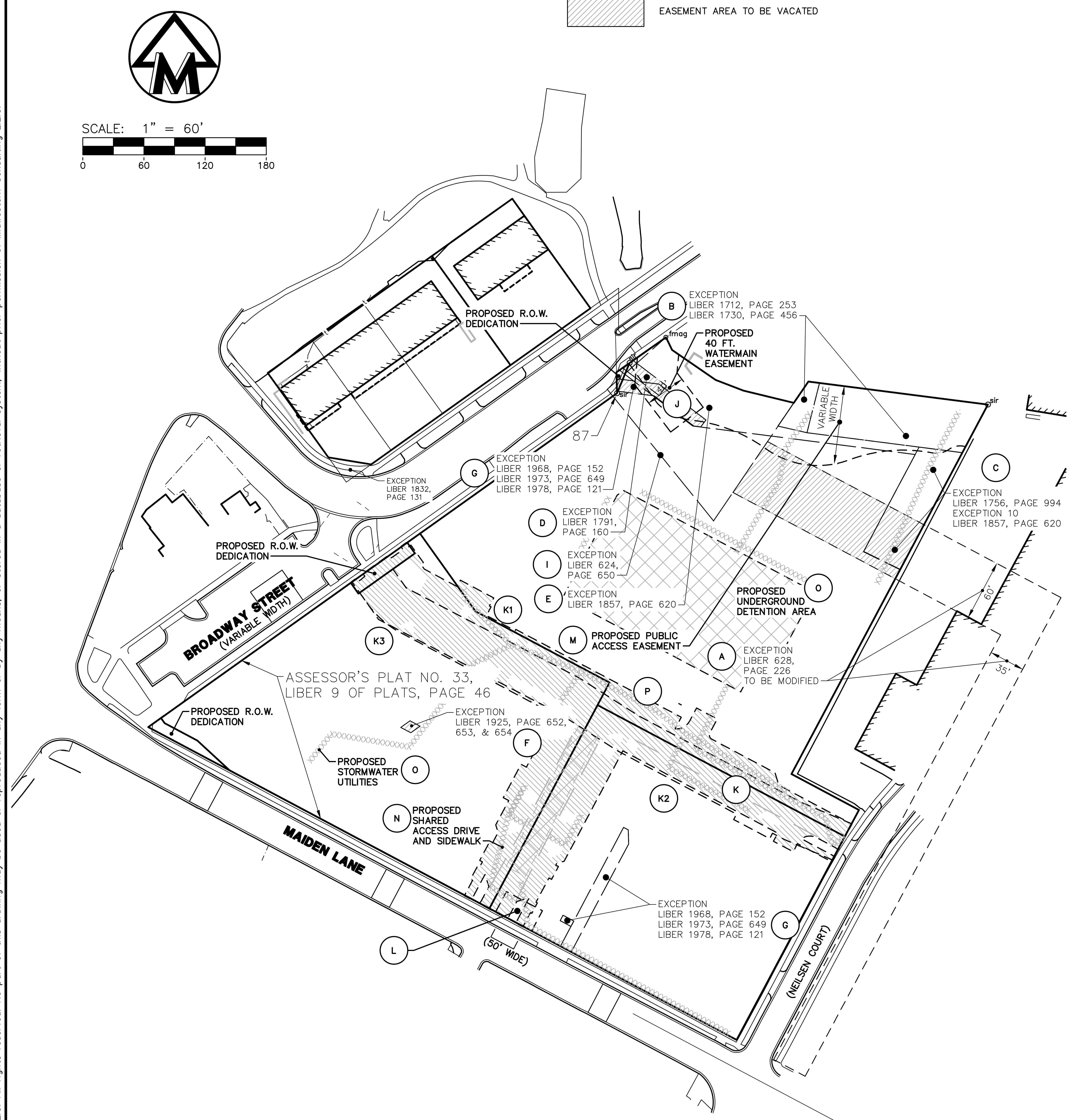
LEGEND

EASEMENT AREA TO BE VACATED



N — Shared access drive and sidewalk per proposed reciprocal easement agreement. PARCELS A–C

O — Shared stormwater drainage system and piping per proposed reciprocal easement agreement. PARCELS A–C

UNDERGROUND DETENTION AREA

XXXXXXXXXXXXXX STORMWATER UTILITIES

P — SEE RECIPROCAL EASEMENT AGREEMENT DOCUMENTS SUBMITTED SEPARATELY. PARCELS A–C

The underground utilities shown have been located from field survey information and existing records. The surveyor makes no guarantees that the underground utilities shown comprise all such utilities in the area, either in-service or abandoned. The surveyor further does not warrant that the underground utilities shown are in the exact location indicated. Although the surveyor does certify that they are located as accurately as possible from the information available.

EXISTING EASEMENTS

A Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in a document:

In favor of: City of Ann Arbor
Purposes: storm and sanitary sewers
Recording No: Liber 628, Page 226 (PLOTTED)

–To be modified

LEGAL DESCRIPTION OF A PORTION OF AN EASEMENT, RECORDED IN LIBER 628, PAGE 226, WASHTENAW COUNTY RECORDS, TO BE ABANDONED, LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence S 58°44'00" E 653.70 feet along the Northerly right-of-way line of Maiden Lane (50.00 feet wide); thence N 31°16'00" E 255.50 feet along the Westerly line of Neilson Court (50.00 feet wide); thence N 58°44'00" W 75.00 feet; thence N 31°16'00" E 217.00 feet along the Northwesterly line of Ross Maiden Lane Apartments to the POINT OF BEGINNING;

thence N 58°44'00" W 180.35 feet;
thence N 37°27'39" E 60.35 feet;
thence S 58°44'00" E 173.84 feet;
thence S 31°16'00" W 60.00 feet along the Northwesterly line of Ross Maiden Lane Apartments to the POINT OF BEGINNING. Being a part of Lot 25 of ASSESSOR'S PLAT NO. 32, as recorded in Liber 9 of Plats, Page 45, Washtenaw County Records. Being subject to easements and restrictions of record, if any.

B Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in documents:

Entitled: Declaration of Taking
Recording Nos: Liber 1712, Page 253, and Liber 1730, Page 456 (PLOTTED)

C Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in document:

Entitled: Right of Way Agreement
Purpose: Public Utilities
Recording Nos: Liber 1756, Page 994 (PLOTTED)

D Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in a document:

In favor of: City of Ann Arbor
Purposes: water mains, storm sewers, sanitary sewers and appurtenances
Recording No: Liber 1791, Page 160 (PLOTTED)

–TO BE ABANDONED

E Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in a document:

In favor of: City of Ann Arbor
Purposes: water mains, storm sewers, sanitary sewers and appurtenances
Recording No: Liber 1857, Page 620 (PLOTTED)

F Right(s) of Way and/or Easement(s) and rights incidental thereto as granted in a document:

Granted to: Michigan Bell Telephone Company
Recording Nos: Liber 1925, Pages 652, 653 and 654 (as to Parcel C)(PLOTTED)

–TO BE ABANDONED

G Right(s) of Way and/or Easement(s) and rights incidental thereto as granted in a document:

Granted to: Detroit Edison Company
Recording Nos: Liber 1968, Page 152; Liber 1973, Page 649; and Liber 1978, Page 121 (as to Parcel C) (PLOTTED)

–TO BE ABANDONED

H Terms, Covenants, and Conditions of Broadway Village at Lower Town Development Agreement as set forth below:

Recording No: Liber 4664, Page 171 (DOCUMENT BLANKET IN NATURE)
An agreement to modify the terms and provisions of said agreement as therein provided
Entitled: First Amendment
Recording No: Liber 4664, Page 172 (DOCUMENT BLANKET IN NATURE)

I Right(s) of Way and/or Easement(s) and rights incidental thereto as set forth in a document:

In favor of: City of Ann Arbor
Purposes: storm sewers, sanitary sewers and appurtenances
Recording No: Liber 624, Page 650 (PLOTTED)

J — PROPOSED 40' WATERMAIN EASEMENT PARCEL A

LEGAL DESCRIPTION OF A PROPOSED EASEMENT FOR WATER MAIN LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence along the Southerly right-of-way line of Broadway Street (variable width) in the following three (3) courses: N 57°48'00" E 564.63 feet; N 01°45'27" E 20.50 feet; N 57°48'00" E 25.31 feet to the POINT OF BEGINNING;

thence continuing N 57°48'00" E 0.57 feet along said right-of-way line;
thence N 58°18'42" E 33.55 feet along said right-of-way line;
thence S 22°41'48" E 13.78 feet;
thence S 52°10'02" E 7.84 feet;
thence S 08°49'21" W 18.00 feet
thence S 33°55'12" E 42.57 feet;
thence S 56°04'48" W 40.00 feet;
thence N 33°55'12" W 58.22 feet;
thence N 08°49'21" E 27.04 feet to the POINT OF BEGINNING. Being a part of Lot 30, of ASSESSOR'S PLAT NO. 32, as recorded in Liber 9 of Plats, Page 45, Washtenaw County Records. Being subject to easements and restrictions of record, if any.

PROPOSED EASEMENTS

K1 — PROPOSED 40' WATERMAIN EASEMENT

LEGAL DESCRIPTION OF A PROPOSED EASEMENT FOR WATER MAIN LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence along the Southerly right-of-way line of Broadway Street (variable width) N 57°48'00" E 327.33 feet; thence S 32°14'33" E 93.87 feet; thence S 58°44'00" E 148.80 feet; thence S 31°16'00" W 12.18 feet to the POINT OF BEGINNING;

thence S 54°13'59" E 41.59 feet;
thence S 58°43'49" E 180.38 feet;
thence S 63°43'49" E 53.02 feet;
thence along the Westerly right-of-way line of Nielsen Court (50 feet wide) S 31°16'00" W 14.15 feet;
thence N 58°44'00" W 274.67 feet;
thence N 31°16'00" E 12.80 feet to the POINT OF BEGINNING. Being a part of Lot 25 of ASSESSOR'S PLAT NO. 32, as recorded in Liber 9 of Plats, Page 45, and Lot 85 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records. Being subject to easements and restrictions of record, if any.

K2 LEGAL DESCRIPTION OF A PROPOSED EASEMENT FOR WATER MAIN LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence N 57°48'00"E 327.33 feet along the Southerly right-of-way line of Broadway Street (variable width); thence S 32°14'33" E 93.87 feet; thence S 58°44'00" E 148.80 feet; thence S 31°16'00" W 24.98 feet to the POINT OF BEGINNING;

thence S 58°44'00"E 274.67 feet;
thence S 31°16'00"W 26.00 feet along the Westerly right-of-way line Nielsen Court (50.00 feet wide);
thence N 63°43'49"W 51.27 feet;
thence N 58°43'49"W 12.99 feet;
thence S 31°16'11"W 6.00 feet;
thence N 58°43'49"W 40.00 feet;
thence N 31°16'11"E 6.00 feet
thence N 58°43'49"W 130.71 feet;
thence N 54°13'59"W 40.02 feet;
thence N 31°16'00"E 27.32 feet to the POINT OF BEGINNING. Being a part of Lots 83 and a vacated alley of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, and being a part of Lot 28 of ASSESSOR'S PLAT NO. 32, as recorded in Liber 9 of Plats, Page 45, Washtenaw County Records. Being subject to easements and restrictions of record, if any.

K3 LEGAL DESCRIPTION OF A PROPOSED EASEMENT FOR WATER MAIN LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence N 57°48'00" E 245.53 feet along the Southerly right-of-way line of Broadway Street (variable width); thence S 31°53'14" E 13.00 feet to the POINT OF BEGINNING;

thence N 57°48'00" E 40.00 feet;
thence S 31°53'14" E 22.57 feet;
thence S 59°13'59" E 191.10 feet;
thence S 54°13'59" E 28.74 feet;
thence S 31°16'00" W 40.12 feet;
thence N 54°13'59" W 30.14 feet;
thence N 59°13'59" W 199.09 feet;
thence N 31°53'14" W 32.08 feet to the POINT OF BEGINNING. Being a part of Lots 81 through 85 and a vacated alley of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records. Subject to easements and restrictions of record, if any.

L — PROPOSED 40' WATERMAIN EASEMENT PARCEL B

LEGAL DESCRIPTION OF A PROPOSED EASEMENT FOR WATER MAIN LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence S 58°44'00" E 386.01 feet along the Northerly right-of-way line of Maiden Lane (50.00 feet wide) to the POINT OF BEGINNING;

thence N 31°16'00" E 22.47 feet;
thence S 58°44'00" E 40.00 feet;
thence S 31°16'00" W 22.47 feet;
thence N 58°44'00"W 40.00 feet along said Northerly right-of-way line of Maiden Lane to the POINT OF BEGINNING. Being a part of Lots 74 and 75 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records.

M — PROPOSED PUBLIC ACCESS EASEMENT PARCEL A

LEGAL DESCRIPTION OF A PUBLIC ACCESS EASEMENT LOCATED IN THE CITY OF ANN ARBOR, WASHTENAW COUNTY, MICHIGAN

Commencing at the Westerly corner of Lot 78 of ASSESSOR'S PLAT NO. 33, as recorded in Liber 9 of Plats, Page 46, Washtenaw County Records; thence along the Southerly right-of-way line of Broadway Street (variable width) in the following three (3) courses: N 57°48'00" E 564.63 feet; N 01°45'27" E 20.50 feet; N 57°48'00" E 14.99 feet to the POINT OF BEGINNING;

thence continuing N 57°48'00" E 10.89 feet along said right-of-way line;
thence N 58°18'42" E 33.55' feet along said right-of-way line;
thence S 22°41'48" E 13.78 feet;
thence S 52°07'48" E 51.77 feet;
thence S 65°43'18" E 29.31 feet;
thence S 73°04'18" E 50.81 feet;
thence N 37°31'42" E 25.40 feet;
thence S 79°25'00" E 177.53 feet along the Northeasterly line of Lot 25 of "Assessor's Plat No. 32", as recorded in Liber 9 of Plats, Page 45, Washtenaw County Records;
thence S 31°16'00" W 46.85 feet;
thence Southwesterly 15.57 feet along the arc of a non-tangential circular curve to the left, radius 18.41 feet, central angle 48°28'25", long chord S 86°27'06" W 15.11 feet;
thence Southwesterly 17.96 feet along the arc of a non-tangential circular curve to the right, radius 22.09 feet, central angle 46°33'42", long chord S 78°51'53" W 17.47 feet;
thence Southwesterly 85.48 feet along the arc of a non-tangential circular curve to left, radius 151.23 feet, central angle 32°23'05", long chord S 88°11'11" W 84.35 feet;
thence Northwesterly 84.00 feet along the arc of a non-tangential circular curve to the right, radius 87.50 feet, central angle 55°00'03", long chord N 78°24'42" W 80.81 feet;
thence Northwesterly 77.51 feet along the arc of a circular curve to the left, radius 152.80 feet, central angle 29°03'53", long chord N 65°26'37" W 76.68 feet;
thence Northwesterly 39.36 feet along the arc of a non-tangential circular curve to the right, radius 55.38 feet, central angle 40°43'18", long chord N 61°20'00" W 38.54 feet;
thence N 32°11'56" W 48.24 feet to the POINT OF BEGINNING. Being a part of Lots 25 & 30, of said ASSESSOR'S PLAT NO. 32. Being subject to easements and restrictions of record, if any.

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1140 BROADWAY STREET

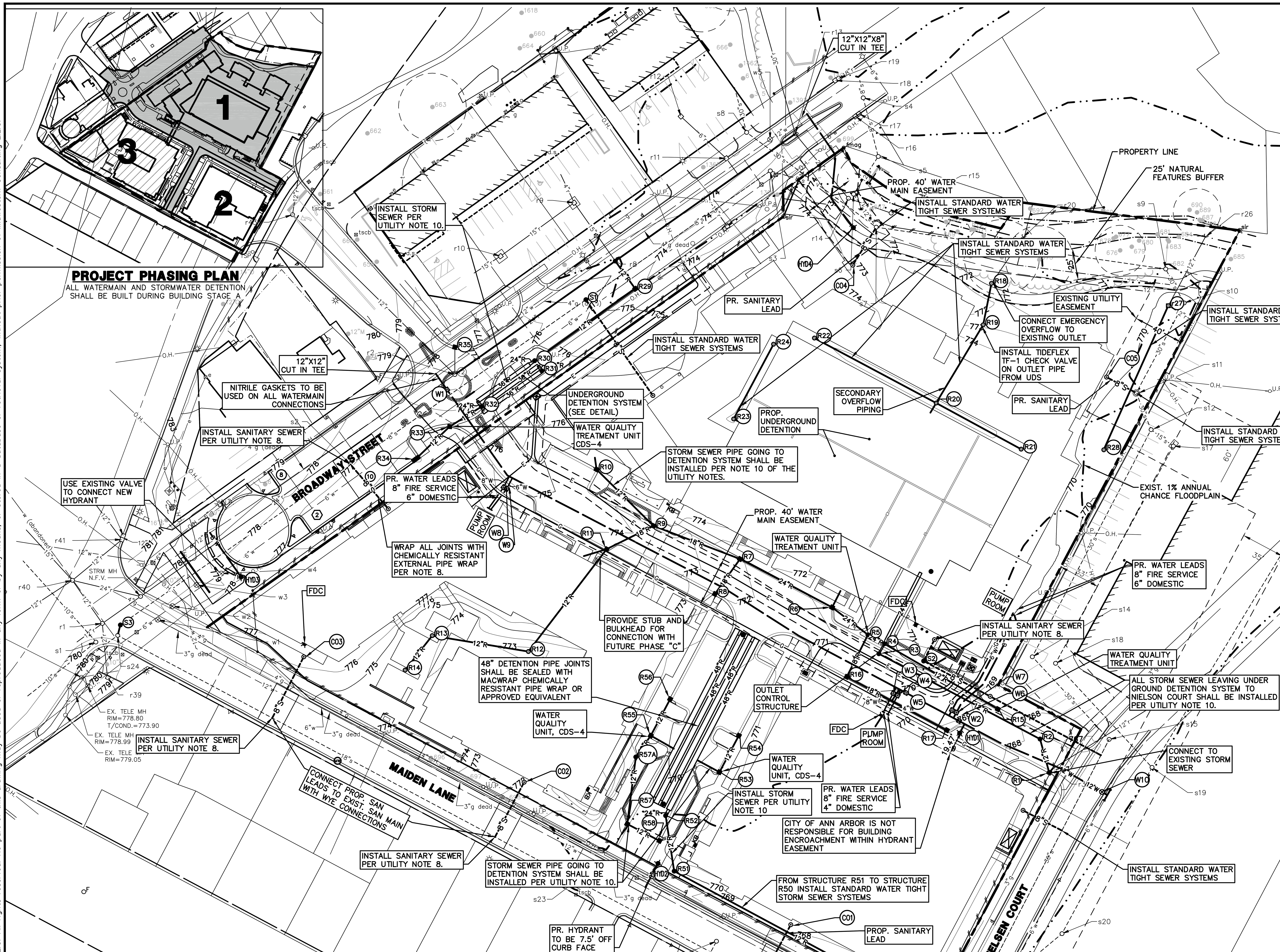
DETAILED ENGINEERING PLANS
EASEMENT PLAN

