

Honeywell
301 Plainfield Road
Suite 330
Syracuse, NY 13212
315-552-9700
315-552-9780 Fax

September 29, 2011

To: Harry Warner, NYSDEC, Region 7 (1 bound)
Diane Carlton, NYSDEC, Region 7 (1 PDF)
Holly Sammon, Onondaga County Public Library (1 bound)
Samuel Sage, Atlantic States Legal Foundation (1 bound)
Mary Ann Coogan, Camillus Town Hall (1 bound)
Stephen Weiter, Moon Library (1 bound)
Joseph J. Heath, Esq., Onondaga Nation (letter only)
Cara Burton, Solvay Public Library (1 bound)

Re: Letter of Transmittal – Onondaga Lake Repository Addition

The below document has been approved by the New York State Department of Environmental Conservation (NYSDEC) and is enclosed for your document holdings:

- 30 & 24" Force Main Rehabilitation letter, design drawings, and specs dated February 2011

Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Enc.

cc: Richard Mustico - NYSDEC

New York State Department of Environmental Conservation

Division of Environmental Remediation

Remedial Bureau D, 12th Floor

625 Broadway, Albany, New York 12233-7013

Phone: (518) 402-9676 • Fax: (518) 402-9020

Website: www.dec.ny.gov



Joe Martens
Commissioner

March 17, 2011

Mr. John P. McAuliffe, P.E.
Program Director, Syracuse
Honeywell
301 Plainfield Road, Suite 330
Syracuse, NY 13212

Re: 30" and 24" Force Main Rehabilitation for the Onondaga Lake Mercury Sediments Site
(Site No. 734030)

Dear Mr. McAuliffe:

The New York State Department of Environmental Conservation has reviewed the letter design dated February 1, 2011. The design is entitled "Onondaga Lake, 30-Inch/24-Inch Force Main Rehabilitation Phase 1" (Design). The rehabilitation of this force main from the leachate pumping station (located adjacent to Waste Bed 12) to its discharge into the METRO sewer system will enable the use of this force main to transfer treated water from the SCA Water Treatment Plant to METRO for ammonia polishing.

The Design, mentioned above, is hereby approved. Any permitting required by the Onondaga County Department of Water Environment Protection (OCDWEP) to implement this work, and any coordination necessary between Honeywell and OCDWEP for this project is still obligatory.

Please attach this approval letter to the design, and distribute copies of the document to the various document repositories, as discussed in the governing consent decree. As per the schedule contained in the Design, the Department looks forward to receiving the Construction Work Plan for review by May 26, 2011. If you have any questions regarding this letter, please feel free to call me at 518-402-9676.

Sincerely,

Richard A. Mustico, P.E.
Project Manager
Remedial Bureau D
Division of Environmental Remediation

c: Timothy Larson - NYSDEC
Mary Jane Peachey - NYSDEC, Syracuse
Margaret Sheen, Esq., - NYSDEC, Syracuse
Harry Warner - NYSDEC, Syracuse
Geoff Laccetti - NYSDOH
Mark Sergott - NYSDOH
Robert Nunes - USEPA, NYC
Argie Cirillo, Esq., USEPA, NYC
Sandra Tuori-Bell - OCDWEP
Nick Capozza - OCDWEP
Michael Lannon - OCDWEP
Daniel Jean - OCDWEP
Jeanne Powers - OCDWEP
Eric Schultheis - OCDWEP
Joseph Heath, Esq. - Onondaga Nation
Thane Joyal, Esq. - Onondaga Nation
Jeanne Shenandoah - Onondaga Nation
Heidi Kuhl - Onondaga Nation
Curtis Waterman - HETF
Alma Lowry, Esq. - Onondaga Nation
Fred Kirschner - AESE, Inc.
William Hague - Honeywell
Al Labuz - Honeywell, Syracuse
Brian Israel, Esq. - Arnold & Porter
Jeff Rodgers - OBG
Christopher Calkins - OBG
Brian White - OBG
Marc Dent - OBG
Steve Miller - Parsons
Paul Blue - Parsons
David Babcock - Parsons

Honeywell
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315-552-9700
315-552-9780 Fax

February 1, 2011

Mr. Richard Mustico, P.E.
Project Manager
NYSDEC Div. of Environmental Remediation
Remedial Bureau D
625 Broadway, 12th Floor
Albany, NY 12233-7016

**RE: 30" and 24" Force Main Rehabilitation
City of Syracuse, Onondaga County, NY
Order on Consent: Index #D7-0008-01-09**

Dear Mr. Mustico:

The purpose of this letter is to transmit documents for the construction of the 30" and 24" Force Main Rehabilitation Project for your review and approval. We have included a general overview of the project, a schedule of key activities, design drawings, and technical specifications.

The existing 30" and 24" Force Mains are approximately 4 miles long (2 miles each) and currently convey approximately 1.5 MGD of leachate from Settling Basins 9-15 to the Syracuse Metropolitan Treatment Plant (Metro) (refer to Sheet G-2). During implementation of the Onondaga Lake Bottom Remedy, water generated during dredging will be treated at the SCA Water Treatment Plant, which will be constructed on Settling Basin 13, and the pretreated effluent will be discharged to the 30" and 24" Force Mains for conveyance to Metro for nutrient polishing.

In 2010, the 30" and 24" Force Main Integrity Investigation was conducted. The project consisted of the following activities:

- Cleaning a portion of the 24" Force Main
- Dewatering, televising (CCTV), pressure testing, and leak detection of the 30" and 24" Force Mains
- Rehabilitation of existing manholes on the 30" Force Main to facilitate access for cleaning and inspection
- Installation of two access ways on the 24" Force Main to facilitate cleaning and inspection

The results of the investigation were used to develop methods for repairing the force mains, including:

- Replace piping in the three areas where leaks were discovered in the 30" Force Main
- Conduct confirmatory pressure tests and leakage tests on the piping that has been replaced
- Install a point of connection for the future SCA Water Treatment effluent discharge piping
- Install piping to establish a cross-connection between the 24" Force Main and the County's 36" Sanitary Force Main. This cross-connection may be used by the County as an emergency backup during periods of high flow at the Westside Pump Station.
- Install a point of connection for the future Willis Avenue Treatment Plant effluent discharge piping
- Replace the 24" Force Main and support structure over Harbor Brook
- Install piping upstream of the existing Monitoring Manhole at Metro to connect the 24" Force Main discharge to the County's 36" Sanitary Force Main
- Replace an existing manhole on the 24" Force Main at Metro

On January 27, 2011 we met with Onondaga County to review this project. The County asked us to consider discharging the flow from the 24" Force Main into the County's 36" Sanitary Force Main at a location upstream of the existing Monitoring Manhole at Metro. The reason for this modification is to reduce flow to the Harbor Brook Interceptor and ultimately the County's low lift pump station. The attached drawings reflect the comments provided by the County.

The following schedule milestones are provided for your information:

- | | |
|---|-----------------|
| • Submit Design Documents to NYSDEC and Onondaga County | 2/1/11 |
| • Receive Comments/Approval from NYSDEC and Onondaga County | 2/22/11 |
| • Incorporate Comments | 2/22 - 3/1/11 |
| • Bid Phase/Procurement | 3/1 - 4/12/11 |
| • Prepare Work Plan | 4/12 - 5/3/11 |
| • Submit Construction Work Plan to NYSDEC | 5/3/11 |
| • NYSDEC Approval of Construction Work Plan | 5/17/11 |
| • Construction Mobilization | 5/17 - 5/31/11 |
| • Construction Complete | 5/31 - 10/18/11 |

Any revisions to the attached documents that result from NYSDEC comments will be addressed on the drawings and specifications included with the Construction Work Plan.

Mr. Richard Mustico, P.E.
February 1, 2011
Page 3

Should you have any questions regarding the work described in these documents, please contact Marc Dent, P.E. at O'Brien & Gere (315-956-6258) or me at your earliest convenience.

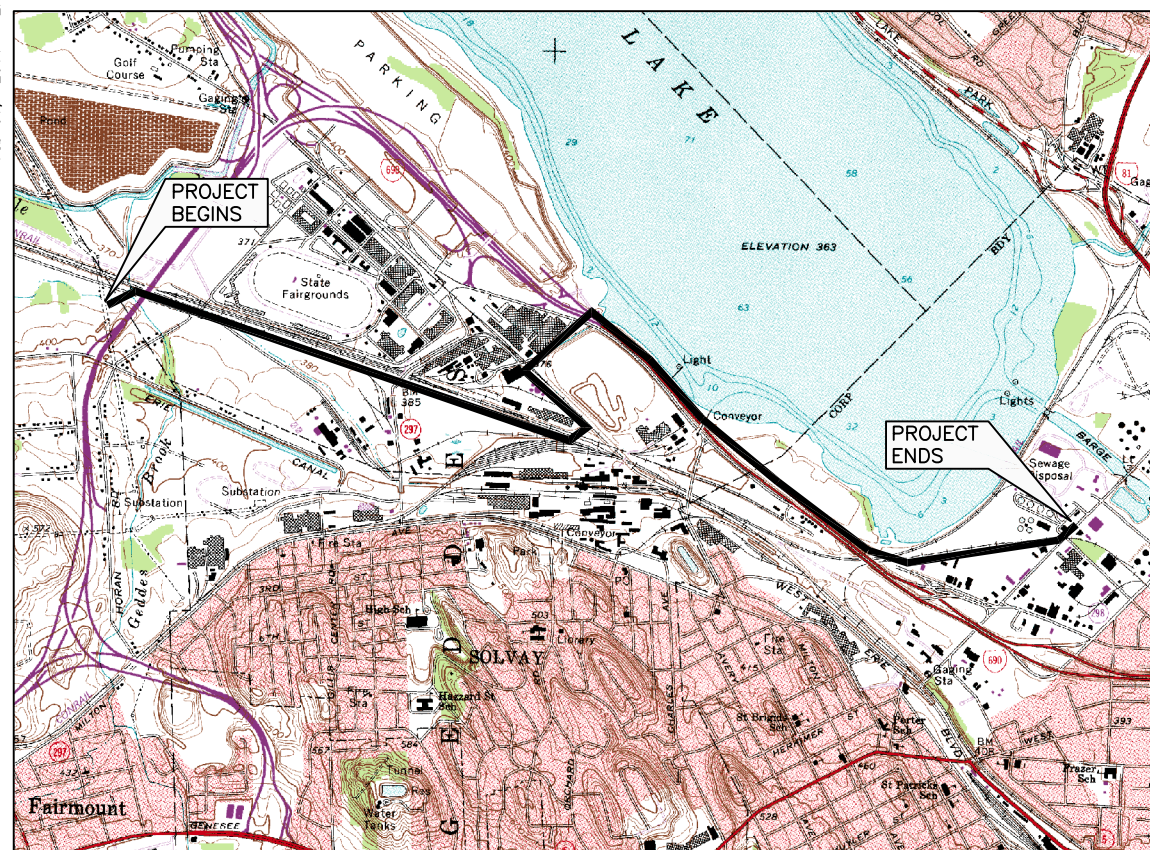
Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Enc. (1 copy, 1 CD – FOR THIS DOCUMENT ONLY)

Cc:	Mr. Robert Nunes	USEPA (4 copies)
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	Mr. Tim Larson	NYSDEC, Albany (1 copy)
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	Mr. Nick Capozza	OCDWEP, Syracuse (ec or CD)
	Mr. Michael Lannon	OCDWEP, Syracuse (ec or CD)
	Mr. Daniel Jean	OCDWEP, Syracuse (ec or CD)
	Ms. Jeanne Powers	OCDWEP, Syracuse (ec or CD)
	Mr. Eric Schultheis	OCDWEP, Syracuse (ec or CD)
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	Ms. Heidi Kuhl	Onondaga Nation (1 copy)
	Mr. Curtis Waterman	Onondaga Nation (ec ltr only)
	Ms. Alma Lowry	Onondaga Nation (ec ltr only)
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	Mr. Paul Blue	Parsons (ec ltr only)
	Mr. David Babcock	Parsons (ec ltr only)
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	Mr. Christopher Calkins	O'Brien & Gere (ec or ec ltr only)
	Mr. Jeffrey Rogers	O'Brien & Gere (ec or ec ltr only)
	Mr. Brian White	O'Brien & Gere (ec or ec ltr only)



95% DESIGN DRAWINGS

ONONDAGA LAKE

30-INCH/24-INCH FORCE MAIN

REHABILITATION PHASE 1

HONEYWELL INTERNATIONAL INC.
MORRISTOWN, NEW JERSEY

FEBRUARY 2011

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S-3	STEEL BRIDGE FRAMING PLAN, ELEVATION & DETAILS
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333 WEST WASHINGTON STREET
SYRACUSE, NY 13221-4873
PHONE: 315-956-6100

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GENERAL CONSTRUCTION SEQUENCE

1. LEAK REPAIR
 - A. EXCAVATE UNDERGROUND PIPE AT THE THREE LEAK LOCATIONS, (1, 2, AND 3), AS SHOWN ON CONTRACT DRAWINGS.
 - B. VERIFY LEAK BY HYDROSTATICALLY PRESSURIZING PIPE.
 - C. REPAIR PIPE AS SPECIFIED.
 - D. PERFORM HYDROSTATIC PRESSURE TESTING IN CONJUNCTION WITH LEAK TESTING TO CONFIRM THAT THE PIPE IS REPAIRED AND ADDITIONAL LEAKS ARE NOT PRESENT (SEE GENERAL NOTE 11). PRESSURE AND LEAK TESTING SHALL BE PERFORMED FROM MH-3 TO MH-6, SMH-7 TO SMH-13, MH-B TO MH-C, AND METRO MANHOLE 90+97 TO THE HARBOR BROOK INTERCEPTOR SEWER CONNECTION.
2. SCA TIE-IN
 - A. EXCAVATE UNDERGROUND PIPING AT THE LOCATION SHOWN ON THE CONTRACT DRAWINGS.
 - B. REMOVE EXISTING PIPE AS APPROPRIATE, TO INSTALL THE SCA TIE-IN.
3. COUNTY FORCEMAIN & WILLIS AVE. GWTP TIE-IN
 - A. EXCAVATE TIE-IN LOCATIONS AT THE EXISTING 36" COUNTY FORCEMAIN TEE AND THE 24" FORCEMAIN WHERE THE BYPASS PIPE AND THE WILLIS AVE. GWTP TIE-IN WILL BE INSTALLED.
 - B. REMOVE CONCRETE CRADLE THAT ENCAPSULATES THE 24" FORCEMAIN AS REQUIRED.
 - C. INSTALL THE 24" BYPASS LINE BETWEEN THE EXISTING BLIND FLANGE ON THE COUNTY FORCEMAIN AND THE 24" FORCEMAIN.
 - D. INSTALL WILLIS AVE. GWTP TIE-IN.
4. HARBOR BROOK CROSSING
 - A. EXCAVATE THE UNDERGROUND PIPING (UPSTREAM AND DOWNSTREAM OF THE CROSSING) TO THE FIRST PCCP PIPE JOINT.
 - B. REMOVE EXISTING ABOVE GRADE 24" PIPE.
 - C. REMOVE EXISTING PIPE SUPPORT TRESTLE USING APPROPRIATE LEAD AND ASBESTOS ABATEMENT PROCEDURES.
 - D. INSTALL NEW PIPE TRESTLE AND PIPE.

SURVEY NOTES:

1. HORIZONTAL DATUM IS NAD83 NEW YORK CENTRAL U.S. FT. AND THE VERTICAL DATUM IS NAVD83.
2. SITE PLAN MAPS SHOWN ARE BASED ON SURVEY DATA PROVIDED BY:
 - C.T. MALE ASSOCIATES, P.C.
TITLED "TOPOGRAPHIC AND UTILITY SURVEY MAP" FOR HONEYWELL INTERNATIONAL
30"/24" FORCEMAIN INTEGRITY INVESTIGATION" DRAWING NO. 09-0907
DATED SEPTEMBER 24, 2009
3. PROFILES SHOWN ARE NOT BASED ON SURVEY DATA. PROFILE DATA OBTAINED FROM:
 - ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION MAP
TITLED "ALLIED CHEMICAL CORPORATION FACILITIES 30" FORCE MAIN"
DRAWN BY CALOCERINOS & SPINA AND DATED JUNE 12, 1978
FILE NO. 125.111-23 TO 125.111-38
 - ONONDAGA COUNTY PUBLIC WORKS COMMISSION DRAWINGS TITLED
"WEST SIDE SANITARY DISTRICT, WEST SIDE FORCE MAIN, WEST SIDE
PUMPING STATION TO HIAWATHA BLVD."
DRAWN BY O'BRIEN & GERE AND DATED AUGUST 4, 1955
FILE NO. 115.27F-04-F-3 TO 115.27F-10-F-4

GENERAL NOTES:

1. EXISTING 30" AND 24" FORCE MAIN PIPING SYSTEMS ARE PRE-STRESSED CONCRETE CYLINDER PIPE UNLESS OTHERWISE NOTED.
2. PIPING WITHIN 30" FORCE MAIN MANHOLE STRUCTURES MAY BE DUCTILE IRON PIPING OR PCCP. CONTRACTOR SHALL CONFIRM MATERIALS OF CONSTRUCTION, AS REQUIRED.
3. EXACT DIMENSIONS AND LOCATIONS OF ALL STRUCTURES AND UTILITIES ARE CONSIDERED APPROXIMATE. THE CONTRACTOR SHALL DETERMINE THE LOCATION AND ELEVATION OF UTILITIES IN THE FIELD PRIOR TO CONSTRUCTION.
4. PROFILE SCALES SHOWN ARE APPROXIMATE ONLY.
5. ROADWAYS ARE TO REMAIN OPEN AT ALL TIMES.
6. THE CONTRACTOR SHALL LIMIT HIS OPERATIONS TO STAY WITHIN THE EXISTING R.O.W.. PERMANENT AND TEMPORARY R.O.W.'S VARY AND ARE APPROXIMATE.
7. CONTRACTOR SHALL COORDINATE WITH THE OWNER & ALL PROPERTY OWNERS AND PROVIDE WRITTEN NOTIFICATION TO ALL OWNERS ONE WEEK IN ADVANCE OF ENTERING THEIR PROPERTY, EVEN IF WORK AREA IS WITHIN THE EXISTING R.O.W.
8. CONTRACTOR TO PROVIDE MAINTENANCE AND PROTECTION OF TRAFFIC AS NECESSARY OR AS REQUIRED IN ACCORDANCE WITH ALL STATE, LOCAL, AND FEDERAL LAWS.
9. CONSTRUCTION WATER GENERATED AT THE HONEYWELL SITE DURING REHABILITATION EFFORTS SHALL BE CONTAINERIZED AND THE SOLIDS REMOVED PRIOR TO TRANSPORTING AND OFF LOADING THE WATER TO THE WILLIS AVENUE TREATMENT PLANT. ACTIVITIES SHALL BE COORDINATED BY THE CONTRACTOR WITH THE OWNER AND THE OPERATORS AT THE TREATMENT PLANT.
10. CONTRACTOR SHALL COORDINATE SHUT DOWNS WITH OWNER TO FACILITATE MANAGEMENT OF WATER LEVELS AT RETENTION PONDS.
11. CONTRACTOR SHALL VERIFY LEAK LOCATION ONCE THE PIPE IS EXPOSED BY HYDROSTATICALLY PRESSURIZING THE LINE AND OBSERVING THE LEAK. ONCE THE LEAK HAS BEEN REPAIRED, THE SECTION OF PIPE SHALL BE ONCE AGAIN HYDROSTATICALLY PRESSURE TESTED AND HAVE LEAK DETECTION PERFORMED. ALL SECTIONS OF 30" AND 24" FORCEMAIN THAT WERE NOT PRESSURE AND LEAK TESTED PRIOR TO THIS SCOPE (DUE TO LEAKS), SHALL BE TESTED UNDER THIS SCOPE AFTER THE LEAKS ARE REPAIRED AND THE PIPING MODIFICATIONS ARE MADE. SEE SHEET G-12 FOR PIPELINE SECTIONS THAT SHALL BE PRESSURE TESTED W/ LEAK DETECTION.
12. IF LEAK LOCATION IS AT AN EXISTING PIPE JOINT, THEN PIPE SHALL BE REMOVED AND REPLACED TO THE NEXT PIPE JOINT UPSTREAM AND DOWNSTREAM.

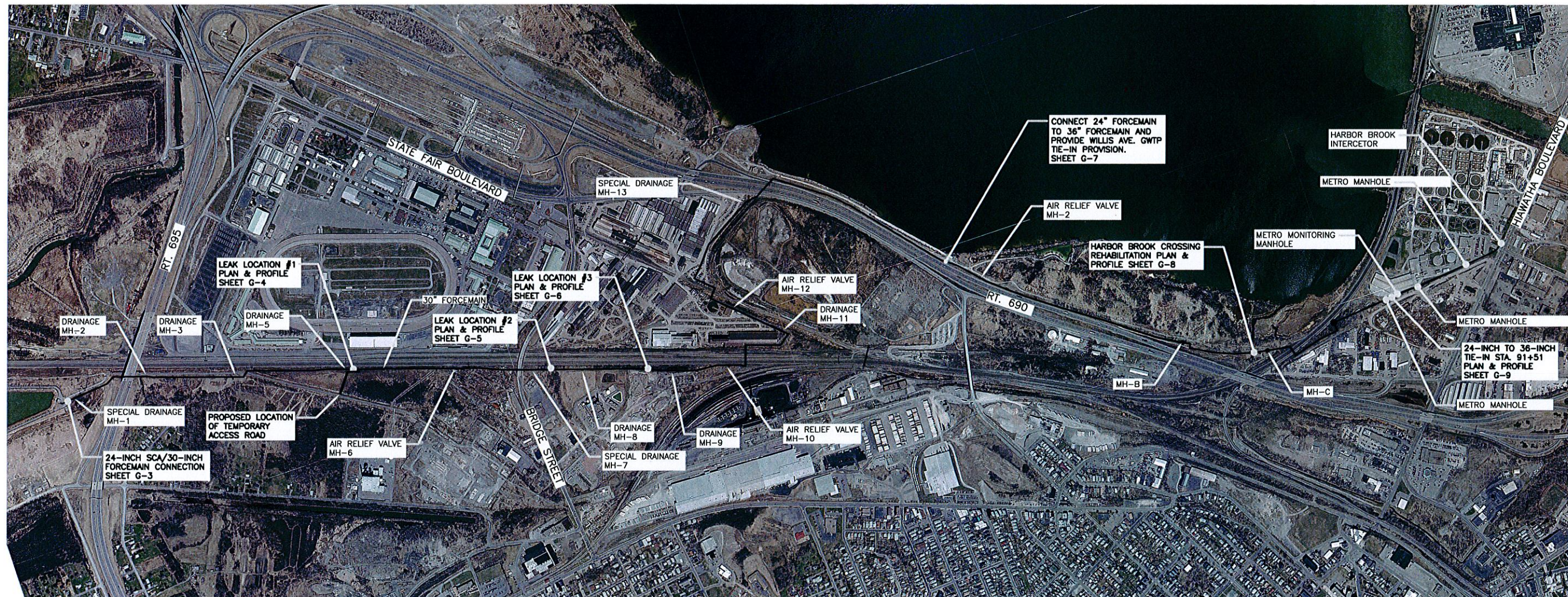
LEGEND

	RAILROAD TRACKS
	STREAM/ EDGE OF WATER
	CHAINLINK FENCE
	UNDERGROUND GAS LINE
	UNDERGROUND WATER LINE
	SANITARY SEWER LINE
	STORM SEWER LINE
	OVERHEAD WIRE
	FORCE MAIN LINE
	FORCE MAIN LINE TO BE REHABILITATED
	NEW FORCE MAIN LINE TO BE INSTALLED
	SIGN
	FIBER OPTIC MARKER
	TRAFFIC SIGNAL BOX
	DRAINAGE MANHOLE
	ELECTRIC MANHOLE
	SANITARY MANHOLE
	BOLLARD
	LIGHT POLE
	ELECTRIC METER
	CATCH BASIN
	UTILITY POLE
	CONIFER, DECIDUOUS TREE

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IN CHARGE OF <u>JRH</u>				 2011 © O'BRIEN & GERE, INC.	HONEYWELL INTERNATIONAL INC. ONONDAGA LAKE 30-INCH/24-INCH FORCEMAIN REHABILITATION PHASE 1 SYRACUSE, NEW YORK	GENERAL GENERAL NOTES	FILE NO. 1163.46358-002	G-1	
DESIGNED BY <u>NMK</u> CHECKED BY <u>MJD</u>							DATE		
DRAWN BY <u>SED</u>	B	02/01/2011	ISSUED FOR NYSDEC REVIEW						FEBRUARY 2011
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PLAN
SCALE: 1"=600'

