Limiting
 - j. Temperature Compensated Load Rolling
 - k. Fan Speed/CFM Control
 - l. Heating/Cooling Interlock
 - m. Hot Water Reset
2. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow operator customization. Programs shall be applied to building equipment as described in the Execution portion of this specification.

D. Custom Process Programming Capability: DDC panels shall be able to execute custom, job-specific processes defined by the operator, to automatically perform calculations and special control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:

- a. Any system-measured point data or status
 - b. Any calculated data
 - c. Any results from other processes
 - d. User-Defined Constants
 - e. Arithmetic functions (+, -, *, /, square root, exponential, etc.)
 - f. Boolean logic operators (and, or, exclusive or, etc.)
 - g. On-delay/Off-delay/One-shot timers
 2. Process Triggers: Custom processes may be triggered based on any combination of the following:
 - a. Time interval
 - b. Time of day
 - c. Date
 - d. Other processes
 - e. Time programming
 - f. Events (e.g., point alarms)
 3. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other DDC panels on the local area network. In addition, a single process shall be able to issue commands to points in any and all other DDC panels on the local area network.
 4. Advisory/Message Generation: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device, buffer the information in a follow-up file, or cause the execution of a dial-up connection to a remote device such as a printer.
 5. Custom Process Documentation: The custom control-programming feature shall be self-documenting. All interrelationships defined by this feature shall be documented via graphical flowcharts and English language descriptors.
- E. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC Workstation or local I/O device, or communications with other panels on the network.
1. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
 2. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during

system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.

3. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices or PC disk files used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
4. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 65-character alarm message to more fully describe the alarm condition or direct operator response.

Each standalone DDC panel shall be capable of storing a library of at least 250 Alarm Messages. Each message may be assigned to any number of points in the panel.

5. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.
 6. Transaction Logging: Operator commands and system events shall be automatically logged to disk in Personal Computer industry standard database format. Operator commands initiated from Direct-connected workstations, dial-up workstations, and local DDC panel Network Terminal devices shall all be logged to this transaction file. This data shall be available at the Operator Workstation. A utility shall be provided to allow the user to search the transaction file using standard database query techniques, including searching by dates, operator name, data point name, etc. In addition, this transaction file shall be accessible with standard third party database and spreadsheet packages.
- F. Historical Data and Trend Analysis: A variety of Historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways:
1. Continuous Point Histories: Standalone DDC panels shall store Point History Files for all analog and binary inputs and outputs.

The Point History routine shall continuously and automatically sample the value of all analog inputs at half-hour intervals. Samples for all points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output

points and analog output points shall include a continuous record of the last ten status changes or commands for each point.

2. Control Loop Performance Trends: Standalone DDC panels shall also provide high resolution sampling capability in one-second increments for verification of control loop performance.
 3. Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours shall be provided. Each standalone DDC panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 5000 data samples.
 4. Data Storage and Archiving: Trend data shall be stored at the Standalone DDC panels, and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file format compatible with Third Party personal computer applications.
- G. Runtime Totalization: Standalone DDC panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification.
1. The Totalization routine shall have a sampling resolution of one minute or less.
 2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.
- H. Analog/Pulse Totalization: Standalone DDC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. KWH, gallons, KBTU, tons. etc.).
 2. The Totalization routine shall have a sampling resolution of one minute or less.
 3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
- I. Event Totalization: Standalone DDC panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.
1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.7 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

- A. Each Digital Panel shall be able to extend its monitoring and control through the use of standalone Application Specific Controllers (ASC).
- B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- C. Each ASC shall have sufficient memory to support its own operating system and data bases including:
 1. Control Processes
 2. Energy Management Applications
 3. Operator I/O (Portable Service Terminal)
- D. The operator interface to any ASC point data or programs shall be through the Digital Panel or portable operator's terminal connected to any ASC on the network.
- E. Application Specific Controllers shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following:
 1. Display temperatures
 2. Display status
 3. Display set points
 4. Display control parameters
 5. Override binary output control
 6. Override analog set points
 7. Modification of gain and offset constants
- F. Powerfail Protection: All system set points, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.
- G. Application Descriptions:
 1. VAV Terminal Controllers:

- a. VAV Terminal Unit Controllers shall support, but not be limited to, the control of the following configurations of VAV boxes to address current requirements described in the "Execution" portion of this specification, and for future expansion:
 - 1) Single Duct Only (Cooling only, or cooling with Reheat
 - 2) Supply/Exhaust
- b. VAV Terminal Unit Controllers shall support the following types of point inputs and outputs:
 - 1) Proportional Cooling Outputs
 - 2) Box and Baseboard Heating Outputs (Proportional, or 1 to 3 Stages)
 - 3) Fan Control Output (On/Off Logic, or Proportional Series Fan Logic)
- c. VAV Terminal Unit Controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this specification, and for future expansion:
 - 1) Daily Schedules
 - 2) Comfort/Occupancy Mode
 - 3) Economy Mode
 - Standby Mode/Economizer Available
 - Unoccupied/Economizer Not Available
 - Shutdown
 - 4) Lighting Logic Interlock to Economy Mode
 - 5) Temporary Override Mode
 - Temporary Comfort Mode (Occupancy-Based Control)
 - Boost (Occupant Warner/Cooler Control)
- d. Occupancy-based Economy/Comfort Mode Control: Each VAV Terminal Unit Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the VAV Terminal Unit Controller shall automatically select either an Economy or Comfort mode.
- e. Occupancy-Based Zone Lighting Control: VAV Terminal Unit Controllers shall provide an auxiliary binary output to serve as the interface to an associated lighting relay. Based upon the status of either an occupancy sensing device or manual wall switch, the VAV Terminal Unit Controller shall provide a contact output to automatically turn on or off the lights. This accommodates occupant requirements while reducing electrical consumption. Economy/Comfort (described in the previous section) and Lighting overrides shall be served by the same occupancy override input.
- f. Temporary Override Modes
 - 1) Temporary Occupancy Mode: The controller interface to the zone temperature sensor shall allow for an optional momentary switch to change the mode of the controller from economy to comfort and optionally interlock the room lights for a preset amount of time.

- 2) Boost Mode: The controller interface to the zone temperature sensor shall allow for an optional momentary switch to override the controller's output to full heating or cooling. This command shall be active for a preset amount of time, to anticipate a substantial change in the room's load.
- g. Continuous Zone Temperature Histories: Each VAV Terminal Unit Controller shall automatically and continuously maintain a history of the associated zone temperature. This allows users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
 - h. Alarm Management: Each VAV Terminal Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
2. Unitary Controllers:
 - a. Unitary Controllers shall support, but not be limited to, the following types of systems to address specific applications described in the "Execution" portion of this specification, and for future expansion:
 - 1) Heat Pumps (Air-to-Air, Water-to-Air)
 - 2) Packaged Rooftops
 - 3) Fan Coils (Two-Pipe, Four-Pipe)
 - b. Unitary Controllers shall support the following types of point inputs and outputs:
 - 1) Economizer Switchover Inputs
 - Dry bulb
 - Outdoor Air Enthalpy
 - Differential Temperature
 - Binary Input from a separate controller
 - 2) Economizer Outputs
 - Integrated Analog with minimum position
 - Binary output to enable self-contained economizer actuator
 - 3) Heating and Cooling Outputs
 - 1 to 3 Stages
 - Analog Output with two-pipe logic
 - Reversing valve logic for Heat Pumps
 - 4) Fan Output
 - On/Off Logic Control
 - c. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this specification, and for future expansion:
 - 1) Daily Schedules
 - 2) Comfort/Occupancy Mode