03

DATE: 1/22/18
SHEET 3 OF 31
CADD:
ENG: HTH
PM: TJC
TECH:
16196EU1.dwg
FB#

JOB No. **16196A**

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	3/16/18
PER MUNICIPAL REVIEW	4/6/18
PER MUNICIPAL REVIEW	5/30/18
PER MUNICIPAL REVIEW	8/9/18
PER MUNICIPAL REVIEW	10/5/18



NOTES:

1. BOOSTER PUMPS ARE ANTICIPATED AND LOCATIONS ARE SHOWN.
2. FIRE COMMAND CENTER LOCATIONS ARE SHOWN.
3. FOOTING DRAINS TO CONNECT TO STORM SEWER.
4. POOL TO DISCHARGE TO STORM SEWER.
5. ALL SANITARY CONNECTIONS SHALL BE CONNECTED WITH A WYE UNLESS NOTED ON PLANS.
6. ALL PROPOSED SANITARY CONNECTIONS TO BE MADE TO EXISTING MANHOLES SHALL HAVE APPROVAL FROM PUBLIC WORKS THAT MANHOLES ARE IN ACCEPTABLE CONDITION OR SHALL BE REBUILT

LEGEND

838	EXIST. CONTOUR
838	PROP. CONTOUR
U.P.	EXIST. UTILITY POLE
U.P.	EXIST. UTILITY POLE W/ TRANS.
	GUY WIRE
	ELEC. TRANSFORMER
	ELEC. GENERATOR
OH	EXIST. OVERHEAD UTILITY LINE
	EXIST. LIGHT POLE
	PROP. LIGHT POLE
t	EXIST. TELEPHONE LINE
T	PROP. TELEPHONE LINE
e	EXIST. ELECTRIC LINE
E	PROP. ELECTRIC LINE
g	EXIST. GAS LINE
G	PROP. GAS LINE
g	EXIST. GAS VALVE
f.o.	EXIST. FIBER OPTIC LINE
F.O.	PROP. FIBER OPTIC LINE
w	EXIST. WATER MAIN
W	PROP. WATER MAIN
	PROP. HYDRANT
	EXIST. HYDRANT
	EXIST. GATE VALVE IN BOX
	PROP. GATE VALVE IN BOX
	EXIST. GATE VALVE IN WELL
	PROP. GATE VALVE IN WELL
	EXIST. CURB STOP & BOX
	PROP. CURB STOP & BOX
r	EXIST. STORM SEWER
R	PROP. STORM SEWER
	EXIST. CATCH BASIN OR INLET
	PROP. CATCH BASIN OR INLET
	PROP. BEEHIVE INLET
RD	PROP. ROOF DRAIN
	END SECTION
	HEAD WALL
	CULVERT
	UNDERGROUND DETENTION
s	EXIST. SANITARY SEWER
S	PROP. SANITARY SEWER
	EXIST. CLEANOUT
	PROP. CLEANOUT
	TELEPHONE RISER
catv	CABLE TELEVISION RISER
e	ELECTRIC METER
	WATER METER
g	GAS METER
glm	GAS LINE MARKER
fiber	FIBER OPTIC MARKER
	FIRE DEPARTMENT CONNECTION
FCC	FIRE COMMAND CENTER
KB	KNOX BOX

UTILITY NOTES

1. ALL PUBLIC UTILITY INSTALLATION SHALL BE INSTALLED IN ACCORDANCE WITH CITY OF ANN ARBOR STANDARD SPECIFICATIONS, CURRENT EDITION. THE OMISSION OF ANY CURRENT STANDARD DETAIL DOES NOT RELIEVE THE CONTRACTOR FROM THIS REQUIREMENT.
2. CONTRACTOR SHALL VERIFY ALL EXISTING UTILITY LOCATIONS, DEPTHS AND ELEVATIONS PRIOR TO CONSTRUCTION.
3. CONTRACTOR SHALL PROTECT EXISTING UTILITIES DURING CONSTRUCTION.
4. NO FIRE WALLS ARE PROPOSED WITHIN NEW CONSTRUCTION.
5. ANY EXISTING UTILITY LEADS NOT TO BE RE-USED ARE TO BE ABANDONED IN ACCORDANCE WITH THE CURRENT CITY OF ANN ARBOR STANDARDS.
6. SUPPORTING FIRE HYDRANT(S) SHALL BE IN PLACE AND ACCEPTED BY THE FIRE MARSHALL PRIOR TO BRINGING COMBUSTIBLE MATERIALS ONTO THE SITE.
7. SANITARY CONNECTION TO EXISTING MANHOLES SHALL BE MADE WITH THE APPROVAL OF PUBLIC WORKS AND CONDITION OF MANHOLES SHALL BE VERIFIED TO BE ACCEPTABLE.
8. ALL SANITARY CONNECTIONS AT PIPE JOINTS, MANHOLE CONNECTIONS AND MANHOLE JOINTS MUST BE SEALED WITH APPROPRIATE MACWRAP CHEMICALLY RESISTANT EXTERNAL PIPE WRAP OR APPROVED EQUIVALENT IN THE AREAS SPECIFIED IN THE UTILITY PLAN.
9. STANDARD WATER TIGHT SEWER SYSTEMS SHALL BE INSTALLED IN AREAS SPECIFIED IN THE UTILITY PLAN.
10. INSTALL ADS HP STORM SEWER PIPE OR EQUIVALENT MATERIAL RESISTANT TO TETRACHLOROETHYLENE. STORM SEWER SHALL BE SEALED WITH MACWRAP CHEMICALLY RESISTANT EXTERNAL WRAP OR APPROVED EQUIVALENT. ALTERNATES MUST BE APPROVED BY OWNER'S ENGINEER.
11. ALL MANHOLE STRUCTURE JOINTS AND CONNECTIONS AT OR BELOW ELEVATION 762.5 MSL SHALL BE EXTERNALLY SEALED WITH MACWRAP CHEMICALLY RESISTANT EXTERNAL WRAP OR APPROVED EQUIVALENT.
12. NITRILE GASKETS OR EQUIVALENT SHALL BE USED AT ALL WATERMAIN FITTINGS.
13. NITRILE GASKETS WILL BE USED AT WATERMAIN ONLY. THIS IS BASED ON DURABILITY AND COMPATIBILITY TO TETRACHOLOROETHENE AND OTHER CHLORINATED VOLATILE ORGANIC COMPOUNDS (CI-VOCs) THAT ARE PRESENT IN GROUNDWATER ON THE SITE.
14. USE OF LINE STOPS IS REQUIRED WHERE EXISTING WATER MAINS CANNOT BE SUFFICIENTLY ISOLATED TO COMPLETE THE WORK. THE COST OF THE ANY LINE STOP INSTALLATION IS THE RESPONSIBILITY OF THE DEVELOPER AND/OR CONTRACTOR.

811 Know what's below. Call before you dig.

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1140 BROADWAY STREET

DETAILED ENGINEERING PLANS
SITE UTILITY PLAN

15

DATE: 01/22/18
SHEET OF 31

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	5/30/18
PER MUNICIPAL REVIEW	8/9/18
PER MUNICIPAL REVIEW	9/25/18
REVISED SEWER MATERIALS	10/26/18

CADD: | ENG: HTH | PM: TJC | TECH:
16196UP1.dwg
JOB No. 16196A

Parking Structure A Basin Stormwater Calculations

W1 - Determining Post-Development Cover Types, Areas, Curve Numbers, and Runoff Coefficients

Rational Method Variables

Cover Type	Soil Type	Area (sft)	Area (ac)	Runoff Coeff. (C)	(C) x (Area)
Building/Pavement		180,613	4.15	0.95	3.94
Grass	B	23,179	0.53	0.25	0.13
Total		203,792	4.68		4.07

Weighted C = (Sum(C)x(Area))/(Area Total)= 0.87

NRCS Variables (Pervious)

Cover Type	Soil Type	Area (sft)	Area (ac)	Curve Number	(CN) x (Area)
Grass	B	23,179	0.53	61	0.32
Total		23,179	0.53		0.32

Weighted CN = (Sum(CN)x(Area))/(Area Total)= 61

NCRS Variables (Impervious)

Cover Type	Soil Type	Area (sft)	Area (ac)	Curve Number	(CN) x (Area)
Building/Pavement		180,613	4.15	98	4.06
Total		180,613	4.15		4.06

Weighted CN = (Sum(CN)x(Area))/(Area Total)= 98

W2 - W2 - First Flush Runoff Calculations (V_{ff})

A. V_{ff} = 1" x 1'/12" x 43560 sft/ac x A x C — where A= 4.68 — and where C= 0.87

V_{ff} = 1" x 1'/12" x 43560 sft/ac x 4.68 x 0.87 = 14,775 cf

W3 - W3 - Pre-Development Bankfull Runoff Calculations (V_{bf-pre})

A. 2 year / 24 hour storm event: P= 2.35 in
B. Pre-Development CN (Good Cover Woods, Type D Soils) CN= 61
C. S = (1000 / CN) - 10 S= 6.393 in
D. Q = [(P-0.2S)^2] / [P+0.8S] Q= 0.154 in
E. Total Site Area excluding "Self-Crediting" BMPs 203,792 sft
F. V_{bf-pre} = Q x (1/12) x Area V_{bf-pre} = 2,611 cft

W4 - Pervious Cover Post-Development Bankfull Runoff Calculations ($V_{bf-per-post}$)

A. 2 year / 24 hour storm event: P= 2.35 in
B. Pervious Cover CN From Worksheet 1 CN= 61
C. S = (1000 / CN) - 10 S= 6.393 in
D. Q = [(P-0.2S)^2] / [P+0.8S] Q= 0.154 in
E. Pervious Cover Area from Worksheet 1 23,179 sft
F. $V_{bf-per-post}$ = Q x (1/12) x Area $V_{bf-per-post}$ = 297 cft

W5 - W5 - Impervious Cover Post-Development Bankfull Runoff Calculations ($V_{bf-imp-post}$)

A. 2 year / 24 hour storm event: P= 2.35 in
B. Impervious Cover CN From Worksheet 1 CN= 98
C. S = (1000 / CN) - 10 S= 0.204 in
D. Q = [(P-0.2S)^2] / [P+0.8S] Q= 2.122 in
E. Impervious Cover Area from Worksheet 1 180,613 sft
F. $V_{bf-imp-post}$ = Q x (1/12) x Area $V_{bf-imp-post}$ = 31,933 cft

W6 - W6 - Pervious Cover Post-Development 100-Year Runoff Calculations ($V_{100-per-post}$)

A. 100 year / 24 hour storm event: P= 5.11 in
B. Pervious Cover CN From Worksheet 1 CN= 61
C. S = (1000 / CN) - 10 S= 6.393 in
D. Q = [(P-0.2S)^2] / [P+0.8S] Q= 1.436 in
E. Pervious Cover Area from Worksheet 1 23,179 sft
F. $V_{100-per-post}$ = Q x (1/12) x Area $V_{100-per-post}$ = 2,773 cft

W7 - W7 - Impervious Cover Post-Development 100-Year Runoff Calculations ($V_{100-imp-post}$)

A. 2 year / 24 hour storm event: P= 5.11 in
B. Impervious Cover CN From Worksheet 1 CN= 98
C. S = (1000 / CN) - 10 S= 0.204 in
D. Q = [(P-0.2S)^2] / [P+0.8S] Q= 4.873 in
E. Impervious Cover Area from Worksheet 1 180,613 sft
F. $V_{bf-imp-post}$ = Q x (1/12) x Area $V_{bf-imp-post}$ = 73,344 cft

W8 - Time of Concentration (Tc-hrs)

A. Assume 15-minute minimum time of concentration Tc= 0.25 hr

W9 - Runoff Summary & On-Site Infiltration Requirement

A. Summary from Previous Worksheets

First Flush Volume (Vff)	**14,775 cft**
Pre-Development Bankfull Runoff Volume (Vbf-pre)	**2,611 cft**
Pervious Cover Post-Development Bankfull Volume (Vbf-per-post)	*297 cft*
Impervious Cover Post-Development Bankfull Volume (Vbf-imp-post)	*31,933 cft*
Total BF Volume (Vbf-post)	**32,230 cft**
Pervious Cover Post-Development 100-Year Volume (V100-per-post)	*2,773 cft*
Impervious Cover Post-Development 100-Year Volume (V100-imp-post)	*73,344 cft*
Total 100-Year Volume (V100)	**76,117 cft**

B. Determine Onsite Infiltration Requirement
Subtract the Pre-Development Bankfull from the Post-Development Bankfull Volume

Total Post-Development Bankfull Volume (Vbf-post)	32,230 cft
Pre-Development Bankfull Runoff Volume (Vbf-pre)	2,611 cft
Bankfull Volume Difference	**29,619 cft**
Infiltration Requirement (Vinf)	**29,619 cft**

W10 - Detention/Retention Requirement

A. Q_p = 238.6 Tc^-0.82 743.63 cfs/(in x sq. mi)
B. Total Site Area excluding "Self-Crediting" BMPs 4.68 ac
C. $Q_{100} = Q_{100-per} + Q_{100-imp}$ (from W6 and W7, respectively) 6.309 in
D. Peak Flow (PF) = Q_p x Q_{100} x Area / 640 34.29 cfs
E. Delta = PF - 0.15 x Area (ac) 33.59 cfs
[0.15 x Area (ac)] *0.70 cfs*
F. V_{det} = Delta / PF x V_{100} 74,559 cft
Required Detention not including infiltration credit or penalty.
Sediment Forebay Volume Required (5% of V100) 3,806 cft

W13 - Site Summary of Infiltration & Detention

A. Stormwater Management Summary

Min Infiltration Requirement (V_{inf})	29,619 cft
Designed/Provided Infiltration Volume	0 cft
% Minimum Required Infiltration Provided	0 %
Total Calculated Detention Volume, V_{det}	74,559 cft
Net Required Detention Volume (V_{det} - Designed/Provided Infiltration Volume)	74,559 cft

B. Detention Volume Increase for sites where the required infiltration volume cannot be achieved.

% Required Infiltration NOT Provided (100% - % Minimum Required Infiltration Provided)	100.0 %
Net % Penalty (20% x % Required Infiltration NOT Provided)	20.0 %
Total Required Detention Volume, including penalty	**89,471 cft**

[(100% + Net % Penalty) x Net Required Detention Volume)]

Detention Outlet Calculcations

A. Required Detention Volumes (Reduced by 6-hour infiltration)

Storm Event	Req'd Volume	less	Infil. Credit	=	Final Volume
First Flush	14,775 cft	-	0 cft	=	**14,775** cft
Bankfull	32,230 cft	-	0 cft	=	**32,230** cft
100 -year	74,559 cft	-	0 cft	-	**74,559** cft
100-year + Req'd Penalty	89,471 cft	-	0 cft	=	**89,471** cft

B. Detention Volumes Provided

Elevation	Area (sft)	Depth (ft)	Volume (cft)	Cum. Volume (cft)
765.0	18,820	0	0	0
766.0	18,820	1	18,820	18,820
766.0	25,458	0	0	18,820
767.0	25,458	1	25,458	44,278
768.0	25,458	1	25,458	69,736
769.0	25,458	1	25,458	95,194
			Total Volume =	95,194

Storage Elevation Calculation

First Flush Elevation (Xff)= $\frac{766.0 - 765.0}{18{,}820 - 0} = \frac{X_{ff} - 765.0}{14{,}775 - 0}$ Xff = 765.79 ft

Bankfull Elevation (Xbf)= $\frac{767.0 - 766.0}{44{,}278 - 18{,}820} = \frac{X_{bf} - 766.0}{32{,}230 - 18{,}820}$ Xbf = 766.53 ft

100-Year Elevation (X100)= $\frac{769.0 - 768.0}{95{,}194 - 69{,}736} = \frac{X_{100} - 768.0}{74{,}559 - 69{,}736}$ X100 = 768.19 ft

C. Two-Stage Outlet Design

First Flush Discharge (24-36 hours for the detention of first flush storm event)

Average Head (H_{ave}) = 2/3 (X_{ff} - X_{bot}) = 2/3 (765.79 - 765) = 0.53 ft
First Flush Max. Flowrate (Q_{ff-max}) = V_{ff} / 24 hrs = 14775cfs / (24 hrs*3600) = 0.17 cfs
Req Area (A_{ff}) = Q_{ff-max} / 0.62 / sqrt(2*g*H_{ave}) = 0.17/0.62/(2*32.2*0.53)^0.5= 0.047 sft
Orifice Diameter, Proposed 2.000 in
Orifice Area = 0.0218 sft
Number Required for 24 hr drainage = A_{ff} / Orifice Area= 0.047 sft / 0.0218 sft = 2.16 holes
Number of Holes to Use 2 holes
Area of (2) - 2 inch Orifice = A_{ff} 0.0436 sft
Actual Flow (Q_{ff}) = 0.62 * A_{ff} * sqrt(2*g*H_{ave}) = 0.62 * 0.0436 *sqrt(2*32.2*0.53) = 0.158 cfs
Actual Time (T_{ff}) = V_{ff} / Q_{ff} = 14775 cf / 0.158 cfs / 3600 = 25.98 hr

Bankfull Discharge (36-48 hours)