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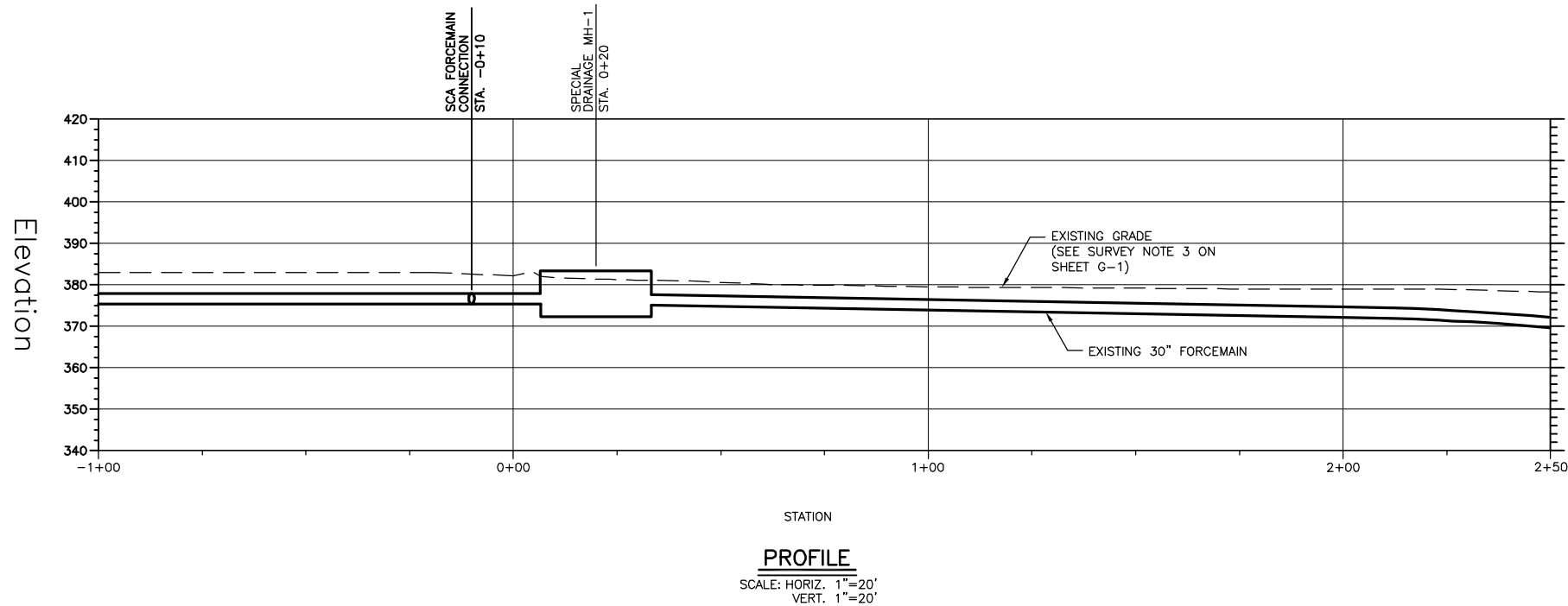
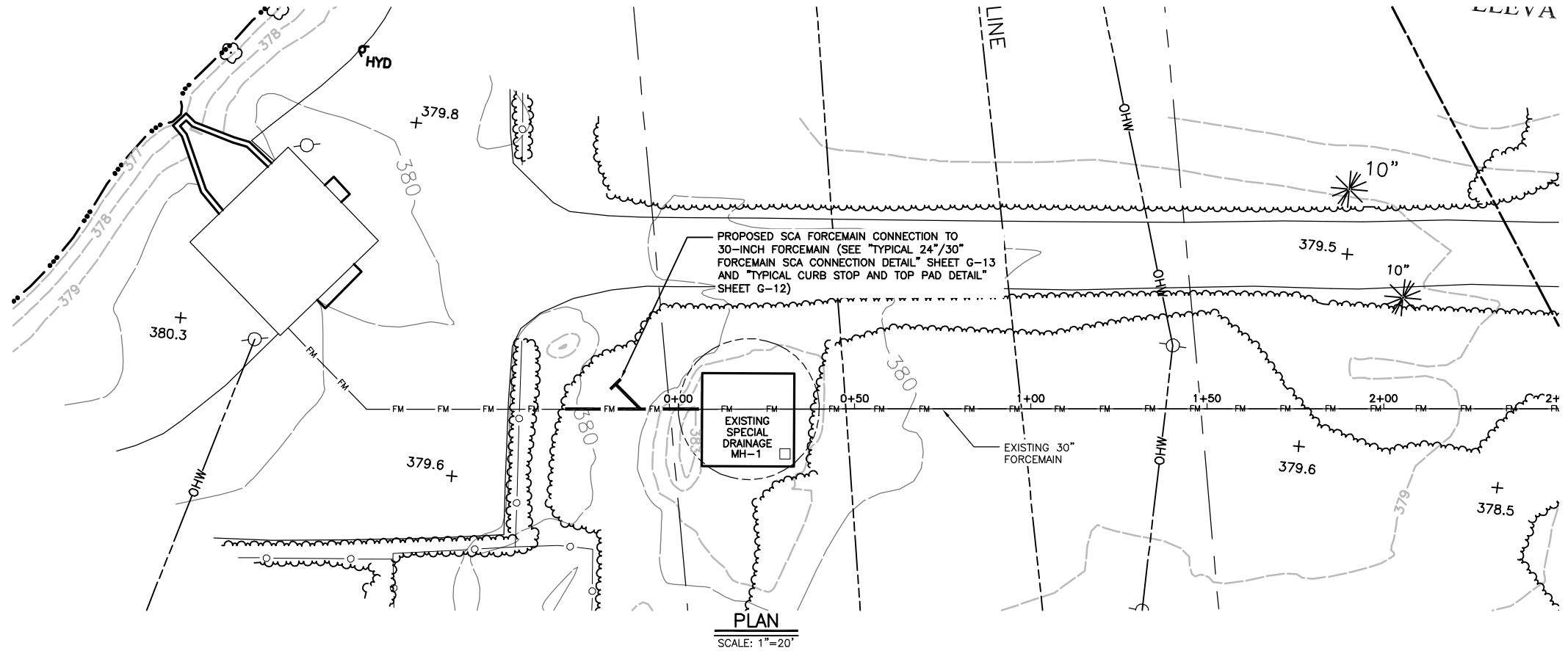
HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
REHABILITATION LOCATIONS

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NOT FOR
CONSTRUCTION
DATE: 02/01/2011

FILE NO.
1163.46358-003
DATE
FEBRUARY 2011

G-2

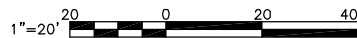


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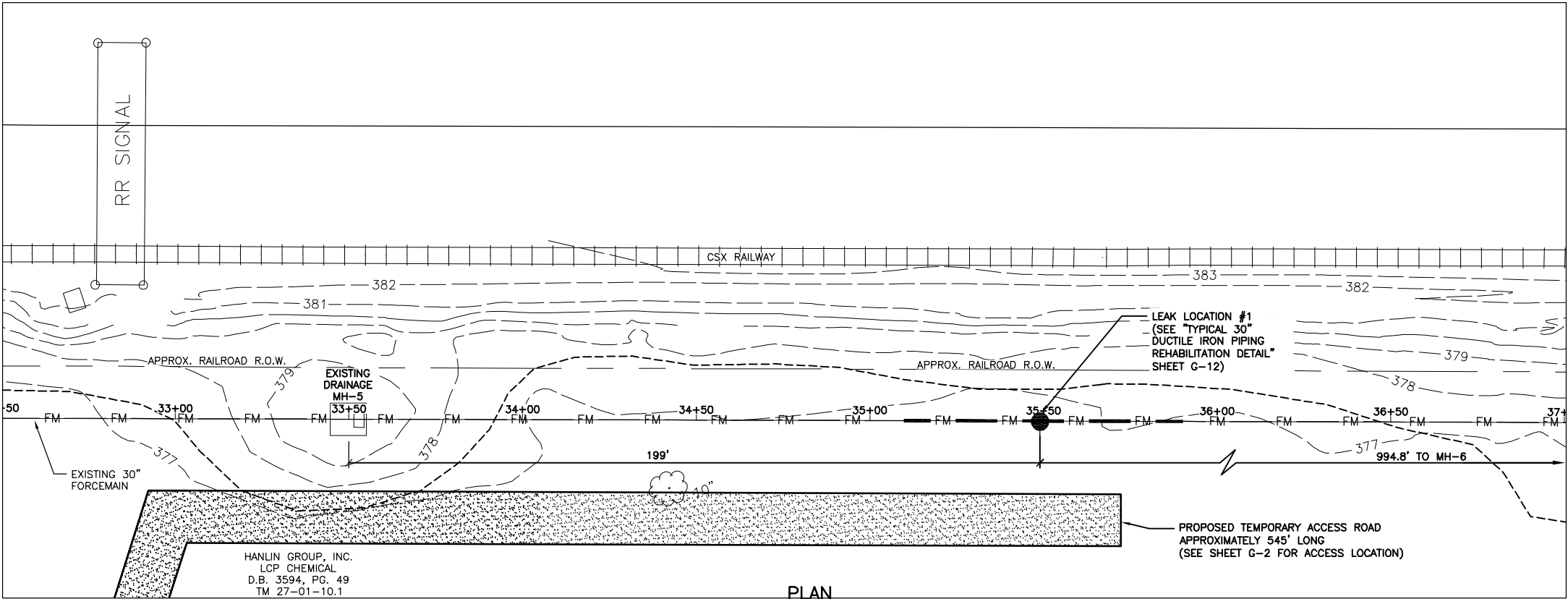
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ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

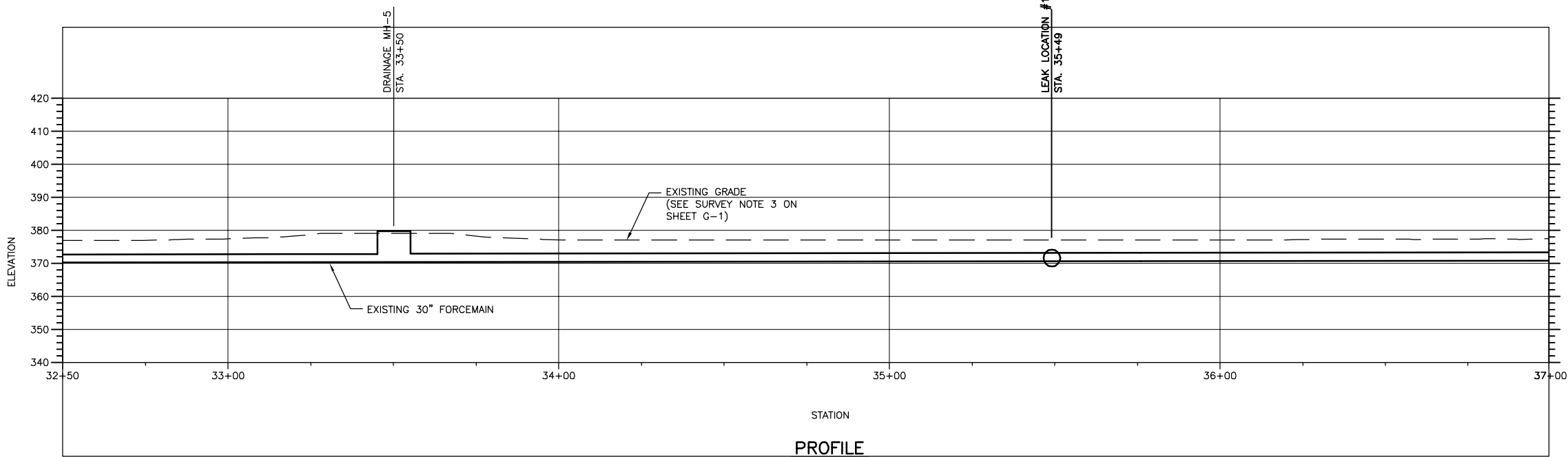
GENERAL
24 INCH/30 INCH FORCEMAIN
SCA CONNECTION

FILE NO.
1163.46358-017
DATE
FEBRUARY 2011

G-3



PLAN
SCALE: 1"=20'



PROFILE
SCALE: HORIZ. 1"=20'
VERT. 1"=20'

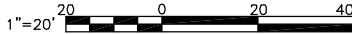
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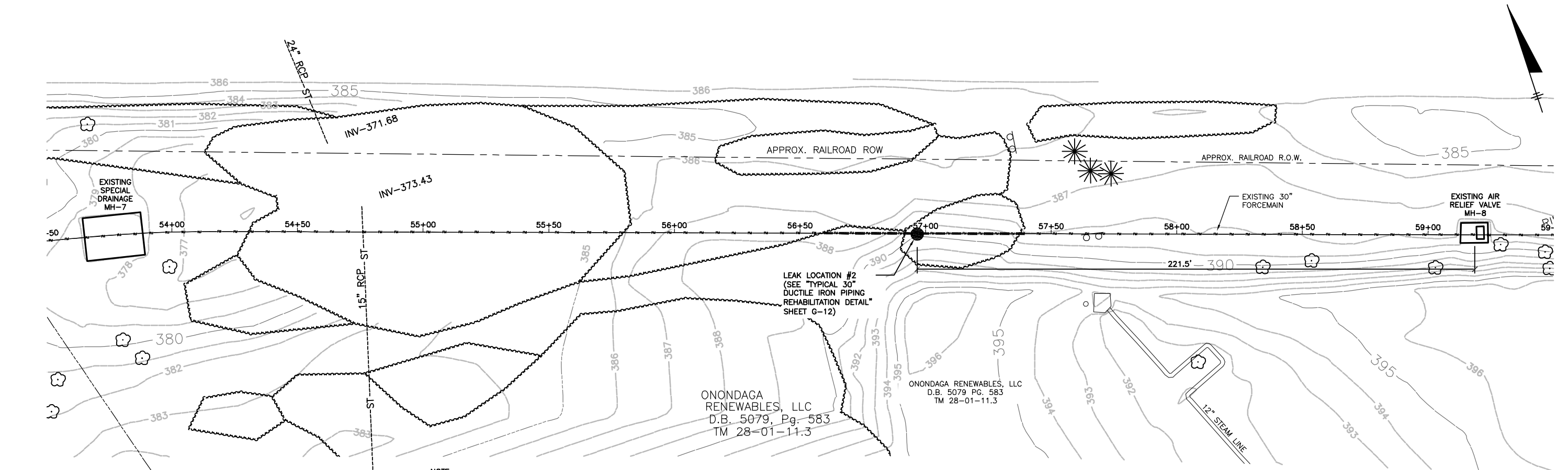
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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
LEAK LOCATION #1
PLAN & PROFILE

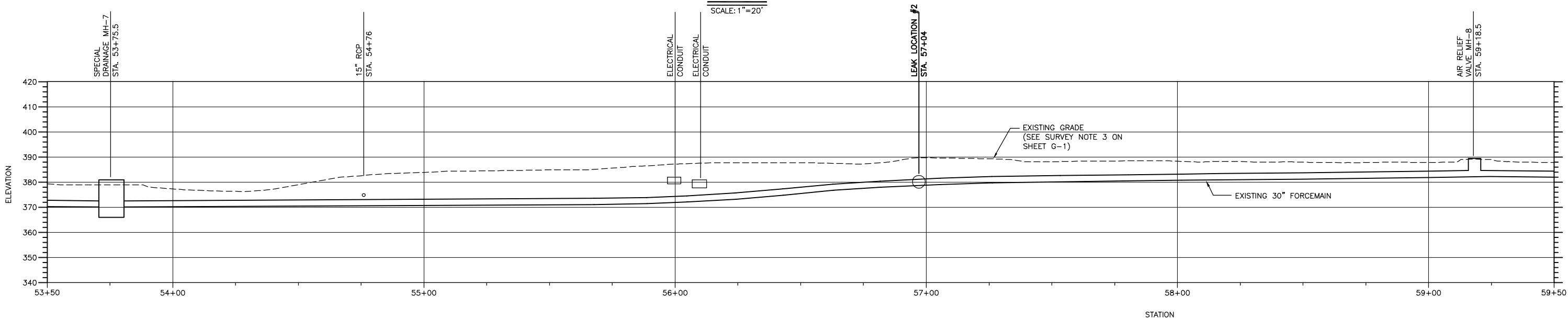
FILE NO.
1163.46358-004
DATE
FEBRUARY 2011

G-4



NOTE:
1. CLEARING AND GRUBBING WILL BE REQUIRED FOR ACCESS.

PLAN
SCALE: 1"=20'



PROFILE
SCALE: HORIZ. 1"=20'
VERT. 1"=20'

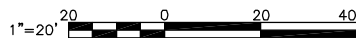
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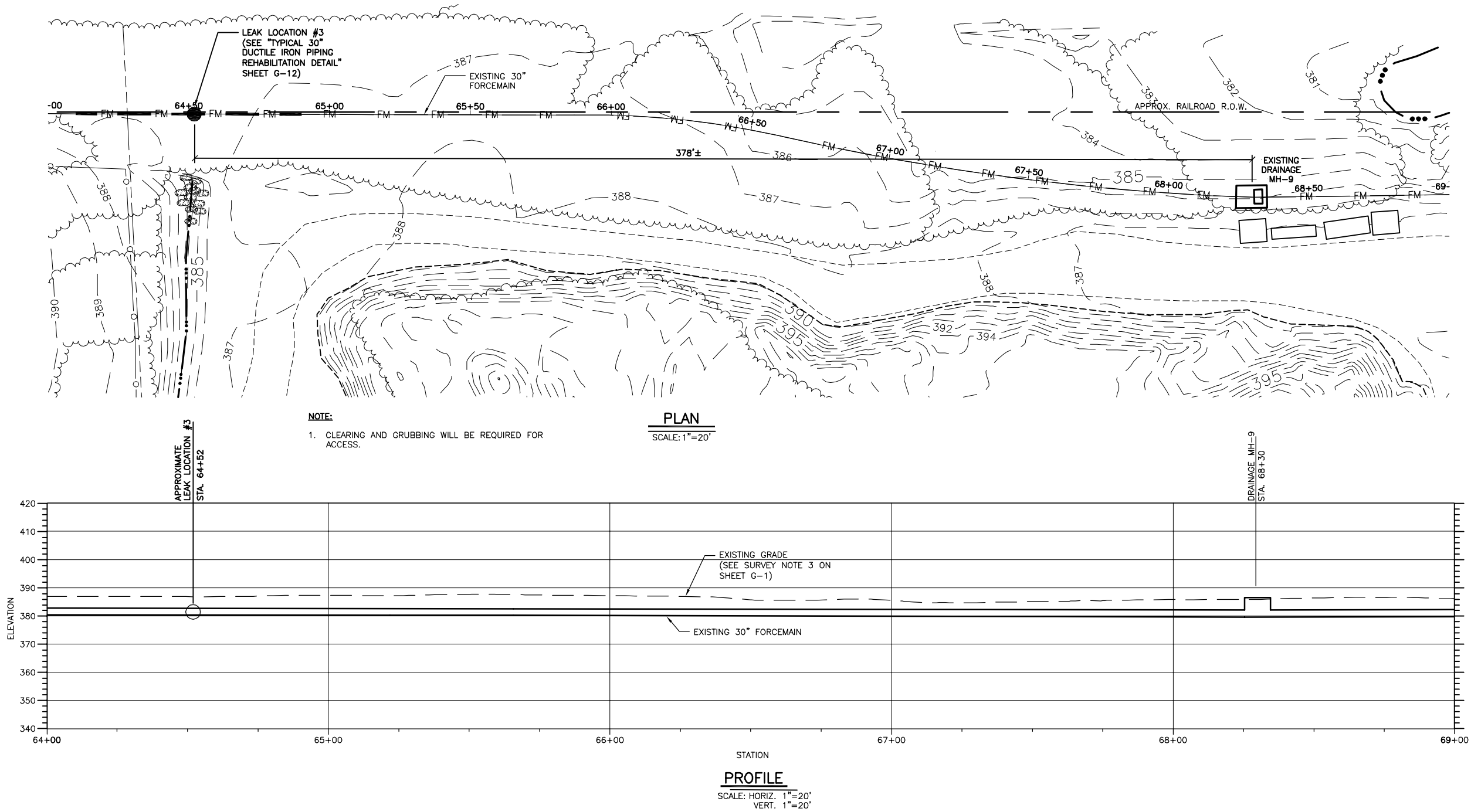
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ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
**LEAK LOCATION #2
PLAN & PROFILE**

FILE NO.
1163.46358-005
DATE
FEBRUARY 2011

G-5



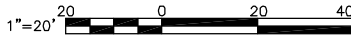
**PRELIMINARY
NOT FOR
CONSTRUCTION**

DATE: 02/01/2011

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IN CHARGE OF JRH
DESIGNED BY NMK CHECKED BY MJD
DRAWN BY SED



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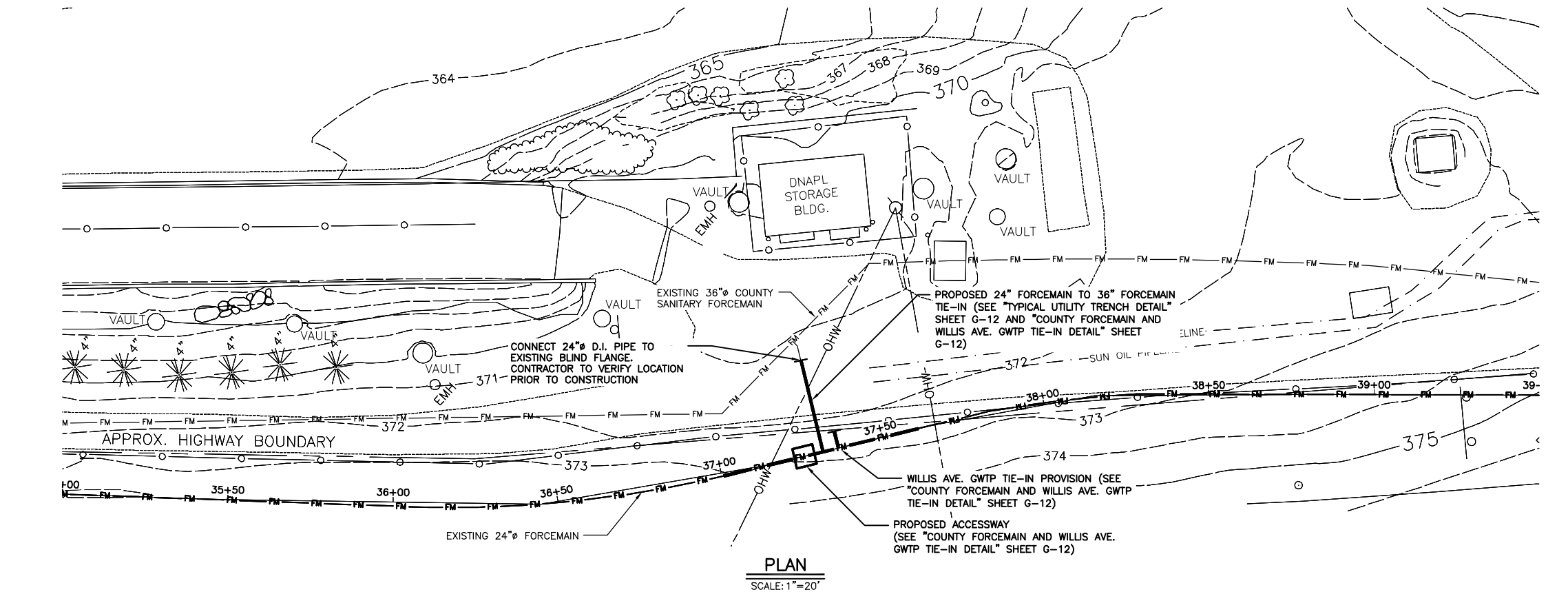


HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

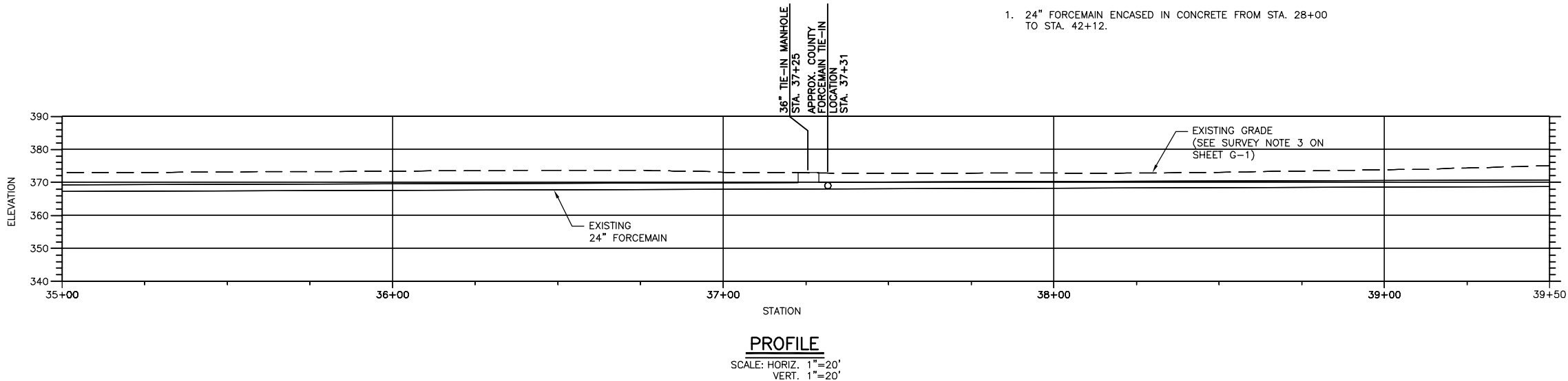
GENERAL
LEAK LOCATION #3
PLAN & PROFILE

FILE NO.
1163.46358-006
DATE
FEBRUARY 2011

G-6



NOTE:
1. 24" FORCEMAIN ENCASED IN CONCRETE FROM STA. 28+00 TO STA. 42+12.



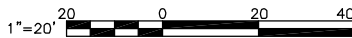
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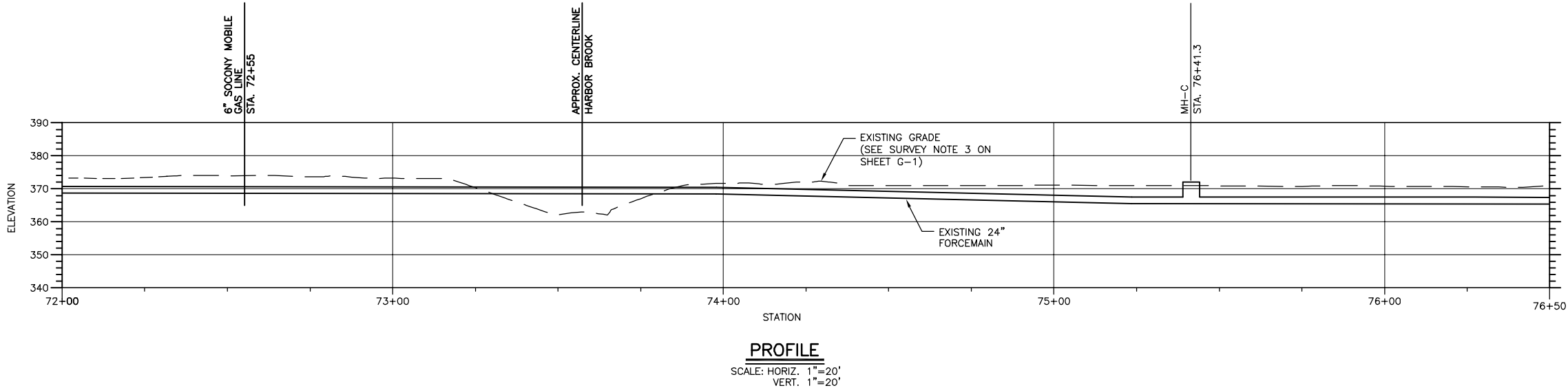
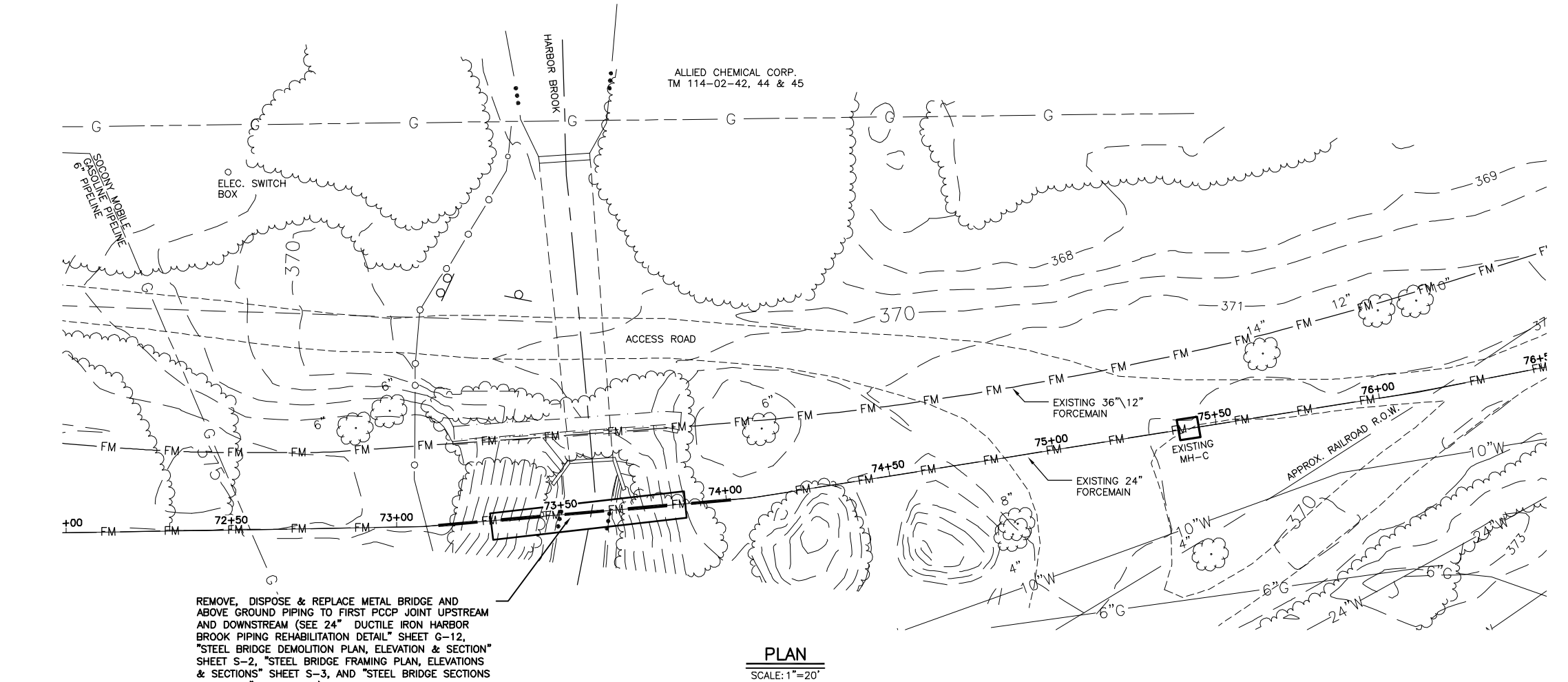
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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
24 INCH/36 INCH
FORCEMAIN CONNECTION
STA. 37+31