- 3) Economy Mode
 - Standby Mode/Economizer Available
 - Unoccupied/Economizer Not Available
 - Shutdown
 - 4) Lighting Logic Interlock to Economy Mode
 - 5) Temporary Override Mode
 - Temporary Comfort Mode (Occupancy-Based Control)
 - Boost (Occupant Warmer/Cooler Control)
 - d. Occupancy-Based Economy/Comfort Mode Control: Each Unitary Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the Unitary Controller shall automatically select either an Economy or Comfort mode.
 - e. Occupancy-Based Zone Lighting Control: Unitary Controllers shall provide an auxiliary binary output to serve as the interface to an associated lighting relay. Based upon the status of either an occupancy sensing device or manual wall switch, the Unitary Controller shall provide a contact output to automatically turn on or off the lights. This accommodates occupant requirements while reducing electrical consumption. Economy/Comfort (described in the previous section) and Lighting overrides shall be served by the same occupancy override input.
 - f. Temporary Override Modes:
 - 1) Temporary Occupancy Mode: The Controller interface to the zone temperature sensor shall allow for an optional momentary switch to change the mode of the controller from economy to comfort and optionally interlock the room lights for a preset amount of time.
 - 2) Boost Mode: the controller interface to the zone temperature sensor shall allow for an optional momentary switch to override the controller's output to full heating or cooling. This command shall be active for a preset amount of time, to anticipate a substantial change in the room's load.
 - g. Continuous Zone Temperature Histories: Each Unitary Controller shall automatically and continuously maintain a history of the associated zone temperature. This allows users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
 - h. Alarm Management: Each Unitary Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
3. Air Handling Unit (AHU) Controllers:
- a. AHU Controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in the "Execution" portion of this specification, and for future expansion:
 - 1) Air Handling Units > 15,000 CFM or < 50,000 CFM
 - Mixed Air-Single Path

Mixed Air-Dual Path
100% Single Path
100% Dual Path

- b. AHU Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.
 - c. AHU controllers shall have a library of control routines and program logic to perform the sequence of operation specified in the "Execution" portion of this specification.
 - d. Continuous Zone Temperature Histories: Each AHU Controller shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
 - e. Alarm Management: Each AHU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
4. Lab and Central Plant (DX9100) Controllers:
- a. DX9100 controllers shall support, but not be limited to, the following configurations of systems to address current requirements described in the "Execution" portion of this specification, and for future expansion.
 - 1) Single boiler or chiller plants with pump logic
 - 2) Cooling towers
 - 3) Zone pressurization of labs
 - 4) Generic system interlocking through hardware
 - b. DX9100 controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.
 - c. DX9100 controllers shall have a built in status and adjust panel interface to allow for the local adjustment of all set points, temporary override of any input or output points and status of any points in alarm.
 - d. Alarm Management: Each DX9100 controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
 - e. The DX9100 shall have its own time clock, single line display, and addressable push buttons, which will control and monitor its dedicated system and any and all systems from a single point. All other manufacturers shall provide as an equal, a resident attached, compact portable monitor controller with related software.
 - f. All systems, AHU's units shall have its own stand-alone controller.
 - g. DX LCD Display Terminal: In addition to the panel mounted DX 9100 indicating controller, provide a DX LCD terminal, which shall provide the following features:
 - 1. *Menu Operation*; allowing the operator to select from a list of functions to monitor and control the system.

2. *Point Data Screen*; to provide identification of system operating values. A system diagnostic tool showing inputs, set points and output values simultaneously.
3. *Alarm Summary Log*; to provide a quick view of current and past alarm conditions.
4. *Password Access*; to provide protection against unauthorized use.
5. *Adjusting/Overriding*; allows authorized users to adjust set points and to override outputs between defined limits.
6. *Time Schedule Definition*; to allow schedules and holidays to be added and/or changed.
7. *Trend Log Display*; provide graphical display of analog and textual digital trend values, which are supported by the DX 9100 indicating controller.
8. *Graphical Home Page*; to provide the owner a definable graphic screen which shall display a logo-mascot and line data from the DX 9100.

2.8 OPERATOR INTERFACE

- A. Basic Interface Description: (Windows 2000 platform Metasys Package)
 1. Command Entry/Menu Selection Process: Operator interface software shall minimize operator training through the use of English language prompting and English language point identification.
 2. Text-Based Display: The Operator interface shall provide consistent text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all operator devices.
 3. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
 - a. Passwords shall be exactly the same for all operator devices.
 - b. A minimum of three levels of access shall be supported:
 - Level 1= Data Access and Display
 - Level 2 = Level 1 + Operator Overrides and Commands
 - Level 3=Level 2 + Database Generation and Modification
 - c. A minimum of 4 passwords shall be supported at each Digital Panel.
 - d. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device shall be limited to only those items defined for the access level of the password used to log-on.
 - e. User-definable, automatic log-off timers of from 1-60

minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

4. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to the following:
 - a. Start-up or shutdown selected equipment
 - b. Adjust set points
 - c. Add/Modify/Delete time programming
 - d. Enable/Disable process execution
 - e. Lock/Unlock alarm reporting for each point
 - f. Enable/Disable Totalization for each point
 - g. Enable/Disable Trending
 - h. Enter temporary override schedules
 - i. Define Holiday Schedules
 - j. Change time/date
 - k. Enter/Modify analog alarm limits
 - l. Enable/Disable demand limiting
 - m. Enable/Disable duty cycle.
 5. Logs and Summaries: Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following types of reports:
 - a. A general listing of all points in the system shall include, but not be limited to, the following:
 - Points currently in alarm
 - Off-line points
 - Points currently in override status
 - Points in Weekly Schedules
 - Holiday Programming
 - b. Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups or for the entire facility without restriction due to the hardware configuration of the facility management system.
 - c. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.
- B. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
 - a. Add/Delete/Modify Application Specific Controllers
 - b. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants

- c. Add/Delete/Modify alarm reporting definition for each point.
 - d. Add/Delete/Modify energy management applications
 - e. Add/Delete/Modify time—and calendar—based programming.
 - f. Add/Delete/Modify Totalization for every point
 - g. Add/Delete/Modify Historical Data Trending for every point.
 - h. Add/Delete/Modify configured control processes
 - i. Add/Delete/Modify dial-up telecommunication definition
 - j. Add/Delete/Modify all operator passwords
 - k. Add/Delete/Modify Alarm Messages.
2. Programming Description: Definition of operator device characteristics, Application Specific Controllers, individual points, applications and control sequences shall be performed through fill-in-the-blank templates.
 - a. Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single ASC, but shall be able to include data from any and all other Application Specific Controllers to allow the development of network-wide control strategies.
 3. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hard copy printouts of all configuration and application data.
 4. Data Base Save/Restore/Back-up: Back-up copies of all ASC and digital Panel data bases shall be stored in at least one personal computer or laptop. Users shall also have the ability to manually execute downloads of an ASC or Digital Panel data base.
- C. COLOR PACKAGE – Metasys Package
- Color Graphic Displays: Color graphic floor plan displays, and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, and hot water boiler systems, shall be generated to optimize system performance analysis and speed alarm recognition. Generation of graphics shall be by the temperature control contractor.
1. System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or textbased commands.
 2. Data Displays: Dynamic temperature valves, humidity values, flow values, and status indication shall be shown in their actual respective locations, and shall automatically update to represent current conditions without operator intervention.
 3. Graphics Definition Package: Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
 - a. The FMS contractor shall provide libraries of

pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

- b. The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:
 - Define symbols.
 - Position and size symbols.
 - Define background screens.
 - Define connecting lines and curves.
 - Locate, orient and size descriptive text.
 - Define and display colors for all elements.
 - Establish correlation between symbols or text and associated system points or other displays.
- c. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points which aids the operator in the analysis of the facility. To accomplish this, the user shall be able to build graphic displays that include point data from multiple application specific controllers.
- d. Provide a minimum of 75 real time graphics. Submit to Engineer for approval.

2.9 GRAPHICAL USER INTERFACE COMPUTER HARDWARE (DESKTOP COMPUTER)

- A. The desktop computer shall consist of an Intel Pentium based laptop computer (minimum processing speed of 200 Mhz with 128 MB RAM and a 2-gigabyte minimum hard drive). It shall include a CD-ROM drive, a 3.5" floppy drive and appropriate connectors and cables for communication connection to the NAC, Ethernet, LonWorks or BACnet networks.