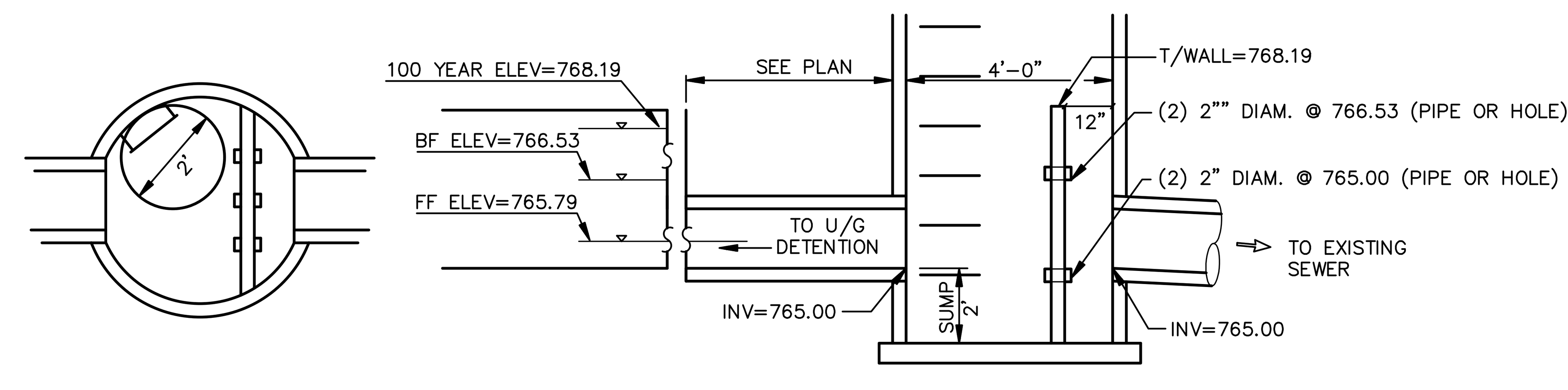
Average Head (H_{ave}) = 2/3 (Xbf - Xbot) = 2/3 (766.53 - 765) = 1.02 ft
Actual Flow (Q_{bf}) = 0.62 * Aff * sqrt(2*g*Have) = 0.62 * 0.0436 * sqrt(2 * 32.2 * 1.02)= 0.22 cfs
Actual Time (T_{bf}) = Vbf / Qbf = 32230 cf / 0.22 cfs / 3600 = 40.69 hr
Drawdown Time for Bankfull Volume is between 36 and 48 hours
Therefore use (2) 2 inch Diameter Holes at Elev 765

100-year Discharge (0.15 cfs/acre max. allowed)

Max Head to Lowest Holes ($Hmax_{100-ff}$) = X_{100} - X_{bot}= 768.19 - 765 = 3.19 ft
Max Flow at Lowest Holes (Q_{max-ff})= 0.62 * A_{ff} * sqrt(2 * g * H_{max}) =
= 0.62 * 0.0436 * sqrt(2 * 32.2 * 3.19) = 0.39 cfs
Max Head to 100yr Holes ($H_{max-100}$) = X_{100} - X_{bf} = 768.19 - 766.53 = 1.66 ft
Q_A (Allowable 100-year release rate)= 0.15 cfs/acre = 0.15 cfs * 4.68 ac = 0.70 cfs
Max flow through 100-year holes = $Q_{max-100}$ = Q_A - Q_{max-ff} = 0.7 cfs - 0.39 cfs = 0.31 cfs
Max. Area for Orifices (A_{100}) = Q_{max} / 0.62 / sqrt (2*g*h-100_{max}) 0.05 sft
Orifice Diameter 2.000 in
Orifice Area 0.022 sft
Number Required for 0.15 cfs/acre drainage 2.22
Number of holes used 2 ea
Area of (2) - 2 inch Orifice (A_{100}) 0.044 sft
100-year orifices - Actual Flow ($Q_{max-100}$) = 0.62 * A_{100} * sqrt (2 * g * H_{max100})
= 0.62 * 0.044 * sqrt (2 * 32.2 * 1.66) = 0.28 cfs
Actual Max Release Rate (Qmax) = Qmax-100 + Qmax-ff = 0.28 cfs + 0.39 cfs = 0.67 cfs

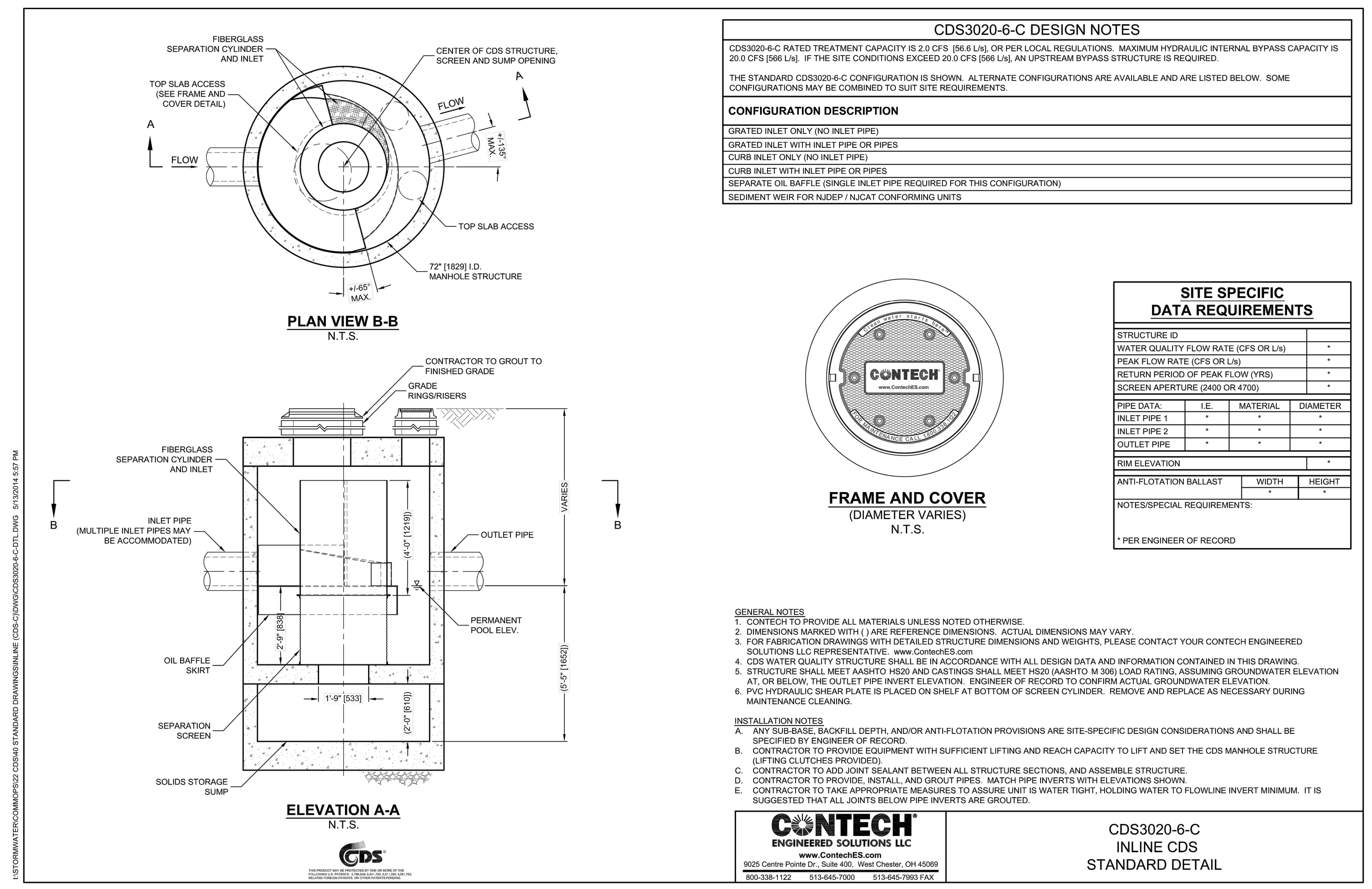
100-year Drawdown Time (72-hour max. to the lowest orifice)

Average head to first flush holes with all orfice in use (H_{ff-ave}) = 2/3 (X_{100} - X_{bf}) + (X_{bf} - X_{bot})
H_{ff-ave} = 2/3 (768.19 - 766.53) + (766.53 -765) = 2.64 ft
Average flow through lowest holes to bankfull elevation = 0.62 * A_{ff} * sqrt (2 * g * H_{ff-ave})
Q_{ff-ave} = 0.62 * 0.0436 * SQRT(2 * 32.2 * 2.64) 0.35 cfs
Average head to 100-year holes with all orifices in use = 2/3 (X_{100}-X_{bf})
$H_{100-ave}$ = 2/3 * (768.19 - 766.53) = 1.11 ft
Average flow through 100-yr holes with all holes in use = 0.62 * A_{100} * sqrt (2 * g * $H_{100-ave}$)
$Q_{100-ave}$ = 0.62 * 0.044 * sqrt(2 * 32.2 * 1.11) = 0.23 cfs
Combined drawdown flow (Q_{100-bf}) = Q_{ff-ave} + $Q_{100-ave}$ = 0.35 cfs + 0.23 cfs = 0.58 cfs
Volume of Storage above Bankfull Elev (V_{rem}) = V_{100} - V_{bf} = 89471 - 32230 = 57,241 cft
Time to drain Volume between 100yr and bankfull elevations = V_{rem}/Q_{100-bf}/3600
= 57241 cf / 0.58 cfs / 3600 = 27.41 hr
Total 100-year drawdown time = T100 = T100-bf + Tbf = 40.69 hrs + 27.41 hrs = 68.10 hr
Therefore use (2) 2 inch Diameter Holes at Elev 766.53

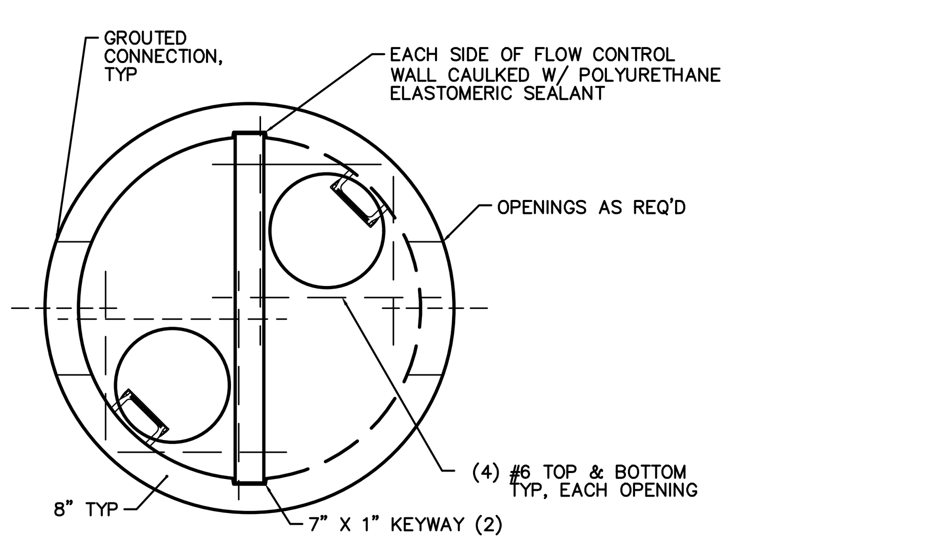


DETENTION AREA OUTLET (R3)

MANHOLE DETAIL W/RESTRICTED OUTLET

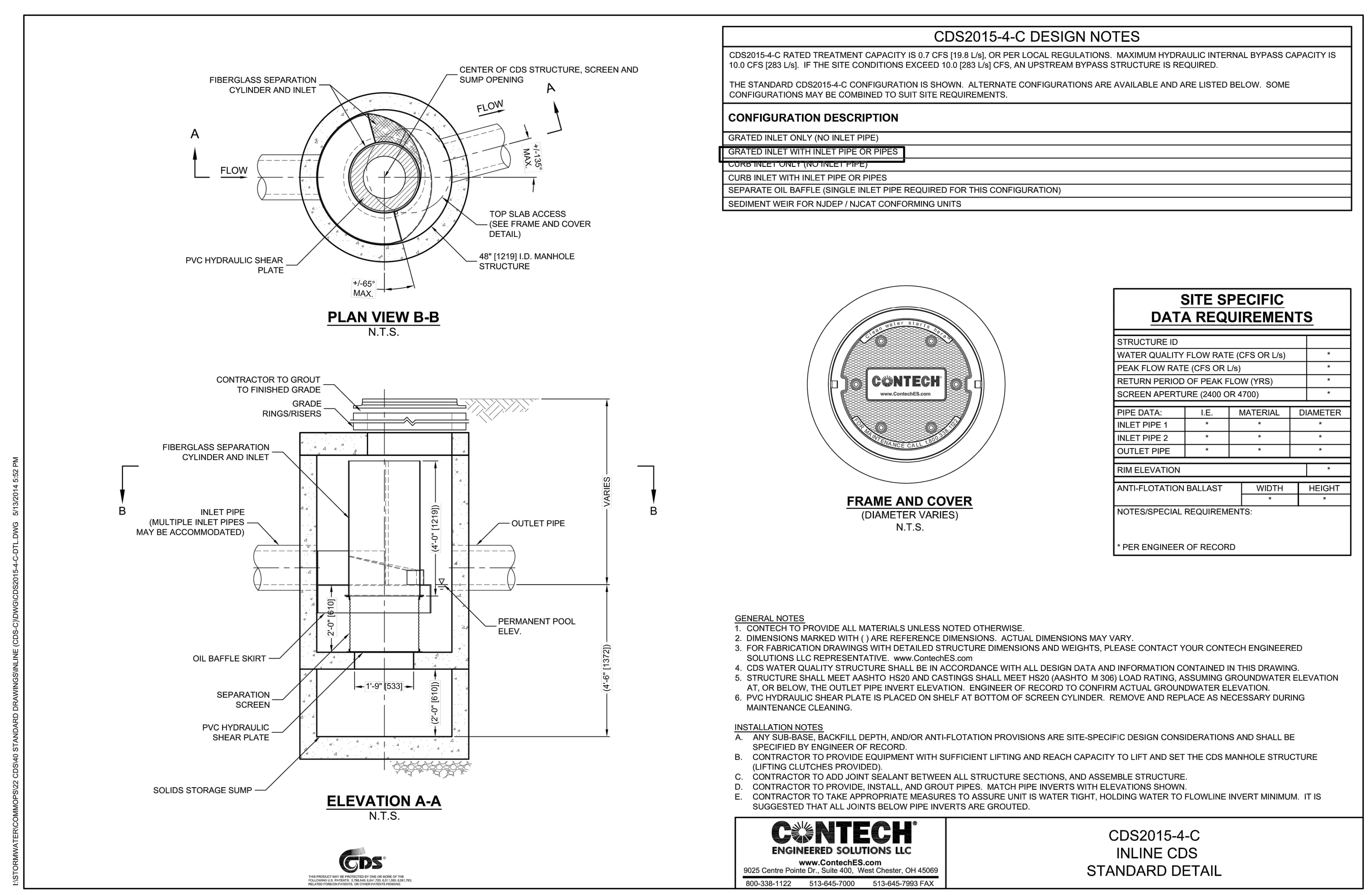


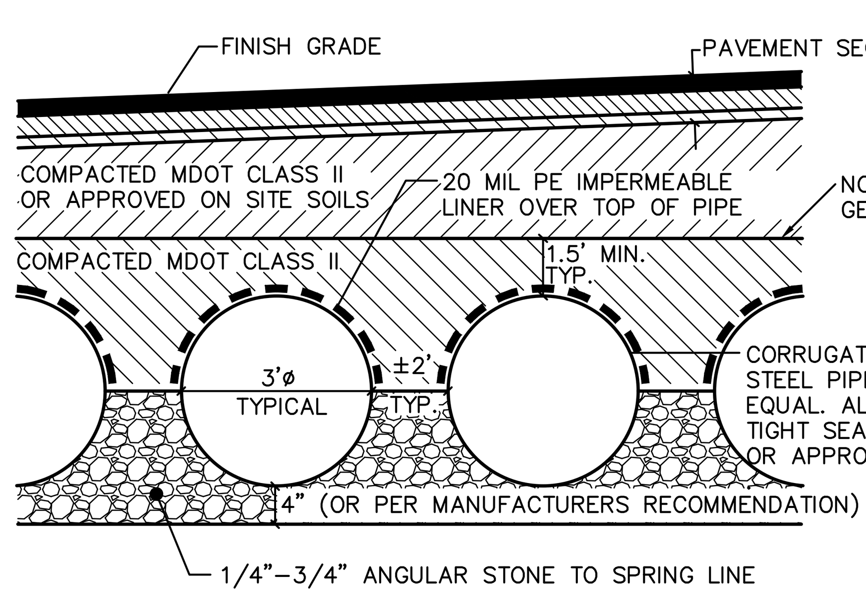
WATER QUALITY UNIT (TYP) (R5)



NOTES:

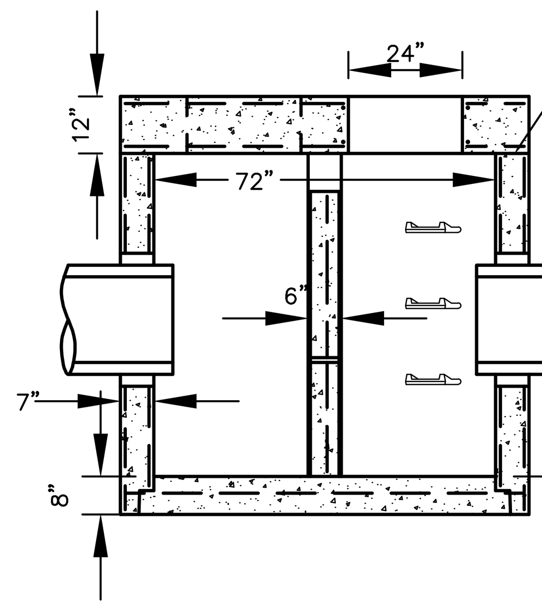
1. MANHOLE SECTIONS TO BE MANUFACTURED TO ASTM C-478 SPECIFICATIONS .
2. REINFORCING SHOWN FOR SCHEMATIC ONLY.
3. CONTRACTOR TO SEAL BETWEEN PRECAST WALL & BASE W/BUTYL ROPE.
4. INLET & OUTLET PIPES SIZE VARIES.