FILE NO.
1163.46358-016
DATE
FEBRUARY 2011

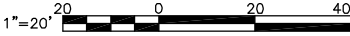
G-7



**PRELIMINARY
NOT FOR
CONSTRUCTION**

DATE: 02/01/2011

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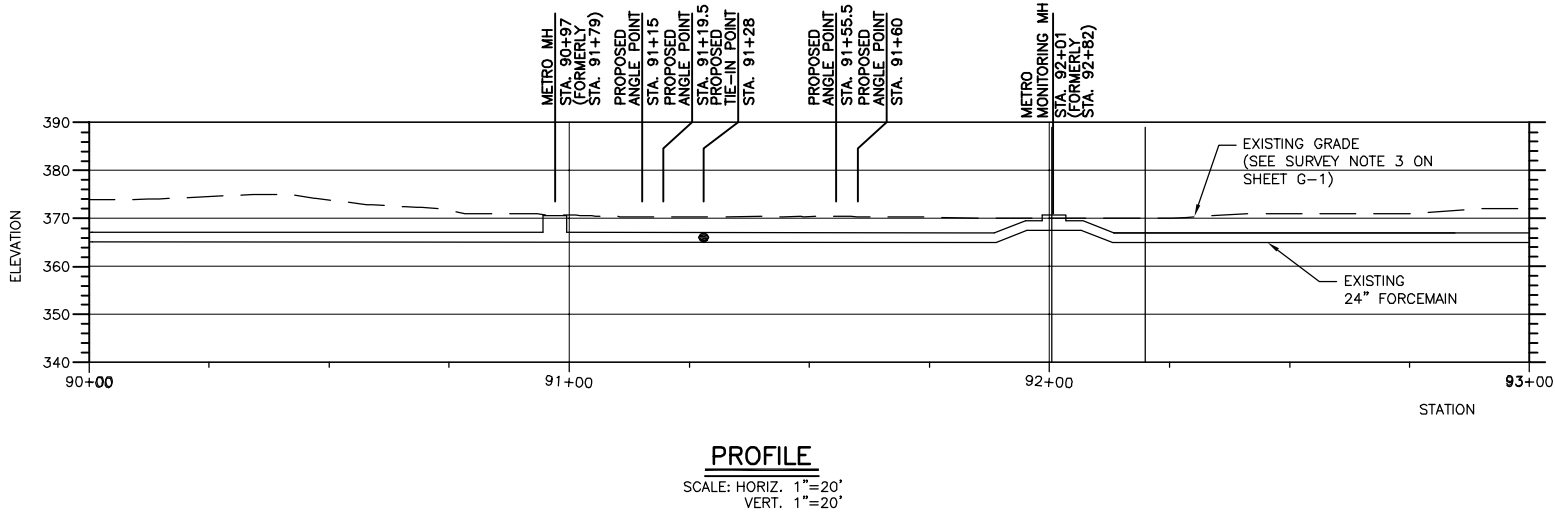
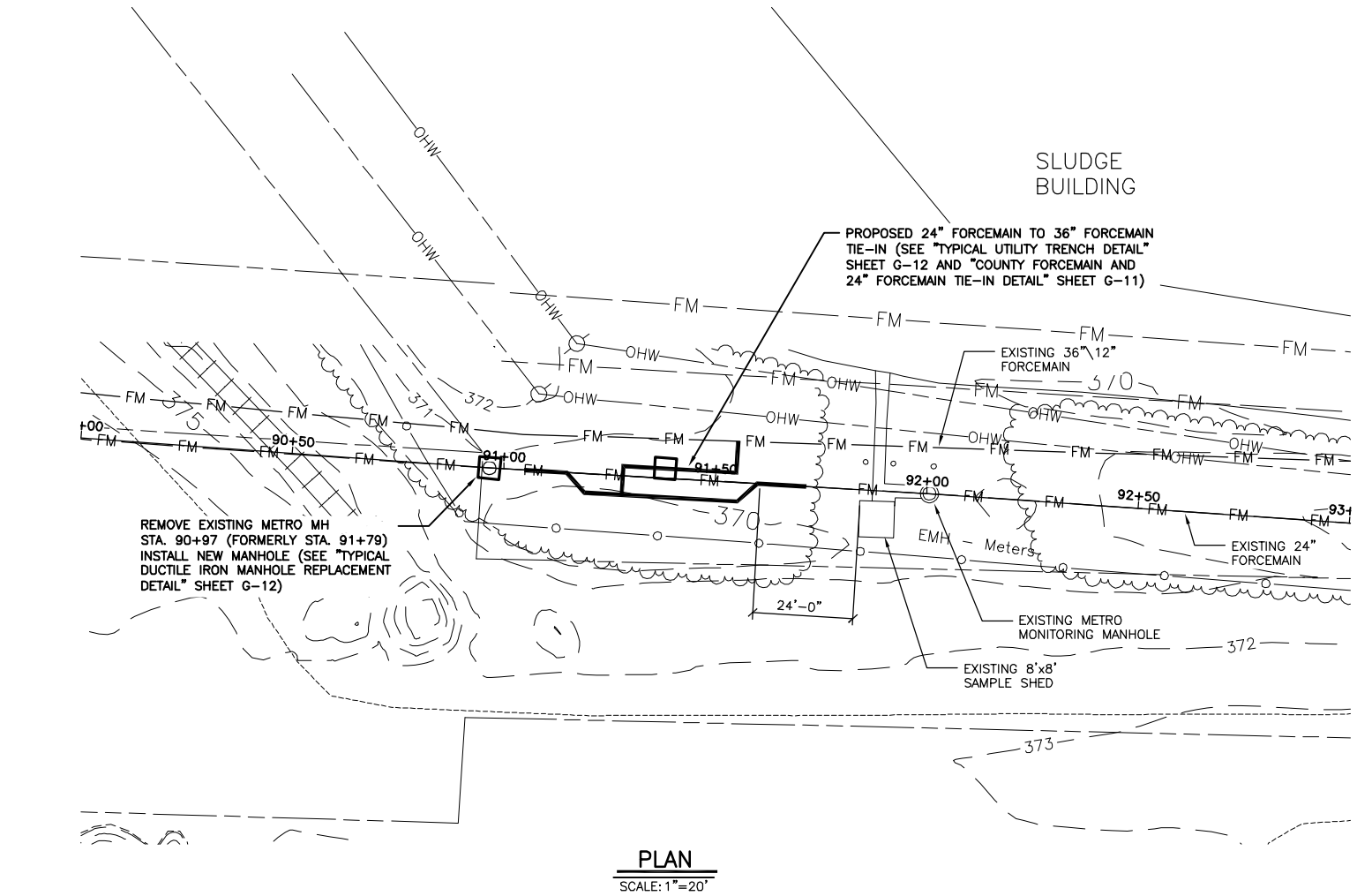


HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
**HARBOR BROOK CROSSING
PLAN & PROFILE**

FILE NO.
1163.46358-007
DATE
FEBRUARY 2011

G-8



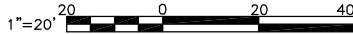
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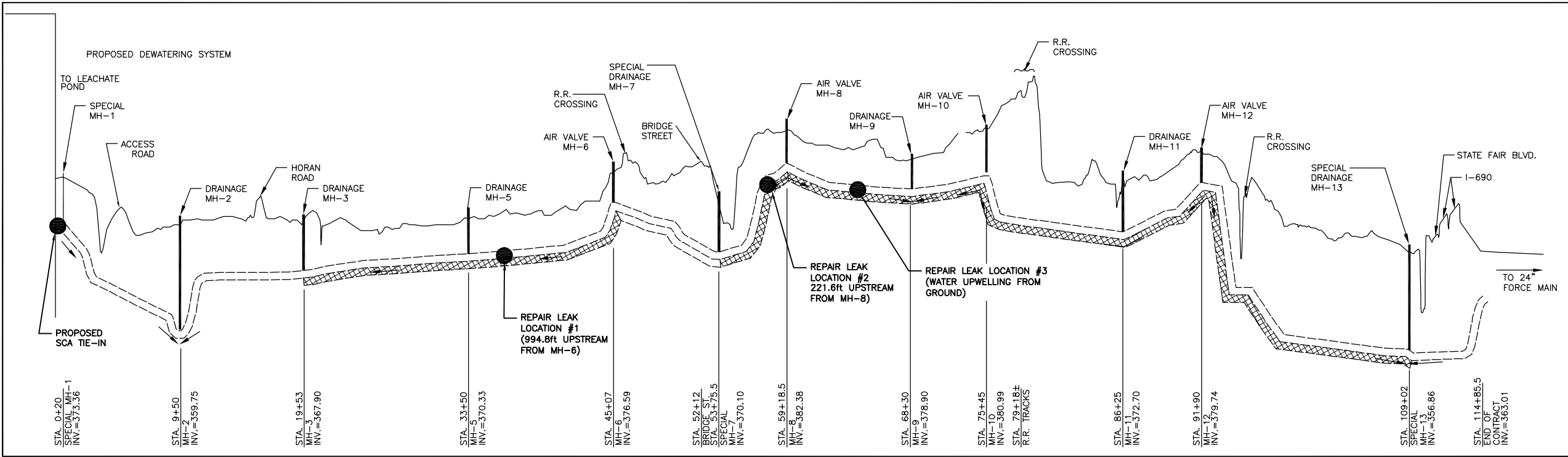
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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

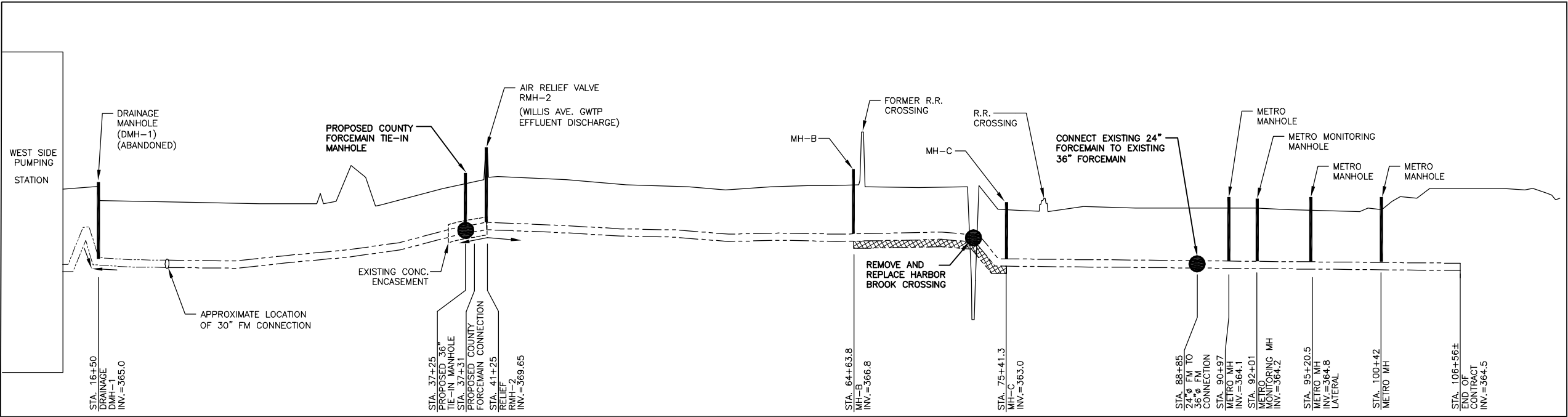
GENERAL
24-INCH/36-INCH
FORCEMAIN CONNECTION
STA. 91+28

FILE NO.
1163.46358-008
DATE
FEBRUARY 2011

G-9



30" (PCCP) FORCE MAIN PROFILE
NOT TO SCALE



24" (PCCP) FORCE MAIN PROFILE
NOT TO SCALE

NOTE:

1. PROFILE INFORMATION WAS OBTAINED FROM SCANNED MAPS AND SCALED RANDOMLY FOR ILLUSTRATION PURPOSES ONLY. DISTANCES AND ELEVATIONS ARE DISTORTED AND NOT TO SCALE.

30 INCH FORCE MAIN		
MANHOLE #		
FROM	TO	DISTANCE (±ft)
MH-1	MH-2	930
MH-2	MH-3	995
MH-3	MH-5	1406
MH-5	MH-6	1157
MH-6	MH-7	873
MH-7	MH-8	576
MH-8	MH-9	974
MH-9	MH-10	615
MH-10	MH-11	1080
MH-11	MH-12	565
MH-12	MH-13	1712
MH-13	RMH-2(24")	3349

24 INCH FORCE MAIN		
MANHOLE #		
FROM	TO	DISTANCE (±ft)
RMH-2	MH-B	2334
MH-B	MH-C	1078
MH-C	MET. MH (90+97)	1556
MET. MH (90+97)	MET. MON. (92+01)	104
MET. MON. (92+01)	MET. MH (95+20.5)	320
MET. MH (95+20.5)	MET. MH (100+42)	522
MET. MH. (100+42)	HBI MH	538±

LEGEND
(THIS SHEET)

- 24" FORCE MAIN
- 30" FORCE MAIN
- 24" FORCE MAIN OUT OF SERVICE
- DRAINAGE DIRECTION
- FORCEMAIN TO BE PRESSURE AND LEAK TESTED THIS CONTRACT
- REPAIR/REHAB LOCATION

PRELIMINARY
NOT FOR
CONSTRUCTION

DATE: 02/01/2011

IN CHARGE OF JRH
DESIGNED BY NMJ CHECKED BY MJD
DRAWN BY SED

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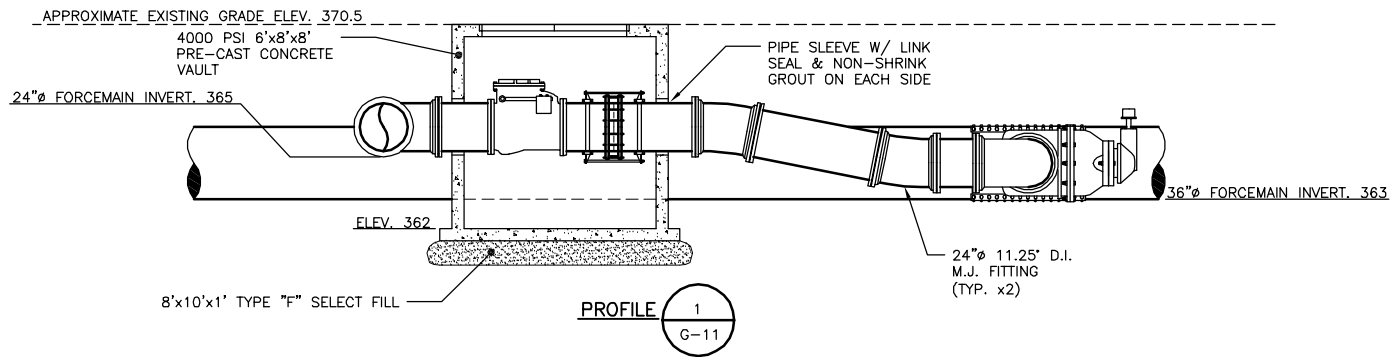
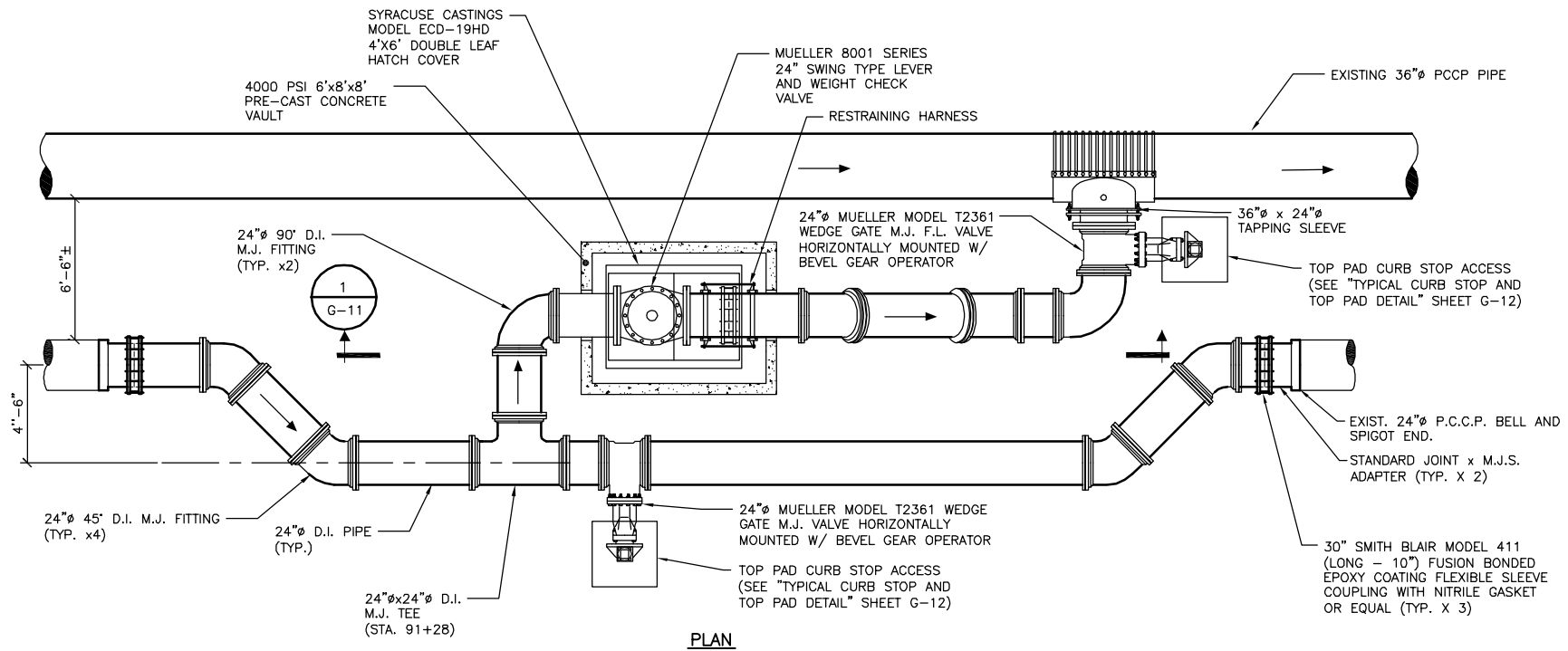
HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
EXAGGERATED FORCEMAIN PROFILE
W/ REPAIR LOCATIONS

FILE NO.
1163.46358-011

DATE
FEBRUARY 2011

G-10



COUNTY FORCEMAIN AND 24" FORCEMAIN
TIE-IN DETAIL STA. 91+28
NOT TO SCALE

PRELIMINARY
NOT FOR
CONSTRUCTION
DATE: 02/01/2011

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IN CHARGE OF _____					
DESIGNED BY _____ CHECKED BY _____					
DRAWN BY _____ SED					
	A	02/01/2011	ISSUED FOR NYSDEC REVIEW		
	NO.	DATE	REVISION	INIT.	

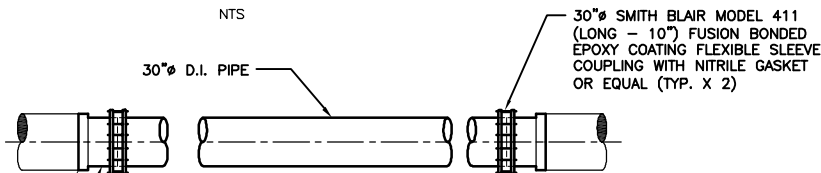
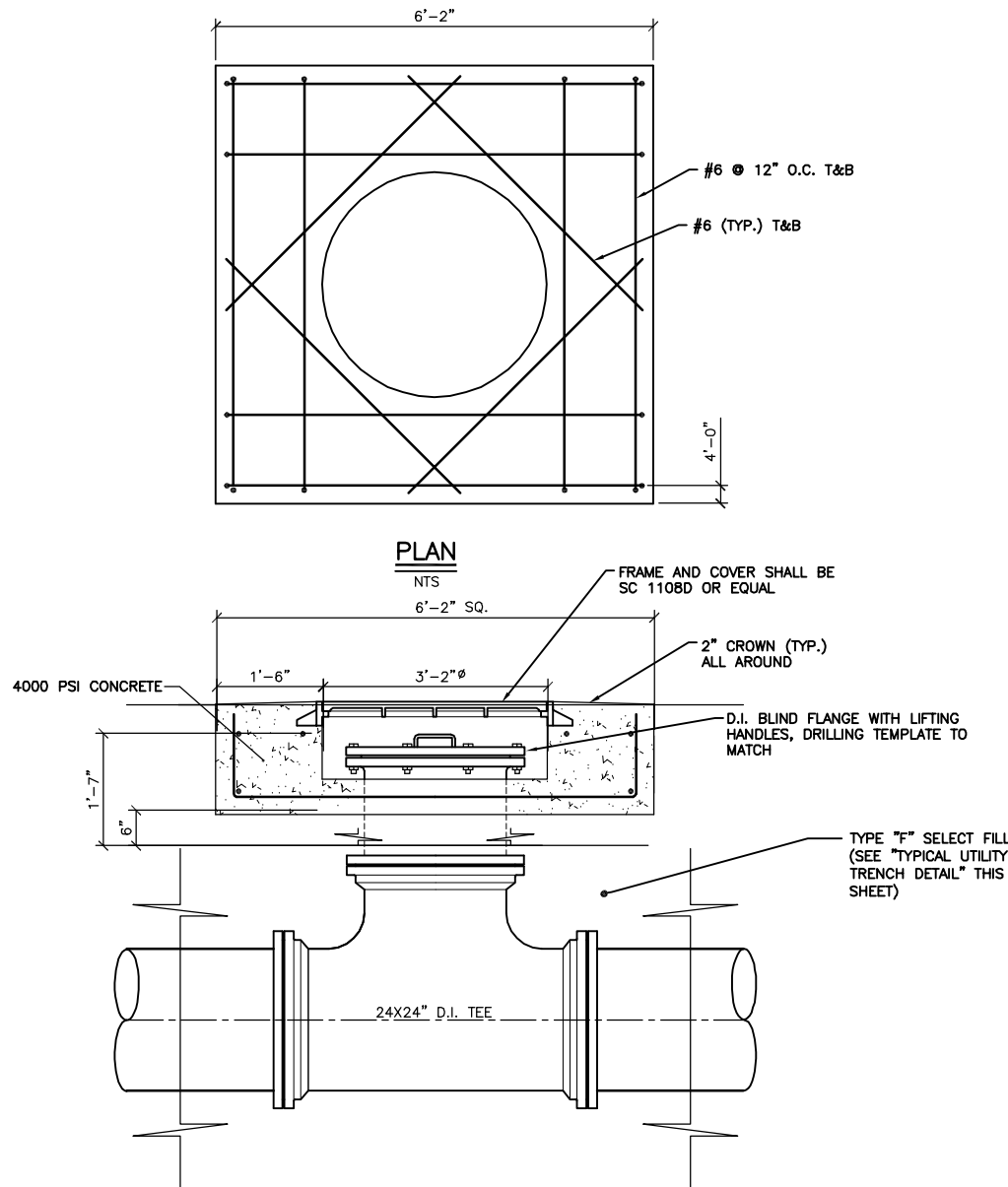


HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN

GENERAL
REHABILITATION
DETAILS

FILE NO.
1163.46358-024
DATE
FEBRUARY 2011

G-11



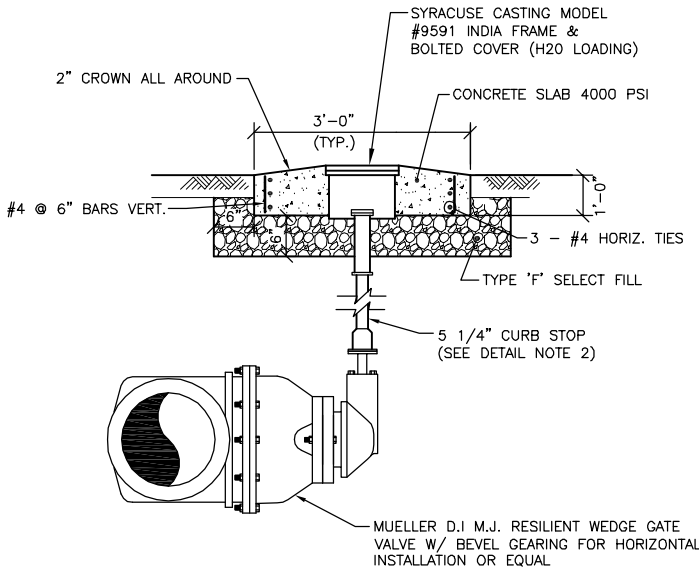
- DETAIL NOTES:
- CONTRACTOR TO VERIFY ALL ELEVATIONS, DISTANCES ETC., PRIOR TO CONSTRUCTION.
 - INSTALL MEGALUG SERIES 1100 AS MFG. BY EBBA IRON SALES, INC. OR EQUAL RETAINER GLANDS ON ALL M.J. PIPE FITTINGS AND VALVES WITHIN THE 40'-0" WORK AREA.
 - SEE SHEETS G-4, G-5, AND G-6 FOR APPLICATION.

TYPICAL 30" DUCTILE IRON PIPING REHABILITATION DETAIL

NOT TO SCALE

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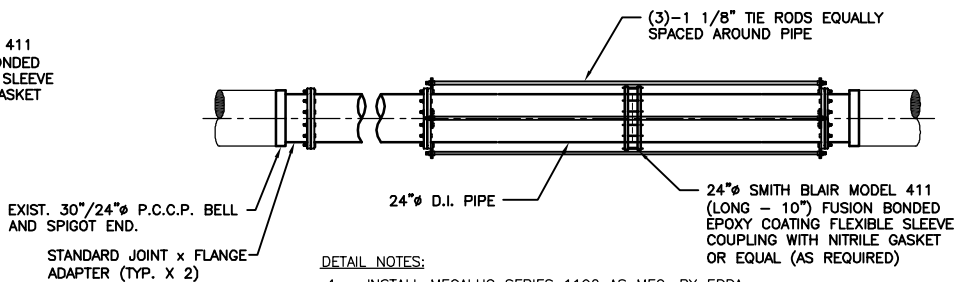


DETAIL NOTE:

- PROVIDE PADLOCK, MASTER LOCK CO. MODEL 1KA (KEY 2537). ALL LOCKS TO BE KEYED THE SAME. PROVIDE 2 EXTRA LOCK SETS TOTAL.
- A CURB STOP EXTENSION SHALL BE USED IF DEPTH OF BEVEL GEAR ON GATE VALVE IS GREATER THAN 8 FEET BELOW GRADE.