2.10 GRAPHICAL USER INTERFACE SOFTWARE

- A. Operating System:
 - 1. The GUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.
- B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
- a. Create, delete or modify control strategies.
 - b. Add/delete objects to the system.
 - c. Tune control loops through the adjustment of control loop parameters.
 - d. Enable or disable control strategies.
 - e. Generate hard copy records or control strategies on a printer.
 - f. Select points to be alarmable and define the alarm state.
 - g. Select points to be trended over a period of time and initiate the recording of values automatically.
- E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

- F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- H. Alarm Console
 - 1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
 - 2. When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.11 CARBON DIOXIDE SENSORS (CO₂)

- A. The carbon dioxide sensor shall be suitable for space or duct mounting as required or as indicated in the specification. This sensor shall have the capability of measuring carbon dioxide concentrations in a duct or space. It shall work on the non-dispersive infrared (NDIR) operating principle with an ambient or duct gas sampling method.
- B. The sensor shall have the following minimum requirements:
 - Range 0 – 1000 PPM
 - Accuracy +/- 5% of reading
 - Response time <4-20 milliamps
 - Relay NO of NC operation
 - Operating life-expectancy 10 years
- C. The CO(2) concentrations shall be able to be read at the touch screen display module and at the Network Control Module (NCM). The NCM will be able to trend the CO(2) concentration of each system over a 24 hour

period of time and print the information at a local printer for owner's records. The sensor shall also have the availability for local readout.

2.12 AIRFLOW MONITORING

- A. Provide airflow monitoring stations on the F.A.I., supply air, and return air of each VAV type AHU. (Provide airflow monitoring on the F.A.I. of each constant volume AHU).
- B. Acceptable Manufacturers:
 - 1. EBTRON, Inc.
 - 2. KURZ Instruments
 - 3. Sierra Instruments
 - 4. Or an approved equal.
- C. Products Included in this Section:
 - 1. Duct and plenum mounted airflow measurement devices.
 - 2. Fan inlet mounted airflow measurement devices.
- D. Airflow/Temperature Measurement Devices
 - 1. Provide airflow/temperature measurement devices where indicated on the plans. Fan inlet sensors shall not be substituted for duct or plenum sensor probes indicated on the plans.
 - a. Duct and plenum mounted sensors shall be fabricated of anodized aluminum alloy tube with 303/304 stainless steel mounting brackets.
 - b. Fan inlet probes shall be field adjustable to fit the fan inlet and have 303/304 stainless steel mounting feet.
 - 2. Each measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Each transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or volumetric rate. Each transmitter shall operate on 24 VAC.
 - 3. Each sensing point shall independently determine the airflow rate and temperature, which shall be equally weighted and averaged by the transmitter prior to output. Devices, which average multiple non-linear sensing point signals, are not acceptable. Pitot tube arrays are not acceptable.
 - 4. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location. Probes and transmitters shall not require field matching for proper operation.

5. The operating airflow range shall be 50-5,000 FPM unless otherwise indicated on the plans.
6. The operating temperature range for the measuring probes shall be -20° F to 140° F. The operating humidity range for the measuring probe shall be 0-99% RH (non-condensing).
7. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be protected from weather and water.
8. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of reading over the entire operating airflow range and be wind tunnel calibrated or verified against standards that are traceable to NIST.
 - a. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
9. Each independent temperature sensor shall have a laboratory accuracy of +/-0.15° F over the entire operating temperature range and be calibrated or verified against standards that are traceable to NIST.
10. The number of sensors for each location shall be as follows:
 - a. Ducts and plenums:

Area (sq.ft.)	Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16
 - b. Fan inlets: 2 per inlet
11. The airflow/temperature measuring device shall be capable of displaying the airflow and temperature readings of each sensor on the transmitter's LCD display.
12. The transmitter shall be capable of communicating with the host controls using the following interface options:
 - a. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
 - b. RS-485: Field selectable ModBus-RTU and Johnson Controls N2 Bus
 - c. 10 Base-T Ethernet: Field selectable ModBus TCP and TCP/IP
 - d. LonWorks Free Topology

13. Airflow/Temperature measuring devices shall be UL listed as an entire assembly.
14. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements

2.13 VARIABLE FREQUENCY DRIVES

A. General:

1. Furnish complete adjustable frequency controllers as specified herein. All standard and optional features shall be included within the VFD enclosure unless otherwise specified.
2. The variable frequency drive shall convert three phase, 60 Hz utility power to adjustable voltage and frequency. Input voltage shall be as specified on the drawing schedules.
3. The VFD shall include a converter and an inverter section. The VFD's shall also include input line reactors, or a DC Bus Choke (above 60 HP).
4. VFD shall be Utech Systems Model UTV-4000 or approved equal with a surface mounted circuit board (units 60 HP and lower). Above 60 HP units to be Utech Systems Module UV 4000, or approved equal.
5. The VFD and options shall be tested to ANSI/U1 standard 508. The complete system shall be listed by nationally recognized testing agency such as UL or ETL.
6. The VFD shall not emit either conducted or radiated RFI in excess of the limitations set forth in the FCC rules and regulations, part 15 sub-part J. The VFD shall not cause objectionable acoustical motor noise. Provide output filters if required.
7. Units to have IGBT transistors as standard to reduce motor noise.

B. Provide protective features on STD for VFD's.

C. Interface features:

1. The VFD shall be housed in NEMA 12 enclosure.
2. Provide LED keypad for indication of status and operation.

3. VFD to have terminal strip to accept N.C. safety contacts such as freezestats, smoke alarms, etc. VFD to safely shut down in any mode when contact opens.
 4. VFD shall accept a 4-20ma, 0-5VDC, 0-10VDC or a 3 -15 psi pneumatic signal (if required).
- D. Special feature options:
1. The following special features shall be included in the VFD enclosure. The unit shall maintain its UL or ETL listing.
 2. Manual bypass shall provide all the circuitry necessary to transfer the motor from the VFD to the power line, or from the line to the controller. The bypass circuitry shall be mounted in a separate section of the VFD enclosure. Overload protection shall be provided in both drive and bypass modes.
 3. A door interlocked, pad lockable, drive disconnect switch shall be provided to disconnect power from the VFD only.
 4. A second fused disconnect switch or circuit breaker shall be provided as a means of disconnecting all power to both the VFD and bypass circuits, as well as providing short circuit and locked rotor protection to the motor while in the bypass mode.

2.14 START-UP SERVICE

- A. The Manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, start-up the drive and check for proper operation.
- B. The VFD shall be warranted by the Manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the Manufacturer to provide factory authorized service.

2.15 PROGRAMMING/OPERATOR STATION

- A. Included alpha-numeric display of output current (accurate +/- 3%, regardless of output frequency), voltage reference DC bus voltage, output power, input terminal status, output terminal status LED lamp check, and EEPROM number.
- B. Alpha-numeric display of faults. Up to four (4) sequential faults shall be retained in non-volatile memory (maintained even after removal of input power).

2.16 COMMISSIONING

- A. Control system shall be set up and checked by factory trained competent technicians skilled in the setting and adjustment of the FMS equipment used in this project. This technician is to be experienced in the type of HVAC systems associated with this project.
- B. At the completion of the commissioning, this Contractor will demonstrate the sequence of operations for each system to the Architect or his representative.

2.17 TRAINING

- A. The FMS contractor will provide 16 hours of instructions to the Owner's personnel in the operation and maintenance of the control system. Training will be provided after the system has been commissioned and demonstrated to the Architect or his representative.

PART 3 – EXECUTION

3.1 BUILDING PURGE

- A. The ATC Contractor shall provide a time schedule, which shall allow the building to be placed in the purge mode for a period of up to one hour. The schedule of the purge cycle shall be determined by the owner and the consulting engineer. When the building is placed in the purge mode, all handling units, shall start and shall go into the ventilation mode. When the system is in the purge mode, the hot water valves shall close, the mechanical cooling shall be de-energized and the outdoor and relief dampers shall open, and the return dampers shall close. The discharge air low limit sensor in each unit shall position the outdoor air, return air, and relief air dampers to prevent the discharge air from falling below 50 degrees F.
- B. When the system is in the purge mode, all the building exhaust fans shall run, and all safeties shall remain active.
- C. The system shall be placed in the purge mode for a period up to one hour (adjustable), whenever the outdoor temperature is above 45 degrees F. The time schedule shall be after 5:00 P.M. on weekdays and after 2:00 P.M. on weekends.
- D. The ATC Contractor shall provide a manual override switch on the existing host computer or the zone override panel, which shall allow for manual operation of the system.

3.2 SYSTEM PHONE SUPPORT

- A. The Owner shall provide a phone line to the ATC equipment and shall pay for this service for the first year of the warranty period. The ATC Contractor

shall maintain, at his office for a period of one year after the system has been accepted, a host computer that shall contain the duplicate of the software that resides in the on site host computer.