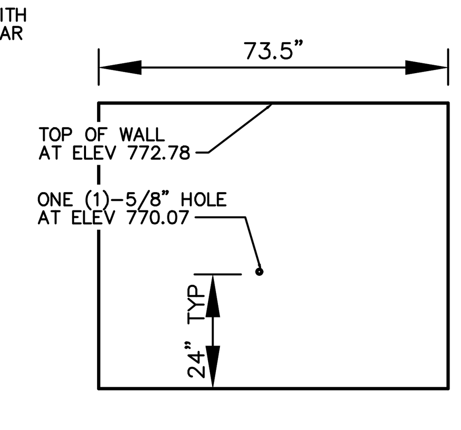




BROADWAY PIPE STORMWATER DETENTION

NOT TO SCALE





BROADWAY OUTLET CONTROL STRUCTURE (R30)

NO SCALE

WATER QUALITY UNIT (TYP) (R15, R16, R33, R53, R55)

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1140 BROADWAY STREET

DETAILED ENGINEERING PLANS
STORMWATER MANAGEMENT CALCULATIONS AND DETAILS

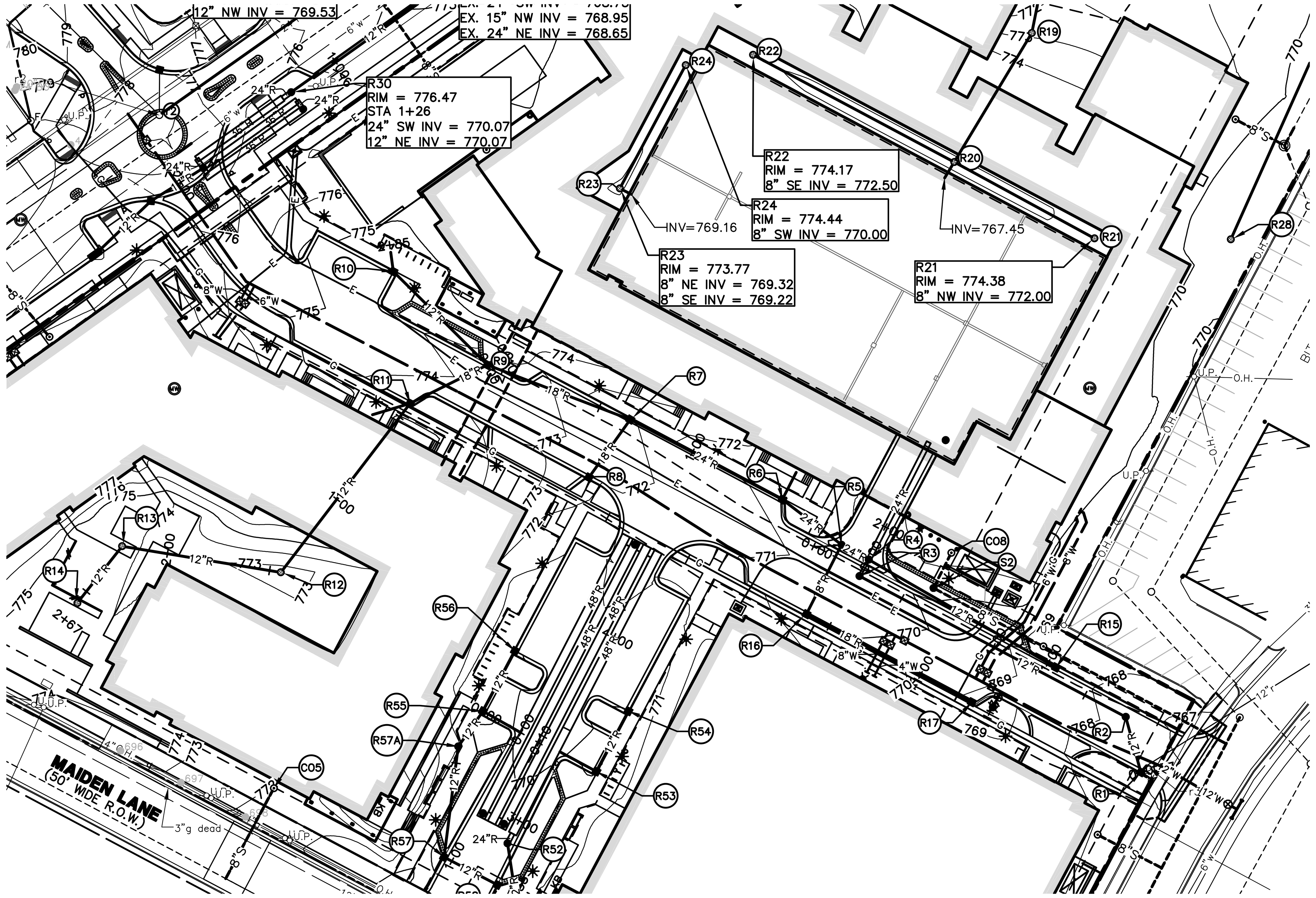
17

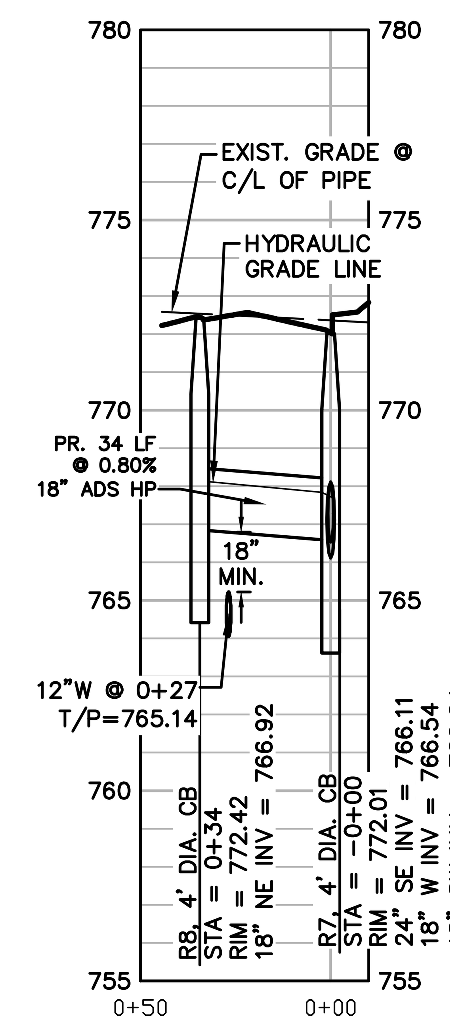
JOB No. 16196A

SCALE: 1" = 4' VERT
SCALE: 1" = 40' HOR
0 40 80 120

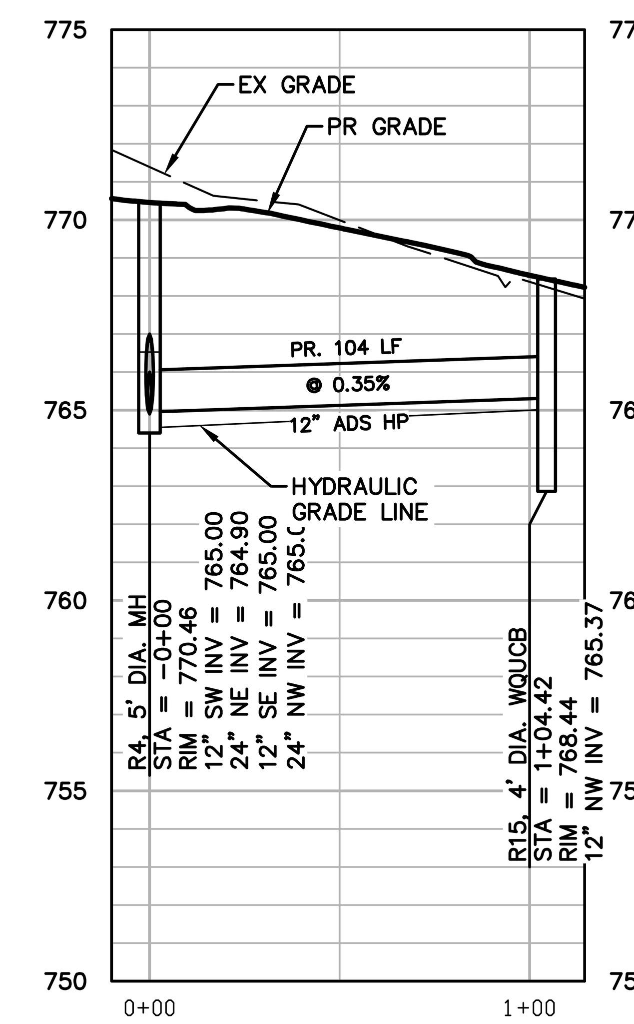
LEGEND

- EXIST. WATER MAIN
- PROP. WATER MAIN
- EXIST. HYDRANT
- PROP. HYDRANT
- EXIST. GATE VALVE IN BOX
- PROP. GATE VALVE IN BOX
- EXIST. GATE VALVE IN WELL
- PROP. GATE VALVE IN WELL
- EXIST. CURB STOP & BOX
- PROP. CURB STOP & BOX
- REDUCER
- EXIST. BLOW-OFF
- PROP. BLOW-OFF
- POST INDICATOR VALVE
- THRUST BLOCK
- EXIST. STORM SEWER
- PROP. STORM SEWER
- EXIST. CATCH BASIN OR INLET
- PROP. CATCH BASIN OR INLET
- END SECTION
- HEAD WALL
- CULVERT
- EXIST. SANITARY SEWER
- PROP. SANITARY SEWER
- EXIST. CLEANOUT
- PROP. CLEANOUT