TYPICAL CURB STOP AND TOP PAD DETAIL

NOT TO SCALE

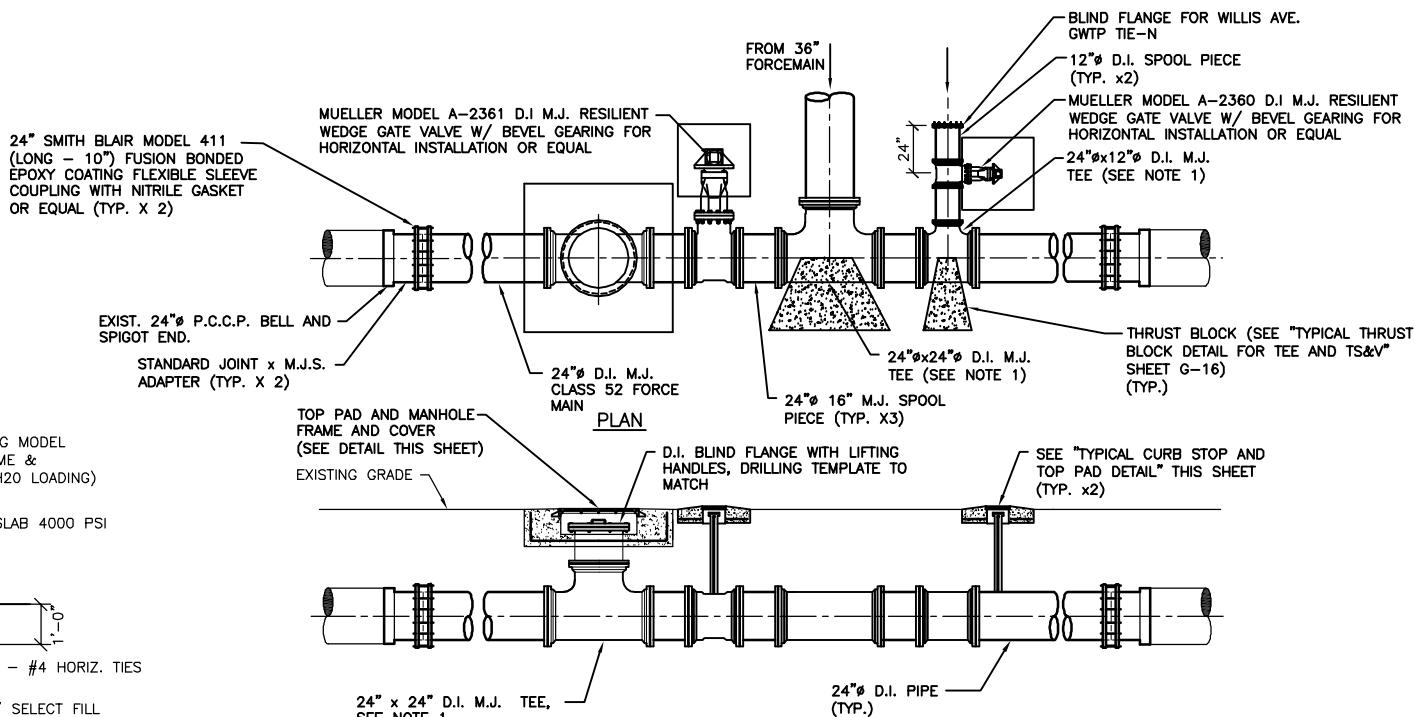


DETAIL NOTES:

- INSTALL MEGALUG SERIES 1100 AS MFG. BY EBBA IRON SALES, INC. OR EQUAL RETAINER GLANDS ON ALL M.J. PIPE FITTINGS AND VALVES WITHIN THE 40'-0" WORK AREA.
- CONTRACTOR TO VERIFY ALL ELEVATIONS, DISTANCES ETC., PRIOR TO CONSTRUCTION.
- PIPE LENGTHS SHALL BE COORDINATED WITH THE STEEL BRIDGE FABRICATION SO THAT THE PIPE IS SUPPORTED ON BOTH SIDES OF THE PIPE JOINT.
- SEE SHEET G-8 FOR APPLICATION.

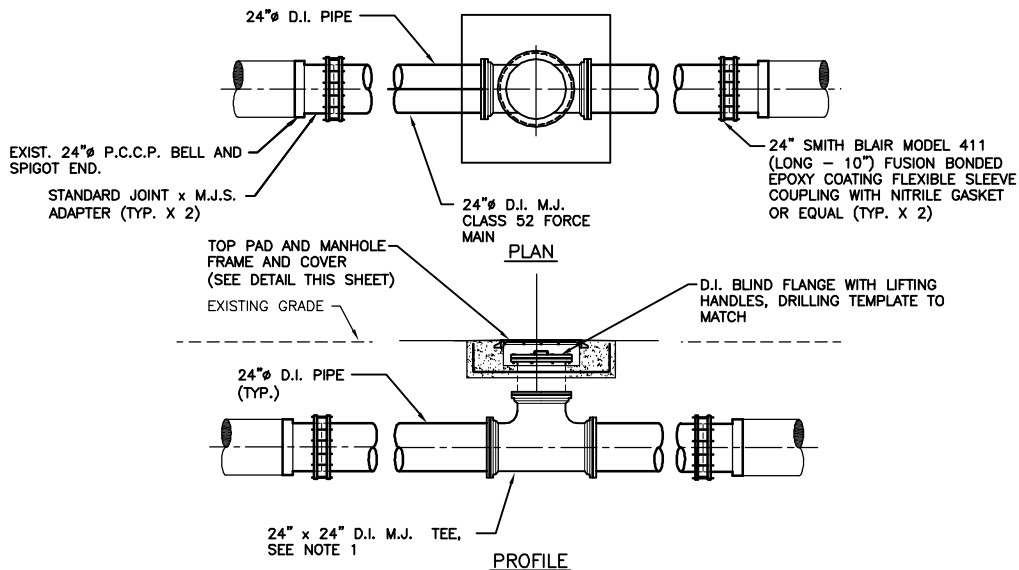
24" DUCTILE IRON HARBOR BROOK PIPING REHABILITATION DETAIL

NOT TO SCALE



COUNTY FORCEMAIN AND WILLIS AVE. GWTP TIE-IN DETAIL

NOT TO SCALE



DETAIL NOTES:

- INSTALL MEGALUG SERIES 1100 AS MFG. BY EBBA IRON SALES, INC. OR EQUAL RETAINER GLANDS ON ALL M.J. ENDS WITHIN THE 40'-0" WORK AREA.
- CONTRACTOR TO VERIFY ALL ELEVATIONS, DISTANCES ETC., PRIOR TO CONSTRUCTION.
- SEE SHEETS G-9 AND G-10 FOR APPLICATION.

TYPICAL DUCTILE IRON MANHOLE REPLACEMENT DETAIL

NOT TO SCALE

PRELIMINARY
NOT FOR
CONSTRUCTION

DATE: 02/01/2011

IN CHARGE OF	JRH
DESIGNED BY	NMK
CHECKED BY	MJD
DRAWN BY	SED

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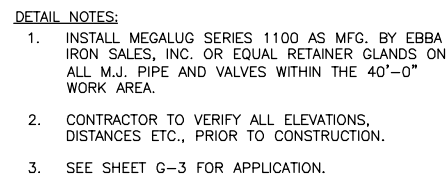
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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

GENERAL
REHABILITATION
DETAILS

FILE NO.
1163.46358-014
DATE
FEBRUARY 2011

G-12



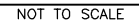
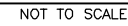
NOT TO SCALE



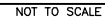
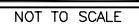
1. PROVIDE TERMINAL POST AT EACH TERMINATION AND CHANGE IN HORIZONTAL OR VERTICAL DIRECTION 30' OR MORE. TERMINAL POST SHALL BE PLUMB WITH TOPS PROPERLY ALIGNED.
2. ALL CHAIN LINK FENCING AND GATES TO BE INSTALLED PER THE MANUFACTURERS RECOMMENDATIONS.
3. PROVIDE HARDENED SECURITY PAD LOCKS, MASTER LOCK CO. PRO SERIES MODEL 6121 W/ LONG THICK SHANK OR EQUAL. ALL LOCKS TO BE THE SAME. PROVIDE 2 EXTRA LOCK SETS IN TOTAL, KEYED THE SAME AS THE OTHERS AND (10) KEYS.

NOT TO SCALE

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PIPE SIZE	DIMENSION		
	A	B	C
30"x30"	3'	3'	2' OR UNDISTURBED EARTH



DATE: 02/01/2011

IN CHARGE OF <u>JRH</u>	NOT TO SCALE					 2011 © O'BRIEN & GERE, INC.	HONEYWELL INTERNATIONAL INC. ONONDAGA LAKE 30-INCH/24-INCH FORCEMAIN REHABILITATION PHASE 1 SYRACUSE, NEW YORK	GENERAL REHABILITATION DETAILS	FILE NO. 1163.46358-018	G-13
DESIGNED BY <u>NMK</u> CHECKED BY <u>MJD</u>									DATE	
DRAWN BY <u>SED</u>		B 02/01/2011	ISSUED FOR NYSDEC REVIEW						FEBRUARY 2011	
		A 01/10/2011	ISSUED FOR CLIENT REVIEW							
		NO.	DATE	REVISION	INIT.					

A. STRUCTURAL GENERAL NOTES

1. WORK SHALL COMPLY WITH THE BUILDING CODE OF NEW YORK STATE (BCNYS) 2010 EDITION.
2. SECTIONS AND DETAILS SHOWN ON DRAWINGS ARE TYPICAL. USE SIMILAR CONSTRUCTION AT LOCATIONS NOT SPECIFICALLY DETAILED.
3. EXAMINE AND COMPARE STRUCTURAL DRAWINGS WITH ARCHITECTURAL, MECHANICAL, PLUMBING, SITE, ELECTRICAL AND PROCESS DRAWINGS. VERIFY LOCATIONS AND DIMENSIONS OF CHASES, INSERTS, OPENINGS, SLEEVES, DEPRESSIONS, AND OTHER PROJECT REQUIREMENTS NOT SHOWN ON THE STRUCTURAL DRAWINGS.
4. VERIFY LOCATION OF EXISTING UNDERGROUND SITE UTILITIES PRIOR TO THE START OF WORK AND COORDINATE LOCATION WITH STRUCTURAL DRAWINGS. NOTIFY THE ENGINEER OF ANY CONFLICTS IN WRITING. DO NOT PROCEED WITH AFFECTED WORK UNTIL CONFLICTS HAVE BEEN RESOLVED.
5. ADEQUATE TEMPORARY BRACING OF CONSTRUCTION ELEMENTS SHALL BE PROVIDED FOR FOUNDATIONS, ABOVE GRADE WALLS, STRUCTURAL STEEL AND OTHER STRUCTURAL SYSTEMS, FOR WIND AND/OR CONSTRUCTION LOADS. BRACING SHALL BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION OPERATIONS PRIOR TO STRUCTURAL ELEMENTS REACHING THEIR SPECIFIED DESIGN STRENGTH AND/OR REACHING THEIR COMPLETED FORM AS SHOWN ON THE CONTRACT DRAWINGS. DESIGN AND MAINTENANCE OF SAID BRACING SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
6. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS & DIMENSIONS PRIOR TO THE START OF WORK.

B. STRUCTURAL CONCRETE NOTES

1. CONCRETE WORK SHALL CONFORM TO REQUIREMENTS OF THE AMERICAN CONCRETE INSTITUTE (A.C.I.) 301, "SPECIFICATIONS FOR STRUCTURAL CONCRETE", A.C.I. 318, "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", AND A.C.I. 350, "CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES".
2. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH AS SHOWN: UNIT WEIGHT MIN. STRENGTH @ 28 DAYS (P.S.I.)

ITEM	MIN. STRENGTH @ 28 DAYS (P.S.I.)	UNIT WEIGHT(P.C.F.)
a. CONCRETE EXPOSED TO FLUID	4500	145
b. WALLS, PIERS, FOOTINGS, MATS, & RETAINING WALLS	4000	145
c. SLAB ON GRADE	4000	145

3. PORTLAND CEMENT USED FOR CONCRETE WORK SHALL COMPLY WITH A.S.T.M. C-150 FOR TYPE I/II CEMENT.
4. NORMAL WEIGHT CONCRETE SHALL CONTAIN FINE AND COARSE AGGREGATES COMPLYING WITH A.S.T.M. C-33. THE MAXIMUM SIZE OF COARSE AGGREGATES SHALL BE OF SIZES SUITABLE FOR PLACEMENT IN STRUCTURAL ELEMENTS CONSIDERING THEIR SIZE AND REINFORCEMENT CONFIGURATION.
5. CONCRETE PLACED UNDER COLD WEATHER CONDITIONS THAT MAY BE EXPOSED TO SUBSEQUENT MOISTURE AND FREEZING CONDITIONS PRIOR TO REACHING DESIGN COMPRESSIVE STRENGTH OR EXTERIOR CONCRETE WORK EXPOSED TO FREEZE / THAW CYCLING SHALL BE AIR-ENTRAINED TO 5-7% AIR CONTENT. HOWEVER, SLAB FLATWORK TO RECEIVE A HARD-TROWEL FINISH SHALL NOT BE AIR ENTRAINED.
6. CONSTRUCTION JOINTS SHOWN ON THE DRAWINGS ARE MANDATORY. OMISSIONS, ADDITIONS OR CHANGES SHALL NOT BE MADE EXCEPT WITH THE SUBMITTAL OF A WRITTEN REQUEST, TOGETHER WITH DRAWINGS OF THE PROPOSED JOINT LOCATIONS, FOR APPROVAL BY THE ENGINEER.
7. WHERE CONSTRUCTION JOINTS ARE NOT SHOWN, OR WHEN ALTERNATE LOCATIONS ARE PROPOSED, DRAWINGS SHOWING LOCATION OF CONSTRUCTION AND CONTROL JOINTS AND CONCRETE PLACING SEQUENCE SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO THE PREPARATION OF THE REINFORCEMENT SHOP DRAWINGS.
8. CONCRETE SHALL BE PLACED WITHOUT HORIZONTAL CONSTRUCTION JOINTS EXCEPT WHERE SHOWN OR NOTED. VERTICAL CONSTRUCTION JOINTS AND STOPS IN CONCRETE WORK SHALL NOT BE MADE AT MID-SPAN OR AT POINTS OF MAX. SHEAR.
9. CONCRETE SLABS ON GRADE, INCLUDING CONCRETE PLACED ON STEEL DECK, SHALL BE PLACED SO THAT THE SLAB THICKNESS IS AT NO POINT LESS THAN THAT INDICATED ON THE CONTRACT DRAWINGS. ADJUST SUBGRADE ELEVATIONS TO ACCOUNT FOR SLOPED SLAB ON GRADE SURFACES.
10. CHAMFER EXPOSED CORNERS OF CONCRETE 3/4 INCH.
11. CONCRETE WALLS SHALL HAVE POCKETS FOR BEAMS & SHELVES FOR STRUCTURAL SLABS NOT MONOLITHIC WITH WALL. PROVIDE 8" MINIMUM BEARING FOR BEAMS AND 4" MINIMUM BEARING FOR SLABS U.O.N.
12. CONCRETE BEAMS SHALL BE MONOLITHIC WITH SLABS. HORIZONTAL JOINTS IN STRUCTURAL SLABS AND BEAMS ARE NOT ALLOWED.
13. PIPES AND CONDUITS RUNNING HORIZONTALLY IN SLABS:
 - a. PLACEMENT: CENTERED IN DEPTH OF SLAB
 - b. MAXIMUM OUTSIDE DIAMETER: 1/3 SLAB THICKNESS
 - c. SPACING: AT LEAST THREE DIAMETERS ON CENTER. COVER SHALL BE MAINTAINED & EMBEDMENTS SHALL NOT CONTACT REINFORCEMENT.

14. CAST INTO CONCRETE ACCESSORIES REQUIRED BY ARCHITECTURAL FINISHES AND MECHANICAL EQUIPMENT. COORDINATE LOCATION AND QUANTITY WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
15. AT CONSTRUCTION JOINTS, PROVIDE A SHEAR KEY 1 1/2 IN. DEEP x 1/3-JOINT-WIDTH. ALSO PROVIDE A TENSION CLASS "B" LAP OF REINFORCING. USE ROUGHENED JOINT WHERE INDICATED ON THE DRAWINGS.
16. SLAB, BEAM, AND JOIST TOP REINFORCING CONTINUOUS OVER A SUPPORT SHALL EXTEND TO THE 1/3-POINT OF THE CLEAR SPAN UNLESS INDICATED OTHERWISE ON THE DRAWINGS. SLAB, BEAM, AND JOIST TOP REINFORCING AT A DISCONTINUOUS END SHALL TERMINATE IN A STANDARD 90 DEGREE HOOK INTO SUPPORTING BEAMS AND WALLS.
17. LOCATE CONSTRUCTION JOINTS IN BEAMS AND STRUCTURAL SLABS IN THE CENTER-1/3 OF SPAN, AND NOT CLOSER THAN 3 FT. FROM AN INTERSECTING BEAM.

C. STRUCTURAL REINFORCEMENT NOTES

1. REINFORCEMENT WORK OF DETAILING, FABRICATION AND ERECTION SHALL CONFORM TO "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (A.C.I. 318)", "CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (A.C.I. 350)", "A.C.I. DETAILING MANUAL - 1988 (SP-86)", "CRSI MANUAL OF STANDARD PRACTICE (MSP I)" AND "STRUCTURAL WELDING CODE - REINFORCING STEEL (A.W.S. D1.4)".
2. STEEL REINFORCEMENT, UNLESS NOTED OTHERWISE, SHALL CONFORM TO THE FOLLOWING:
 - a. BARS, TIES AND STIRRUPS A.S.T.M. A615 GRADE (Fy = 60,000 P.S.I.)
 - b. REINFORCING TO BE WELDED SHALL CONFORM TO A.S.T.M. A706 (Fy = 60,000 P.S.I.) OR MILL TEST REPORTS SHALL BE SUBMITTED SHOWING CARBON EQUIVALENT.
3. MINIMUM CONCRETE PROTECTIVE COVER FOR REINFORCEMENT OF NON-ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES SHALL BE AS FOLLOWS U.O.N.:
 - a. UNFORMED SURFACES CAST AGAINST AND PERMANENTLY IN CONTACT WITH EARTH . . . 3.0"
 - b. BUILDING SURFACES FORMED IN CONTACT WITH EARTH OR EXPOSED TO WEATHER, #6 THROUGH #18 BARS 2.0"
#5 BARS AND SMALLER 1.5"
 - c. BUILDING SURFACES NOT IN CONTACT WITH OR EXPOSED TO WEATHER (WALLS AND SLABS) #14 AND #18 BARS 1.5"
#11 BARS AND SMALLER 0.75"
 - d. BUILDING BEAMS, GIRDERS AND COLUMNS - PRINCIPAL REINFORCEMENT, TIES, STIRRUPS AND SPIRALS 1.5"
4. MINIMUM CONCRETE PROTECTIVE COVER FOR LIQUID CONTAINING STRUCTURES SHALL CONFORM TO "CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (A.C.I. 350)".
5. WHERE CONTINUOUS REINFORCEMENT IS CALLED FOR, IT SHALL BE EXTENDED CONTINUOUSLY AROUND CORNERS AND LAPPED AT NECESSARY SPLICES OR HOOKED AT DISCONTINUOUS ENDS.
6. LAPS SHALL BE CLASS B TENSION LAP SPLICES, UNLESS NOTED OTHERWISE.
7. WHERE REINFORCEMENT IS NOT SHOWN ON THE CONTRACT DRAWINGS, PROVIDE REINFORCEMENT IN ACCORDANCE WITH APPLICABLE DETAILS AS DETERMINED BY THE ENGINEER. IN NO CASE SHALL REINFORCEMENT BE LESS THAN THE MINIMUM REINFORCEMENT PERMITTED BY THE APPLICABLE CODES NOR LESS THAN THE FOLLOWING:
 - a. BEAM STIRRUPS: #4 @ 12" O.C.
 - b. BEAM STIRRUP SUPPORTS: 1-#5 @ EACH STIRRUP BEND
 - c. FACE REINFORCEMENT IN BEAMS OR PORTIONS OF BEAMS: #4 @ 12" O.C.
 - d. STRUCTURAL SLABS: 0.0018 x GROSS CONCRETE AREA IN EACH DIRECTION
 - e. STRUCTURAL COLUMNS: 0.01 x GROSS CONCRETE CROSS SECTIONAL AREA
 - f. STRUCTURAL BEAMS: 0.0033 x GROSS CONCRETE CROSS SECTIONAL AREA
 - g. DOWELS FROM TOP OF CONCRETE WALLS TO CONCRETE SLABS: MAIN SLAB REINFORCING: #4@12"
TEMPERATURE & SHRINKAGE: #4@12"
8. EXTEND DOWELS TO THE 1/4-POINT OF SLAB SPAN.
9. WHERE REINFORCEMENT IS SHOWN IN SECTION, REINFORCEMENT IS CONSIDERED TYPICAL WHEREVER THE SECTION APPLIES.
10. WHERE THERE IS A CONFLICT BETWEEN LOCATION OF COLUMN VERTICAL BARS AND BEAM HORIZONTAL BARS, THE COLUMN BARS SHALL REMAIN IN THEIR DESIGNATED POSITIONS AND BEAM BARS LOCATIONS SHALL BE ADJUSTED.
11. REINFORCEMENT SHALL BE CONTINUOUS THROUGH CONSTRUCTION JOINTS UNLESS OTHERWISE SHOWN.
12. COLUMN DOWELS SHALL BE SET AND POSITIONED SO AS TO BE ENCLOSED BY THE COLUMN TIES.
13. PROVIDE DOWELS FROM FOUNDATION TO MATCH BAR SIZE AND NUMBER OF REINFORCING IN THE SUPPORTED ELEMENT, UNLESS NOTED OTHERWISE.
14. REINFORCEMENT SHALL NOT BE TACK WELDED OR HEATED FOR BENDING.
15. INSTALLATION OF REINFORCEMENT SHALL BE COMPLETED AT LEAST 24 HOURS PRIOR TO THE SCHEDULED CONCRETE PLACEMENT. NOTIFY ENGINEER OF COMPLETION AT LEAST 24 HOURS PRIOR TO THE SCHEDULED COMPLETION OF THE INSTALLATION OF REINFORCEMENT.
16. WELDING OF REINFORCEMENT SHALL CONFORM TO A.W.S. D1.4 (INCLUDING PREHEAT REQUIREMENTS). ONLY BARS INDICATED ON DRAWINGS TO BE WELDED SHALL BE WELDED.

D. NEOPRENE ELASTOMERIC PAD

1. ELOSTOMERIC MATERIAL PROPERTIES:

ITEM	ASTM METHOD	REQUIREMENT
HARDNESS, DUROMETER, A	D2240-81	45 - 75
TENSILE STRENGTH, PSI	D412-80	2500 (MIN.)
LOW TEMPERATURE, -40°F	D746-79	NO FAILURE

E. STRUCTURAL STEEL NOTES

1. FABRICATE AND ERECT STRUCTURAL STEEL SYSTEMS IN ACCORDANCE WITH "A.I.S.C. SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS (A.S.I.C. 360-05)".
2. STEEL MEMBERS HAVE BEEN PROPORTIONED UTILIZING ALLOWABLE FLEXURAL STRENGTH (ASD) METHODS AS PRESCRIBED BY A.I.S.C.
3. STRUCTURAL STEEL SHALL BE DETAILED IN ACCORDANCE WITH "DETAILING FOR STEEL CONSTRUCTION (A.I.S.C.)" AND WHERE REQUIRED, DESIGNED IN ACCORDANCE WITH CITED REFERENCES.
4. STRUCTURAL STEEL SHALL BE NEW AND CONFORM TO:
 - a. UNLESS OTHERWISE NOTED (W SHAPES) A.S.T.M. A992 (Fy=50 K.S.I.)
 - b. HOLLOW STRUCTURAL SECTIONS
 - a. ROUND A.S.T.M. A500 GRADE B (Fy=42 K.S.I.)
 - b. SQUARE OR RECTANGULAR A.S.T.M. A500 GRADE B (Fy=46 K.S.I.)
 - c. MISC. STRUCTURAL SHAPES & CONNECTIONS (C SHAPES, ANGLES, PLATES) A.S.T.M. A36 (Fy=36 K.S.I.)
 - d. ANCHOR BOLTS A.S.T.M. A36 OR F1554
 - e. HIGH STRENGTH BOLTS A.S.T.M. A325-N
5. WELDING SHALL CONFORM TO THE REQUIREMENTS OF A.W.S. D1.1, AND SHALL BE PERFORMED BY APPROVED, CERTIFIED PERSONS.
6. WELDED CONNECTIONS SHALL UTILIZE E70XX ELECTRODES.
7. WELDS SHALL DEVELOP THE FULL STRENGTH OF THE MATERIALS BEING WELDED, UNLESS NOTED OTHERWISE, EXCEPT THAT FILLET WELDS SHALL BE A MINIMUM OF 3/16" U.O.N.
8. ANCHOR BOLTS, LEVELING PLATES OR BEARING PLATES SHALL BE LOCATED AND BUILT INTO CONNECTING WORK, PRESET BY TEMPLATES, AND SET IN FULL BEDS OF NON-SHRINK GROUT.
9. PRINCIPAL STRUCTURAL BOLTED CONNECTIONS (BEAM-BEAM, BEAM-GIRDER, BEAM OR GIRDER TO COLUMN) SHALL BE MADE USING 3/4" DIAMETER MINIMUM A.S.T.M. A325 BOLTS IN BEARING CONNECTIONS.
10. BEAM CONNECTIONS SHALL PROVIDE CONNECTION CAPACITY BY ALLOWABLE STRESS DESIGN (ASD) METHODS. WHERE BEAM REACTIONS ARE NOT INDICATED ON THE PLANS, CONNECTION CAPACITY SHALL BE DETERMINED AS FOLLOWS:
 - a. NON-COMPOSITE BEAMS: SUPPORT A REACTION "R" EQUAL TO 1/2 THE TOTAL UNIFORM LOAD CAPACITY OF THE BEAM FOR A GIVEN SHAPE, SPAN, AND GRADE OF STEEL PER "ALLOWABLE LOADS ON BEAMS" PART 3, A.I.S.C. "STEEL CONSTRUCTION MANUAL, 13TH EDITION.
 - b. ADD TO "R" THE LOADS OR REACTIONS OF MEMBERS SUPPORTED BY THE BEAM NEAR SUPPORTS AND/OR THE VERTICAL COMPONENTS OF FORCE IN DIAGONAL BRACING MEMBERS FRAMING INTO THE BEAM.