- B. The ATC Contractor shall, through his host computer, help debug the system by means of offering on-line troubleshooting of the system and software modifications as required. The ATC Contractor shall, on a regular basis for the one-year warranty period, call up the system and identify and correct any system problems.
- C. The ATC Contractor shall provide the Owner with the necessary software programs, so that the owner shall be able to dial into the system from a remote location on either a laptop computer or desk top computer and be able to interrogate the system and to check the function of the entire system and make whatever changes he feels to change the operating parameters of the system.

3.3 FIRE ALARM SYSTEM

- A. The Fire Alarm Contractor shall provide, in the fire alarm panel, a set of dry contacts, which shall signal the network control module that the system is in the alarm mode. When the system is in the alarm mode all supply fans and exhaust fans shall be de-energized. The supply fans and exhaust fans shall return to the automatic mode when the fire alarm panel is manually reset. Provide indication at the host computer when the fire alarm panel is in alarm.

3.4 EXHAUST FANS

- A. The exhaust fans associated with selected air handling units, shall run whenever their respective supply air fans are running and their zone is in the occupied cycle.
- B. All toilet exhaust fans shall run when any unit is running in the occupied cycle in its respective zone.

3.5 CABINET HEATERS

- A. For each unit, provide an aquastat and a normally closed hot water valve. On a call for heat from the room thermostat, the hot water valve shall open. The aquastat shall cycle the unit fan motor when hot water is flowing through the hot water coil. When the space thermostat is satisfied, the hot water valve shall close, and then the aquastat shall energize the unit fan motor.

3.6 CONSTANT VOLUME AIR HANDLING UNIT, RTU-4, WITH ENTHALPY WHEEL HEAT RECOVERY

- A. The units shall be provided with integral controls as outlined under the Equipment Specification. The ATC Contractor shall provide the DDC

controller, sensors, valves, damper actuators and other required control devices to provide the following sequence of control. All ATC Controls shall be field mounted.

- B. The unit shall be indexed for occupied/unoccupied mode through its DDC controller or through a push-button O/R timer on the host computer for up to three (3) hours.
- C. When the system is in the unoccupied mode, the outdoor air shall be closed, the return air damper shall be open, the hot water valve shall be under control of room sensor to maintain a minimum space temperature, the exhaust fan shall remain off and DX cooling shall be inoperative. The space unoccupied sensor shall cycle the supply air fan to maintain a minimum space temperature of 60 degrees F. (adjustable).
- D. In the occupied cycle the supply air fan shall be energized and shall run continuously. The return air sensor shall place the system in the warm-up cycle until the return air temperature rises above 68 degrees F. (adjustable). When the system is in the warm-up cycle the outdoor air damper shall remain closed and the return air damper shall remain open. The supply air sensor through the system DDC controller shall proportionately position the hot water coil control valve to maintain a supply air temperature of 100 degrees F. When the return air temperature rises to 68 degrees F. the system shall then be placed in the ventilation mode, which shall allow the outdoor air damper to open and return air dampers to close and the exhaust fan to run.
- E. The supply air sensor shall modulate the hot water coil control valve to maintain a supply air temperature of 60 degrees F (adjustable).
- F. Provide an auto reset anti-freeze stat in the air duct of the unit on the leaving airside of the hot water coil. When the discharge air temperature falls below 40 degrees F., the sensor shall close the unit outdoor air intake and relief air damper and open the return air damper. When the supply air temperature rises above 45 degrees F., the dampers shall be returned to normal operation. If the discharge air falls below 35 degrees F. the unit supply and exhaust fan motors shall stop, the outdoor intake damper and relief air damper shall close and the return air damper and HW valve shall open. It shall also indicate at the Host Computer when the anti-freeze stat is tripped. The anti-freeze stat shall be reset through a software switch from the host computer.
- G. Provide at each filter a differential pressure switch. The switch shall be set as per the Manufacturers rating for a dirty filter. Whenever the filter exceeds this rating, the filter switch shall indicate a dirty filter alarm at the host computer.
- H. The unit shall be indexed for summer/winter mode manually from the host computer or automatically whenever the outdoor temperature rises above 70 degrees F. (adjustable). When the unit is indexed for summer operation,

the hot water coil control valve shall close, the heat wheel shall run on high speed. The room sensor shall cycle the DX cooling to maintain the space temperature of 72 degrees F. (adjustable).

- I. Provide a color graphic screen on the host computer with the following information:

- Read mixed air temperature
- Reset mixed air temperature
- Read discharge air temperature
- Reset discharge air temperature
- Override day/night operation
- Assign daily occupied/unoccupied times
- Read dirty filter
- Fan Status - Supply and Exhaust
- Outdoor Air CFM

Note: the above information and O/R switches shall also be available at the local DDC controller.

- J. The Air Handling unit manufacturer shall provide V.F.D.'s on the supply air fan and exhaust air fan motors. The ATC contractor shall provide a HI occupancy/normal switch on the graphic screen on the host computer. When the system is in the unoccupied mode and the normal mode of operation, the supply fan and exhaust fans shall run at 3200 CFM (adjustable from the host computer). When the system is placed in the HI occupancy mode the supply air fan and exhaust air fan shall run and 6400 CFM.

3.7 HOT WATER SYSTEM

- A. The Boiler shall be provided with integral controls as outlined in the Boiler specification and shall also be provided with a T-2 Metasys interface module, which shall facilitate low level translation between the Boiler system and the Johnson BAS. The ATC Contractor shall provide any additional hardware to provide the following sequence of control.
- B. When the outdoor temperature falls below 70 degrees F (adjustable) the selected primary hot water pump shall be energized and shall run continuously. The master Boiler panel shall energize the Boilers in sequence to maintain the required supply water temperature to the system. The selected main hot water pump shall be rotated on a weekly basis to provide even wear. Provide on the host computer a main hot water pump selector switch and an outdoor temperature override switch for the heating system. The ATC Contractor shall also provide a differential pressure switch, located across each pump, which shall energize the stand-by pump when the active main hot water pump has failed and indicate an alarm at the host computer. When the outdoor temperature is between 50 degrees F and 70 degrees F and all units are in the unoccupied mode, the hot water system shall remain

off.

- C. The ATC Contractor shall provide a time delay, which shall run the selected main hot water pump for two (2) minutes after the hot water system, has been de-energized.
- D. The selected main hot water pump shall run continuously and the speed of the pump shall be controlled by a variable frequency drive, which shall match the speed of the pump with the demand for heating from the system. Provide a minimum of two differential pressure sensors located at the end of the hot water mains (as approved by the Consulting Engineer). The VFD's shall maintain the speed of the hot water pump to meet the demand of the controller requiring the most heating. Provide an interlock, which shall start the standby hot water pump when the primary pump has failed.
- E. Provide an interface with the VFD's which shall start the stand-by VFD when the primary pump has failed. The pumps shall be rotated on a weekly basis to provide even wear on both pumps.
- F. Provide a color graphic screen on the host computer with the following display:
 - 1. Read and reset hot water supply temperature
 - 2. Read hot water return temperature
 - 3. Read pump status (EA)
 - 4. Read and reset system differential pressure
 - 5. Pump VFD alarm (EA)
 - 6. Common Boiler alarm
 - 7. Boiler display and adjustable points (see boiler spec for data) available to be indicated at the host computer

3.8 VAV BOX AIR BALANCING

- A. The ATC Contractor shall provide the required software programs to the air balancer for balancing, the new VAV. The air balancer through his laptop computer shall set the design minimum and maximum airflow for each box. The ATC Contractor shall provide sixteen hours instruction to the air balancer.

3.9 VAV BOXES (Typical)

- A. The VAV Box Manufacturer shall provide the boxes complete with cross flow sensors and shall mount the DDC control actuator at his factory. The ATC Manufacturer shall provide the DDC control actuator, room temperature transmitter, 2-way modulating control valves and associated controls and transformers.
- B. The room temperature transmitter shall proportionately position the primary air dampers and modulate the radiant panel valve (where applicable) and

hot water coil control valve in sequence to maintain desired space temperature. On a call for cooling from the room transmitter the DDC controller shall modulate the box damper open to deliver the required CFM of primary air to maintain space temperature. As room temperature continues to increase the DDC controller shall continue to modulate open until it reached the box maximum CFM.