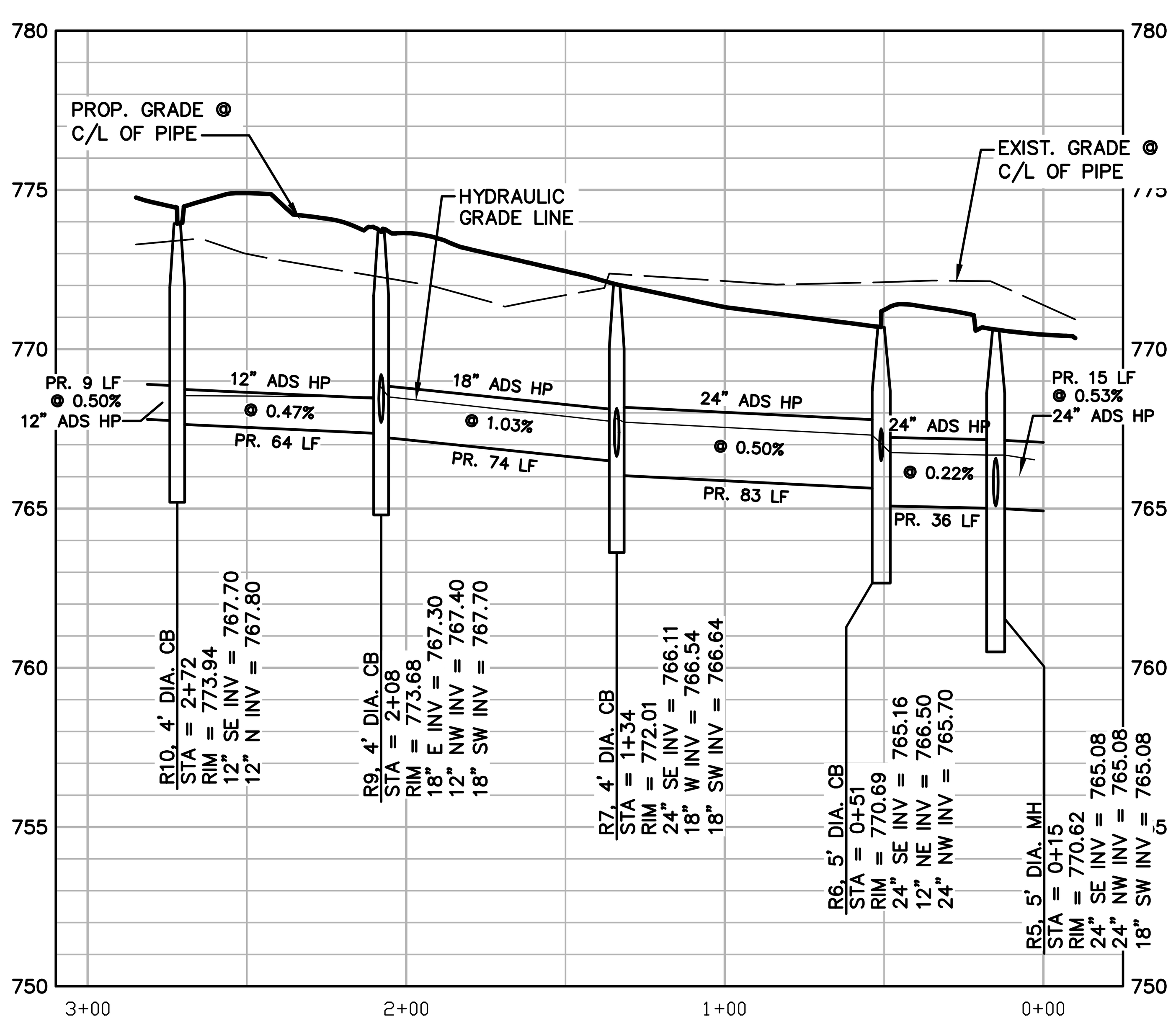




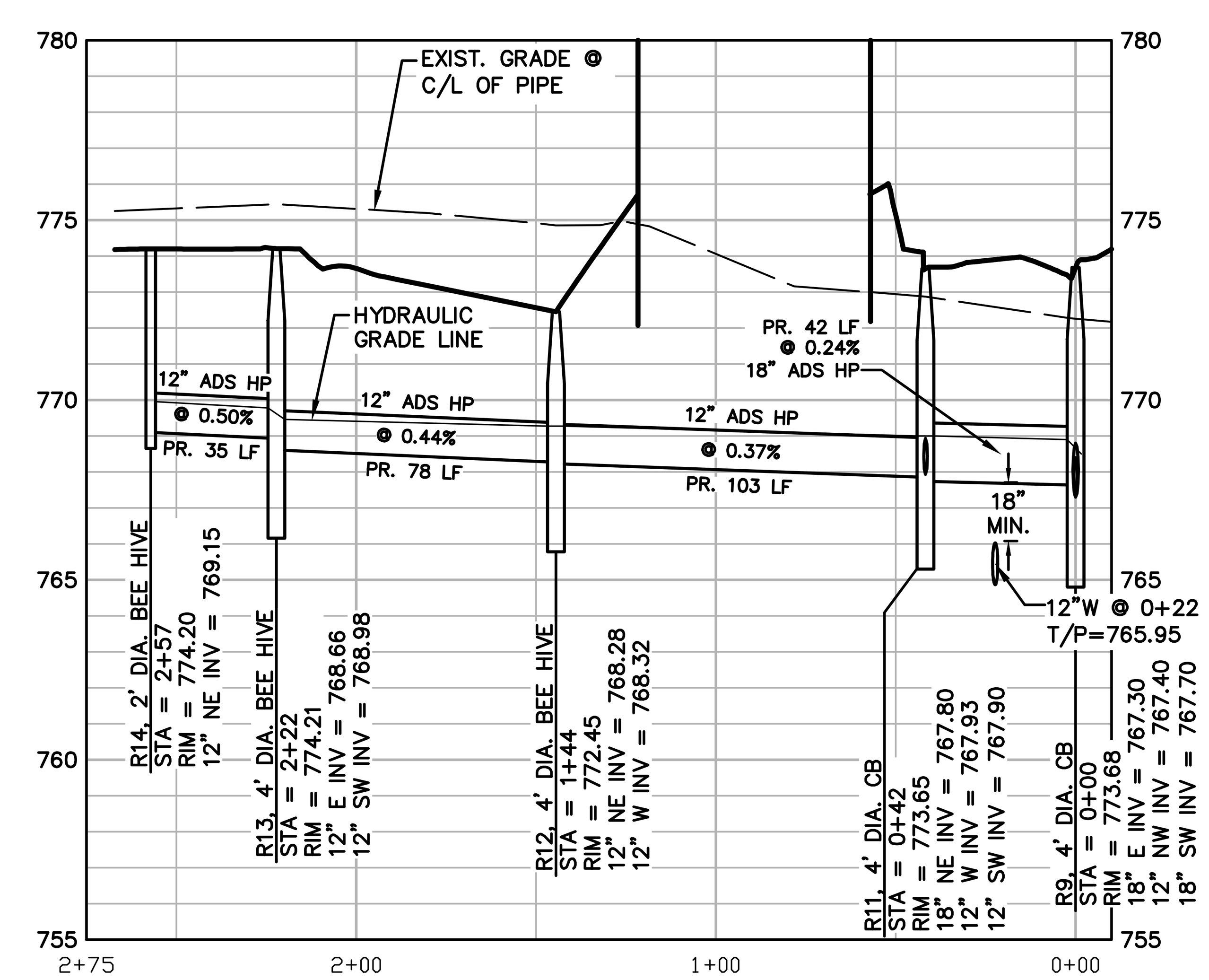
R8 TO R7



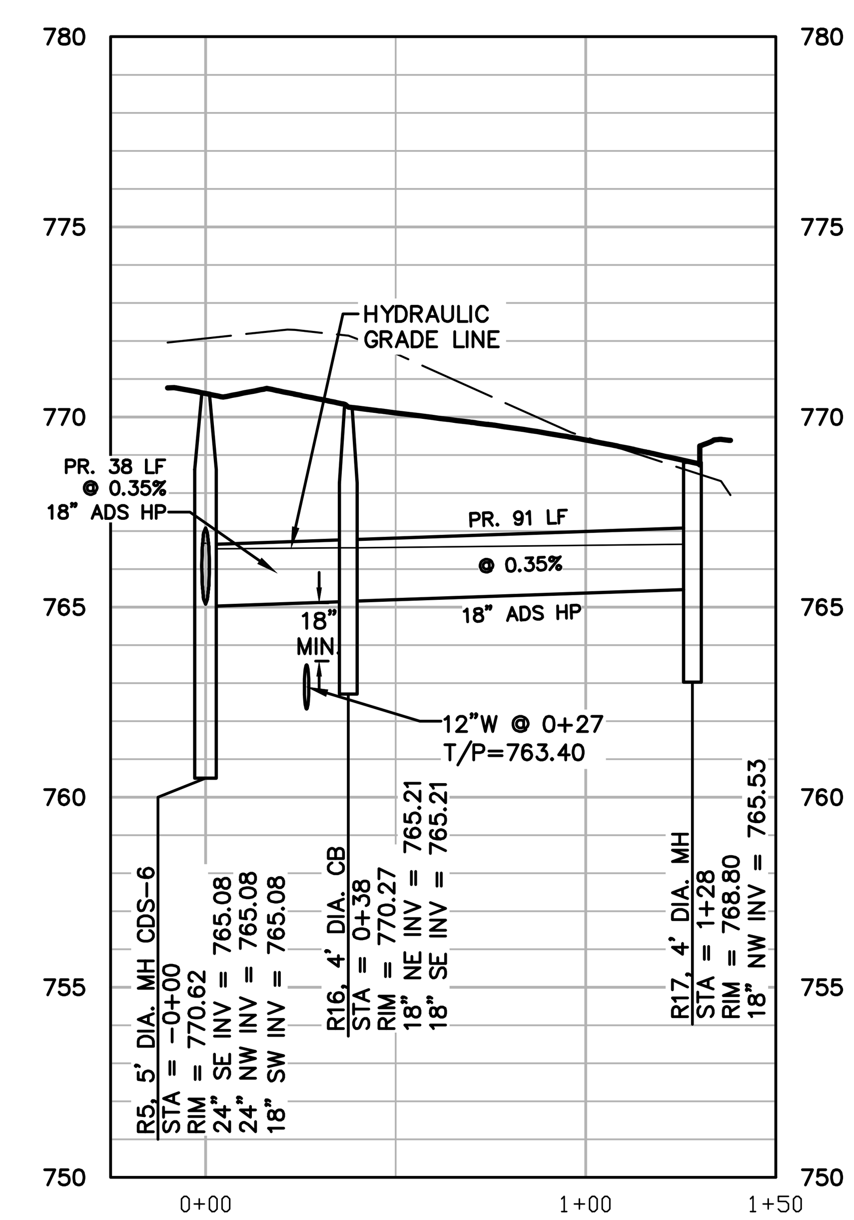
R15 TO R4



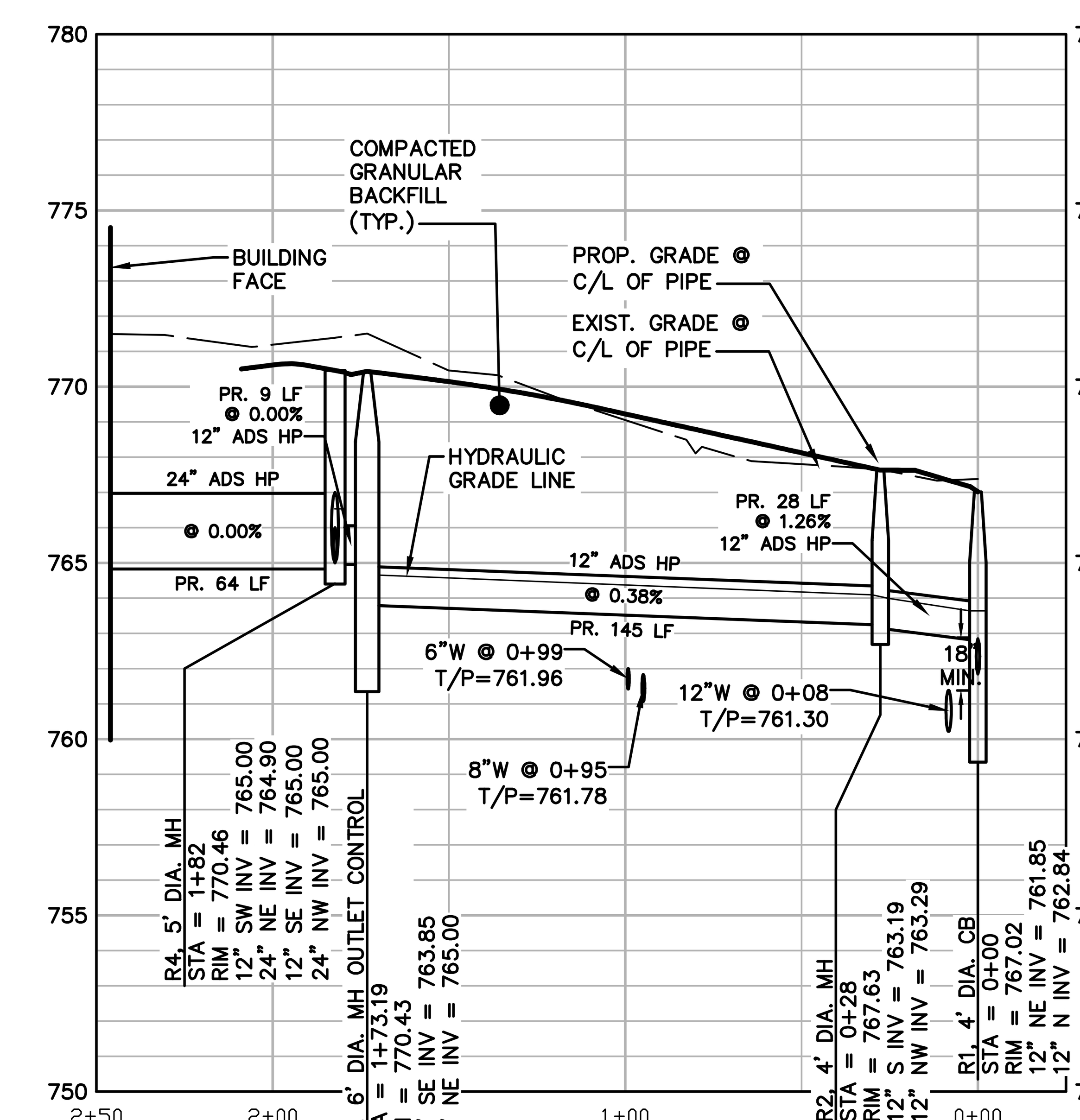
R10-R3



R14 TO R9



R17 TO R5 (WQU)



DETENTION TO R1

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STORM SEWER PROFILES

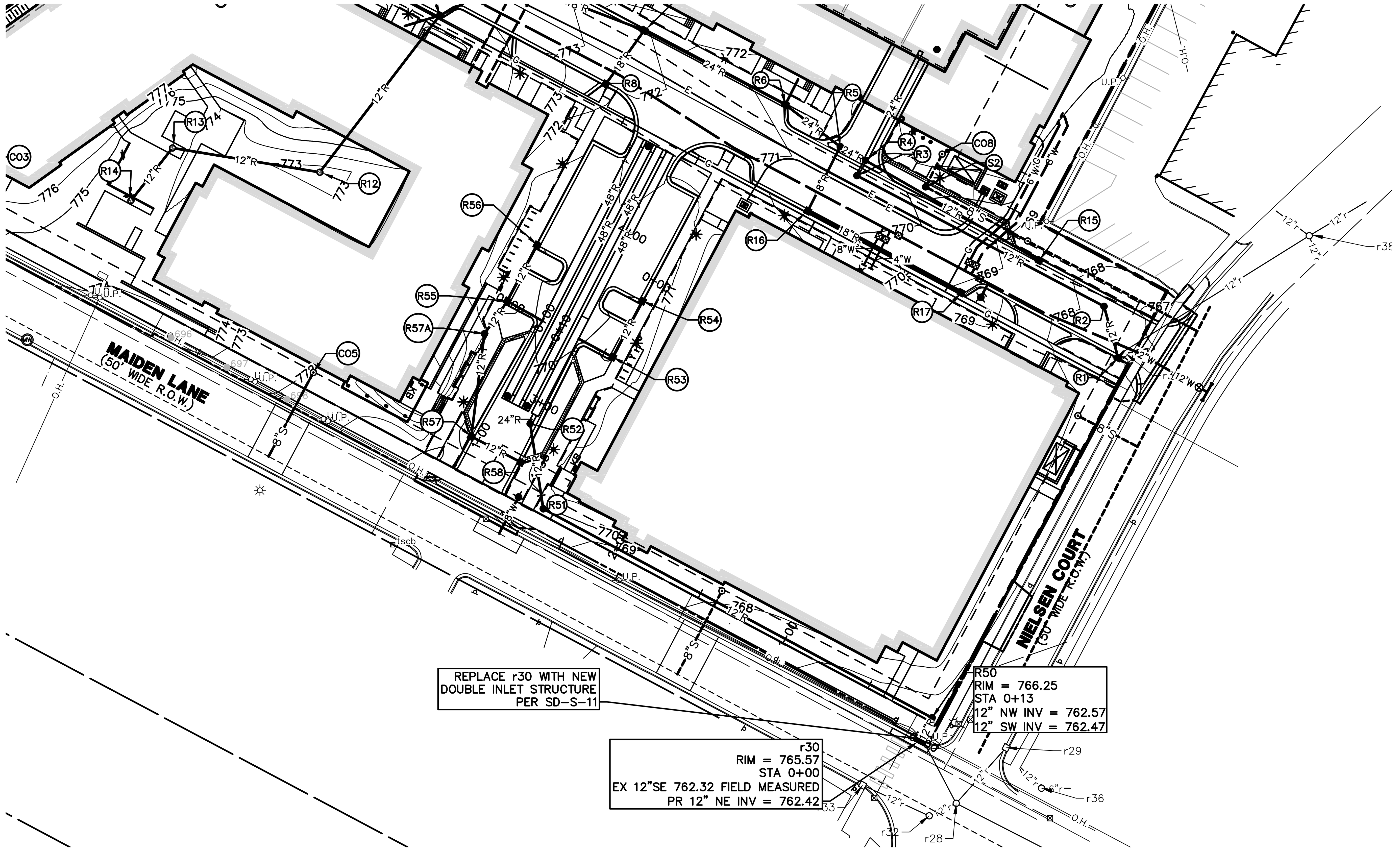
21

JOB No. 16196A

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	3/16/18
PER MUNICIPAL REVIEW	5/30/18
PER WCWRC REVIEW	6/15/18
PER MUNICIPAL REVIEW	8/3/18
PER MUNICIPAL REVIEW	10/5/18
PIPE MATERIALS	10/18/18

DATE: 01/22/18
SHEET 18 OF 31
CADD:
ENG: HTH
PM: TJC
TECH:
16196PR1.dwg

M:\Civil3d_Proj\16196\Detailed Engineering\16196PR1.dwg, 10/26/2018 2:04 PM, Heath Hartt, 21 STORM SEWER PROFILES, MCLLC PDF.pc3



SCALE: 1" = 4' VERT
SCALE: 1" = 40' HOR
0 40 80 120

LEGEND

- EXIST. WATER MAIN
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- PROP. GATE VALVE IN WELL
- EXIST. CURB STOP & BOX
- PROP. CURB STOP & BOX
- REDUCER
- EXIST. BLOW-OFF
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- P.I.V. POST INDICATOR VALVE
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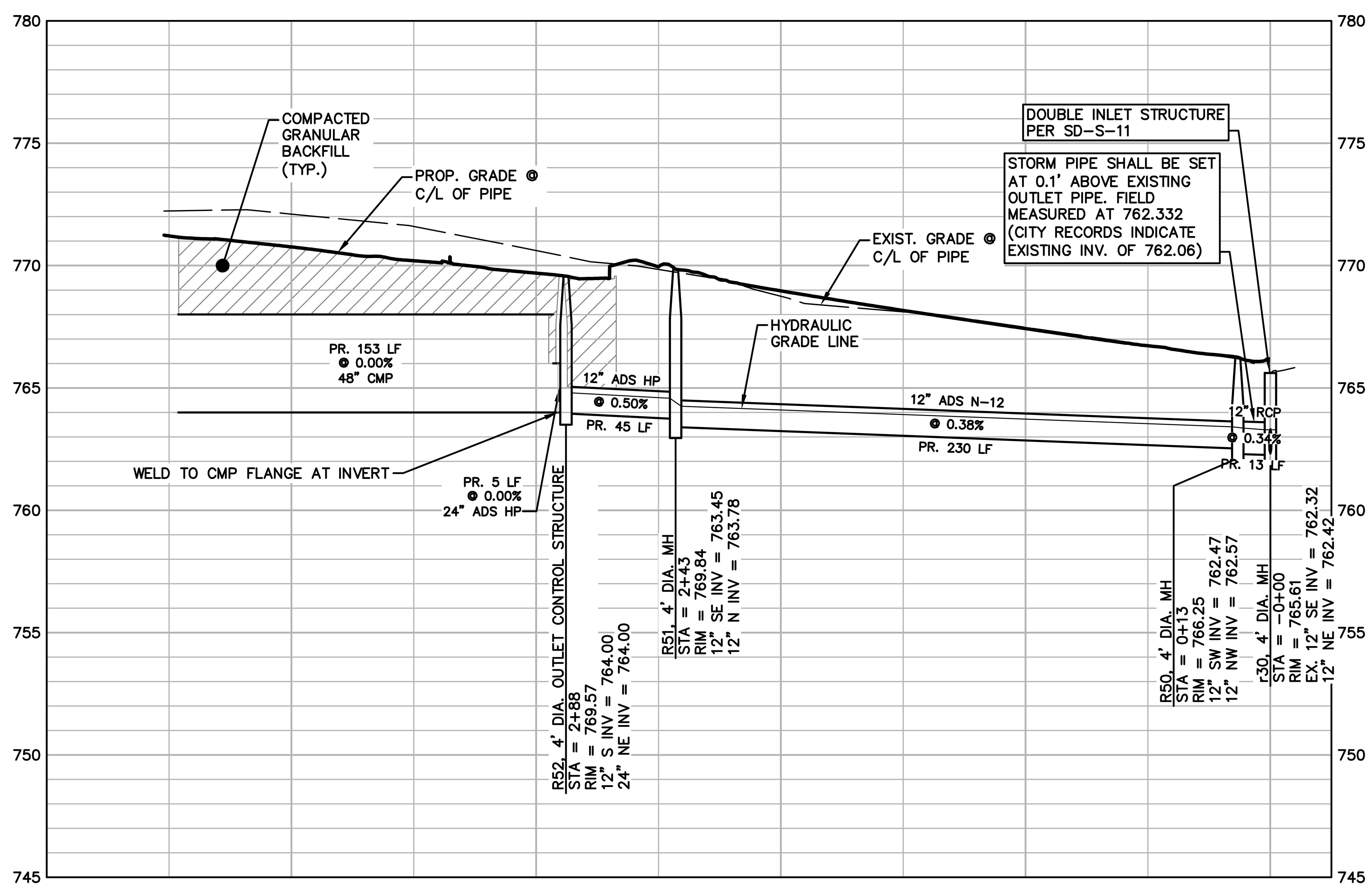
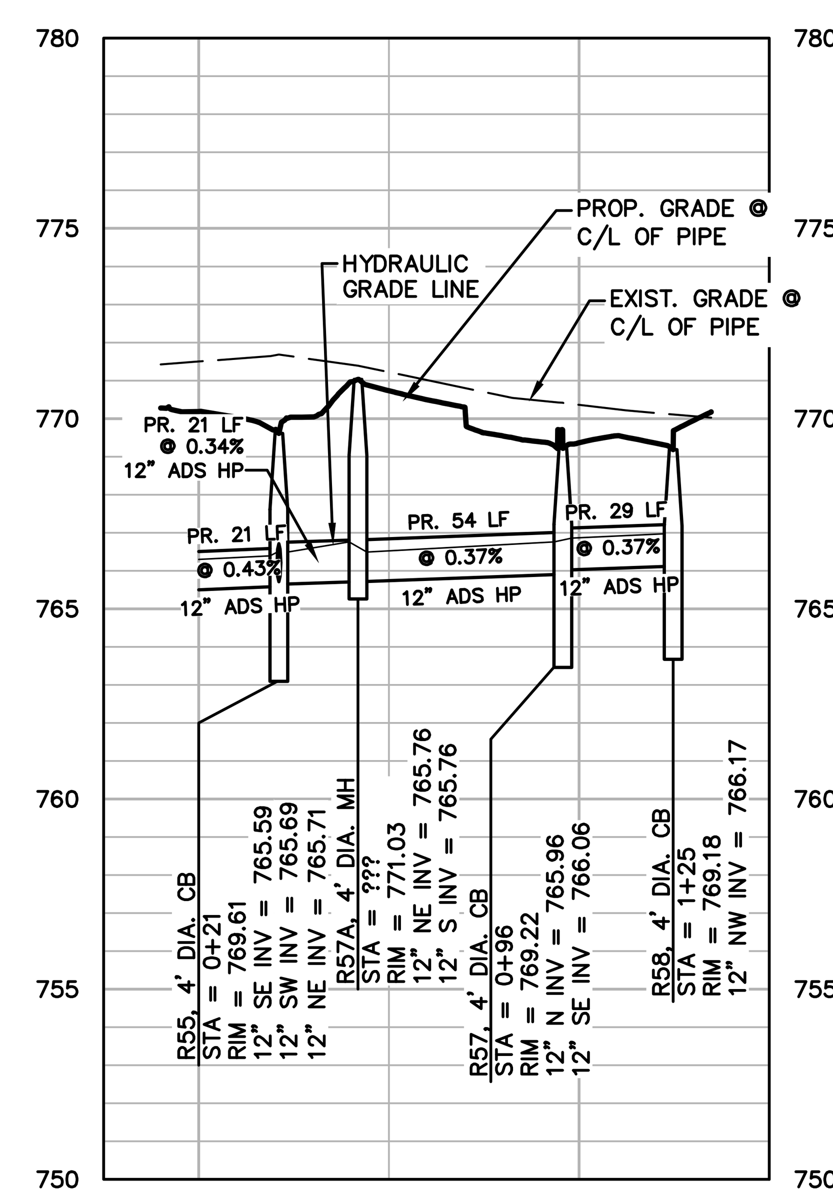
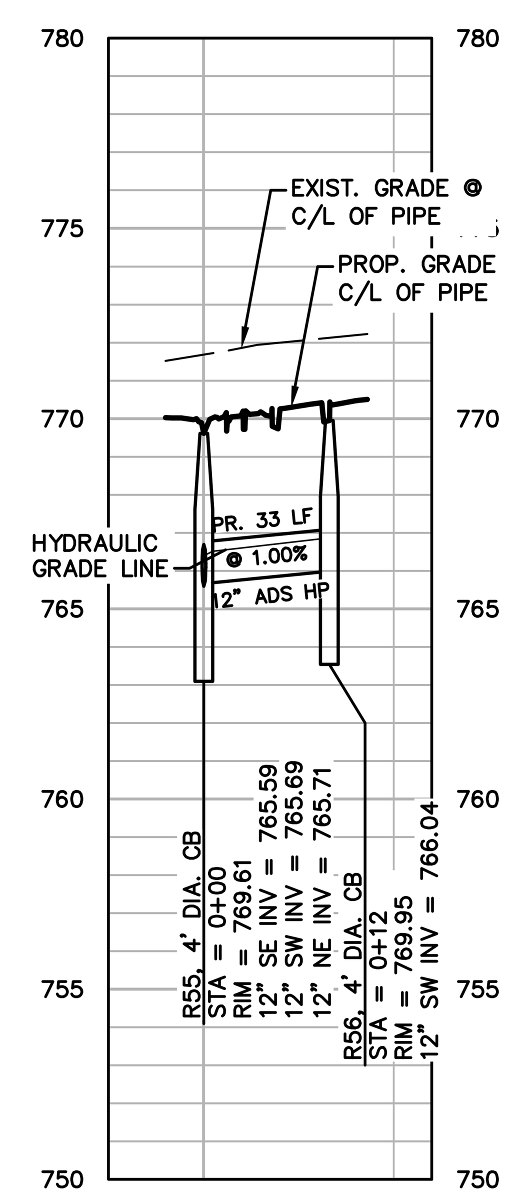
- PROP. CATCH BASIN OR INLET
- END SECTION
- HEAD WALL
- CULVERT
- EXIST. SANITARY SEWER
- PROP. SANITARY SEWER
- EXIST. CLEANOUT
- PROP. CLEANOUT