11. A MINIMUM OF TWO (2) BOLTS SHALL BE UTILIZED AT CONNECTIONS.
12. ENDS OF COLUMNS AT SPLICES AND AT OTHER BEARING CONNECTIONS SHALL BE "FINISHED TO BEAR" TO COMPLETE TRUE BEARING.
13. PROVIDE STIFFENERS "FINISHED TO BEAR" UNDER LOAD CONCENTRATIONS ON SUPPORTING MEMBERS, OVER COLUMNS AND WHERE SHOWN ON THE DRAWINGS.
14. PROVIDE TEMPORARY ERECTION BRACING AND SUPPORTS TO HOLD STRUCTURAL STEEL FRAMING SECURELY IN POSITION. SUCH TEMPORARY BRACING AND SUPPORTS SHALL NOT BE REMOVED UNTIL PERMANENT BRACING HAS BEEN INSTALLED AND CONCRETE FLOOR SLABS HAVE ATTAINED 75% OF SPECIFIED CONCRETE STRENGTH.
15. STRUCTURAL FRAMING SHALL BE TRUE AND PLUMB BEFORE CONNECTIONS ARE FINALLY BOLTED OR WELDED. WHERE STEEL SHELF ANGLES FOR FACADE SUPPORT ARE PRESENT, TOP OF SHELF ANGLE ON SUCCESSIVE FLOORS WILL BE SET IN SAME VERTICAL PLANE.
16. FIELD CUTTING OF STRUCTURAL FRAMING AND/OR FIELD MODIFICATIONS OF STRUCTURAL FRAMING SHALL NOT BE MADE WITHOUT PRIOR WRITTEN APPROVAL BY ENGINEER FOR EACH SPECIFIC CASE.
17. UNLESS OTHERWISE SHOWN, COLUMNS SHALL BE EXTENDED TO TOPS OF BEAMS AND FRAMED CONNECTIONS.
18. THE CONTRACTOR SHALL FURNISH & INSTALL ALL PLATES, CLIP ANGLES, CONNECTION MATERIALS, ETC. AS REQUIRED FOR COMPLETION OF THE STRUCTURE, EVEN IF SUCH ITEMS ARE NOT SPECIFICALLY SHOWN ON THE STRUCTURAL DRAWINGS.
19. WHERE STRUCTURAL FRAMING OR MISCELLANEOUS LINTELS ARE INDICATED BY ARCHITECTURAL, HVAC, ELECTRICAL OR PLUMBING DOCUMENTS AND (1) NO CORRESPONDING MEMBER APPEARS ON STRUCTURAL DOCUMENTS AND (2) NO OTHER TRADES ARE NOTED TO PROVIDE AND INSTALL SUCH COMPONENTS, THESE ITEMS SHALL BE FURNISHED AND/OR INSTALLED IN THE WORK BY THE FABRICATOR. WHERE NO SIZES ARE INDICATED ON ARCHITECTURAL, HVAC, ELECTRICAL OR PLUMBING DOCUMENTS, THE CONTRACTOR SHALL INCLUDE THE COST TO FURNISH, AND INSTALL WHERE APPLICABLE, 30 POUNDS PER LINEAR FOOT OF STEEL MEMBER, WITH REQUIRED FINISH IN HIS BID.

DESIGN CRITERIA

LIVE LOAD:
STAIRS & EXITS: 100 P.S.F. OR 0.3 KIPS CONCENTRATED
WALKWAYS & ELEVATED PLATFORMS: 60 P.S.F.

SNOW LOAD:
GROUND SNOW (Pg): 50 P.S.F.
FLAT ROOF SNOW (Pf): 46.2 P.S.F.
SNOW EXPOSURE (Ce): 1.0
SNOW THERMAL (Ct): 1.2
SNOW IMPORTANCE (Is): 1.1

WIND LOAD:
BASIC WIND SPEED: 90 M.P.H.
WIND IMPORTANCE: 1.15
WIND EXPOSURE: "C"

EARTHQUAKE:
SEISMIC USE GROUP: II
SEISMIC IMPORTANCE: 1.25
Ss = 0.194g Sds = 0.207g
S1 = 0.078g Sd1 = 0.125g
SITE CLASS: "D"

BASIC SEISMIC FORCE RESISTING SYSTEM: ORDINARY STEEL MOMENT FRAME,
ORDINARY CONCENTRICALLY BRACED STEEL FRAME

SEISMIC DESIGN CATEGORY (SDC): "B"
DESIGN BASE SHEAR: VARIES BY STRUCTURE (ASCE 7, EQ.9.5.2-1)
ANALYSIS: EQUIVALENT LATERAL FORCE PROCEDURE

STRUCTURAL SYMBOLS:

	—	—	COMPACTED GRANULAR BASE
	—	—	COMPACTED STONE FILL
	—	—	CONCRETE
	—	—	DECK SPAN
	—	—	DEMOLITION
	—	—	FINAL GRADE
	—	—	GRATING
	—	—	GROUT
	—	—	REINFORCING STEEL IN CONCRETE
	—	—	SLOPE
	—	—	STEEL
	—	—	UNDISTURBED EARTH
	—	—	UNDISTURBED ROCK

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CONSTRUCTION

DATE: 02/01/2011

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DESIGNED BY	DMN	CHECKED BY	RFB
DRAWN BY	RAE		

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NO.	DATE	REVISION	INIT.



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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

STRUCTURAL

FILE NO.

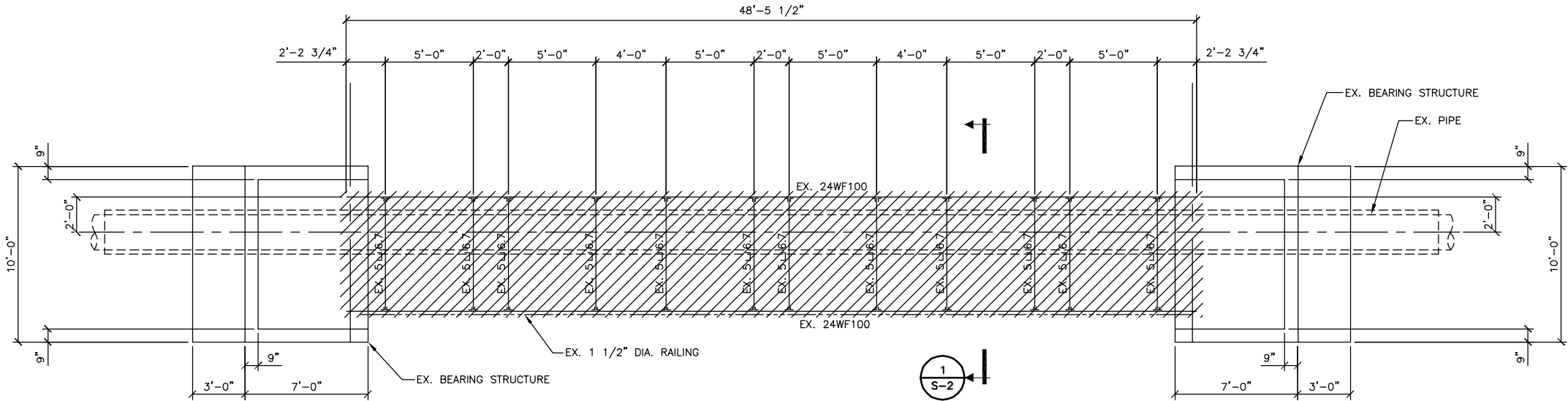
1163.46358-S001

DATE

FEBRUARY 2011

S-1

GENERAL NOTES,
SYMBOLS & ABBREVIATIONS

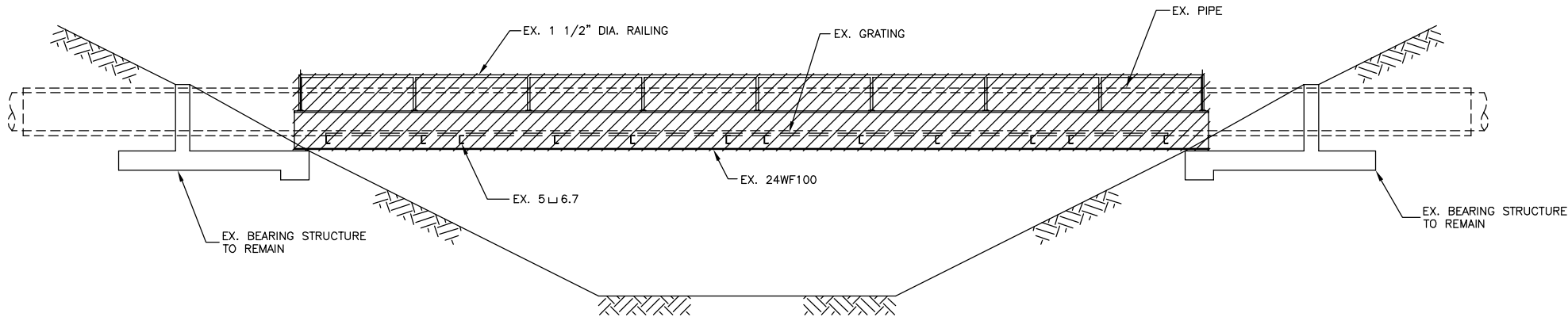


EX. STEEL BRIDGE DEMOLITION PLAN

SCALE: 1/4" = 1'-0"

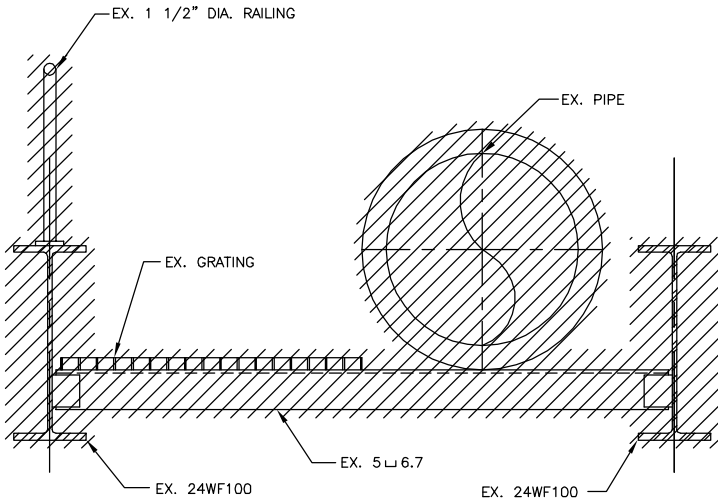
NOTE:

1. CONTRACTOR SHALL DISPOSE OF BRIDGE AND PIPING IN COMPLIANCE WITH THE APPROPRIATE LEAD & ASBESTOS ABATEMENT PROCEDURES.



ELEVATION

SCALE: 1/4" = 1'-0"



SECTION
SCALE: 1" = 1'-0"

1
S-2

ITEMS TO BE REMOVED
& DISPOSED OF BY
CONTRACTOR

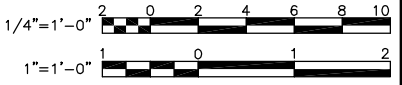
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DESIGNED BY DMN CHECKED BY RFB
DRAWN BY RAE



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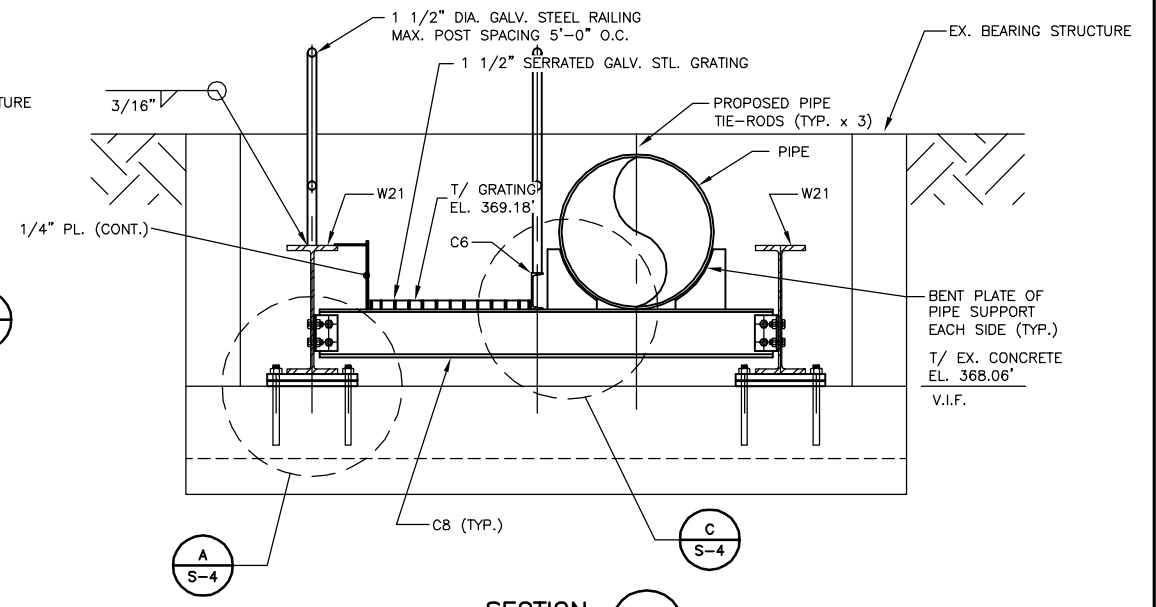
HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

STRUCTURAL

**STEEL BRIDGE DEMOLITION
PLAN, ELEVATION & SECTION**

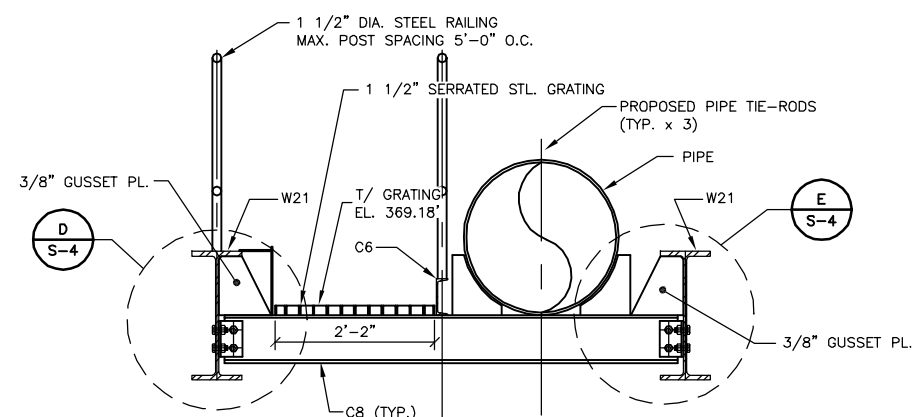
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1163.46358-S002
DATE
FEBRUARY 2011

S-2



SECTION 2
SCALE: $\frac{3}{4}" = 1'-0"$ S-3

SECTION
SCALE: $\frac{3}{4}" = 1'-0"$



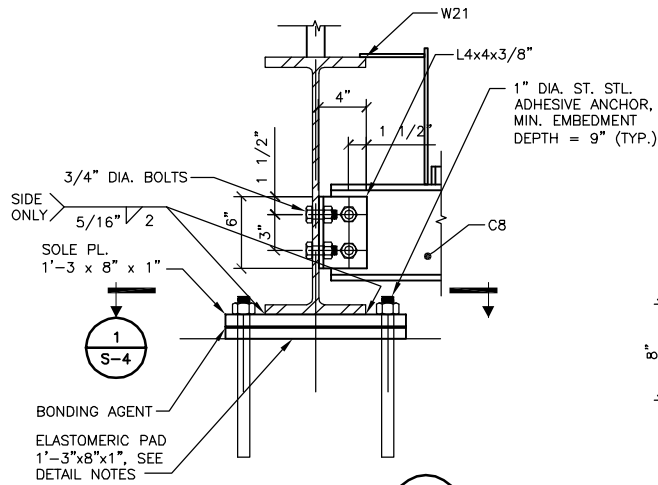
SECTION
SCALE: $\frac{3}{4}" = 1'-0"$

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DATE: 02/01/2011

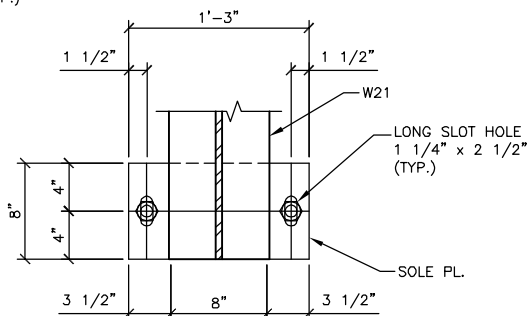
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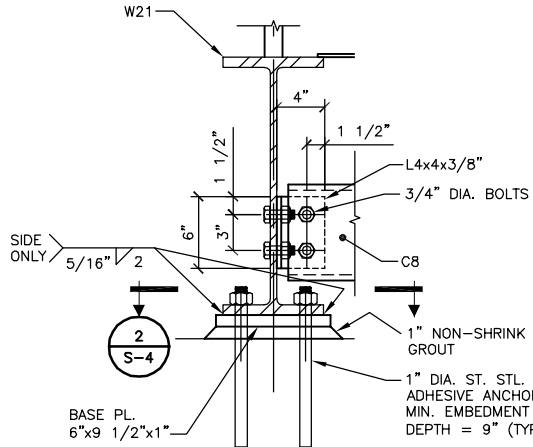


DETAIL A
SCALE: 1 1/2" = 1'-0"
S-3

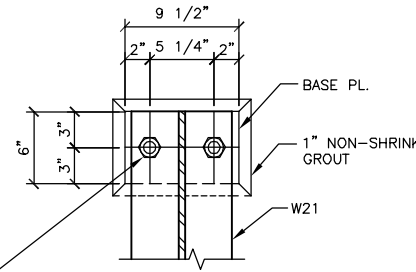
- DETAIL NOTES:**
1. DURING SHOP OR FIELD WELDING, THE TEMPERATURE OF STEEL IS NOT TO EXCEED 250 DEGREES FAHRENHEIT FOR ANY STEEL IN DIRECT CONTACT WITH THE ELASTOMERIC PAD.
 2. USE TEMPERATURE-CRAYONS TO MONITOR STEEL DURING WELDING.



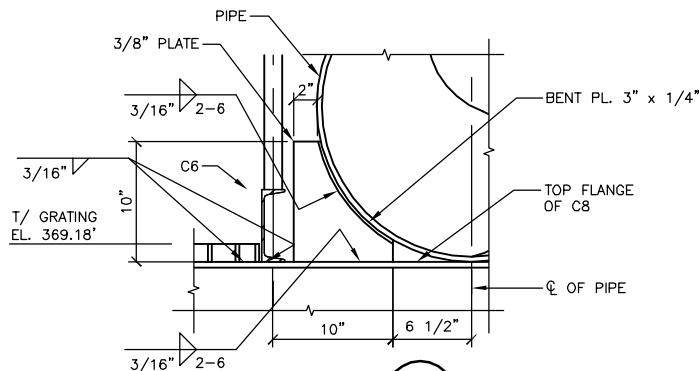
SECTION 1
SCALE: 1 1/2" = 1'-0"
S-4



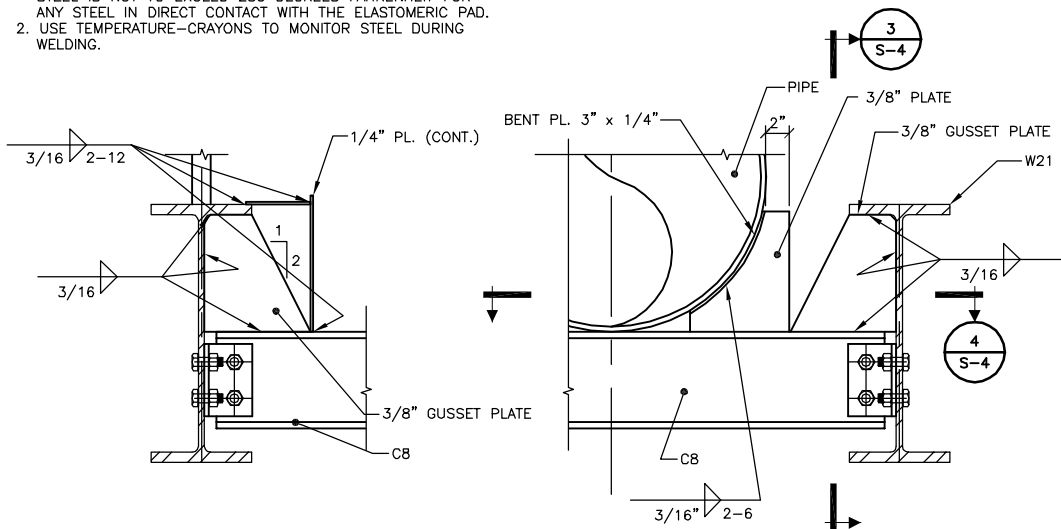
DETAIL B
SCALE: 1 1/2" = 1'-0"
S-3



SECTION 2
SCALE: 1 1/2" = 1'-0"
S-4

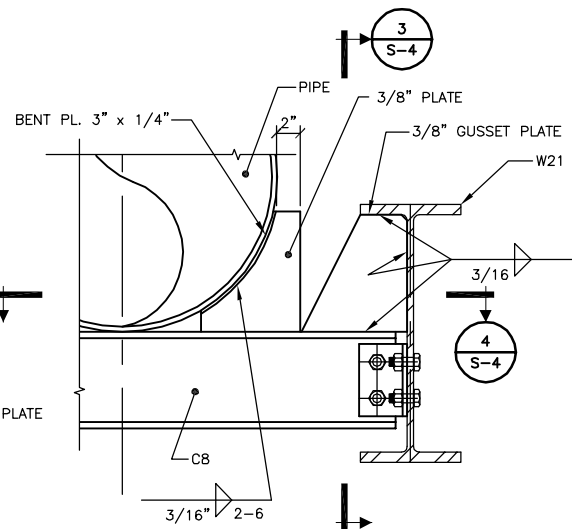


DETAIL C
SCALE: 1 1/2" = 1'-0"
S-3

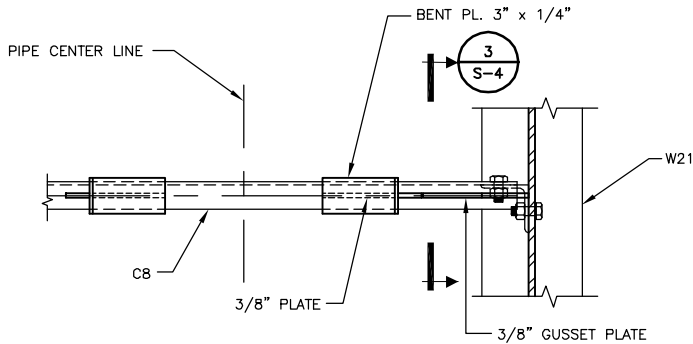


DETAIL D
SCALE: 1 1/2" = 1'-0"
S-3

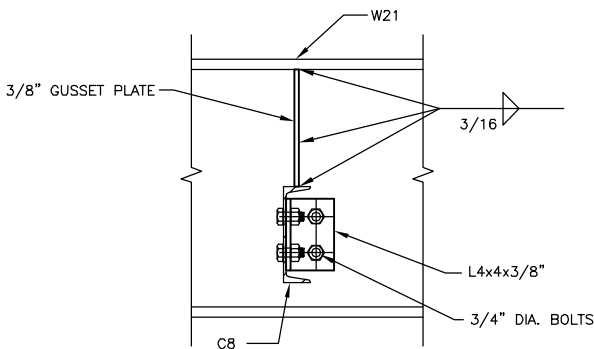
- DEATIL NOTES:**
1. 1 1/2" SERRATED STEEL GRATING NOT SHOWN FOR CLARITY.



DETAIL E
SCALE: 1 1/2" = 1'-0"
S-3



SECTION 3
SCALE: 1 1/2" = 1'-0"
S-4



SECTION 4
SCALE: 1 1/2" = 1'-0"
S-4

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DATE: 02/01/2011

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DESIGNED BY DMN CHECKED BY RFB
DRAWN BY RAE

1 1/2"=1'-0"

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HONEYWELL INTERNATIONAL INC.
ONONDAGA LAKE
30-INCH/24-INCH FORCEMAIN
REHABILITATION PHASE 1
SYRACUSE, NEW YORK

STRUCTURAL
**STEEL BRIDGE SECTIONS
& DETAILS**

FILE NO.
1163.46358-003
DATE
FEBRUARY 2011

S-4

SPECIFICATIONS

30-inch/24-inch Force Main Integrity Rehabilitation Phase 1

**Town of Geddes and City of Syracuse,
NY**

Honeywell

January 2011

**30-inch/24-inch Force Main Rehabilitation Phase 1
Honeywell International Inc.
Morristown, New Jersey**

**TECHNICAL SPECIFICATIONS
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02226	Trenching, Backfilling and Compacting
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SECTION 01160

SPILL AND DISCHARGE CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Preparation, submission, and implementation of an acceptable Spill and Discharge Control Plan by the Contractor as specified herein and in accordance with all provisions of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Honeywell Syracuse Portfolio Health and Safety Programs (HSP2)

1.3 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

- A. Not Used.

1.4 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Spill and Discharge Control Plan
 - 2. Spill Incident Reports

PART 2 PRODUCTS

2.1 GENERAL

- A. Spill and Discharge Control (SDC) Plan
 - 1. The Contractor shall develop, implement, maintain, supervise, and be responsible for a Spill and Discharge Control Plan. This SDC Plan shall provide contingency measures for potential spills of oil and hazardous materials and construction-related materials including, but not limited to, fuels, hydraulic fluids, lubricants, and construction water.
 - 2. Procedures outlined in the SDC Plan shall follow applicable local, State, and Federal laws and regulations. The plan shall, at a minimum, contain the following:
 - a. Procedures for Containing Dry and Liquid Spills.
 - b. Absorbent Material available on-site.
 - c. Procedures for collection, storage, and handling/disposal of spilled materials.

- d. Decontamination Procedures. Decontamination procedures may be required after cleanup to eliminate traces of the substance spilled or reduce it to an acceptable level. Acceptable levels shall be in accordance with all applicable local, State, and Federal laws and regulations and shall be approved by the New York State Department of Environmental Conservation (NYSDEC). Complete cleanup may require removal of contaminated soils. All contaminated materials that cannot be decontaminated must be properly containerized, labeled, and properly disposed of within 90 days. Any and all testing and disposal costs related to the cleanup of a spill caused by the Contractor's activities shall be borne by the Contractor.
- e. Spill Incident Report Format. A written report detailing the spill or discharge shall include, at a minimum, the cause and resolution of the incident, the substance and quantity spilled, outside agencies involved, date and time the incident occurred and actions taken to prevent incident reoccurrence. The report shall be submitted to the Owner's Representative, the Owner, and NYSDEC, within 24 hours of the incident, and earlier if necessary to comply with local, state, or federal regulations. The Contractor shall document the location of all spills on the Site Drawings and submit the Drawings to the Owner's Representative at project completion.

B. Spill and Discharge Control

- 1. The Contractor shall provide methods, means, equipment, facilities, and personnel required to prevent contamination of soil, water, air, equipment, or materials by the discharge of bulk wastes from spills due to Contractor's operations.
- 2. The Contractor shall provide methods, means, equipment, facilities and personnel to perform emergency measures required to contain any spillage and to remove spilled materials and soils or liquids that become contaminated due to spillage. All collected spill material shall be properly disposed of at the Contractor's expense.

C. Decontamination

- 1. The Contractor shall provide equipment and personnel to perform decontamination measures that may be required to remove spillage from previously uncontaminated structures, equipment, or material. Decontamination residues shall be properly disposed of at the Contractor's expense. Hazardous waste shall be handled in accordance with General Requirement Section 01100 "Remediation Construction Requirements" Item 3.12.9 Hazardous & TSCA Waste.

PART 3 EXECUTION

3.1 GENERAL

- A. Contractor shall be responsible for all liabilities related to spills, discharges, leaks, or emissions from equipment, tankage, vessels, drums, or any other devices owned, operated, or controlled by the Contractor, his subcontractors, vendors, personnel, agents, or assigns.
- B. In the case of a spill or discharge, the Contractor shall follow procedures outlined in the SDC Plan.

3.2 NOTIFICATION

- A. The Contractor shall notify the Owner and Owner's Representative at the time of occurrence and follow-up in writing within 24 hours.
- B. The Contractor shall report a spill or discharge to regulatory agencies, as necessary to comply with local, state, and federal regulations.