- C. On a call for heating from the room transmitter the DDC controller shall modulate the box damper closed to deliver the required CFM to maintain space temperature. As the room temperature continues to fall the box shall continue to modulate to the minimum box CFM. After the VAV box has reached its minimum position and the room temperature continues to fall the VAV box shall re-position to the reheat minimum CFM and shall modulate the hot water coil control valve open to maintain space temperature. On boxes with auxiliary radiation, on a call for heat, the radiation valves shall open first.
- D. The room temperature transmitter shall have local set point adjustments without thermometers and shall be initially set for 72 degrees F. The set point adjustment for each room transmitter shall have their set points limited from the NCM to plus or minus 5 degrees F of set point.
- E. Provide a dynamic color graphic screen at the host computer with the following information:
 - Reset room set point
 - Read/log room temperature
 - Override day/night operation
 - Change maximum CFM flow rate
 - Change minimum CFM flow rate
 - Assign daily occupied/unoccupied times
 - Read CFM flow rate
 - Supply air temperature
 - Hot water coil valve position
 - Damper position
 - Auxiliary valve position
- F. When the VAV Box is in the unoccupied mode the hot water coil control valve shall remain under control of its room sensor and shall modulate to maintain a minimum space temperature of 60 degrees F.
- G. The ATC Contractor shall designate (2) unoccupied space sensors which shall cycle the AHU whenever the minimum space temperature falls below 60 degrees F (adjustable).

3.10 VAV AIR HANDLING UNITS WITH HEAT RECOVERY RTU 1, 2, 3, & 5

- A. The ATC Contractor shall provide the DDC controller, sensors, valves, damper actuators and other required control drivers. All ATC controls shall be field mounted.
- B. The unit shall be indexed for occupied/unoccupied mode through its DDC controller or through a push-button O/R timer on the existing Host Computer for up to (3) hours.
- C. When the system is in the unoccupied mode, the outdoor air and relief air damper shall be closed, the return air damper shall be open and the DX cooling shall be inoperative. The space unoccupied sensor shall cycle the supply air and fan to maintain a minimum space temperature of 60 degrees F. (adjustable).
- D. When air handling unit is running in the heating unoccupied mode (adjustable). The VAV boxes shall open to provide the maximum CFM and the room sensor shall proportionally position the hot water coil control valve to maintain a minimum space temperature of 60 degrees F.
- E. In the occupied cycle the supply air fan shall be energized and shall run continuously. The return air sensor shall place the system in the warm-up cycle until the return air temperature rises above 68 degrees F. (adjustable). When the system is in the warm-up cycle the outdoor air damper shall remain closed and the return air damper shall remain open. When the return air temperature rises to 68 degrees F. the system shall then be placed in the ventilation mode, which shall allow the outdoor air damper to open and return air dampers to close. The heat wheel and exhaust fan shall run continuously. The heat wheel speed shall vary to maintain a air temperature of 60 degrees F.
- F. The ATC Contractor shall provide a duct counted static pressure controller located in the supply air duct of the unit. The static pressure high pressure tap shall be located in the supply air duct work approximately 2/3 distance downstream of the supply air fan, and the low pressure tap shall be open to atmosphere. The static pressure controller shall vary the speed of the supply air fan "VFD" to maintain a minimum supply air static pressure of 1.5" W.C.
- G. The ATC Contractor shall provide a space mounted static pressure controller with its low pressure tap open to the atmosphere. The static pressure controller shall vary the speed of the exhaust fan VFD to maintain a minimum building pressure of 0.05" W.C.
- H. The VFD's shall also be provided with a "Ramp Up" time delay which shall required the fans to ramp up to speed over a 10 minute period when they are energized.
- I. The ATC Contractor shall provide airflow stations in the outdoor intake duct, the return air duct and the supply air duct. The DDC controller shall receive signals from all the airflow stations and shall provide a variable signal to the

exhaust fan VFD to provide a constant minimum outdoor airflow rate. The setting shall be provided by the Consulting Engineer.

- J. Provide at each filter a differential pressure switch. The switch shall be set as per the Manufacturers rating for a dirty filter. Whenever the filter exceeds this rating, the filter switch shall indicate a dirty filter alarm at the host computer.
- K. The unit shall be indexed for summer/winter mode manually from the host computer or automatically whenever the outdoor temperature rises above 55 degrees F. (adjustable). When the unit is indexed for summer operation, the outdoor, return air and relief air dampers shall open to allow the minimum amount of outdoor air and the heat wheel shall run at maximum speed. The supply air sensor shall cycle the DX cooling to maintain the supply air temperature of 55 degrees F. (adjustable).
- L. Provide an auto reset anti-freeze stat in the air duct of the unit on the leaving airside of the coil. When the discharge air temperature falls below 40 degrees F., the sensor shall close the unit outdoor air intake and relief air damper and open the return air damper. When the supply air temperature rises above 45 degrees F., the dampers shall be returned to normal operation. If the discharge air falls below 35 degrees F., the unit supply and return fan motors shall stop, the outdoor intake damper and relief air damper shall close and the return air damper shall open. It shall also indicate at the host computer when the anti-freeze stat is tripped. The anti-freeze stat shall be reset through a software switch from the host computer.
- M. Provide local indication on the DDC controller which shall provide temperature, pressure and humidity indication. The DDC controller shall also have status indication of each digital input point and have the ability to override each digital and analog output point through a local override switch.
- N. The unit shall be index for Ecomizer control whenever the outdoor temperature rises above 53 degrees F (adjustable). When the unit is in the Ecomizer mode the heat wheel shall stop and the unit outdoor intake dampers shall open fully. The ATC Contractor shall provide an outdoor enthalpy sensor which shall position the bypass dampers to the minimum position and start the heat wheel if the outdoor enthalpy is not suitable for free cooling.
- O. Provide a high limit static pressure sensor located in the supply air duct of the unit. The high limit sensor shall shut down the supply air fan whenever the duct static pressure exceeds 4" W.C. (adjustable). Provide a manual reset from the host computer.
- P. Provide a color graphic screen on the host computer with the following information:
 - Read mixed air temperature

- Reset mixed air temperature
 - Read discharge air temperature
 - Reset discharge air temperature
 - Override day/night operation
 - Assign daily occupied/unoccupied times
 - Change minimum OA CFM
 - Read dirty filters
 - Minimum outdoor air CFM, supply air CFM, and return air CFM
 - Read & reset supply air static pressure
 - Read & reset space static pressure
 - Supply air fan VFD alarm & status
 - Exhaust air fan VFD alarm & status
 - Outdoor enthalpy
 - Return air enthalpy
 - Duct static high limit reset
- Q. AHU 1 & 5 shall be fixed plate Heat Recovery Units. The ATC contractor shall position the face and by pass dampers, in place of the V.F.D. controlling speed of the heat recovery wheel, to maintain space temperature.
- R. Refer to the Ventilation Schedules contained on Drawing M713 for the control sequence on the modulation of the outdoor air damper. The occupancy sensors referred to in the Ventilation Schedules are provided and installed by the Electrical Contractor. The ATC system shall receive a relay output from these particular sensors to control the outdoor air damper position of their respective AHU's. Coordinate with the Electrical and Mechanical Contractors as to which occupancy sensors are required to have the capability to provide the relay output.