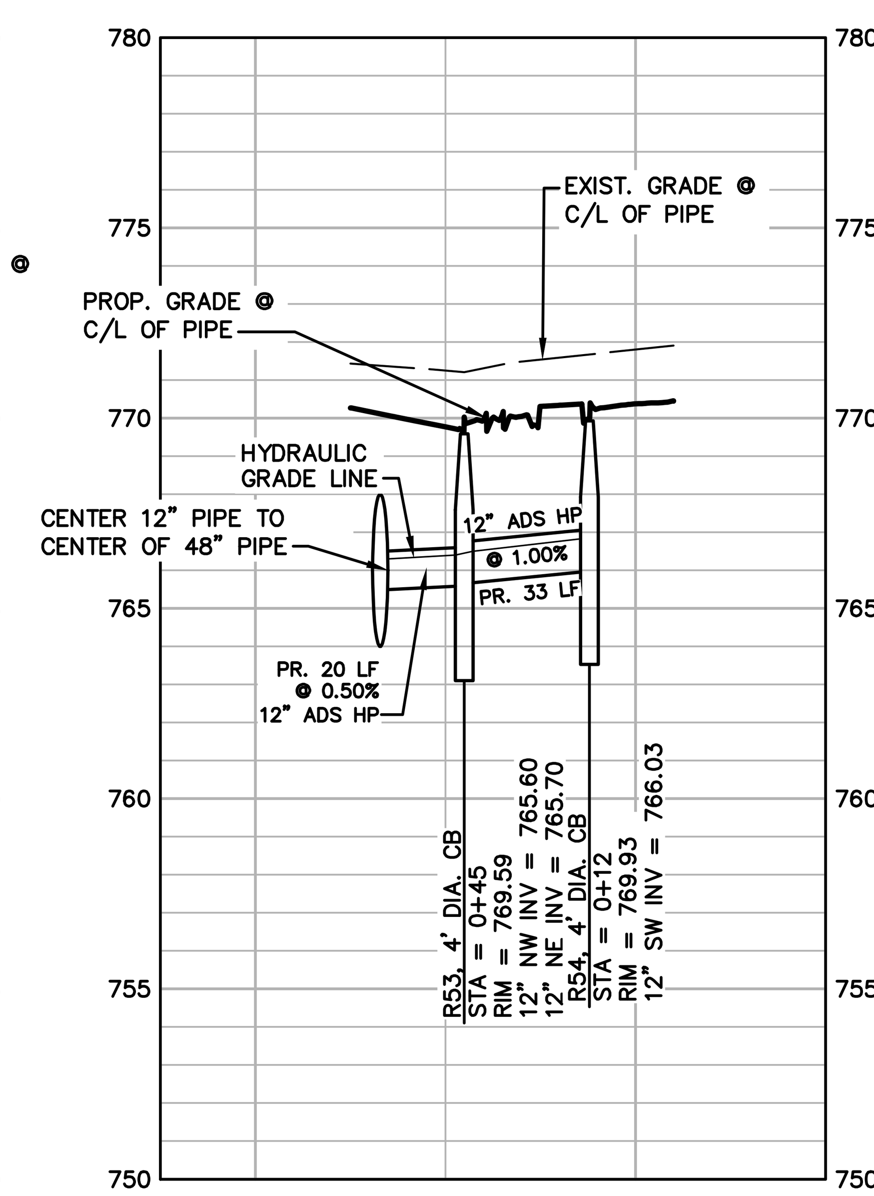
SHORT RD DETENTION OUTLET



R58 TO SHORT RD DETENTION



R56 TO R55



R54 TO SHORT RD DETENTION

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STORM SEWER PROFILES

22

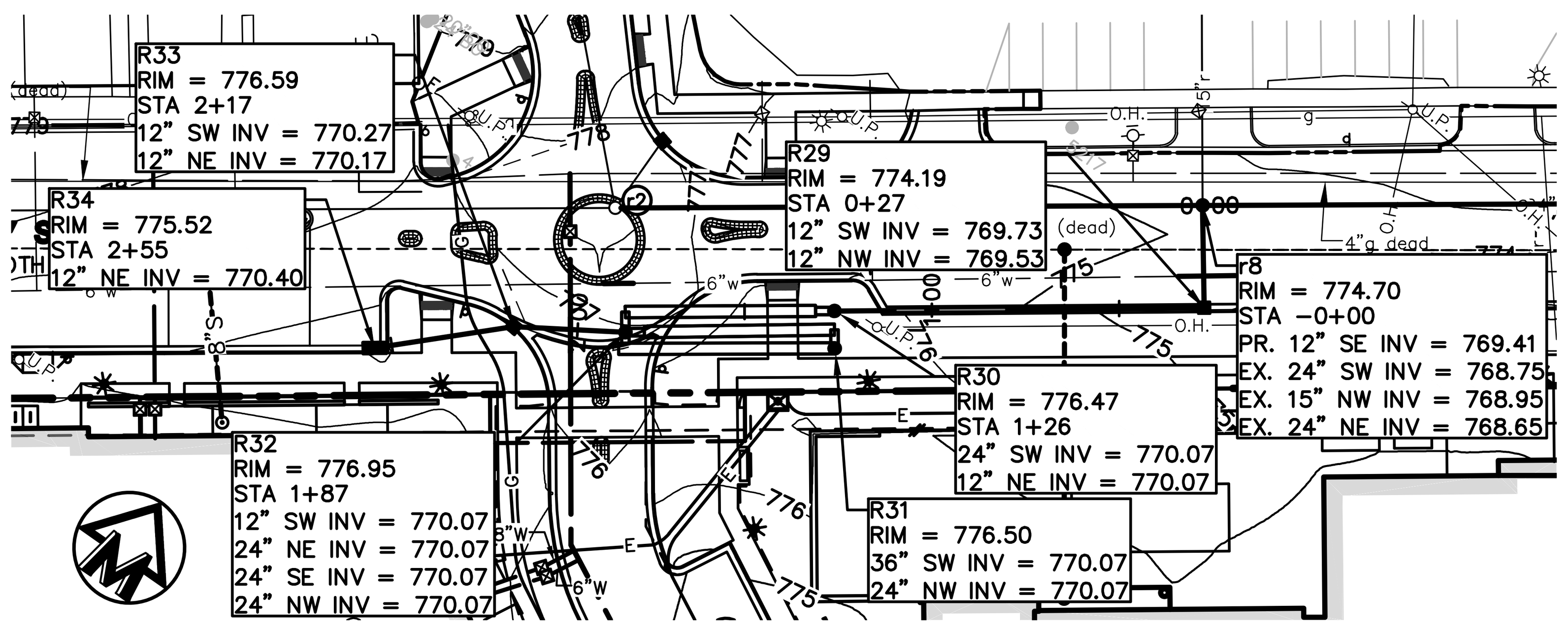
DATE: 01/22/18
SHEET 19 OF 31

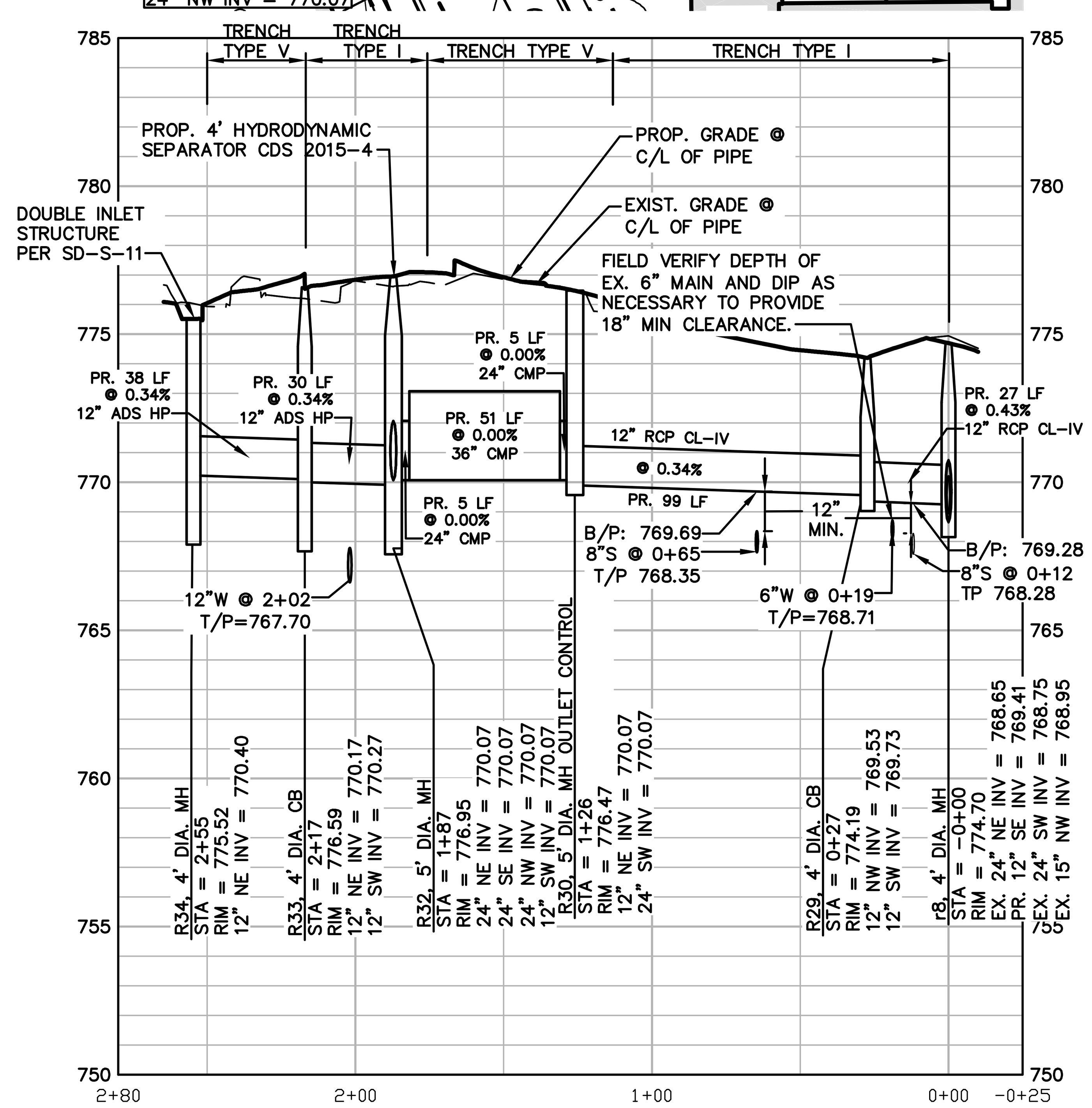
REVISIONS:	REV. DATE	
PER MUNICIPAL REVIEW	3/16/18	CADD:
PER MUNICIPAL REVIEW	5/30/18	ENG: HTH
PER WCWRC REVIEW	6/20/18	PM: TJC
PER MUNICIPAL REVIEW	8/9/18	TECH:
PER MUNICIPAL REVIEW	10/5/18	16196PR1.dwg
PIPE MATERIALS UPDATE	10/18/18	
PER MUNICIPAL REVIEW	10/26/18	

JOB No. 16196A

MIDWESTERN CONSULTING, L.L.C. 3815 Plaza Drive Ann Arbor, MI 48108 (734) 995-0200, Fax (734) 995-0599	Runoff Formula: Q = CIA I = x/T+y x = 175 y= 25 (10 Year Storm Event) Type of Pipe = rcp n = 0.012 0.013 (RCP)	PROJECT/CLIENT: Job No.: 16196 Date: 05/08/18 By: HTH Revised: 06/15/18

Structure No. From	Structure No. To	Drainage Area A (Acres)	Runoff Coeff. C	CxA	ADD. CxA	Σ CxA	Time T (min.)	Rainfall I (in./hr.)	Q (cfs)	Pipe Dia. (in.)	Pipe Length (ft.)	Pipe Slope %	H.G. Slope %	Velocity Flowing Full (ft./sec.)	Travel Time (min.)	Pipe Capacity (cfs)	Surface Elev. Upstr.	H.G. Upstr.	H.G. Dwnstr.	Invert Elev. Upstr.	Invert Elev. Dwnstr.
R58	R57	0.04	0.74	0.03		0.03	15.00	4.38	0.14	12	29	0.37	0.00	3.00	0.16	2.35	769.18	766.97	766.86	766.17	766.06
R57	R55	0.04	0.74	0.03		0.07	15.16	4.36	0.29	12	73	0.37	0.01	3.00	0.41	2.35	769.22	766.76	766.49	765.96	765.69
R56	R55	0.04	0.74	0.03		0.03	15.57	4.31	0.14	12	33	1.00	0.00	4.93	0.11	3.87	769.95	766.84	766.51	766.04	765.71
R55	DET	0.04	0.74	0.03	0.07	0.13	15.68	4.30	0.57	12	21	0.43	0.02	3.23	0.11	2.54	769.61	766.39	766.30	765.59	765.50
R54	R53	0.10	0.78	0.07		0.07	15.00	4.38	0.33	12	33	1.00	0.01	4.93	0.11	3.87	769.93	766.83	766.50	766.03	765.70
R53	DET	0.04	0.73	0.03		0.11	15.11	4.36	0.46	12	20	0.50	0.01	3.48	0.10	2.74	769.59	766.40	766.30	765.60	765.50
R52	R51	0.00	0.00	0.00	0.24	0.24	15.00	4.38	1.04	12	45	0.50	0.09	3.48	0.21	2.74	769.57	764.80	764.58	764.00	763.78
R51	R50	0.00	0.00	0.00		0.24	15.21	4.35	1.03	12	226	0.37	0.08	3.00	1.26	2.35	769.93	764.25	763.41	763.45	762.61
R50	r30	0.00	0.00	0.00		0.24	16.47	4.22	1.00	12	15	0.37	0.08	3.00	0.08	2.35	766.35	763.31	763.26	762.51	762.46
R34	R33	0.19	0.35	0.07		0.07	15.00	4.38	0.29	12	38	0.34	0.01	2.65	0.24	2.08	775.52	770.90	770.76	770.10	769.96
R33	R32	0.19	0.35	0.07		0.13	15.24	4.35	0.58	12	30	0.34	0.03	2.65	0.19	2.08	776.59	770.66	770.56	769.86	769.76
R30	R29	0.00	0.00	0.00		0.13	15.42	4.33	0.58	12	99	0.35	0.03	2.69	0.61	2.11	776.59	770.56	770.22	769.76	769.42
R29	r8	0.00	0.00	0.00		0.13	16.04	4.26	0.57	12	27	0.37	0.03	2.77	0.16	2.17	776.59	770.12	770.02	769.32	769.22
R28	R27	0.19	0.35	0.07		0.07	15.00	4.38	0.29	12	126	0.37	0.01	3.00	0.70	2.35	769.46	768.10	767.63	767.30	766.83
R19	R18	0.94	0.93	0.87		0.87	15.00	4.38	3.83	12	34	3.00	0.98	8.53	0.07	6.70	772.24	768.11	767.10	767.31	766.30
R17	R16	0.94	0.93	0.87		0.87	15.00	4.38	3.83	18	78	0.32	0.11	3.65	0.35	6.45	768.66	766.65	766.56	765.35	765.10
R16	DET	0.00	0.00	0.00		0.87	15.35	4.34	3.79	18	26	0.52	0.11	4.66	0.09	8.23	770.05	766.56	766.53	764.98	764.85
																		766.53			
R15	R4	0.13	0.83	0.11		0.11	15.00	4.38	0.46	12	93	0.50	0.01	3.48	0.44	2.74	768.44	765.01	764.55	764.21	763.75
R14	R13	0.07	0.57	0.04		0.04	15.00	4.38	0.17	12	35	0.50	0.00	3.48	0.17	2.74	774.20	769.95	769.78	769.15	768.98
R13	R12	0.28	0.90	0.25		0.29	15.17	4.36	1.25	12	78	0.44	0.11	3.27	0.40	2.57	774.21	769.46	769.27	768.66	768.32
R12	R11	0.25	0.70	0.17		0.46	15.56	4.31	1.99	12	102	0.37	0.27	3.00	0.57	2.35	772.45	769.27	769.00	768.28	767.90
R11	R9	0.39	0.92	0.35		0.82	16.13	4.25	3.47	18	42	0.24	0.09	3.16	0.22	5.59	774.15	769.00	768.90	767.80	767.70
R10	R09	0.26	0.84	0.22		0.22	15.00	4.38	0.95	12	64	0.47	0.06	3.38	0.32	2.65	773.94	768.54	768.50	767.70	767.40
R09	R07	0.06	0.84	0.05	0.82	1.08	16.35	4.23	4.57	18	74	1.04	0.16	6.58	0.19	11.64	773.80	768.50	767.74	767.30	766.54
R08	R07	0.29	0.90	0.26	1.08	1.34	15.00	4.38	5.86	18	34	0.80	0.27	5.78	0.10	10.21	772.42	768.12	767.84	766.92	766.64
R07	R06	0.65	0.93	0.61		1.95	16.54	4.21	8.21	24	83	0.50	0.11	5.53	0.25	17.38	772.01	767.71	767.30	766.11	765.70
R06	R05	0.07	0.83	0.06		2.01	16.79	4.19	8.42	24	29	0.27	0.12	4.06	0.12	12.77	770.69	766.76	766.68	765.16	765.08
R05	DET	0.00	0.00	0.00		2.01	16.91	4.18	8.40	24	41	0.43	0.12	5.13	0.13	16.11	771.06	766.68	766.53	765.08	764.91
																		766.53			
R03	R02	0.00	0.00	0.00	0.30	0.30	15.00	4.38	1.32	12	133	0.42	0.12	3.19	0.69	2.51	770.30	764.65	764.09	763.85	763.29
R02	R01	0.00	0.00	0.00		0.30	15.69	4.30	1.30	12	28	1.26	0.11	5.53	0.08	4.34	767.63	763.99	763.64	763.19	762.84