* * * * *

SECTION 01170

MATERIAL HANDLING AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

- A. Preparation, submission, and implementation by the contractor of an acceptable Material Handling and Disposal Plan, as specified herein and in accordance with all provisions of the Contract Documents.
- B. Contractor shall develop and submit methods and sequencing of all intended operations hereinafter referred to as the Material Handling and Disposal Plan. The Material Handling and Disposal Plan shall include, but not be limited to, methods, plans, and drawings necessary for staging equipment, stockpiling materials, designating work zones and requirements for other construction activities. Construction activities shall not be initiated until the methods and sequencing of all operations are reviewed by the Owner's Representative. Review by the Owner's Representative does not relieve the Contractor of his obligations for the proper handling and disposal of the material.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Construction Water Management, Section 02141
- B. Earthwork, Section 02220
- C. Trenching, Backfilling and Compacting, Section 02226

1.3 APPLICABLE PUBLICATIONS, CODES, STANDARDS, AND SPECIFICATIONS

NOT USED.

1.4 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Material Handling and Disposal Plan

PART 2 PRODUCTS

2.1 MATERIAL HANDLING AND DISPOSAL PLAN

- A. The Material Handling and Disposal Plan shall describe in detail the Contractor's plan for handling all materials during the execution of the work.
 - 1. The Material Handling and Disposal Plan shall establish approaches for the handling of all materials except including means, methods, equipment, facility, personnel, and sequencing, that:
 - a. Minimize contamination of uncontaminated materials.

- b. Minimize recontamination of cleaned areas or contamination of uncontaminated areas.
 - c. Minimize the tracking of contaminated and potentially contaminated material to uncontaminated areas on or off site.
 - d. Minimize the generation of dust.
 - e. Minimize the generation of construction water.
 - 2. The Material Handling Plan and Disposal shall coordinate the management and tracking of all materials, through completion of construction activities.
 - 3. The Material Handling and Disposal Plan shall also include, in detail:
 - a. The identification of exclusion zones, contamination reduction zones, and support zones, for the purpose of transport and handling of materials.
 - b. Procedures for decontaminating personnel and equipment, for the purpose of transport and handling of materials.
 - 4. The Material Handling and Disposal Plan shall address handling hazardous waste in accordance all applicable Local, State and Federal regulations.
 - 5. The Material Handling and Disposal Plan shall address material handling and disposal issues associated with the activities identified in this specification.
- B. Acceptable methods of handling and disposal of material include, but are not limited to, the following:
- 1. Stockpiling of materials on 10 mil polyethylene sheeting and covered with 10 mil polyethylene sheeting.
 - 2. Off-site disposal of spoil material in accordance with all applicable Local, State and Federal regulations.

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall implement the Material Handling and Disposal Plan.
- B. The Contractor shall update the Material Handling and Disposal Plan as necessary to incorporate changes in site conditions and construction activities.
- C. It shall be the responsibility of the Contractor to investigate and comply with all applicable Federal, State, and Local laws and regulations governing the handling and temporary storage of materials.

- D. The Contractor shall obtain all required permits required for the handling and temporary storage of materials.
- E. The Contractor shall be responsible for any sampling and analyses necessary to protect the health and welfare of the Contractor's employees and/or agents.
- F.. Contractor shall provide assistance to Honeywell as required to mark, label, placard, package and manifest wastes in accordance with applicable codes, regulations, and statutes.
- H. The Contractor shall make every effort to minimize the generation of spoil materials.
- I. Material handling shall utilize equipment compatible with anticipated contaminants which may be present.

3.2 SOLIDS, HANDLING, AND DISPOSAL

- A. Containerize solids and/or spoil to a relatively dry condition as determined by the Owner's Representative.
- B. Transport in watertight container to a site area designated by the Owner.
- C. Place specified 10 mil polyethylene barrier on existing grade.
- D. Place spoil.
- E. Securely cover with 10 mil daily and at end of project.

3.3 DISPOSAL OF WASTES

- A. Contractor shall characterize construction water related wastes and any settled solids, excavated materials, or other residuals as necessary for disposal at a site location designated by the Owner.

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SECTION 02090

LEAD BASED PAINT

PART 1 GENERAL

1.1 SUMMARY

- A. Testing has detected lead in two paint samples. Disturbance of paint or painted materials could release lead. The Contractor shall provide required training and worker protection from lead for its workers, conduct demolition and/or renovation of these materials with LBP without discharging lead into the environment, and dispose these waste materials in accordance with regulatory requirements.

1.2 LBP SAMPLING AND ANALYTICAL INFORMATION

- A. Representative painted surfaces that will be impacted by construction have been sampled and analyzed by the Owner for concentrations of lead. Copies of the analytical reports are available from the Owner and Engineer. The Contractor shall review the lead-based paint analytical report. At the Contractor's option and expense, additional testing may be conducted to determine lead content in paint using laboratory testing of paint chips or X-ray fluorescence (XRF) techniques. Other testing methods will not be permitted and all testing results shall be submitted to the Owner. At the Contractor's option and expense, dust sampling may be conducted to establish background levels. The Owner reserves the right to independently verify testing results.

1.3 WORKER PROTECTION

- A. The Contractor shall be responsible for all worker protection (including personnel air monitoring) and record keeping associated with lead-based paint disturbance as may be required by the applicable regulations.

1.4 ENVIRONMENTAL PROTECTION

- A. The Contractor shall prevent discharge of lead or lead contaminated materials into the air, water (including storm and sanitary sewers), soil or adjacent properties.

1.5 WORK OPERATIONS

- A. The Contractor shall conduct all operations which impact existing paint or painted surfaces in compliance with 29 CFR 1926.62 and all other applicable regulations. All demolition and other operations which impact existing paint or painted surfaces shall be in accordance with these Contract Documents. In the event of a discrepancy between these Contract Documents and existing regulations, the more stringent requirement shall apply.
- B. All power tools used for paint removal shall be equipped with HEPA rated filters and shall function without excessive dust generation. All chemical solvents used for paint removal operations shall be utilized in strict accordance with the manufacturer's instructions. Copies of MSDS data sheets for all chemicals utilized shall be furnished to the Owner and shall be available on-site throughout the work.

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PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

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SECTION 02111

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes clearing and grubbing by removal or destruction of trees, underbrush, logs, stumps, decayed or growing organic matter above the surface of the ground, and snow and ice which interfere with construction or landscaping, specified or directed within or adjacent to the lines of work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Earthwork, Section 02220
- B. Restoration of Surfaces, Section 02503

PART 2 PRODUCTS

2.1 GENERAL

- A. Contractor shall protect trees with suitable stakes.

PART 3 EXECUTION

3.1 GENERAL

- A. Only those portions of the site necessary and essential to be cleared for work shall be cleared.
- B. Tree Protection
 - 1. The work of this project may necessitate the removal of some trees. Any tree which will not, in the opinion of the Owner's Representative, hinder construction or landscaping shall be protected.
 - 2. Special care shall be exercised to minimize injury to trees that will not be removed. Any damaged branches shall be properly pruned and all wounds covered with approved tree paint. This repair work shall be done on a daily basis without exception. Careful digging will be performed to minimize root damage. Roots may be cut and removed up to 25 percent of the estimated root area. If more than 25 percent is required to be cut, the Owner's Representative shall decide whether the tree shall be removed. Straggling roots shall be pruned. When it becomes absolutely necessary to remove a tree, it shall be completely taken out, including the stump.
 - 3. Any tree which is trimmed during construction shall be cut cleanly outside of the branch collar. Trimmed trees shall be protected by application of appropriate sealer to exposed surfaces.

4. Any tree which will not hinder construction or landscaping and is a minimum of 4 inches in diameter shall be protected by stakes placed in a circle having a radius of not less than five feet as measured from the base of the trunk around the tree. The stakes shall extend at least four feet above the existing ground. Each circle shall consist of at least six stakes. Landscaping within the circle shall be accomplished by hand tools unless otherwise permitted by the Owner's Representative. In lieu of staking individual trees, the Contractor may protect groups of trees using 4' high snow fencing set 5 feet from the trees to be protected.

C. Removal of brush, trees, stumps, and spoil

1. Contractor shall chip brush, tree trunks and tree limbs.
2. Contractor shall likewise chip tree stumps, provided however, that if the tree was located in a potentially contaminated area, all soil adhering to the stump must first be removed prior to chipping. Soil adhering to the stump shall be handled in a manner accepted by the Owner's Representative.
3. All chipped brush, trees, stumps, and spoil material shall be removed from the area and disposed of by the Contractor in a manner accepted by the Owner and Owner's Representative.

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SECTION 02141

CONSTRUCTION WATER MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the Contractor's development and implementation of an acceptable Construction Water Management Plan. The plan shall include, but not be limited to, the responsible party for each task, the contractor's proposed method of handling, sampling and analyses, methods for minimizing the volume of construction water and associated sediments, storage (if necessary), treatment (if necessary) and disposal of construction water generated during construction in accordance with all applicable Local, State, and Federal regulations.
- B. The Contractor is to obtain, and operate within, all required Local, State, and Federal Permits and requirements required to implement the proposed Construction Water Management Plan.
- C. Provide all labor, materials, and equipment required for the handling of construction water in accordance with the approved Construction Water Management Plan.
- D. All construction water that enters an excavation is considered contaminated and shall be handled in accordance with General Requirement Section 01100 "Remediation Construction Requirements" Item 3.12.9 Hazardous & TSCA Waste.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Spill and Discharge Control, Section 01160
- B. Material Handling and Disposal, Section 01170

1.3 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Construction Water Management Plan
 - 2. Shop drawings and test results used in design of the method of handling construction water.

1.4 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of all applicable federal, state, and local codes, ordinances, regulations, statutes, standards and specifications, except where more stringent requirements have been specified herein.

PART 2 PRODUCTS

2.1 CONSTRUCTION WATER MANAGEMENT PLAN

- A. The Contractor shall submit his plan for handling construction water. The plan shall include, but not be limited to, the responsible party for each task, the contractor's proposed method of handling, sampling and analyses (if required), methods for minimizing the volume of construction water and associated sediments, storage (if necessary), treatment (if necessary) and disposal of construction water generated during construction.
- B. Acceptable methods of handling construction water include, but are not limited to, the following:
 - 1. Collection (by Contractor), on-site transport, and discharge to the existing Willis Avenue/Semet IRM GWTP after pretreatment to remove suspended solids to the extent feasible, in accordance with the applicable influent limits.
 - 2. Collection (by Contractor), off-site transport, off-site treatment, and disposal in accordance with all applicable Local, State and Federal regulations (by Honeywell).
- C. Acceptable methods of handling sludge generated by the Contractor's management of construction water include, but are not limited to:
 - 1. Collection (by Contractor), on-site transport and disposal in an area designated by the Owner.
 - 2. If sludge is hazardous waste, it shall be handled in accordance with General Requirement Section 01100 "Remediation Construction Requirements" Item 3.12.9 Hazardous & TSCA Waste.

PART 3 EXECUTION

3.1 GENERAL

- A. It shall be the responsibility of the Contractor to investigate and comply with all applicable Federal, State, and Local laws and regulations governing the handling and temporary storage of construction water and associated sediments.
- B. The Contractor shall obtain all required permits required for the handling and temporary storage of construction water and associated sediments.
- C. The Contractor shall be responsible for any sampling and analyses necessary to protect the health and welfare of the Contractor's employees and/or agents.
- D. The Contractor will be responsible for providing water storage tanks for temporary storage of collected construction water. At the time of project close out the contractor shall be responsible for cleaning the tanks and performing all decontamination, wash down and analytical to prove cleanliness to Honeywell's satisfaction prior to leaving the site.

- E. Contractor shall provide assistance to Honeywell as required to mark, label, placard, package and manifest wastes in accordance with applicable codes, regulations, and statutes.
- F. The Contractor shall make every effort to minimize the generation of construction water. Appropriate methods to minimize generation of construction and contaminated water include, but are not limited to, erection of temporary berms, use of low permeability tarpaulin or suitable means to cover exposed contaminated areas, limiting the amount of exposed contaminated areas, grading to control run-on and run-off, engineering controls on construction activities to minimize contact of personnel and equipment with contaminated areas thus minimizing the amount of decontamination required, and other appropriate methods.
- G. Construction water and associated sediments, shall be handled using equipment compatible with anticipated contaminants which may be present.

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SECTION 02220

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes excavation and backfilling including the loosening, removing, refilling, transporting, storage and disposal of all materials classified as "earth" necessary to be removed for the construction and completion of all work under the Contract, and as shown on the Contract Drawings, specified or directed.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

- 1. American Society for Testing and Materials (ASTM)
 - a. A328 Specification for Steel Sheet Piling
 - b. D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
 - c. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - d. D1760 Specification for Pressure Treatment of Timber Products
 - e. D2922 Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Material Handling and Disposal, Section 01170
- B. Construction Water Management, Section 02141

1.4 DEFINITIONS

- A. Excavation (or Trenching)
 - 1. Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for all purposes incidental to the construction and completion of all the work under construction.
 - 2. All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removing of the same.

3. All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, well pointing, or otherwise disposing of water.
4. The removing and disposing of all surplus materials from the excavations in the manner specified.
5. The maintenance, accommodation and protection of travel.
6. The supporting and protecting of all tracks, rails, buildings, curbs, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over- or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury.
7. All temporary bridging and fencing and the removing of same.

B. Earth

1. All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, roots or pieces of timber, soft or disintegrated rock, not requiring blasting, barring, or wedging from their original beds, and specifically excluding all ledge or bedrock and individual boulders or masonry larger than one-half cubic yard in volume.

C. Backfill

1. The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

D. Spoil

1. Surplus excavated materials not required or not suitable for backfills or embankments.

E. Embankments

1. Fills constructed above the original surface of the ground or such other elevation as specified or directed.

F. Limiting Subgrade

1. 6-inches below the underside of the pipe barrel for pipelines
2. 6-inches below the underside of footing lines for structures

G. Excavation Below Subgrade

1. Excavation below the limiting subgrades of structures or pipelines.

2. Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Wood Sheeting and Bracing

1. Shall be sound and straight; free from cracks, shakes and large or loose knots; and shall have dressed edges where directed.
2. Shall conform to National Design Specifications for Stress Grade Lumber having a minimum fiber stress of 1200 pounds per square inch.
3. Sheeting and bracing to be left-in-place shall be pressure treated in accordance with ASTM D1760 for the type of lumber used and with a preservative approved by the Owner's Representative.

B. Steel Sheeting and Bracing

1. Shall be sound
2. Shall conform to ASTM A328 with a minimum thickness of 3/8 inch.

PART 3 EXECUTION

3.1 UNAUTHORIZED EXCAVATION

- A. Whenever excavations are carried beyond or below the lines and grades shown on the Contract Drawings, or as given or directed by the Owner's Representative, all such excavated space shall be refilled with special granular materials, concrete or other materials as the Owner's Representative may direct. All refilling of unauthorized excavations shall be at the Contractor's expense.
- B. All material which slides, falls or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense and no extra compensation will be paid the Contractor for any materials ordered for refilling the void areas left by the slide, fall or cave-in.

3.2 REMOVAL OF WATER

A. General

1. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work.

2. Unless otherwise specified, all excavations which extend down to or below the static groundwater elevations shall be dewatered by lowering and maintaining the groundwater beneath such excavations at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or pipe thereon.
3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Owner's Representative may permit.
4. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction.
5. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be managed per Section 02141 Construction Water Management and without injury to adjacent property, the work under construction, or to pavements, roads, drives, and water courses. No water shall be discharged to sanitary sewers.
6. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.

B. Work Included

1. The construction and removal of sheeting and bracing, and the furnishing of materials and labor necessary therefor.
2. The excavation and maintenance of ditches.
3. The furnishing and operation of pumps, well points, and appliances needed to maintain thorough drainage of the work in a satisfactory manner.

3.3 STORAGE OF MATERIALS

A. Sod

1. Any sod cut during excavation shall be removed and stored during construction so as to preserve the grass growth. Sod damaged while in storage shall be replaced in like kind at the sole expense of the Contractor.

B. Topsoil

1. Topsoil suitable for final grading shall be removed and stored separately from other excavated material.

C. Excavated Materials

1. All excavated materials shall be stored in locations so as not to endanger the work, and so that easy access may be had at all times to all parts of the excavation. Stored materials shall be kept neatly piled and trimmed, so as to cause as little inconvenience as possible to public travel or to adjoining property holders. Erosion & Sediment control practices shall be installed, inspected, and maintained around stockpiled material.
2. Special precautions must be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways, and other points where access may involve the safety and welfare of the general public.

3.4 DISPOSAL OF MATERIALS

A. Spoil Material

1. All spoil materials shall be disposed of as required by the local, state or federal regulations pertaining to the area or as described in Section 01170 titled "Material Handling and Disposal".
2. The surface of all spoil areas shall be graded and dressed and no unsightly mounds or heaps shall be left on completion of the work.

3.5 SHEETING AND BRACING

A. Installation

1. The Contractor shall furnish, place and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, injure the pipe, structures, or other work; diminish the width necessary for construction; otherwise damage or delay the work of the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.
2. In no case will bracing be permitted against pipes or structures in trenches or other excavations.
3. Sheeting shall be driven as the excavation progresses, and in such manner as to maintain pressure against the original ground at all times. The sheeting shall be driven vertically with the edges tight together, and all bracing shall be of such design and strength as to maintain the sheeting in its proper position. Seepage which carries fines through the sheeting shall be plugged to retain the fines.
4. Where breast boards are used between soldier pile, the boards shall be back packed with soil to maintain support.
5. The Contractor shall be solely responsible for the adequacy of all sheeting and bracing.

B. Removal

1. In general, all sheeting and bracing, whether of steel, wood or other material, used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a pipe or structural foundation shall not be withdrawn, unless otherwise directed, before more than 6 inches of earth is placed above the top of the pipe or structural foundation and before any bracing is removed. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.
2. The Contractor shall not remove sheeting and bracing until the work has attained the necessary strength to permit placing of backfill.

C. Left in Place

1. If, to serve any purpose of his own, the Contractor files a written request for permission to leave sheeting or bracing in the trench or excavation, the Owner's Representative may grant such permission, in writing, on condition that the cost of such sheeting and bracing be assumed and paid by the Contractor.
2. The Contractor shall leave in place all sheeting, shoring and bracing which are shown on the Contract Drawings or specified to be left in place or which the Owner's Representative may order, in writing, to be left in place. All shoring, sheeting and bracing shown or ordered to be left in place will be paid for under the appropriate item of the Contract. No payment allowance will be made for wasted ends or for portions above the proposed cutoff level which are driven down instead of cut-off.
3. In case sheeting is left in place, it shall be cut off or driven down as directed so that no portion of the same shall remain within 24 inches of the street subgrade or finished ground surface.

3.6 BACKFILLING

A. General

1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown, specified or directed.
2. Backfilling shall be done with suitable excavated materials which can be satisfactorily compacted during refilling of the excavation. In the event the excavated materials are not suitable, Special Backfill as specified or ordered by the Owner's Representative shall be used for backfilling.
3. Any settlement occurring in the backfilled excavations shall be refilled and compacted.

B. Unsuitable Materials

1. Stones, pieces of rock or pieces of pavement greater than 1 cubic foot in volume or greater than 1.5 feet in any single dimension shall not be used in any portion of the backfill.
2. All stones, pieces of rock or pavement shall be distributed through the backfill and alternated with earth backfill in such a manner that all interstices between them shall be filled with earth.
3. Frozen earth shall not be used for backfilling.

C. Compaction and Density Control

1. The compaction shall be as specified for the type of earthwork, i.e., structural, trenching or embankment.
 - a. The compaction specified shall be the percent of maximum dry density.
 - b. The compaction equipment shall be suitable for the material encountered.
2. Where required, to assure adequate compaction, in-place density test shall at the expense of the Contractor be made by an approved testing laboratory.
 - a. The moisture-density relationship of the backfill material shall be determined by ASTM D698, Method D.
 - 1) Compaction curves for the full range of materials used shall be developed.
 - b. In-place density shall be determined by the methods of ASTM D1556 or ASTM D2922 and shall be expressed as a percentage of maximum dry density.
3. Where required, to obtain the optimum moisture content, the Contractor shall add, at his expense, sufficient water during compaction to assure the specified maximum density of the backfill. If, due to rain or other causes, the material exceeds the optimum moisture content, it shall be allowed to dry, assisted if necessary, before resuming compaction or filling efforts.
4. The Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of backfill.

3.7 OTHER REQUIREMENTS

A. Drainage

1. All material deposited in roadway ditches or other water courses shall be removed immediately after backfilling is completed and the section, grades

and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

B. Unfinished Work

1. When, for any reason, the work is to be left unfinished, all trenches and excavations shall be filled and all roadways, sidewalks and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways and sidewalks shall have a temporary pavement.

C. Hauling Material on Streets

1. When it is necessary to haul material over the streets or pavements, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled material.

D. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of his operations to such a degree that it will not endanger the safety and welfare of the general public.
2. Calcium chloride, chemicals, and petroleum products shall not to be used for dust control.

E. Test Pits

1. For the purpose of obtaining detail locations of underground obstructions, the Contractor shall make excavations in advance of the work or as ordered by Owner's Representative. Test pits shall include sheeting, bracing, pumping, excavation and backfilling.

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SECTION 02226

TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes excavation and backfill as required for pipe installation or other construction in the trench, and removal and disposal of water, in accordance with the applicable provisions of the Section entitled "Earthwork" unless modified herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXCAVATION

- A. The trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface.
- B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.
- C. The alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system.
- D. The minimum width of trench excavation shall be 9 inches on each side of the pipe hub for 24-inch diameter pipe and 12 inches for pipes larger than 24 inches.
- E. Open trenches shall be protected and barricaded as required.
- F. Bridging across open trenches shall be constructed and maintained where required.

3.2 SUBGRADE PREPARATION FOR PIPE

- A. Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with special granular material as specified or directed, shall be deposited in layers not to exceed 6 inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.
- B. The subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

- C. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench.

3.3 STORAGE OF MATERIALS

- A. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The excess material shall be removed to locations selected and obtained by the Contractor.

- 1. The Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.

- B. If directed by the Owner's Representative, the Contractor shall refill trenches with select fill or other suitable materials and excess excavated materials shall be disposed of as spoil.

3.4 REMOVAL OF WATER AND DRAINAGE

- A. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work.
- B. The removal of water shall be in accordance with the Section entitled "Earthwork" and "Construction Water Management".

3.5 PIPE EMBEDMENT

- A. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.
- B. Materials placed above the centerline of the pipe shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of embedment being installed.

3.6 BACKFILL ABOVE EMBEDMENT

- A. The remaining portion of the pipe trench above the embedment shall be refilled with suitable materials or as shown on the Contract Documents compacted as specified.

1. Trenches shall be refilled in horizontal layers not more than 8 inches in thickness, and compacted to obtain 95% maximum density, and determined as set forth in the Section entitled "Earthwork".
2. Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.

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SECTION 02230

SELECT FILL

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes select fill materials used in either embedment or special backfill, as specified or as directed by the Owner's Representative.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. D422 - Method for Particle-Size Analysis of Soil

1.3 SUBMITTALS

- A. The following items shall be submitted:
 - 1. The name and location of the source of the material.
 - 2. Samples and test reports of the material.

1.4 DEFINITIONS

- A. Embedment or Lining
 - 1. Any type granular material specified or directed placed below an imaginary line drawn one foot above the inside diameter of the pipe and within the trench limits.
- B. Special Backfill
 - 1. Pipelines
 - a. Any select fill material specified or directed placed above an imaginary line drawn one foot above the inside diameter of the pipe and within the trench limits.
 - 2. Structures
 - a. Any select fill material specified or directed placed within the excavation limits, either in, under or adjacent to the structure.

C. Special Granular Material

1. Special granular material shall mean any of the granular materials listed below or other materials ordered by the Owner's Representative.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type A

1. Crushed Gravel

- a. Thoroughly washed crushed, durable, sharp angled fragments of gravel free from coatings. Crushed particles shall be a minimum of 85% by weight of the particles with at least two fractured faces. The total area of each fractional face shall exceed 25% of the maximum cross-sectional area of the particle.
- b. Crushed gravel shall have the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100%	1½-inch
0-25%	¾-inch
0-5%	½-inch

B. Type B

1. Crushed Stone

- a. Thoroughly washed clean, sound, tough, hard crushed limestone or approved equal free from coatings. Gradation for crushed stone shall be the same as specified for Type A material.

C. Type C

1. Crushed Stone

- a. Thoroughly washed, clean, sound, tough, hard, crushed limestone or approved equal free from coatings. It shall have a gradation by weight of 100% passing a 1-inch square opening and 0 - 15% passing a ¼-inch square opening.

D. Type D

1. Washed Sand

- a. Washed coarse sand having the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	3/8 inch
95 – 100	No. 4
80 – 100	No. 8
50-85	No. 16
25 – 60	No. 30
10 – 30	No. 50
2 – 10	No. 100

E. Type E

1. Run-of-Bank Gravel

- a. Run-of-bank gravel or other acceptable granular material free from organic matter with a gradation by weight of 100% passing a 1½-inch square opening, 30 to 65% passing a 1/4-inch square opening and not more than 10% passing a No. 200 mesh sieve as determined by washing through the sieve in accordance with ASTM D422.

F. Type F

1. Run-of-crusher Stone

- a. Run-of-crusher hard durable limestone or approved equal having the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	1½- inch
95 – 100	1
65 – 80	½
40 – 60	¼
0 – 10	#200 Sieve

G. Type G

1. A mixture of Type E material and Portland cement mixed in a ratio of 15:1 and placed and compacted in a dry state.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Special granular material as specified or directed for pipeline embedment shall be placed in accordance with the Section entitled "Trenching, Backfilling and Compacting".

- B. Special backfill where specified or directed shall be placed in accordance with the backfilling provisions of the Section entitled "Trenching, Backfilling, and Compacting", and the Section entitled "Earthwork".

3.2 DISPOSAL OF DISPLACED MATERIALS

- A. Materials displaced through the use of Select Fill shall be wasted or disposed of by the Contractor as specified.

3.3 SETTLEMENTS

- A. Any settlements in the finished work shall be repaired by the Contractor.

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SECTION 02503

RESTORATION OF SURFACES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes restoration and maintenance of all types of surfaces, culverts and other features disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the Contractor.
- B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)

1.3 SUBMITTALS

- A. The following items shall be submitted:
 - 1. A schedule of restoration operations. After an accepted schedule has been agreed upon it shall be adhered to unless otherwise revised with the approval of the Engineer.
 - 2.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

3.7 STONE OR GRAVEL PAVEMENT

- A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.
 - 1. The depth of the stone or gravel shall be at least equal to the existing.
 - 2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.9 LAWNS AND IMPROVED AREAS

- A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface.
 - 1. If the depth of existing topsoil prior to construction was greater than 4 inches, topsoil shall be replaced to that depth.
- B. The furnishing and placing of topsoil, seed and mulch shall be in accordance with the Section entitled "Topsoil and Seeding".
- C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.
- D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.
- E. The Contractor shall maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.10 OTHER TYPES OF RESTORATION

- A. Trees, shrubs and landscape items damaged or destroyed as a result of the construction operations shall be replaced in like species and size.
 - 1. All planting and care thereof shall meet the standards of the American Association of Nurserymen.
- B. Water courses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the water course shall be protected.
- C. Culverts destroyed or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original location and grade. When there is minor damage to a culvert and with the consent of the Engineer, a repair may be undertaken, if satisfactory results can be obtained.