3.11 REHEAT COIL CONTROL (TYPICAL)

- A. Provide where shown on the Contract drawings, a room sensor, discharge sensor, 2-way modulating hot water coil control valve, and the required DDC controller.
- B. The room sensor, through the DDC controller, shall proportionately position the hot water coil control valve to maintain desired space temperature. On a call for heating from the room sensor, the 2-way hot water coil control valve shall then modulate open to maintain desired space temperature. On a rise in space temperature, the reverse sequence shall take place. The room sensor shall be provided with a local set point adjustment without thermometer, and shall be initially set for 72 degrees F. The set point for each sensor shall have their set point limited from the host computer or local DDC controller to plus or minus 5 degrees F of set point.
- C. Provide a screen color graphic screen on the host computer with the following display:
- Read and reset room temperature

- Read supply air temperature
- Read hot water valve position

3.12 TYPICAL FAN COIL UNIT HOT WATER/DX COOLING

- A. For each unit, provide a DDC controller, a wall mounted space sensor, a low limit discharge sensor, a 2-way normally open hot water coil control valve.
- B. The unit shall be indexed for occupied/unoccupied cycle from the unit mounted DDC controller or through the host computer. The unit can be indexed to the occupied mode for up to 3 hours from the push-button override timer located on the room thermostat.
- C. The room temperature sensor shall have local set point adjustments and shall be initially set for 72 degrees F. The set point adjustment shall be limited from the host computer to plus or minus 5 degrees F. of set point.
- D. In the occupied mode, the supply air fan shall be energized and shall run continuously. Upon the initial start-up, the space sensor shall place the system in the warm-up cycle if the space temperature is more than 5 degrees F. below set point.
- E. Provide at each filter a differential pressure switch. The switch shall be set as per the Manufacturers rating for a dirty filter. Whenever the filter exceeds this rating, the filter switch shall indicate a dirty filter alarm at the host computer.
- F. The unit shall be indexed for summer/winter mode manually from the host computer. When the unit is placed in the summer cycle the hot water valve shall close, the auxiliary radiation valve shall close, the low limit sensor shall be removed from the circuit and the outdoor intake damper shall open to the minimum outdoor air position. The room thermostat shall cycle the DX cooling to maintain space temperature. Each unit may be manually placed in the summer mode from the host computer.
- G. Provide a color graphic screen on the host computer with the following information:
 - Read room temperature
 - Reset room temperature
 - Read mixed air temperature
 - Reset mixed air temperature
 - Read discharge air temperature
 - Reset discharge air temperature
 - Assign daily occupied/unoccupied times
 - Override occupied/unoccupied operation
 - Override heating/cooling operation
 - Fan status
 - Valve position (hot water)
 - Filter status

3.13 DRAIN PAN OVERFLOW SENSOR

- A. The ATC contractor shall provide, field mount and wire, a drain pan overflow sensor located in the condensate drain pan of each air handling unit and each fan coil unit.
- B. The drain pan sensor shall shut down the unit supply air fan and indicate an alarm condition at the host computer whenever the sensor senses an overflow condition at each drain pan.

END OF SECTION 15970

SECTION 16621 - PACKAGED ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division 16 Section "Wires and Cables".
- C. Division 16 Section "Raceways, Boxes, and Cabinets".
- D. Division 16 Section "Grounding".
- E. Division 16 Section "TVSS".

1.2 SUMMARY

- A. Related Sections include the following:
 - 1. Division 16 Section "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generator sets.
 - 2. Division 16 Section "Grounding".
 - 3. Division 16 Section "Wires and Cables".

1.3 SCOPE

- A. Provide complete factory assembled generator set equipment with digital microprocessor-based) electric controls. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.
- B. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.
- C. The generator set supplier shall be responsible for complete compliance to all specification requirements for both the generator set and the paralleling equipment.
- D. Prototype testing, factory testing, site testing.

1.4 CODES AND STANDARDS

- A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.
1. ANSI S1.13-1971—Measurement of Sound Pressure Levels in Air
 2. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 3. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 4. NFPA 30 – Flammable and Combustible Liquids
 5. NFPA 37 – Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines
 6. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 7. NFPA 99 – Essential Electrical Systems for Health Care Facilities
 8. NFPA 110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- B. The generator set and supplied accessories shall meet the requirements of the following standards:
1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
 2. UL142 – Sub-base Tanks
 3. UL1236 – Battery Chargers
 4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.
- C. The control system for the generator set shall comply with the following requirements.
1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 4. FCC Part 15, Subpart B.
 5. IEC8528 part 4. Control Systems for Generator Sets
 6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
- D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.5 ACCEPTABLE MANUFACTURERS

- A. Basis-of-Design Product: Cummins Onan: Subject to compliance with requirements, provide or a comparable product by one of the following:
1. Caterpillar, Inc.; Engine Division
 2. Cummins.
 3. Or other approved equal

PART TWO - PRODUCTS

2.1 GENERATOR SET

- A. Ratings
1. The generator set shall operate at 1800 rpm and at a voltage of 277/480 Volts AC, Three phase, 4-wire, 60 hertz.
 2. The complete generator set shall be rated per ISO8528 at 150 kW, 188 kVA at 0.8 PF, stand-by rating, based on site conditions of : Altitude 2850 ft. (868 meters), ambient temperatures up to 104 degrees F (40 degrees C), based on temperature measured at the control for indoor installations, and measured at the air inlet closest to the alternator for outdoor equipment.
 3. The generator set rating shall be based on emergency/standby service and marked as such per NFPA110.
- B. Performance
1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The gas engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 500 kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.
7. The generator set, complete with sound attenuated enclosure, shall be tested by the generator set manufacturer per ANSI S1.13. Data documenting performance shall be provided with submittal documentation.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.
3. All outdoor equipment shall be enclosed with corrosion-protected materials. Steel components used in enclosures shall be powder coated and baked, and shall provide fade and corrosion resistance in compliance to Dry film thickness shall be shd3363 of 2H+all a minimum of 1.8 Mils, gloss at 60degrees per ASTMD523 of 80+/- 10, pencil hardness per ASTM D3363

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.2 ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be natural gas, radiator and fan cooled.. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:
- B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.
- C. Skid-mounted radiator and cooling system rated for full load operation in 50 degrees C ambient as measured at the generator air inlet, based on 0.5 in H₂O external static head. Radiator shall be sized based on a core temperature which is 10C higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
- D. Electric starters capable of three complete cranking cycles without overheating.
- E. Positive displacement, mechanical, full pressure, lubrication oil pump.
- F. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
- G. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
- H. Replaceable dry element air cleaner with restriction indicator.
- I. Flexible supply and return fuel lines.
- J. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.
- K. Coolant heater
 1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
 2. The coolant heater shall be installed on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant

system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection shall be provided for a single AC power connection to the coolant heater system.
 4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 40C in a 15C ambient, in compliance with NFPA110 requirements, as a minimum, or the temperature required for starting and load pickup requirements of this specification.
- L. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
- M. Starting and Control Batteries shall be lead acid type, 24 volt DC, sized as recommended by the engine manufacturer for compliance to NFPA110 starting requirements, complete with battery cables and connectors.
- N. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- O. Provide 1 fully regulated, constant voltage, current limited, multi-rate battery charger(s) for each generator set. The chargers shall be designed for heavy-duty industrial service, primarily to quickly recharge and maintain batteries that start internal combustion engines. Charger shall be rated a minimum of 12 amps, and be capable of operating in parallel with another like charger for reliability and added charging capacity.
1. Charger shall provide 4 distinct charge states: "dead battery", "bulk charge", "absorption", and "float". Charge rate shall be temperature compensated to provide proper charging in ambient conditions from -20 to +55C.
 2. Provide LED indication of general charger condition, including charging, fault, and equalize. Provide a 2 line LCD display to indicate charge rate, battery voltage, faults, and provide for charger set up. Charger shall provide relay contacts for fault conditions as required by NFPA110.
 3. The charger shall operate properly during fault conditions, including battery disconnection while charging, reversed battery polarity connections, and shorted battery.
 4. The charger shall be compliant to the same RFI/EMI and voltage surge performance as are specified for the genset control.

2.3 LOW VOLTAGE AC ALTERNATOR

- A. The AC alternator shall be; synchronous, four pole, 2/3 pitch, brushless, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. The alternator design shall prevent shaft current from flowing and eliminate the need for insulated bearings. All insulation system components shall meet NEMA MG1 requirements for Class H insulation systems. Actual temperature rise measured by resistance method at full load shall not exceed 1058Cⁱ in a 408C ambient.
- B. The alternator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage up to 5 percent above or below rated voltage.
- C. The alternator shall be supplied with an dedicated, independent power source for the voltage regulation system, which provides sufficient excitation for the alternator to supply 300% of rated output current for 10 seconds.
- D. The subtransient reactance of the alternator shall not exceed 12 percentⁱⁱ, based on the standby rating of the generator set.
- E. Provide an anti-condensation heater for the alternator for generator sets installed outdoors or in unheated environments.