BROADWAY STORM

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SCALE: 1" = 40' HOR
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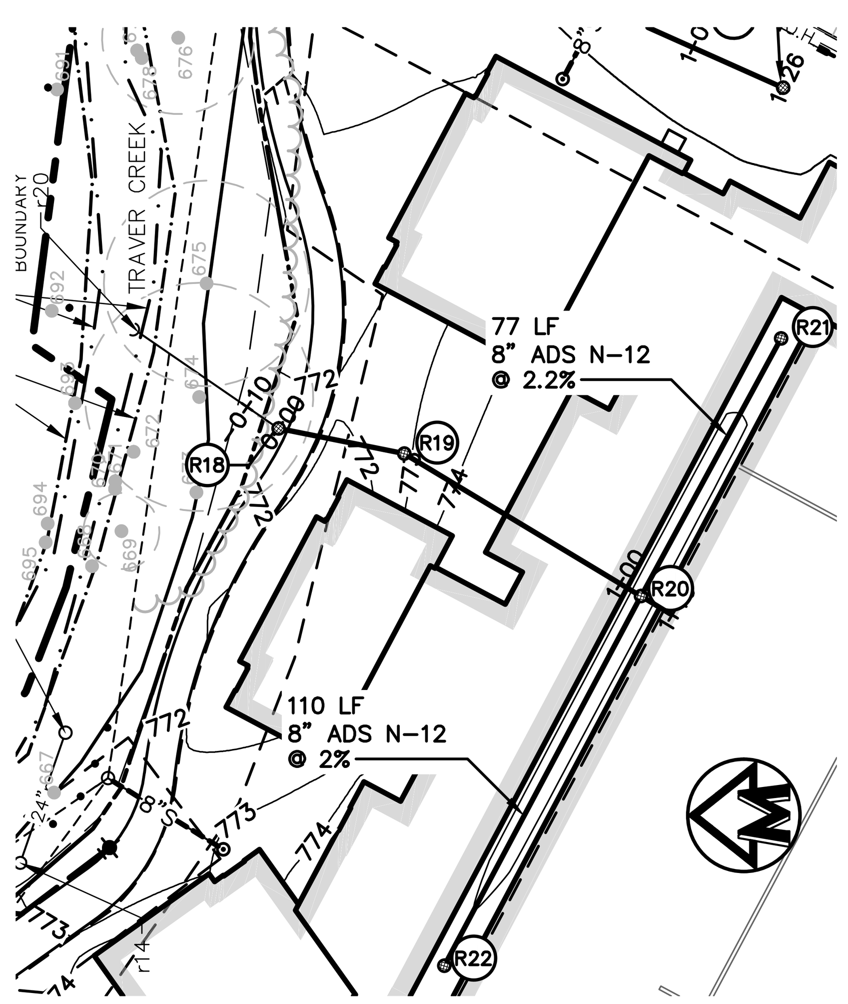
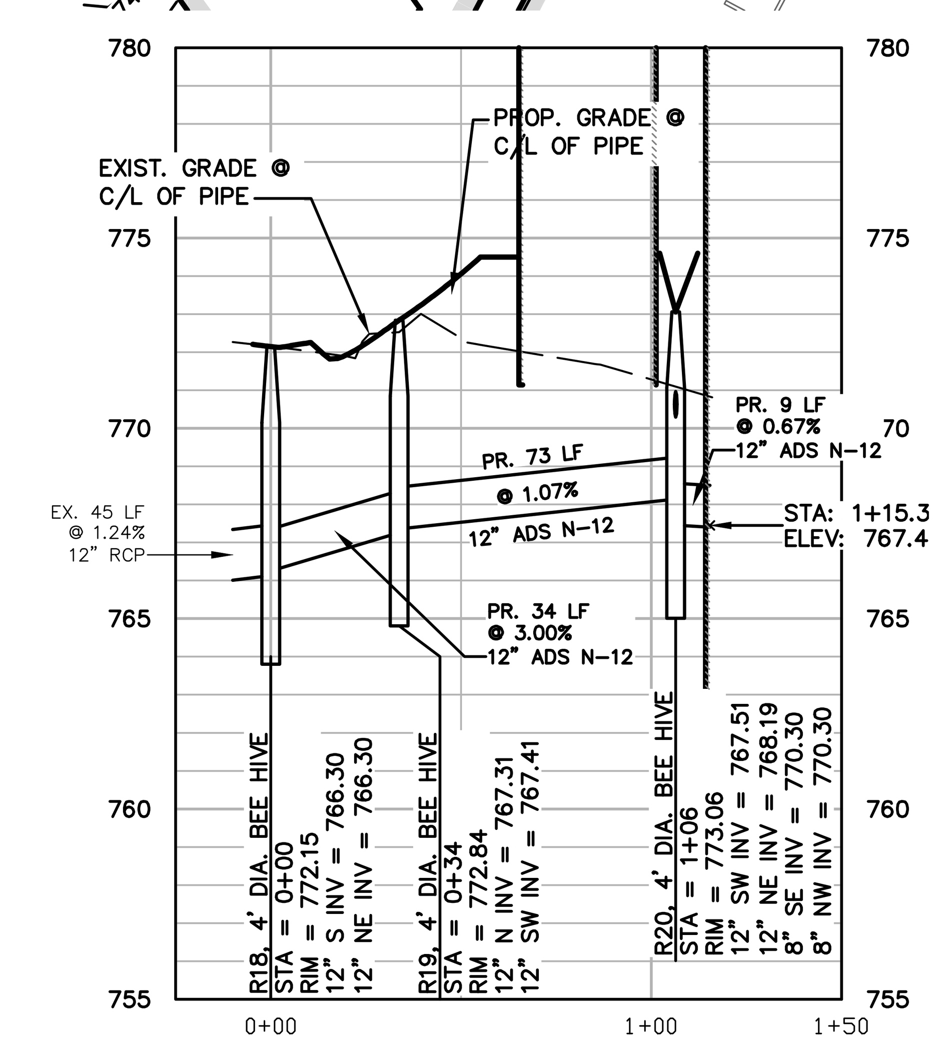
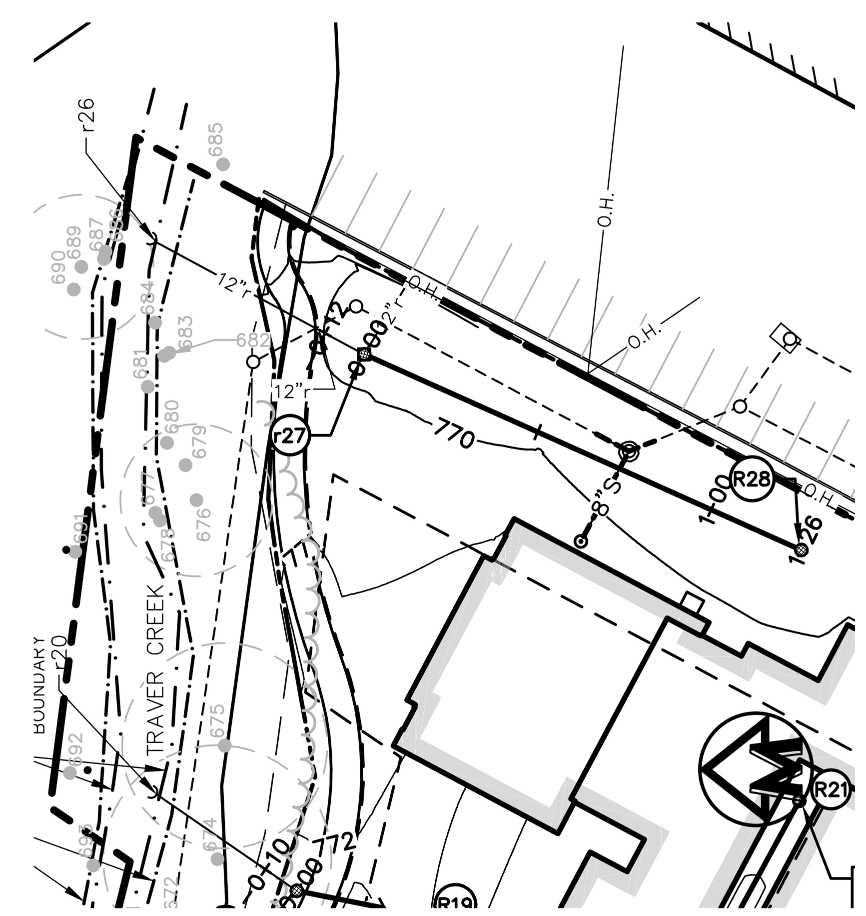
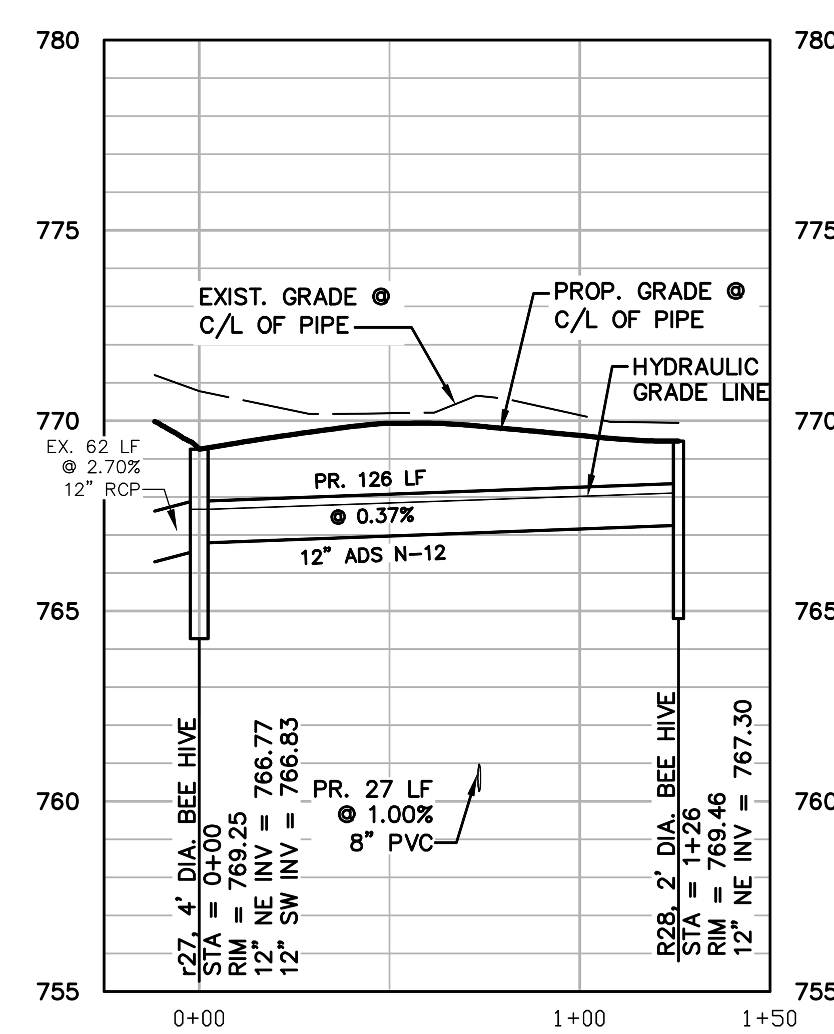




DETENTION TO R18





R28-R27

STRUCTURE TABLE						
STRUCTURE NO.	TYPE	RIM ELEV.	INV.	DEPTH	SUMP	COVER TYPE
R52	4' DIAM. OUTLET CONTROL STRUCTURE	769.57	24" NE 764.00 12" S 764.00	5.57	0'	EJIW 1040 Type B
R53	4' DIAM. CB	769.59	12" NE 765.70 12" NW 765.60	5.99	2'	EJIW 7045 Type M1
R54	4' DIAM. CB	769.93	12" SW 766.03	5.90	2'	EJIW 7045 Type M1
R55	4' DIAM. CB	769.61	12" SW 765.69 12" NE 765.71 12" SE 765.59	6.02	2'	EJIW 7045 Type M1
R56	4' DIAM. CB	769.95	12" SW 766.04	5.91	2'	EJIW 7045 Type M1
R57	4' DIAM. CB	769.22	12" SE 766.06 12" N 765.96	5.26	2'	EJIW 7045 Type M1
R57A	4' DIAM. MH	771.03	12" S 765.76 12" NE 765.76	5.27	0'	EJIW 1040 Type B
R58	4' DIAM. CB	769.18	12" NW 766.17	5.01	2'	EJIW 7045 Type M1

STRUCTURE TABLE						
STRUCTURE NO.	TYPE	RIM ELEV.	INV.	DEPTH	SUMP	COVER TYPE
r27	4' DIAM. BEE HIVE	769.25	12" SW 766.83 12" NE 766.77	4.48	2'	EJIW 1040 Type N
r30	4' Diam DIAM. MH	765.61	12" NE 762.42 12" SE 762.32	3.29	0'	EJIW 7045 Type M1
R1	4' DIAM. CB	767.02	12" N 762.84 12" NE 761.85	7.17	2'	EJIW 7045 Type M1
R2	4' DIAM. MH	767.63	12" NW 763.29 12" S 763.19	4.44	0'	EJIW 1040 Type B
R3	6' DIAM. MH	770.43	12" NE 765.00 12" SE 763.85	8.58	2'	EJIW 1040 Type B
R4	5' Diam DIAM. MH	770.46	24" NE 764.90 12" SE 765.00 24" NW 765.00 12" SW 765.00	5.56	0'	EJIW 1040 Type A
R5	6' DIAM. MH	770.62	24" NW 765.08 18" SW 765.08 24" SE 765.08	9.62	4'	EJIW 1040 Type B
R6	5' DIAM. CB	770.69	24" NW 765.70 24" SE 765.16 12" NE 766.50	7.53	2'	EJIW 7045 Type M1
R7	4' DIAM. CB	772.01	18" W 766.54 18" SW 766.64 24" SE 766.11	7.90	2'	EJIW 7045 Type M1
R8	4' DIAM. CB	772.42	18" NE 766.92	7.50	2'	EJIW 7045 Type M1
R9	4' DIAM. CB	773.68	12" NW 767.40 18" SW 767.70 18" E 767.30	8.38	2'	EJIW 7045 Type M1
R10	4' DIAM. CB	773.94	12" N 767.80 12" SE 767.70	8.24	2'	EJIW 7045 Type M1
R11	4' DIAM. CB	773.65	12" W 767.93 12" SW 767.90 18" NE 767.80	7.85	2'	EJIW 7045 Type M1
R12	4' DIAM. BEE HIVE	772.45	12" W 768.32 12" NE 768.28	6.17	2'	EJIW 1040 Type N
R13	4' DIAM. BEE HIVE	774.21	12" SW 768.98 12" E 768.66	7.55	2'	EJIW 1040 Type N
R14	2' DIAM. BEE HIVE	774.20	12" NE 769.15	5.05	0'	EJIW 1040 Type N
R15	4' DIAM. CB	768.44	12" NW 765.37	5.08	2'	EJIW 7045 Type M1
R16	4' DIAM. CB	770.27	18" SE 765.21 18" NE 765.21	7.06	2'	EJIW 7045 Type M1
R17	4' DIAM. MH	768.80	18" NW 765.53	5.28	2'	EJIW 7045 Type M1
R18	4' DIAM. BEE HIVE	772.15	12" S 766.30 12" NE 766.30	7.85	2'	EJIW 1040 Type N
R19	4' DIAM. BEE HIVE	772.84	12" SW 767.41 12" N 767.31	7.53	2'	EJIW 1040 Type N
R20	4' DIAM. BEE HIVE	773.06	8" SE 770.30 8" NW 770.30 12" SW 767.51 12" NE 768.19	7.55	2'	EJIW 1040 Type M1
R21	2' DIAM. BEE HIVE	774.38	8" NW 772.00	2.38	0'	EJIW 1040 Type M1
R22	2' DIAM. BEE HIVE	774.17	8" SE 772.50	1.67	0'	EJIW 1040 Type M1
R23	2' DIAM. BEE HIVE	773.77	8" NE 769.32 8" SE 769.22	4.55	0'	EJIW 1040 Type M1
R24	2' DIAM. BEE HIVE	774.44	8" SW 770.00	4.44	0'	EJIW 1040 Type M1
R28	2' DIAM. BEE HIVE	769.46	12" NE 767.30	4.17	2'	EJIW 1040 Type N
R29	4' DIAM. CB	774.19	12" SW 769.73 12" NW 769.53	4.67	0'	EJIW 1040 Type B
R30	5' Diam DIAM. MH	776.47	24" SW 770.07 12" NE 770.07	6.40	0'	EJIW 1040 Type A
R32	5' DIAM. MH	776.95	12" SW 770.07 24" NE 770.07 24" SE 770.07 24" NW 770.07	8.88	2'	EJIW 1040 Type B
R33	4' DIAM. CB	776.59	12" SW 770.27 12" NE 770.17	8.41	2'	EJIW 7045 Type M1
R34	4' Diam DIAM. MH	775.52	12" NE 770.40	7.12	2'	EJIW 7045 Type M1
R35	4' DIAM. CB	777.31	12" S 773.32	3.99	0'	EJIW 7045 Type M1
R50	4' DIAM. MH	766.25	12" NW 762.57 12" SW 762.47	3.79	0'	EJIW 1040 Type B
R51	4' DIAM. MH	769.84	12" N 763.78 12" SE 763.45	6.39	0'	EJIW 1040 Type B

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DETAILED ENGINEERING PLANS
STORM SEWER PROFILES

23

PER MUNICIPAL REVIEW 10/26/18

JOB No. 16196A

DATE: 1/22/18 SHEET 20 OF 31

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	3/16/18
PER MUNICIPAL REVIEW	5/30/18
PER WCWRC REVIEW	6/20/18
PER MUNICIPAL REVIEW	7/18/18
PER MUNICIPAL REVIEW	10/5/18
PIPE MATERIAL UPDATE	10/8/18