3.11 MAINTENANCE

- A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

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SECTION 02600

PIPELINE INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes all metallic pipelines as shown on the Contract Drawings, complete with fittings and specials.
- B. Certain features of pipes shall be as scheduled.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society of Testing and Materials (ASTM)
 - 2. American Water Works Association (AWWA)

1.3 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Pipe
 - 1. Materials for the piping, joints and fittings shall be as specified in the Section for the type of pipe to be installed, shown in the pipe schedule or on the Contract Drawings.
 - a. Pipe and appurtenances shall comply with the applicable standards for its type of material.
- B. Joints
 - 1. Type of joints shall be as scheduled in the pipe schedule or as shown or noted on the Contract Drawings.

C. Inspection

1. Pipe and appurtenances shall be inspected by the Contractor in the presence of the Owner's Representative on delivery and prior to installation for conformance with the standards and specifications.
 - a. Materials not conforming to the standards and specifications shall not be stored on site but removed at once and replaced with material conforming to the specifications.

2.2 ACCESSORIES

A. Flexible Couplings

1. Flexible couplings shall be provided where shown or scheduled.

B. Wall Castings and Sleeves

1. All pipelines passing through walls, floors or slabs of structures shall be installed in a wall casting or sleeve.

PART 3 EXECUTION

3.1 INSTALLATION - UNDERGROUND

A. General

1. Install pipelines, fittings, specials, and accessories in accordance with the configuration shown on the Contract Drawings.
2. Excavation and backfilling shall be in accordance with the applicable provisions of the Section entitled "Trenching, Backfilling and Compacting".
3. Blocking will not be permitted under pipe.
4. No pipe shall be laid upon a foundation in which frost exists; nor at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
5. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.
6. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.

B. Location and Grade

1. Pipelines and appurtenances shall be located as shown on the Contract Drawings or as directed.

2. The alignment and grades shall be determined and maintained by a method acceptable to the Owner's Representative.

C. Subgrade

The subgrade for pipelines shall be earth or special embedment as specified or directed and shall be prepared in accordance with the Section entitled "Trenching, Backfilling and Compacting".

D. Joints

1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer's recommendations.

E. Embedment

1. Embedment shall be deposited and compacted in accordance with the Section entitled "Trenching, Backfilling and Compacting", and the Section for the type of pipe being installed and shall be one of the embedments shown below unless otherwise specified or directed.

2. Type "A" Embedment

Pipe of: Ductile Iron Pipe
 Prestressed Concrete Cylinder Pipe

- a. The embedment shall be 6 inches of Type F Select fill below the pipe to 12 inches above the top of the pipe.
- b. Type F Select Fill material shall be deposited and tamped in 6-inch layers to the centerline of the pipe.
- c. Type F Select Fill material shall be placed up to 12 inches over the top of the pipe shall be deposited in such manner as to not damage the pipe.
- d. NYSDOT Item 304.03, Type 2, or acceptable Native Material shall be placed above the Type F to grade and shall be deposited in such manner as to not damage the pipe

3.2 CUTTING AND SPECIAL HANDLING

- A. Field cuts of pipes shall be in accordance with the manufacturer's instructions.
- B. Where a pipe requires special handling or installation it shall be in accordance with the Section for that type of pipe.

3.3 FINAL INSPECTION OF FORCE MAINS

- A. Each section of pipe shall be inspected prior to final acceptance.

- B. The inspection shall determine the pipeline to be true to line and grade, to show no leaks, to have no obstruction to flow, to have no projections or protruding of connecting pipes or joint materials, shall be free from cracks and shall contain no deposits of sand, dirt or other materials.
- C. All deficiencies located during the inspection shall be corrected by the Contractor.

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SECTION 02602
LEAKAGE TESTING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes leakage tests of all hydraulic structures, pressure and non-pressure piping for leakage as specified.
 - 1. The Contractor shall furnish all labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.
- B. All testing shall be witnessed by the Engineer.

1.2 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:
 - 1. Reports of test results.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 LEAKAGE TESTS FOR STRUCTURES

- A. Tanks, vaults, wells and other fluid containing structures, shall be tested before backfilling by filling the structure with water to overflowing, or other level as may be directed by the Engineer, and observing the water surface level twenty-four hours thereafter.
 - 1. When testing absorbent materials such as concrete, the structure shall be filled with water at least 24 hours before the test is started.
- B. The exterior surface, especially at the construction joint, will be inspected for leakage during and upon completion of the 24 hour test.
 - 1. Leakage will be considered to be within the allowable limits when there is no visible sign of leakage on the exterior surface and where the water surface does not drop except as associated with evaporation.

2. A slight dampness on the exterior wall surface during the test period will not be considered as leakage, except in the case of prestressed concrete structures.

3.4 MANHOLE TESTING

A. General

1. Each manhole shall be tested by either exfiltration or infiltration.
2. A manhole will be acceptable if the leakage does not exceed an allowable of one gallon per vertical foot of depth for 24 hours. Regardless of the allowable leakage any leaks detected shall be permanently stopped.

- B. Exfiltration test may be performed prior to or after backfilling. The test shall be made by filling the manhole with water and observing the level for a minimum of eight hours.

- C. Infiltration tests shall be performed when the groundwater level is above the joint of the top section of a precast manhole.

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SECTION 02603

HYDROSTATIC PRESSURE TEST/LEAK DETECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes hydrostatic pressure testing and leak detection for the 24-inch and 30-inch force mains as specified.
 - 1. The Contractor shall furnish all labor, equipment, plugs, restraints, test connections, pumps, vents, water and materials necessary to conduct hydrostatic pressure tests and leak detection services.
- B. All testing shall be witnessed by the Owner's Representative, including section tested.

1.2 SUBMITTALS

- A. The following items shall be submitted:
 - 1. Detailed description, drawing, equipment, and schedule for conducting pressure tests and leak detection of the 30-inch and 24-inch force main for the Owner's review and approval prior to initiating activities.
 - 2. Reports of test results for the Hydrostatic Pressure Test and Leak Detection including section tested (in plan and profile view), pressure at start of test and every 15 minutes water added, leak locations with GPS coordinates and three ties for wood markers at leak detection.
 - 3. The successful vendor shall supply evidence of a minimum of 5 successful leak detection projects on prestressed concrete cylinder pipes of 24 inches and larger. Documented performance of leaks 1.0 gpm or larger.

PART 2 PRODUCTS

- 2.1 Leak Detection Technology:
 - 1. Leakfinder RT by Echologics or equal.

PART 3 EXECUTION

3.1 TESTS ON PRESSURE PIPING FOR TRANSPORT OF WATER OR SEWAGE

- A. General
 - 1. Pipelines shall be tested hydrostatically and for leakage.

2. The length of piping and sections included in the tests shall meet the approval of the Owner's Representation.
3. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the Contractor at his expense.
4. All fittings and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices must be installed and maintained by the Contractor based on his means and methods with pressure testing.

B. Pressure Test

1. Test pressure shall be 50 psi.
2. Test pressure shall be held on the piping for a period of at least 2 hours, unless a longer period is requested by the Owner's Representative.

C. Leak Detection

1. Leak Detection shall be conducted concurrently with the pressure test.
2. The rate of leakage shall be determined at 15-minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
 - a. At the completion of the test the pressure shall be released at the furthestmost point from the point of application.
3. All exposed piping shall be examined during the test and all leaks and identified in a report.
4. The allowable leakage for pressure pipelines shall not exceed the following in gallons per 24 hours per inch of diameter per mile of pipe:

Type of Pipe	Leakage
High Density Polyethylene, with butt fused joints	0
Ductile iron	10
Prestressed Concrete with steel and rubber joints	10

5. The leak detection technology shall be capable of operating at any flow velocity, down to 0 fps.

6. The technology used must be robust, and there must be 0% probability of the following occurrences:
 - Any foreign matter being introduced into the pipe
 - Loss of any components inside the pipe
 - Disruption or disturbance of any deposits in the pipe
7. The technology shall have demonstrated ability to determine the presence of potential leaks up to 2 miles from the measurement location. This would entail evidence of the measurement of a leak at this distance that was eventually found and repaired.
8. The technology shall have demonstrated ability to determine the presence of potential leaks within a minimum of 3 feet accuracy.

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SECTION 02618

DUCTILE IRON PIPE

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes centrifugally cast ductile iron pipe class 52 as shown on the Contract Drawings, complete with fittings and accessories.
- B. Certain features of ductile iron pipe shall be as scheduled.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Water Works Association (AWWA)
 - 3. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

- A. In addition to those submittals identified in the Contract Documents, the following items shall be submitted:
 - 1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.
 - 2. Pipe and joint details.
 - 3. Layout drawings for Ductile Iron Pipe to be installed within structures, showing the location and details of the support system, sleeves and appurtenances.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Ductile iron pipe and fittings shall comply with the following standards:

	<u>ANSI/AWWA</u>
Ductile Iron Pipe	C151
Fittings	C110
Joints-Mechanical and Push-On	C111
Joints-Flanged	C115
Cement Lining	C104
Polyethylene Encasement	C105
Compact Fittings	C153

- B. All shipments of material shall be tested in accordance with the provisions for testing in the applicable standards.

- C. All flange material shall be Ductile Iron.

2.2 ACCESSORIES

- A. Joints

1. The type of joints for ductile iron pipe and fittings shall be as scheduled in the pipe schedule and/or as shown on the Contract Drawings. Gasket material shall be appropriate for the fluid being transmitted.
2. Restrained joints shall have positive metal to metal restraint as provided by U.S. Pipe's TR-FLEX joint, American Ductile Iron Pipe's Fast Grip joint, or equal. Rubber gaskets with metal inserts which hold by wedging into the spigot end of the pipe shall not be used as a restrained joint.
3. Mechanical joints shall be assembled in accordance with the Notes on Method of Installation, AWWA C111, Appendix A. All bolts shall be high strength, low alloy steel and shall be tightened by means of torque wrenches such that the follower shall be brought up evenly. If effective sealing is not obtained at the specified torques, the joint shall be disassembled, cleaned and reassembled.
4. Flanged joints shall be assembled with through bolts of the size required for the pipe being installed. Stud bolts shall be used only where shown or required. Connecting flanges shall be in proper alignment and no external force shall be required or used to bring them together.
 - a. Flanges for flanged joints shall be drilled to 125 # template unless otherwise specified.

- b. Flange bolts and nuts shall be steel, ASTM A307, Grade B, and shall be zinc or hot dipped galvanized except where other materials are called for in the pipe schedule.
- c. Gaskets for flanged joint piping shall be full-faced, 1/8 inch thick rubber gaskets meeting requirements of AWWA C111 for water and sewage application.
- d. Gaskets for other service(s) shall be as specified.

2.3 COATING, PAINTING AND LINING

- A. Coating, painting and lining shall be as follows unless otherwise specified in the pipe schedule:
 - 1. Pipe installed in the ground, in exposed exterior locations, in contact with water or inside structures but not scheduled for painting:
 - Interior: Standard thickness cement lining with sealcoat unless otherwise specified.
 - Exterior: Asphaltic coating.
 - 2. Pipe installed inside structures or scheduled for painting:
 - Interior: Standard thickness cement lining with sealcoat unless otherwise specified.
 - Exterior: Pipes with asphaltic coatings shall be coated with Inertol "Tar Stop", or Mobil Anti-Bleeding Sealer Aluminum 13-A-1 or equal, or sandblasted as specified, before additional coats are applied.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install ductile iron pipe, fittings, specials, and accessories in accordance with the configuration shown on the Contract Drawings and applicable provisions of the Sections entitled "Trenching, Backfilling and Compacting" and "Pipeline Installation".
- B. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.

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SECTION 02720
CONCRETE VAULTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes access vaults complete with frames and covers, manhole steps and appurtenances as shown on the Contract Drawings.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Association of State Highway Transportation Officials (ASHTO)

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Concrete
 - 1. Cast-in-place concrete for vaults and inlets shall be as specified under the Section entitled "Cast in Place Concrete".
 - 2. Precast concrete sections shall be in accordance with ASTM C478 for manhole sections and ASTM C913 for other structures with a minimum wall thickness of 5 inches. Top sections shall withstand H-20 wheel loads and shall be of the type shown.
 - a. Bell and spigot joints of precast sections shall have an appropriate "O" or square Buna-N rubber section ring as supplied by the manufacturer.
- B. Masonry Units
 - 1. Brick shall meet the requirements of ASTM C62, Grade SW, and shall be of a hard-burned manufacture.
 - 2. Concrete blocks shall conform to the requirements of ASTM C139 and shall be solid and of the size shown on the Contract Drawings.

C. Mortar

1. Masonry cement for mortar shall meet the requirements of ASTM C 91, Type II and shall be mixed with a graded quality sand conforming to ASTM C144.
2. Mix shall be one part masonry cement to three parts sand using the minimum amount of clean water required for workability.

D. Castings

1. Frames and covers, grates, inlets, and other castings shall be as shown on the Contract Drawings and be in accordance with ASTM A48, Class 30. All castings shall be manufactured to withstand H-25 wheel loads. Lettering shall be "Storm Sewers" or other appropriate designation cast as directed. Frames and covers shall have machined bearing surfaces.
2. Steps shall be manhole steps manufactured of cast iron in accordance with ASTM A48, Class 30 or others acceptable to the Engineer.
 - a. Steps shall have a minimum tread width of 16 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Precast Sections

1. Precast sections shall be installed level on a flat stable subgrade. Where an unstable condition exists, the Contractor shall excavate the unstable material and replace with compacted granular material.
2. All joints shall be filled inside and out with mortar to provide a smooth and continuous surface.
3. Exterior of the vault shall have a minimum of three applications of an exterior waterproofing such as Koppers 300M or equal.

B. Frames and Castings

1. Frames and castings shall be set in a full bed of mortar a maximum of 1/2" thick. Where required to adjust the frames and castings to grade there shall be installed to a maximum of four brick courses.

C. Steps

1. Steps shall be installed in vertical alignment spaced 12 inches on center.
2. In concrete sections the steps shall be cast into the section or secured with cadmium plated bolts to threaded inserts which are precast into the concrete.
3. In masonry construction the steps shall be built into the masonry walls.

E. Plastering

1. Plaster shall be with mortar not less than 2 inch thick and troweled smooth.
2. Outside of masonry structures.
3. Inside and outside of brick courses under frames and castings.

F. Sumps

1. Sumps of the size specified shall be built into the floors of vaults and similar structures. Floors shall be sloped to the sump.

3.2 FIELD TESTING

- A. Perform leakage tests in accordance with the applicable provisions of the Section entitled "Leakage Testing".

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SECTION 02981

TOPSOIL AND SEEDING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes topsoil, fertilizer, seed, mulch anchorage, and associated work.

1.2 SUBMITTALS

- A. The following items shall be submitted:
 - 1. The location of source and data for off-site topsoil.
 - 2. Analysis of the seed.
 - 3. Should hydroseeder be used, the Contractor shall submit all data including material and application rates.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil shall be unfrozen friable clayey loam free from clay lumps, stones, roots, sticks, stumps, brush or foreign objects.
- B. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 10 percent nitrogen, 10 % phosphoric acid and 10 % potash.
 - 1. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.
- C. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.
 - 1. All seed shall meet the New York State standards of germination and purity.
 - 2. The percent of pure live strain of the seed shall be submitted with the seed mixture.

D. Seed mixture for disturbed site areas:

<u>Species</u>	<u>Content (%)</u>	
	<u>Lawn Areas</u>	<u>Unmaintained Areas</u>
Kentucky Bluegrass	50	20
Creeping Red Fescue	30	20
Manhattan or Pennfine Ryegrass	20	60

- F. Mulch shall be stalks of oats, wheat, rye or other approved crops which are free from noxious weeds.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface. If the depth of topsoil existing prior to construction was greater than 4 inches, the topsoil shall be replaced not less than the greater depth.
1. All debris and inorganic material shall be removed and the surface loosened for a depth of 2 inches prior to the placing of the topsoil.
 2. The topsoil shall not be placed until the subgrade is in suitable condition and shall be free of excessive moisture and frost.
- B. Satisfactory topsoil removed from the excavations shall be placed on the prepared subgrade to the depth required.
1. In the event the topsoil removed during excavation is unsatisfactory or inadequate to obtain the required finish grades, the Contractor shall furnish the required quantity of satisfactory topsoil from approved sources off site.
 2. All topsoil shall be free from stones, roots, sticks and other foreign substances and shall not be placed in a frozen or muddy condition.
 3. The finished surface shall conform to the lines and grades of the area before disturbed or as shown on the Contract Drawings. Any irregularities shall be corrected before the placement of fertilizer and seed.
- C. The fertilizer shall be applied uniformly at the rate of 20 pounds per 1000 square feet.
1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disc or other suitable method traveling across the slope if possible.

- D. When the topsoil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader. Restored banks shall be seeded with the seed mixture specified in item 2.1.D above at a rate of 15 pounds per acre. Other disturbed areas shall be seeded with the seed mixture specified in item 2.1.E above at a rate of not less than 10 pounds per 1000 square feet.
 - 1. The seed shall be raked lightly into the surface and rolled with a light hand lawn roller.
 - 2. Seeding and mulching shall not be done during windy weather.
- E. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches uniform thickness at loose measurement. Excessive amounts or bunching of mulch will not be permitted.
 - 1. Mulch shall be anchored by an acceptable method.
 - 2. Unless otherwise specified, mulch shall be left in place and allowed to disintegrate.
 - 3. Any anchorage or mulch that has not disintegrated at time of first mowing, shall be removed. Anchors may be removed or driven flush with ground surface.
- F. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.
- G. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed and mulch. The Contractor shall submit all data regarding materials and application rates to the Owner's Representative for review.

3.2 MAINTENANCE

- A. Restoration areas shall not be mowed unless required for access.

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, waterstops, mixture design, placement procedures, and finishes, for the following:
1. Footings and piers
 2. Foundation walls.
 3. Slabs-on-grade.
 4. Grade beams

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications (Contractor shall provide copies of all documents on-site), except where more stringent requirements are specified herein:
1. American Concrete Institute (ACI)
 - a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
 - b. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - c. ACI 301 – Specification for Structural Concrete.
 - d. ACI 302 – Guide for Concrete Floor and Slab Construction.
 - e. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - f. ACI 305R - Hot Weather Concreting.
 - g. ACI 306R - Cold Weather Concreting.
 - h. ACI 308 - Standard Practice for Curing Concrete.
 - i. ACI 315 - Details and Detailing of Concrete Reinforcement
 - j. ACI 318 - Building Code Requirements for Structural Concrete.
 - k. ACI 350 – Environmental Engineering Concrete Structures.
 - l. ACI 350.1 and 350.1R – Tightness Testing of Environmental Engineering Concrete Structures and Commentary.
 - m. ACI 350.3R – Seismic Design of Liquid Containing Concrete Structures and Commentary.
 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A615 - Deformed and Plain Billet Steel for Concrete Reinforcement.
 - b. ASTM C33 - Concrete Aggregates.
 - c. ASTM C94 - Ready-Mixed Concrete.
 - d. ASTM C150 - Portland Cement.
 - e. ASTM C260 - Air Entraining Admixtures for Concrete.

- f. ASTM C309 - Liquid membrane-forming compounds for curing concrete
 - g. ASTM C494 - Chemical Admixtures for Concrete.
 - h. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete
- 3. Concrete Reinforcing Steel Institute (CRSI)
 - a. Manual of Standard Practice.
 - b. Design Handbook.
- 4. Building Code of New York State (BCNYS), 2007

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Scheduling: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
- B. Product data for each type of manufactured material and product indicated, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, dry-shake finish materials, fiber reinforcement, curing materials, floor and slab treatments, bonding agents and others, if requested by Owner's Representative.
- C. Written mix design shall be based on field experience or trial mixture. Submit documentation for each type of concrete in accordance with ACI 301, Section 4.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- D. Laboratory test reports for concrete materials and mix designs.
- E. Shop drawings for detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, arrangement, and support of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
- F. Proposed method of concrete curing.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete".
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.
 - 2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place concrete.
- F. Qualifications
 - 1. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a NRTL as defined by OSHA in 19 CFR 1910.7.
 - 2. Testing Firm's Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.
- G. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Form-Facing Panels for As-Cast Exposed Finishes: plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
- B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- D. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
- E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; non-staining; in longest practicable lengths.
- F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch thick.
- G. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS that adheres to form joint substrates.
- H. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
- I. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of those surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- J. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
- K. Form Ties: Factory-fabricated ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish ties that, when removed, will leave holes 1 inch in diameter on concrete surface.
 - 2. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches from the concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls that are designed to retain water.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - c. Silica Fume: ASTM C 1240, amorphous silica.
- B. Normal-Weight Aggregates: ASTM C 33, Class 5M coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse Aggregate Size: 1 inch.
- C. Normal-Weight Fine Aggregate: ASTM C 33, manufactured or natural sand, from same source for entire Project.
- D. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Accelerating Admixture: ASTM C 494/C 494M, Type C.
 - 4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 5. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 6. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

9. Crystalline waterproofing admixture shall meet the following requirements:
 - a. Permeability: concrete treated with admixture shall resist a water pressure of 150 psi with no measurable leakage.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 1. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.5 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of cast-in-place concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
- B. Proportion concrete mixtures as follows:
 1. Mix A - 4500-psi 28-day compressive strength; water-cement ratio 0.42 maximum; for use in all concrete exposed to water, wastewater or groundwater. Admixtures in the mix include air entraining and water reducing; crystalline waterproofing; a high-range water reducing admixture may be added if required to facilitate pumping.
 2. Mix B - 4000-psi 28-day compressive strength; water-cement ratio 0.45 maximum; for use in all other concrete work, unless noted otherwise. Admixtures in the mix include air entraining, if used in exterior exposure, and water reducing; a high-range water reducer may be added if pumped.
 3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size. Use air-entraining admixture for exterior exposed concrete.
- C. Cementitious Materials: For cast-in-place concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301, 318 and 350 requirements. Use fly ash, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 1. Clean equipment used to mix and deliver cast-in-place concrete to prevent contamination from other concrete.
 2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.8 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcing bars shall be ASTM A615, Grade 60, deformed. Reinforcing bars to be welded shall be ASTM A706.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place; manufacture according to CRSI's "Manual of Standard Practice."
 1. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected bar supports.

2.9 FIBER REINFORCEMENT

- A. Fiber reinforcement shall be as scheduled below as manufactured by Fibermesh®, or equal. Dosage rate shall be as specified by the manufacturer. Use in strict accordance with the manufacturer's instructions.
 1. Fiber reinforcement for fiber-reinforced exterior slabs shall be Fibermesh® 300, or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

2. Fiber reinforcement for fiber-reinforced dry interior slabs shall be Fibermesh® 300, or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.
3. Fiber reinforcement for fiber-reinforced submerged interior slabs shall be Novomesh® 950, or equal, applied at the application rate of 5.0 lbs. per cubic yard of concrete.
4. Fiber reinforcement for fiber-reinforced composite metal floor deck shall be Novomesh® 850, or equal, applied at the application rate of 24.0 lbs. per cubic yard of concrete.
5. Fiber reinforcement for fiber-reinforced submerged exterior concrete slabs, fillets and topping shall be Fibermesh® 300, or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Limit deflection of form-facing panels to not exceed ACI 347 requirements.
- B. In addition to ACI 347 limits on form-facing panel deflection, limit cast-in-place concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Class B, 1/4 inch.
- C. Fabricate forms to result in cast-in-place concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 2. Do not use rust-stained steel form-facing material.
- E. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exterior corners and edges of cast-in-place concrete.
- G. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REINFORCEMENT AND INSERTS

- A. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
- B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
- B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place concrete surfaces.

3.4 JOINTS

- A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- B. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, up to the limits of the specified water-cement ratio and slump, subject to limitations of ACI 301. This presumes that not all mixing water is added at the batching plant.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.

4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 QUALITY CONTROL DURING CONSTRUCTION

- A. The Contractor shall employ a testing agency, approved by the Engineer, to perform tests and to submit test reports. Field testing to be performed by an ACI certified concrete field testing technician grade I.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - a. Slump testing shall be in accordance with ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air content testing shall be in accordance with ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - c. Testing of concrete temperature shall be in accordance with ASTM C1064; one test hourly when air temperature is 40 deg F and below, when 80 deg F and above, and one test for each set of compressive-strength specimens.
 - d. Molding of cylinders for compression testing shall be in accordance with ASTM C31; one set of four standard 6-inch dia. cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-strength testing shall be in accordance with ASTM C 39; one set for each 100 cu. yd. or fraction thereof, of each concrete mix placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive testing shall consist of impact hammer, sonoscope, or other nondestructive device but shall not be used as the sole basis for acceptance or rejection.
- E. The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.7 REMOVING FORMS

- A. Formwork not supporting the weight of concrete, such as sides of walls, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, concrete is able to support its own weight and provided curing and protection operations are maintained.
- B. Formwork supporting the weight of concrete, such as slabs and other structural elements, may be removed in less than 14 days but in no case until concrete has attained at least 75 percent of design minimum compressive strength at 28 days, unless otherwise noted. Determine representative compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.8 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to

avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Owner's Representative.

3.9 CONCRETE SURFACE REPAIRS

- A. Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Owner's Representative.
- B. Mix dry-pack mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
 - 1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Remove and replace formed concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects includes cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 - 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 - 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Owner's Representative.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs with prior acceptance by Owner's Representative for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

3.10 FINISHES, GENERAL

- A. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
 1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 AS-CAST FORMED FINISHES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306 for cold-weather protection and with ACI 305 for hot-weather protection during curing.

- B. Begin curing cast-in-place concrete immediately after applying as-cast formed finishes to concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
1. Moisture Curing: Keep exposed surfaces of cast-in-place concrete continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
 3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

END OF SECTION

SECTION 03306

CONCRETE FOR PIPELINES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place concrete used in the construction of pipelines and appurtenances including cradles, encasements, thrust blocks, anchors, and manholes; cast-in-place concrete used in the construction of sidewalks, gutters, curbs and other items of restoration; and reinforcing steel, formwork, and items of concrete accessories required for the completion of the work.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Concrete Institute (ACI)

1.3 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:
 - 1. Name and location of concrete supplier.
 - 2. Concrete mix design indicating amount of all ingredients for each class of concrete to be used in the work.
 - 3. Manufacturer's literature for curing compounds, joint materials, admixtures, etc.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement
 - 1. Cement shall conform to ASTM C150, Type I/II.
 - 2. Type III may be employed with the Engineer's acceptance.
- B. Fine and Coarse Aggregates

1. Aggregates shall comply in all respects to ASTM C33.
 2. Maximum size of coarse aggregate:
 - a. General concrete – 1½ inches (Size No. 467)
 - b. Sidewalks, curbs and gutters ¾ inches (Size No. 67)
 3. Coarse aggregate for concrete used for sidewalks, curbs, and gutters shall be crushed stone or approved equal.
- C. Water
1. Water shall be obtained from the public potable water supply and shall be clear and free from injurious substances.
- D. Admixtures
1. Water reducing admixtures shall conform to ASTM C 494, Type A.
 2. Air-entraining admixtures shall conform to ASTM C260.
- E. Reinforcing steel bars shall be deformed new billet steel conforming to ASTM A615, Grade 60. Wire fabric shall be cold drawn steel conforming to ASTM A185.
- F. Expansion joint material shall be resilient and nonextruding type premolded bituminous impregnated fiberboard, 1/2-inch thickness and of the width required for full depth joints.
- G. Membrane curing compound shall be pigmented and conform to the requirements of ASTM C309.
- H. Grout
1. Grout shall be non-shrink, non-metallic, non-gas forming, preblended and ready for use requiring only the addition of water.