2.4 GENERATOR SET CONTROL: The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

- A. Control Switches
 - 1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - 2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting. The switch shall include a lockout provision for use in safely disabling the generator set for necessary service.

3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
 5. Voltage and Frequency Adjustment. The genset mounted control shall include digital raise/lower switches for adjustment of voltage and frequency.
- B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:
1. Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
 2. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
 3. Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.
- C. Generator Set Alarm and Status Display.
1. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of all alarm, shutdown, and status conditions associated with the generator set, including all paralleling control functions and the engine ECM on an alphanumeric display on the genset. The following alarm, shutdown, and status conditions are required, as a minimum:
 - low oil pressure (alarm)
 - low oil pressure (shutdown)
 - oil pressure sender failure (alarm)
 - low coolant temperature (alarm)
 - high coolant temperature (alarm)
 - high coolant temperature (shutdown)
 - engine temperature sender failure (alarm)
 - low coolant level (alarm or shutdown-selectable)
 - fail to crank (shutdown)
 - fail to start/overcrank (shutdown)
 - overspeed (shutdown)

low DC voltage (alarm)
high DC voltage (alarm)
weak battery (alarm)
low fuel-daytank (alarm)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (alarm)
over load (alarm)
emergency stop (shutdown)

2. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control :
engine oil pressure (psi or kPA)
engine coolant temperature (degrees F or C)
engine oil temperature (degrees F or C)
engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)
2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

3. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
4. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator. The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown).
4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
5. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

6. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.
- G. The generator set shall be provided with a network communication module to allow real time communication with the generator set control by remote devices. The control shall communicate all engine and alternator data; alarm, shutdown and status conditions; and allow starting and stopping of the generator set via the network in both test and emergency modes.
- H. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.
- I. The generator set shall be provided with a utility grade protective relay, designed to provide thermal overload protection for the alternator, and performance certified for that purpose by a 3rd party testing organization. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided. Relay shall be installed to allow shutdown of the generator excitation system on an alternator overload condition, with the engine operating for a cool-down period before shutdown. The relay shall not include an instantaneous trip function.
- J. Control Interfaces for Remote Monitoring:
 1. No field connections for control devices shall be made in the AC power output enclosure. Provide the following features in the control system:
 2. Form "C" dry contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
 3. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
 4. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

5. A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
6. The control shall be provided with a direct serial communication link for the communication network interface as described elsewhere in this specification and shown on the drawings.

PART THREE - OPERATION

3.1 SEQUENCE OF OPERATION

- A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set. The generator set shall complete a time delay start period as programmed into the control.
- B. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
 1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
 2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
- C. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.
- D. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
- E. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
 1. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

PART FOUR - OTHER REQUIREMENTS

- 4.1 **SUBMITTALS.** Within 10 days after Notice to Proceed, provide six sets of the following information for review:

- A. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
- B. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
- C. Manufacturer's certification of prototype testing.
- D. Manufacturer's published warranty documents.
- E. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
- F. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
- G. Manufacturer's installation instructions.

4.2 FACTORY TESTING

- A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. All testing shall be performed with calibrated metering.
- B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.
- C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include:
- D. Make these bullets: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

4.3 INSTALLATION

- A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- D. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

- E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
- F. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

4.4 ON-SITE ACCEPTANCE TEST:

- A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
- B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
- C. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load (resistive) test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.
- E. The generator set supplier shall issue a test report documenting the results of testing, and including a complete list of all settings in the control system.

4.5 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

4.6 SERVICE AND SUPPORT

- A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of \$3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.
- B. The generator set shall be serviced by a local service organization that is trained and

factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year.

- C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

4.7 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. shall be allowed during the minimum noted warranty period described in paragraph A above.

4.8 QUALIFICATIONS

- A. The generation set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
- B. The manufacturer of this equipment shall have produced similar equipment for a minimum period of ten years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

4.9 REGULATORY REQUIREMENTS

- A. The generator set shall be UL2200 listed and labeled.
- B. The generator set overcurrent protection shall be UL listed as a utility grade protective device.
- C. The generator set engine shall comply with all applicable emissions standards at the date of installation.

END OF SECTION 16621

SEE TEST PIT NOTES

PERFORM UNDERGROUND UTILITY MARK OUT. EXCAVATE TEST PITS AT ALL LOCATIONS WHERE EXISTING GAS & WATER SERVICES CROSS THE PROPOSED STORM SEWER (PER SW-105) AND VERIFY CLEARANCES.

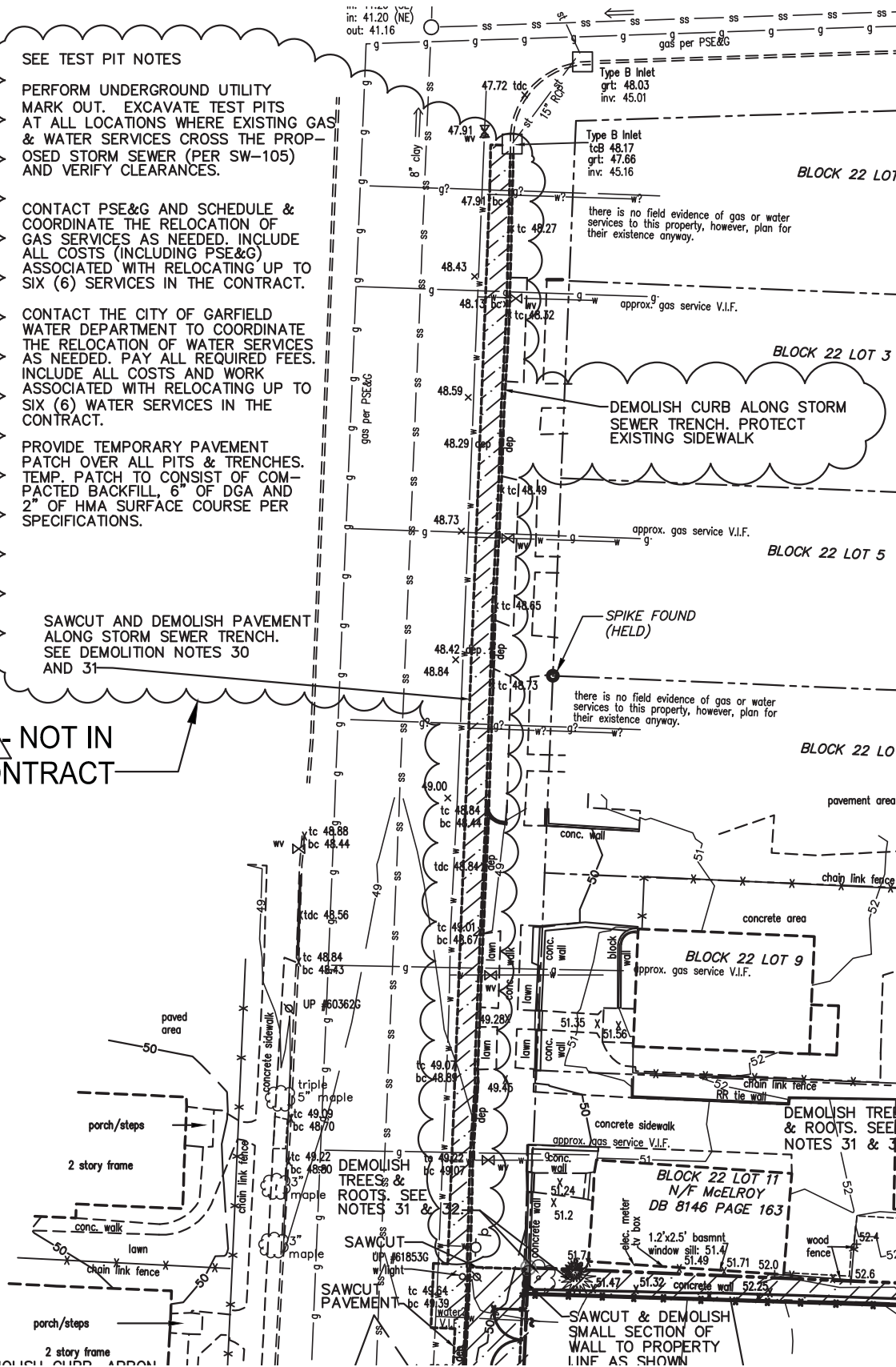
CONTACT PSE&G AND SCHEDULE & COORDINATE THE RELOCATION OF GAS SERVICES AS NEEDED. INCLUDE ALL COSTS (INCLUDING PSE&G) ASSOCIATED WITH RELOCATING UP TO SIX (6) SERVICES IN THE CONTRACT.

CONTACT THE CITY OF GARFIELD WATER DEPARTMENT TO COORDINATE THE RELOCATION OF WATER SERVICES AS NEEDED. PAY ALL REQUIRED FEES. INCLUDE ALL COSTS AND WORK ASSOCIATED WITH RELOCATING UP TO SIX (6) WATER SERVICES IN THE CONTRACT.

PROVIDE TEMPORARY PAVEMENT PATCH OVER ALL PITS & TRENCHES. TEMP. PATCH TO CONSIST OF COMPACTED BACKFILL, 6" OF DGA AND 2" OF HMA SURFACE COURSE PER SPECIFICATIONS.

SAWCUT AND DEMOLISH PAVEMENT ALONG STORM SEWER TRENCH. SEE DEMOLITION NOTES 30 AND 31

A2 - NOT IN CONTRACT



ADDENDUM #2 - REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

AD2

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Project Name
New James
Madison School #10
NJ SDA
NT-0014-C03

Project Owner Name
NJ Schools
Development Authority
Garfield School
District

Project Location
99 Marsellus Place
Garfield, NJ

Project Number
4423
Project Date
08.06.15
Checked By
W.B.E.
Drawn By
SRP-EEG
Scale
NONE

Drawing Name
DELETION OF STORM
SEWER WORK ALONG
MARSELLUS PLACE
Ref. SW-102

Revisions
No. Date Description
A2 8.06.15 Addendum Sketch

Drawing Number
AD2-SK1

A2 - NOT IN CONTRACT

CONSTRUCT FULL DEPTH HEAVY DUTY BITUMINOUS PAVEMENT ALONG THE STORM SEWER TRENCH. SAWCUT PAVEMENT ALONG TRENCH

RECONSTRUCT INLET AS PART OF NEW PIPE CONNECTION
REPLACE PAVEMENT MARKINGS IN-KIND

CONSTRUCT NEW CONCRETE CURB-TYP

SPIKE FOUND (HELD)

RESTORE ALL DISTURBED LAWN AREAS - TYP.

RECONSTRUCT ALL DEPRESSED CURBS "IN KIND" AND REPLACE ANY SIDEWALK DAMAGED BY WORK

STEP NEW WALL TO MEET OLD WALL
NEW CONC. SIDEWALK TO MEET EXISTING

REPLACE PAVEMENT MARKINGS IN-KIND

6" THK. REINF. CONC. APRON & SIDEWALK

TAPERED CURB END EA. SIDE OF DRIVEWAY

END NEW CURB

4" THK. CONC. SIDEWALK BETWEEN CURB & WALL & BEHIND INLET
7" GAP IN WALL FOR DRAINAGE. END CONC. CENTER OF WALL
INSTALL METAL WINDOW WELL
1.2'x2.5' basmt window sill: 31.4
elec. meter
wood fence
NJ WI
6' HIGH WITH PI
R7-13M
PAVEMENT TAPER
END GUIDE RAIL TERMINAL SECTION 2+00
ONLY

ADDENDUM #2 - REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

AD2

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Project Name
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NJ SDA
NT-0014-C03

Project Owner Name
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Development Authority
Garfield School
District

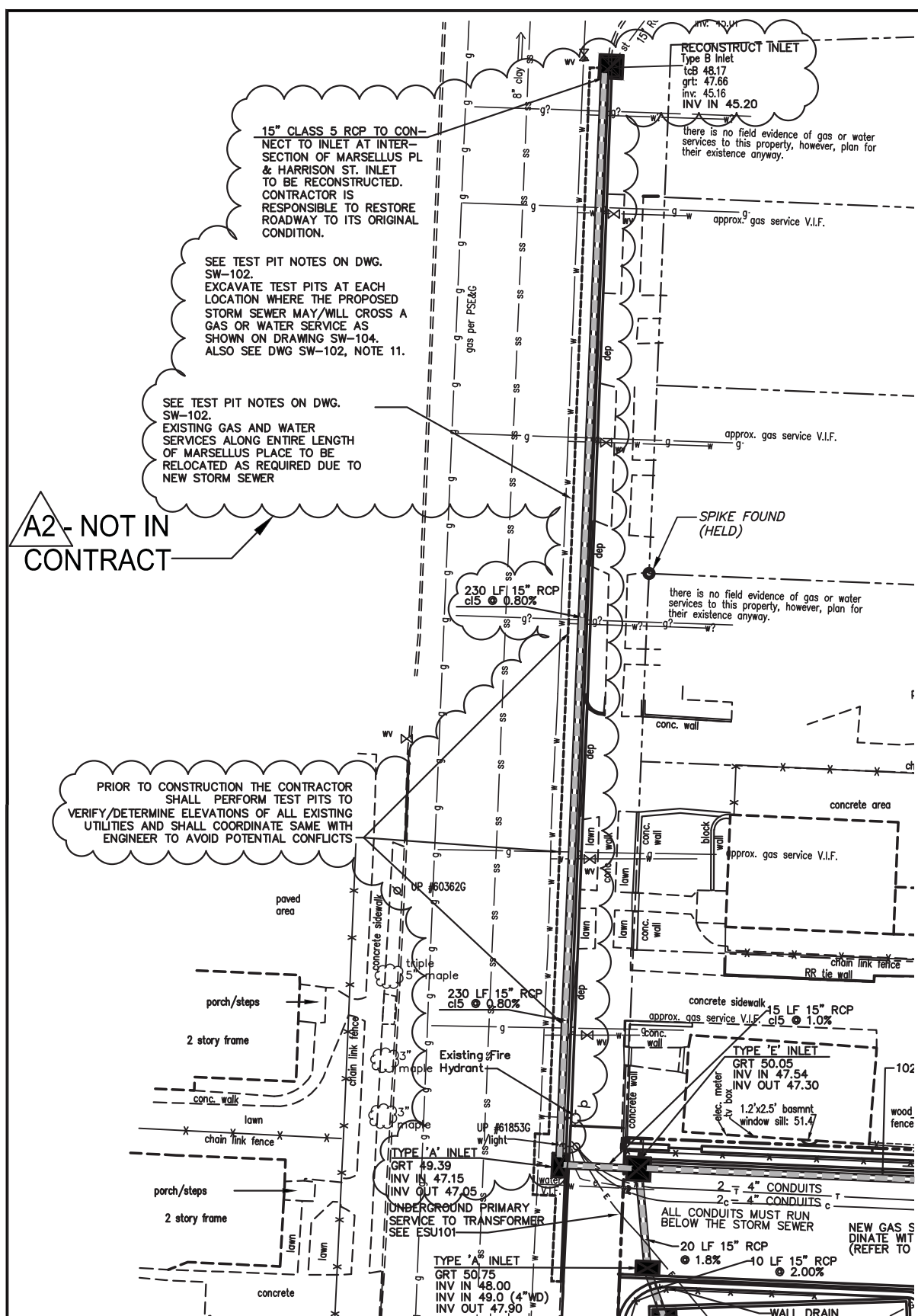
Project Location
99 Marsellus Place
Garfield, NJ

Project Number
4423
Project Date
08.06.15
Checked By
W.B.E.
Drawn By
SRP-EEG
Scale
NONE

Drawing Name
DELETION OF STORM
SEWER WORK ALONG
MARSELLUS PLACE
Ref. SW-103

Revisions
No. Date Description
A2 8.06.15 Addendum Sketch

Drawing Number
AD2-SK2



ADDENDUM #2 - REMOVE FROM THE CONTRACT ALL WORK RELATED TO THE STORM SEWER EXTENSION ALONG MARSELLUS PLACE.

AD2

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Project Name
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NJ SDA
NT-0014-C03

Project Owner Name
NJ Schools
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Garfield School
District

Project Location
99 Marsellus Place
Garfield, NJ

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4423
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MARSELLUS PLACE
Ref. SW-105

Revisions	No.	Date	Description
A2	8.06.15	Addendum Sketch	

Drawing Number
AD2-SK3