PART 3 EXECUTION

3.1 MIX DESIGN

- A. Mix design shall be established by the concrete supplier based on a proven strength record for concrete made with similar ingredients.
- B. Mix designs shall conform to ACI 211, except as specified herein, using approved materials.
- C. The various classes of concrete are designated as follows:

<u>Design Compressive Strength at 28 Day psi</u>	<u>Maximum Water / Cement Ratio by Weight</u>	<u>Minimum Lbs. of Cement Per Cu. Yd</u>
4000 psi non air-entrained	0.50	564
4000 psi air-entrained	0.44	564
3000 psi	0.64	470

D. Maximum Slump

1. General - 4 inches
2. Sidewalks, curbs and gutters - 3 inches
3. Use minimum water possible subject to workability.

- E. Except where otherwise specified, all concrete exposed to the weather, or in contact with sewage shall be air-entrained in the range of 5% to 7%.

3.2 BATCHING AND MIXING

A. Batching

1. The Contractor shall have at his disposal a modern and dependable batch plant within a reasonable distance from the work.
2. Batching shall conform to ACI 304.
3. Use only approved materials.

B. Mixing and Delivery

1. Mixing and delivery shall conform to ASTM C94.

3.3 PLACING CONCRETE

A. Placing shall conform to ACI 304.

- B. Forms shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced and tied so as to maintain position and shape during and after placing of concrete.

- C. The Contractor shall build into the concrete reinforcing steel, sleeves, waterstops, etc., as shown on the Contract Drawings. The Contractor shall repair or replace existing structures, utilities, pavement and any other items that have been removed, destroyed, or damaged during the execution of this construction project.

- D. Concrete shall be thoroughly consolidated by the use of vibrators or by spading or puddling sticks and tampers.

- E. Concrete shall not be deposited under water without written permission of the Engineer and then only in accordance with proper tremie techniques.

F. Cold weather concreting shall conform to ACI 306.

G. Hot weather concreting shall conform to ACI 305.

3.4 FINISHING

A. Formed concrete surfaces to be exposed shall be given a rubbed finish. In the case of restoration, the rubbed finish shall be equal to that of the concrete surface being replaced.

B. Inverts, benchwalls, floors or structures and similar surfaces shall be given a float finish.

C. Sidewalks shall be hand floated using a magnesium float and given a broom finish perpendicular to traffic, edges of slabs to be tooled.

3.5 CURING

A. Concrete shall be maintained in a moist condition for seven days using methods that will induce complete and continuous saturation.

3.6 NON-SHRINK GROUTING

A. For openings that are left in new concrete or where made in existing concrete for the insertion of wall castings, pipes or other fixtures, the space around these items shall be made watertight by completely filling with a non-shrink grout unless another means is specified elsewhere in the Contract Documents.

B. Work shall be done in strict accordance with the manufacturer's recommendations.

3.7 QUALITY CONTROL

A. The Contractor shall be solely responsible for the quality control of all concrete.

B. Concrete which does not meet the requirements of these specifications may be rejected by the Engineer.

* * * * *

SECTION 05120
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes structural steel, as shown on the Contract Drawings, complete including framing members, base and anchor plates, connections, grouting under base and anchor plates, fabrication, delivery and installation.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:

1. American Society for Testing and Materials (ASTM)
 - a. ASTM A6 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.
 - b. ASTM A36 - Carbon Structural Steel.
 - c. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - d. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - e. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
 - f. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - g. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - h. ASTM A325 – Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - i. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
 - j. ASTM A992, Grade 50 - Structural Steel Shapes.
 - k. ASTM F959 - Compressible - Washer - Type Direct Tension Indicators for Use with Structural Fasteners.

1. ASTM F1554 - Anchor Bolts, Steel, 36, 55 and 105 KSI Yield Strength.
2. American Welding Society
 - a. AWS D1.1 - Structural Welding Code.
 - b. AWS A2.0 - Standard Welding Symbols.
3. American Institute of Steel Construction
 - a. AISC 360 - Specification for Structural Steel for Buildings.
4. SSPC - Steel Structures Painting Council.
5. Research Council on Structural Connections (RCSC) Specification for Structural Joints Using A325 or A490 bolts.

1.3 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:
- B. Product data for each type of product indicated.
- C. Shop drawings showing fabrication of structural steel components.
 1. Include profiles, sizes, spacing and locations of structural members, details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical, high-strength bolted connections.
- D. Manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.
- E. Mill test reports signed by manufacturers certifying that the following products comply with requirements:
 1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Shop primers.
 4. Nonshrink grout.

1.4 QUALITY ASSURANCE

- A. Fabricator qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work. Fabricator shall have AISC Category I, II or III Quality Certification.

- B. Installer qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Perform work in accordance with the applicable provisions of the following specifications and documents:
 - 1. AISC, "Specification for the Design and Erection of Structural Steel for Buildings."
 - a. Connections, unless noted otherwise on the Contract Documents, shall be properly designed for the end loads indicated on the Contract Drawings. Connections shall be made with double clip angles unless otherwise indicated on the Contract documents. Shop standards shall be used to the largest extent possible.
 - b. Design connections not detailed on the Contract Drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state of New York.
 - 2. AISC, "Specification for Allowable Stress Design of Single-Angle Members."
 - 3. AISC, "Seismic Provisions for Structural Steel Buildings."
 - 4. ASTM A6, "Specification for General Requirements for Rolled Steel Plates, Shapes, and Bars for Structural Use."
 - 5. Research Council on Structural Connections (RCSC), "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 6. AWS D1.1, "Structural Welding Code".
- D. Professional Engineer shall be a licensed engineer legally authorized to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver structural steel to project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Contract Drawings.

1.7 SEQUENCING

Supply anchorage items to be embedded in, or attached to, other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. W-Shapes shall comply with ASTM A992, Grade 50, high-strength steel.
- B. Steel channels, angles, plates and threaded rods shall comply with ASTM A36, carbon steel.
- C. Pipe shall comply with ASTM A53, Grade B.
- D. Structural steel tubes shall comply with ASTM A500, Grade B.
- F. Anchor rods shall comply with ASTM F1554, Grade 36.
- G. Bolts, nuts, and washers shall meet ASTM A325.
 1. Direct Tension Indicators (DTI's) shall comply with ASTM F959 Type 325 compressible washer type.
 2. Provide beveled washers for S-shapes and channels.
- H. Welding materials shall meet AWS D1.1, type required for materials being welded.
- I. Grout shall be a non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- J. Primer shall be fast curing, lead and chromate free, universal primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS-TT-P-664. Primer shall be compatible with finish paint system.

2.2 FABRICATION

- A. Fabricate and assemble in shop to greatest extent possible. Fabricate items according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC specifications referenced in this section, and as indicated on final shop drawings.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials. Coordinate with Owner's Representative for fabrication sequence.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 - 4. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
 - 5. Provide cambered structural-steel members where indicated.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- F. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure, free of marking, burns and other defects.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC specifications. Exposed structural steel shall receive a finish paint system.
- B. Surface preparation, primer and finish coating shall be as specified in the specification entitled "Painting."

2.4 SHOP CONNECTIONS

- A. High Strength Bolts: Shop-install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Welded Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examination
 - 1. Verify that field conditions are acceptable and are ready to receive work.
 - 2. Beginning of installation means erector accepts existing conditions.
- B. Setting Bases and Bearing Plates
 - 1. Remove bond-reducing materials from all concrete and masonry bearing surfaces and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 2. Set loose and attached base plates and bearing plates for structural members or wedges or other adjusting devices. A minimum of 4 anchor bolts shall be used for column base plates.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Erection

1. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
2. Erect structural steel accurately in locations and to elevations indicated and according to AISC specs referenced in this section.
3. Field weld components indicated on Contract Drawings. Components shall be free of primer and paint prior to field welding.
4. Do not field cut or alter structural members without prior notification to Owner's Representative.
5. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.
6. Level and plumb individual members of structures within specified AISC tolerances.
7. Align and butt weld joints in bent plate at slab edges.
8. Align and plumb edges of roof edge angle as dimensioned on contract drawings.

D. FIELD CONNECTIONS

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - a. Fully pretensioned connections, as indicated on the Contract Drawings, shall be pretensioned and fully tightened $\frac{3}{4}$ inch dia. A325 bolts. Minimum pretension for fully tightened $\frac{3}{4}$ inch dia. bolts shall be 28 kips. Direct tension indicators shall be used at these connections to assure that bolts are properly installed and tensioned.
2. Welded Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work. Field weld components indicated on Contract Drawings. Components shall be free of primer and paint prior to field welding.

3.2 QUALITY CONTROL

- A. Testing Agency: Owner's Representative will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections as required by the Building Code of New York State, 2007.
- B. Bolted Connections: Bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Welded connections shall be inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes miscellaneous metal fabrications as shown on the Contract Drawings, complete including fabrication, shop finishing and installation.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:

1. American Society for Testing and Materials (ASTM)
 - a. ASTM A36 - Carbon Structural Steel.
 - b. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - f. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
 - g. ASTM A194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - h. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - i. ASTM A276 - Stainless Steel Bars and Shapes
 - j. ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
 - k. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - l. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
 - m. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
 - n. ASTM A992 - Structural Steel Shapes.
 - o. ASTM B177 - Engineering Chromium Electroplating.
 - p. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - q. ASTM B308 - Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - r. ASTM F1554 - Anchor bolts, Steel, 36, 55, and 105-KSI Yield Strength.
2. American Welding Society (AWS)
 - a. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

- b. AWS D1.1 - Structural Welding Code-Steel.
- c. AWS D1.2 - Structural Welding Code-Aluminum.
- 3. SSPC - Steel Structures Painting Council.

1.3 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:
 - 1. Shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. Prepare shop drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of New York.
 - 2. Use certified welders employed on the Work, with verification of AWS qualification within the previous 12 months.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Structural steel W-shapes shall be ASTM A992, Grade 50.
- B. Steel M, S, C, MC and L-shapes, plates and threaded rods shall be ASTM A36.
- C. Steel anchor bolts shall be ASTM F1554, Grade 36.
- D. Aluminum sections shall be ASTM B308, Alloy 6061-T6.
- E. Steel tubing shall be ASTM A500, Grade B.
- F. Steel pipe shall be ASTM A53, Grade B, Schedule 40. Bollards shall be Schedule 80.
- G. Bolts, nuts, and washers for structural steel connections shall be ASTM A325, galvanized to ASTM A153 for galvanized components.
- H. Stainless steel extrusions shall comply with ASTM A269, Type 304 or 316.

- I. Stainless steel bolts shall be ASTM A193, Type 304 or 316, grade B8 or B8M.
- J. Stainless steel nuts shall be ASTM A194, Type 304 or 316, grade 8 or 8M.
- K. Stainless steel washers shall be ANSI B18.22.1.
- L. Welding materials shall comply with AWS D1.1 or AWS D1.2; type required for materials being welded.
- M. Adhesive anchors for solid base substrates shall be a two-component adhesive system supplied in manufacturer's standard side-by-side or co-axial cartridge dispensed through a static mixing nozzle. System shall be capable of anchoring internally threaded inserts, threaded rods and steel reinforcing. Adhesive anchor system shall be one of the following:
 - 1. For applications above 40°F, use one of the following:
 - a. HIT HY 150 MAX or HIT RE 500 Injection Adhesive system by HILTI, Inc.
 - b. SET High Strength Epoxy system by Simpson Strong-Tie
 - 2. For applications below 40°F, use one of the following:
 - a. HIT-ICE Injection Adhesive system by HILTI, Inc.
 - b. ACRYLIC-TIE system by Simpson Strong-Tie
- N. Adhesive anchors for hollow base substrates shall be a two-component adhesive system supplied in manufacturer's standard side-by-side or co-axial cartridge dispensed through a static mixing nozzle. System shall be capable of anchoring internally threaded inserts, threaded rods and steel reinforcing. Adhesive anchor system shall be one of the following:
 - 1. For applications above 40°F, use one of the following:
 - a. HIT HY 20 Injection Adhesive system with screen tube by HILTI, Inc.
 - b. SET High Strength Epoxy system with screen tube by Simpson Strong-Tie
 - 2. For applications below 40°F, consult manufacturer for recommendation.
- O. Expansion bolts shall be HSL Expansion anchors by HILTI, Inc. or WEDGE-ALL wedge anchors by Simpson Strong-Tie.
- P. Primer for steel shall be fast-curing, lead and chromate free, universal primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS-TT-P-664. Primer shall be compatible with finish paint system.

2.2 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- D. Exposed mechanical fastenings shall consist of flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

- A. Surface preparation, primer and finish coatings shall be as specified in the Section entitled "Painting."
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Items to be galvanized shall be given a minimum 2.0 oz/sq ft zinc coating in accordance with ASTM A123.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examination
 - 1. Verify that field conditions are acceptable and are ready to receive work.
 - 2. Beginning of installation means erector accepts existing conditions.
- B. Preparation
 - 1. Clean and strip primed steel items to bare metal where site welding is required.
 - 2. Supply items required to be cast into concrete or embedded in masonry with setting templates.
- C. Erection
 - 1. Install items plumb and level, accurately fitted, free from distortion or defects.
 - 2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
 - 3. Field weld components indicated on shop drawings.
 - 4. Perform field welding in accordance with AWS D1.1 or AWS D1.2.
- D. Erection Tolerances
 - 1. Maximum variation from plumb shall be 1/4 inch per 10 feet, non-cumulative.
 - 2. Maximum offset from true alignment shall be 1/4 inch.
- E. Schedule
 - 1. Bollards shall be steel pipe, concrete filled, crowned cap, size as detailed; galvanized.

2. Ledge and shelf angles, channels and plates not attached to structural framing shall be steel, prime painted.
3. Lintels shall be galvanized steel, as detailed and prime painted.
4. Overhead door frames and wall openings shall be steel channel sections, prime painted.
5. Fixed metal ladders shall be aluminum, mill finish, unless indicated otherwise on the Contract Drawings.
6. Aluminum structural shapes shall be mill finish.

END OF SECTION

SECTION 05521

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Mechanically connected aluminum pipe handrails and railing systems.
 - 2. Aluminum pipe handrails and railing systems anodized in accordance with the finish requirements specified herein, unless otherwise noted.
 - 3. Welded steel pipe handrails and railing systems.
 - 4. Welded stainless steel pipe handrails and railing systems.

1.2 DEFINITIONS

- A. Definitions in ASTM E985 for railing-related terms apply to this Section.

1.3 QUALITY ASSURANCE

- A. Obtain handrails and railing systems of each type and material from a single manufacturer.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors and connections:
 - 1. Top rail and posts of railing and handrail system:
 - a. Concentrated load of 200 lb. applied at any point in any direction.
 - b. Uniform load of 50 lb./ft. applied horizontally.
 - c. Concentrated and uniform loads are not assumed to act concurrently.
- B. Provide handrails and railing systems that allow for thermal movements resulting from the following maximum differential in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Engineering calculation shall be based on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature differential of 120-deg. F ambient and 180 deg. F material surfaces.

- C. Prevent galvanic action and other forms of corrosion by insulating different metals from direct contact with other incompatible materials.

1.5 SUBMITTALS

- A. In addition to those submittals identified in the General Conditions, the following items shall also be submitted:

1. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.
2. For each type of railing system in the Work, provide the following samples of same design and finish indicated in the Work:
 - a. 6-inch long section of each distinctly different linear railing member, including handrails, top rails, posts and balusters.
 - b. Fittings and brackets.
 - c. After approval of railing system, submit full-size assembled sample of railing system, made from full-size components, including top rail, post, handrail and infill. Show method of finishing members at intersections. Sample shall be kept in the Engineer's Field Office.

1.6 STORAGE

- A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.7 PROJECT CONDITIONS

- A. Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Aluminum pipe and tube handrail and railing systems:
 - a. Alumagard.
 - b. Aluminum Tube Railings, Inc.
 - c. J.G. Braun & Co., Inc.
 - d. Thompson Fabricating Co.
 - e. Or equal.
 2. Steel pipe and tube handrail and railing systems:
 - a. Humane Equipment Co.
 - b. R & B Wagner, Inc.
 - c. Or equal.
 3. Stainless steel pipe handrail and railing systems:
 - a. Julius Blum & Co., Inc.
 - b. CraneVeyor Corp.
 - c. KDI Paragon, Inc.
 - d. R & B Wagner, Inc.
 - e. Or equal.

2.2 METALS

- A. Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Provide aluminum alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with not less than the strength and durability properties of alloy and temper designated below, and with not more than 5 foot post spacing (o/c) for each aluminum form required. Reinforcing inserts shall be supplied as needed to meet the minimum design requirements.
1. Horizontal members of handrail and railing system:
 - a. 1½" dia. Schedule 40, extruded structural pipe (ASTM B429), alloy 6063-T6.
 - b. HSS 1.9x0.145 extruded structural tube (ASTM B221, B429), alloy 6063-T6.
 2. Vertical members of handrail and railing system:
 - a. Single Span (max. # of posts: 2):
 - (1) 1½" dia. Schedule 80, extruded structural pipe (ASTM B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 - (2) HSS 2.375x0.125 extruded structural tube (ASTM B221, B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 - b. Double Span (max # of posts: 3):
 - (1) 1½" dia. Schedule 40, extruded structural pipe (ASTM B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 - (2) HSS 1.9x0.145 extruded structural tube (ASTM B221, B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 - c. Triple or more span:
 - (1) 1½" dia. Schedule 40, extruded structural pipe (ASTM B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 - (2) HSS 1.9x0.145 extruded structural tube (ASTM B221, B429), alloy 6061-T6, 6005-T5, or 6105-T5.
 3. Extruded bar and tube shall meet ASTM B221 (ASTM B221M), alloy 6061-T6, 6005-T5, or 6105-T5.
 4. Extruded structural pipe and tube shall meet ASTM B429, alloy 6061-T6, 6005-T5, or 6105-T5.
 5. Drawn seamless tube shall meet ASTM B210 (ASTM B210M), 6063-T832.
 6. Plate and sheet shall meet ASTM B209 (ASTM B209M), 6061-T6.
 7. Die and hand forgings shall meet ASTM B247 (ASTM B247M), 6061-T6.
 8. Castings shall meet ASTM B26/B26M, A356-T6.
- C. Provide steel grade and type with not less than the strength and durability properties of grade and type designated below, and with not more than 5 foot post spacing (o/c) for each carbon steel form required. Reinforcing inserts shall be supplied as needed to meet the minimum design requirements:
1. Horizontal members of handrail and railing system:
 - a. 1½" dia. Schedule 40, Structural pipe (ASTM A53), Type F, Type E and S Grade A or B.

2. Vertical members of handrail and railing system:
 - a. Single Span (max. # of posts: 2):
1½" dia. Schedule 80, Structural pipe (ASTM A53), Type E and S Grade B.
 - b. Double Span (max # of posts: 3):
1½" dia. Schedule 40, Structural (ASTM A53), Type E and S Grade B.
 - c. Triple or more span:
1½" dia. Schedule 40, Structural (ASTM A53), Type E and S Grade B.
 3. Steel pipe shall meet ASTM A53/ A53M; finish, type, and weight class as follows:
 - a. Black finish, unless otherwise indicated.
 4. Plates, shapes and bars shall meet ASTM A36/A36M.
 5. Castings shall be either gray or malleable iron, unless otherwise indicated.
 - a. Gray iron shall meet ASTM A48/ A48M, Class 30, unless another class is indicated or required by structural loads.
 - b. Malleable iron shall meet ASTM A47/ A47M.
- D. Provide stainless steel grade and type with not less than the strength and durability properties of grade and type designated below and with not more than 5 foot post spacing (o/c) for each stainless steel form required. Reinforcing inserts shall be supplied as needed to meet the minimum design requirements:
1. Horizontal members of handrail and railing system:
 - a. 1½" dia. Schedule 40S, stainless steel pipe (ASTM A269), Grade TP 304 or TP 316.
 2. Vertical members of handrail and railing system:
 - a. Single Span (max. # of posts: 2):
1½" dia. Schedule 80S, stainless steel pipe (ASTM A269), Grade TP 304 or TP 316.
 - b. Double Span (max # of posts: 3):
1½" dia. Schedule 40S, stainless steel (ASTM A269), Grade TP 304 or TP 316.
 - c. Triple or more span:
1½" dia. Schedule 40S, stainless steel (ASTM A269), Grade TP 304 or TP 316.
 3. Plates and bars shall meet ASTM A167, Type 304 or 316.
 4. Castings shall meet ASTM A743, Grade CF 8 or CF 20.
- E. Provide brackets, flanges and anchors, in cast or formed metal of the same type of material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS AND ANCHORS

- A. Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength and compatibility in fabricated items.
- B. Select fasteners of type, grade and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
 1. For aluminum or stainless steel handrails and railings, use fasteners fabricated from Type 304 or Type 316 stainless steel.
 2. For steel handrails, railings and fittings, use plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.

- C. Use fasteners for interconnecting handrail and railing components fabricated from the same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.

- D. Cast-in-place and post-installed anchors shall be of the type indicated below, fabricated from corrosion resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
 - 1. Adhesive anchors.
 - 2. Expansion anchors.

2.4 ANCHORING GROUT

- A. Use premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

- A. Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads specified by OSHA.
- B. Assemble handrails and railing systems in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form changes in direction of members as follows:
 - 1. By bending.
 - 2. By mitering at elbow bends.
 - 3. By any method indicated above, applicable to change of direction involved.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Fabricate handrails and railing systems for connection of members by the following means:
 - 1. Fabricate steel and stainless steel handrails and railing for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

- a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove flux immediately.
 - d. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
2. Fabricate handrails and railings for connecting aluminum members with concealed mechanical fasteners and fittings, unless indicated otherwise. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

Fabricate splice joints for field connection using an epoxy structural adhesive when this is manufacturer's standard splicing method.

- F. Provide wall brackets, flanges, miscellaneous fittings and anchors to interconnect handrail and railing
- G. Provide inserts and other anchorage devices for connecting handrails and railings to concrete and masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings.
- H. For removable railing posts, provide slip-fit steel sockets for steel posts and stainless steel sockets for aluminum and stainless steel posts with an inside dimension only slightly larger than the post to enable tight fit as follows:
 1. Limit movement of post without lateral load, measured at top, to not more than one-fortieth of the post height.
 2. Provide socket covers designed and fabricated to resist being dislodged.
- I. Provide chains with eye, snap hook and staple at locations indicated. Use steel chain for steel railings and stainless steel chain for aluminum and stainless steel handrail and railing systems.
- J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- K. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- L. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- M. Fabricate joints that will be exposed to weather in a manner to exclude water.
- N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- O. Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.6 ALUMINUM FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. All aluminum hand railing and railing systems shall receive the following finish:

Class II Clear Anodized Finish:
 - 1. AA-M12C22A31
 - a. Mechanical finish shall be as fabricated, nonspecular
 - b. Chemical finish shall be etched, medium matte
 - c. Anodic coating shall be Class II Architectural, clear film > 0.4 mil.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.

2.7 STEEL FINISHES

- A. Prepare uncoated ferrous-metal surfaces to comply with for SSPC surface preparation specifications and environmental exposure conditions of installed handrails and railings as follows:

SSPC-SP6, "Commercial Blast Cleaning."
- B. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. See Section "Painting".

2.8 STAINLESS STEEL FINISHES

- A. Finish shall be Ornamental Grade, AISI No. 4

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- D. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated.
- E. Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Use fabricated fittings for permanently connecting aluminum railing components by mechanical connection. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.
- B. Use fully welded joints for permanently connecting steel and stainless steel railing components.
- C. Install expansion joints not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending two inches beyond the joint on each side, fasten internal sleeve securely to one side and locate joint within six inches of post.

3.4 ANCHORING POSTS

- A. Foam or core-drill holes not less than 6 inches deep and 0.6 inch larger than OD of post for post installation in concrete. Clean holes of loose material, insert posts and fill annular space between post and concrete with non-shrink, non-metallic grout or anchoring cement.
- B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- C. Install removable railing sections, where indicated, in slip-fit metal sockets.

3.5 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2 inch clearance from inside face of handrail to finished wall surface.
- B. Locate brackets at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
1. For concrete and solid masonry, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry, use toggle bolts.

3.6 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, followed by rinsing with clean water.
- B. Cleaning and touchup painting of steel surfaces are specified in Section “Painting”.

3.7 PROTECTION

- A. Protect finishes of handrail and railing systems from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 05530
METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the Following:
1. Metal bar gratings.
 2. Extruded-aluminum plank gratings.
 3. Metal frames and supports for gratings.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:
1. National Association of Architectural Metal Manufacturer's (NAAMM)
 - a. NAAMM MBG 531 - Metal Bar Grating Manual for Steel, Stainless Steel and Aluminum Gratings and Stair Treads.
 - b. Metal Finishes Manual for Architectural and Metal Products
 2. American Welding Society (AWS)
 - a. ASW D1.2 - Structural Welding Code – Aluminum
 3. American Society for Testing and Materials (ASTM)
 - a. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate
 - b. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.3 QUALITY ASSURANCE

- A. Fabricator shall be experienced in producing gratings similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Metal Bar Grating Standards: Comply with applicable requirements of the following:
1. Non-Heavy-Duty Metal Bar Gratings: Comply with NAAMM MBG 531, "Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads."
- C. Comply with applicable provisions of AWS D1.2 "Structural Welding Code – Aluminum".
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 SUBMITTALS

- A. The Following Items Shall be Submitted:
 - 1. Product Data
 - a. Metal bar gratings.
 - b. Extruded-aluminum plank gratings.
 - c. Clips and anchorage devices for gratings.
 - 2. Shop Drawings detailing fabrication and erection of gratings. Include plans, elevations, sections, and details of connections. Show areas of fixed and removable sections, anchorage, accessory items, and load tables. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.5 PROJECT CONDITIONS

- A. If possible, design gratings so that they do not have to fit other construction, and delete this article.
- B. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. 6061-T1, for grating crossbars.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5052-H32.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.

2.3 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.5 METAL BAR GRATINGS

- 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. IKG Industries; a division of Harsco Corporation.
 - 2. Ohio Gratings, Inc.
 - 3. Klemp. Corp
- B. Pressure-Locked, Rectangular Bar Aluminum Grating: Fabricated by [pressing rectangular flush-top crossbars into slotted bearing bars] [or] [swaging crossbars between bearing bars].
 - 1. Bearing Bar Spacing: 1-3/16 inches o.c., unless otherwise noted on Contract Drawings.
 - 2. Bearing Bar Depth: As indicated on the Contract Drawings.

3. Bearing Bar Thickness: 3/16 inch.
 4. Crossbar Spacing: 4 inches o.c.
 5. Traffic Surface: As indicated.
 6. Aluminum Finish: Mill finish.
- C. Pressure-Locked, Aluminum I-Bar Grating: Fabricated by swaging crossbars between bearing bars.
1. Bearing Bar Spacing: 1-3/16 inches o.c. unless otherwise noted on the Contract Drawings.
 2. Bearing Bar Depth: As indicated on the Contract Drawings.
 3. Bearing Bar Flange Width: 3/16 inch.
 4. Crossbar Spacing: 4 inches o.c.
 5. Traffic Surface: As indicated on the Contract Drawings.
 6. Aluminum Finish: Mill finish.
- D. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- E. Grating Attachment to Supports
1. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16 inch or more o.c., with each clip designed and fabricated to fit over two bearing bars.
- F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- G. Do not notch bearing bars at supports to maintain elevation.

2.6 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
 - 2. Wherever grating is pierced by pipes, ducts and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as bearing bars.
 - 3. Cutouts for circular obstructions are to be at least 2 inches larger in diameter than the obstruction. Cutouts for all piping 4 inches or less shall be made in the field.
 - 4. All rectangular cutouts are to be made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.
 - 5. Utilize standard panel widths wherever possible.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 INSTALLING METAL PLANK GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

END OF SECTION