ENG: HTH
PM: TJC
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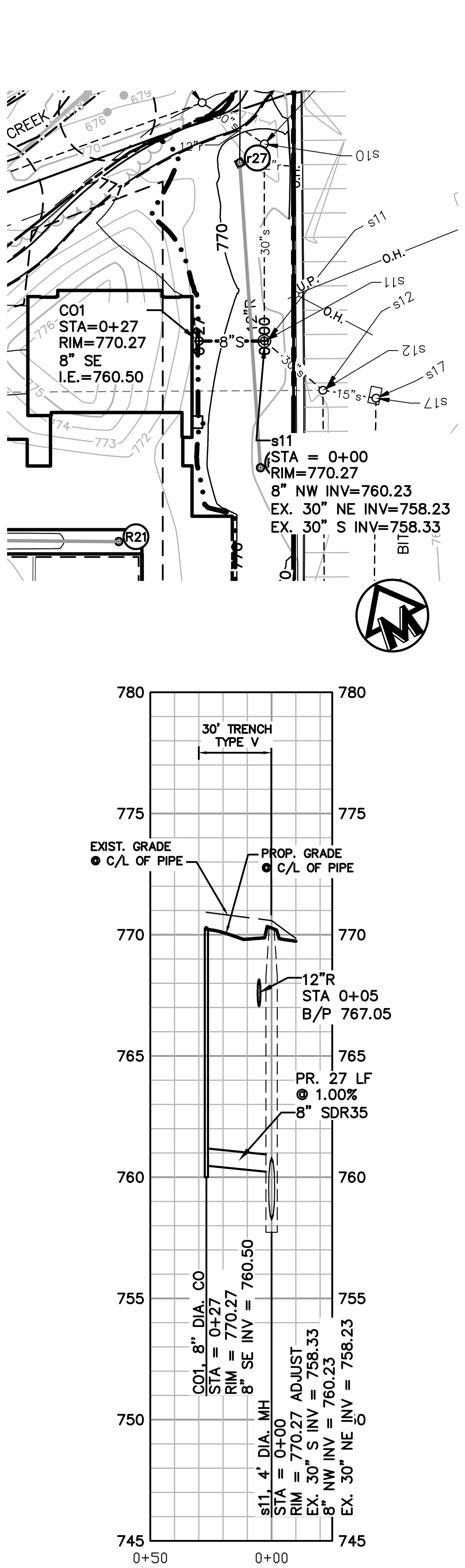

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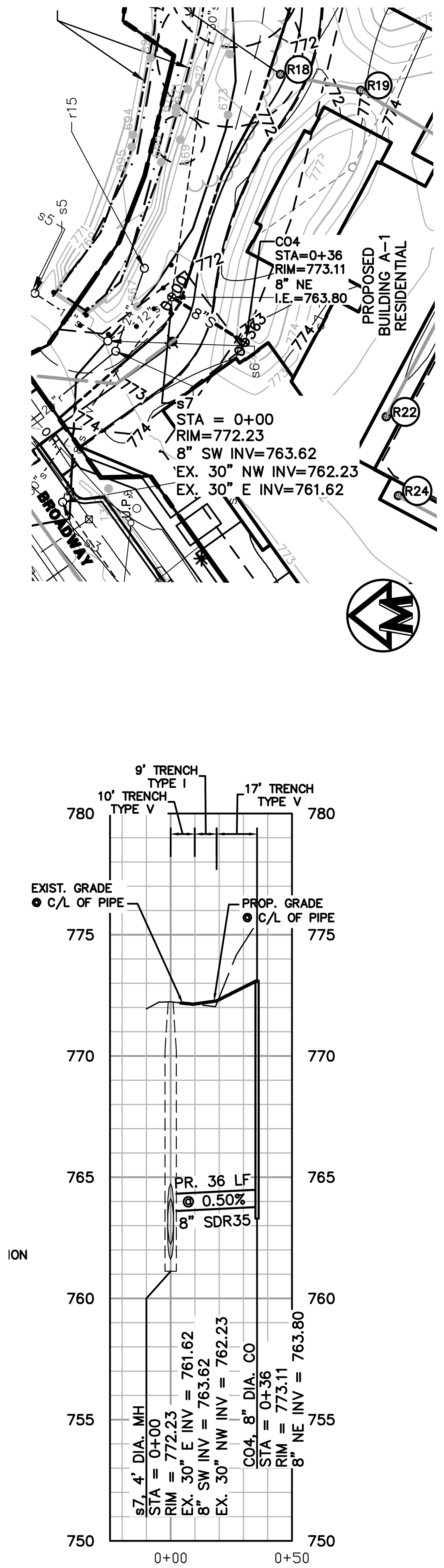

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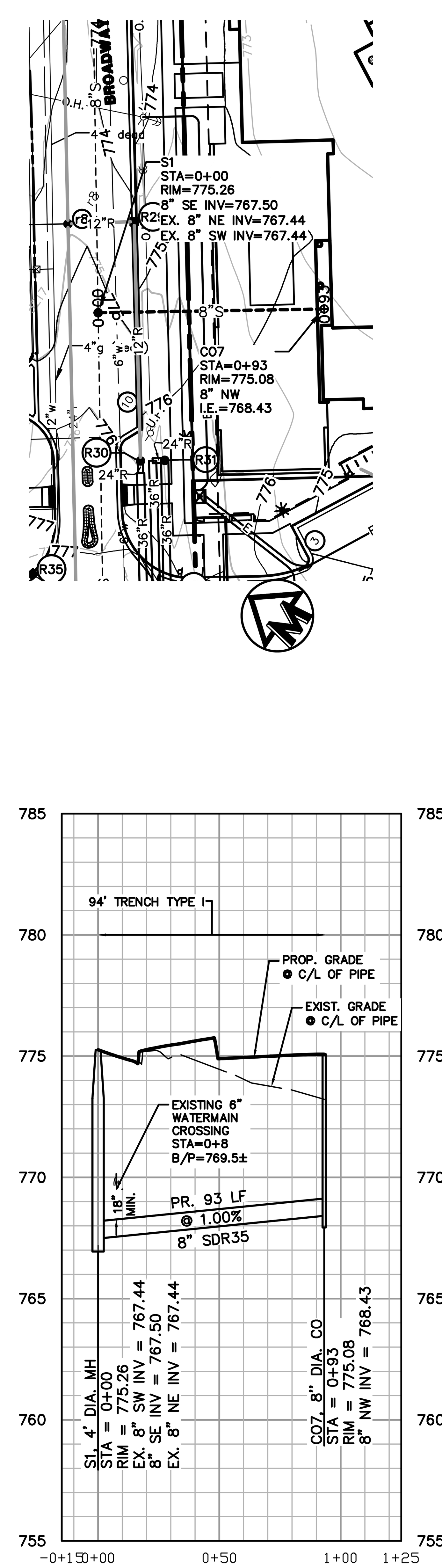

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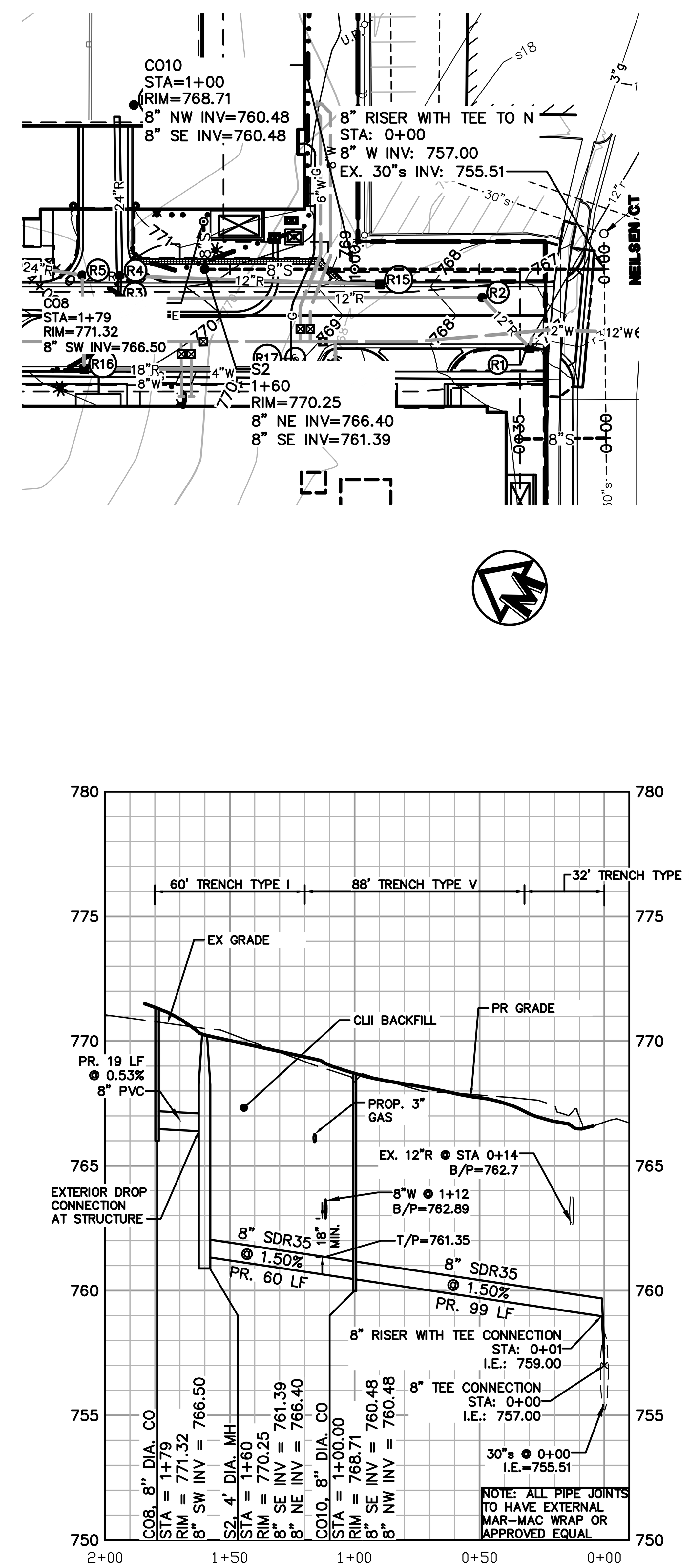

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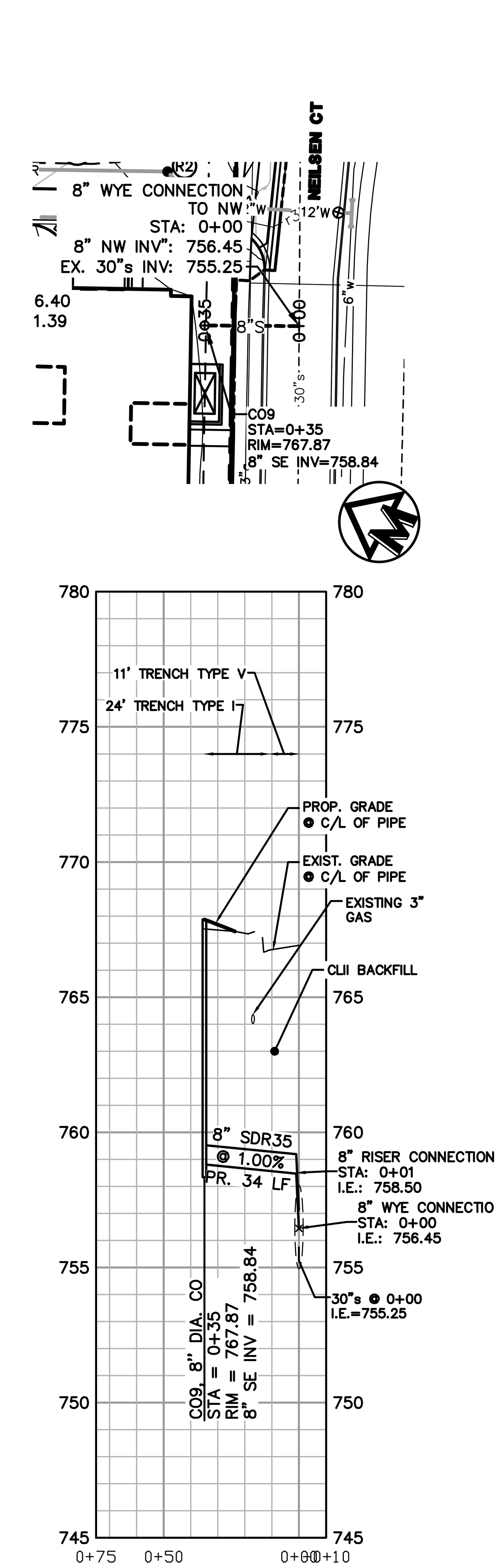

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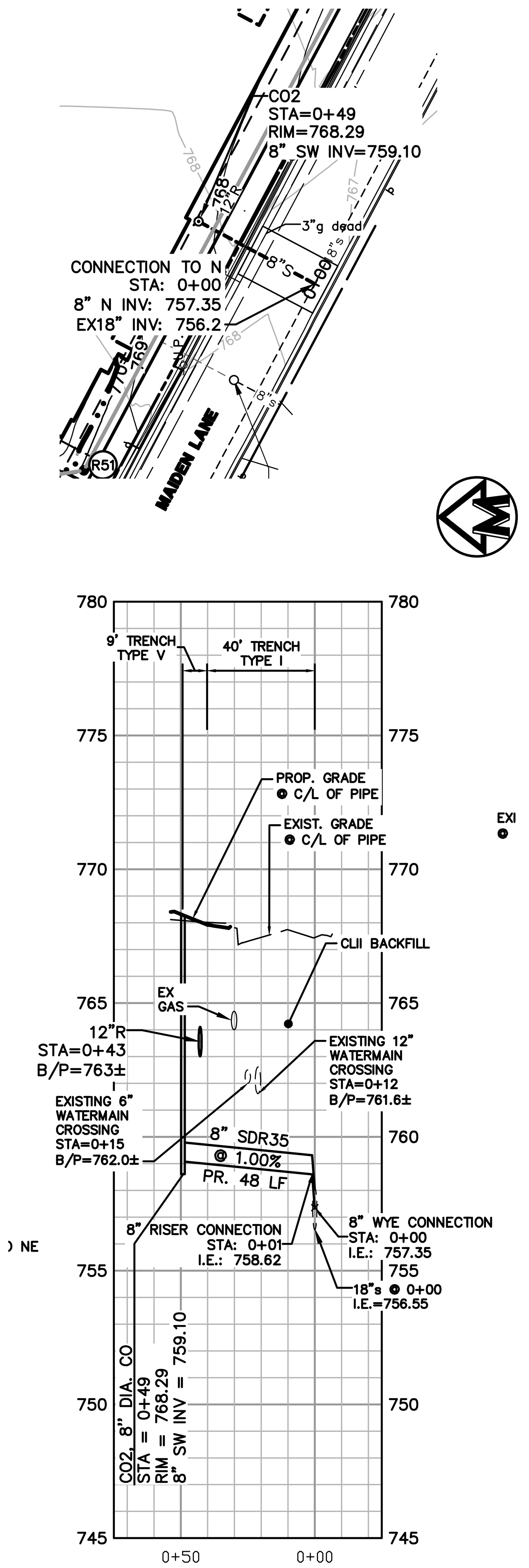

BLDG B SAN SOUTH

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SCALE: 1" = 4' VERT
SCALE: 1" = 40' HOR
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DETAILED ENGINEERING PLANS
SANITARY LEAD PROFILES

24

DATE: 1/22/18
SHEET 21 OF 31

REVISIONS:	REV. DATE	
PER MUNICIPAL REVIEW	3/16/18	CADD:
PER MUNICIPAL REVIEW	5/30/18	ENG: HTH
PER MUNICIPAL REVIEW	8/9/18	PM: TJC
PER MUNICIPAL REVIEW	10/3/18	TECH:
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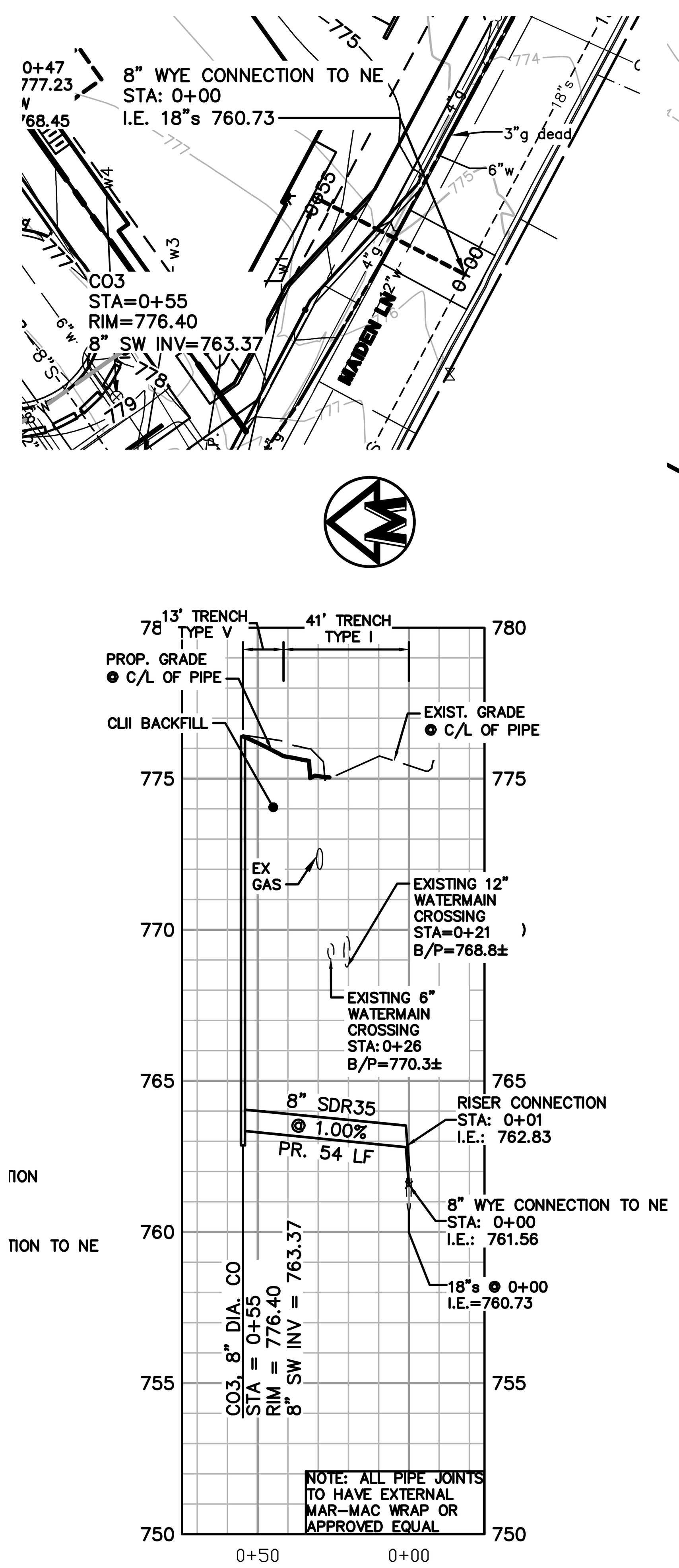
PER MUNICIPAL REVIEW 10/26/18

JOB No. 16196A



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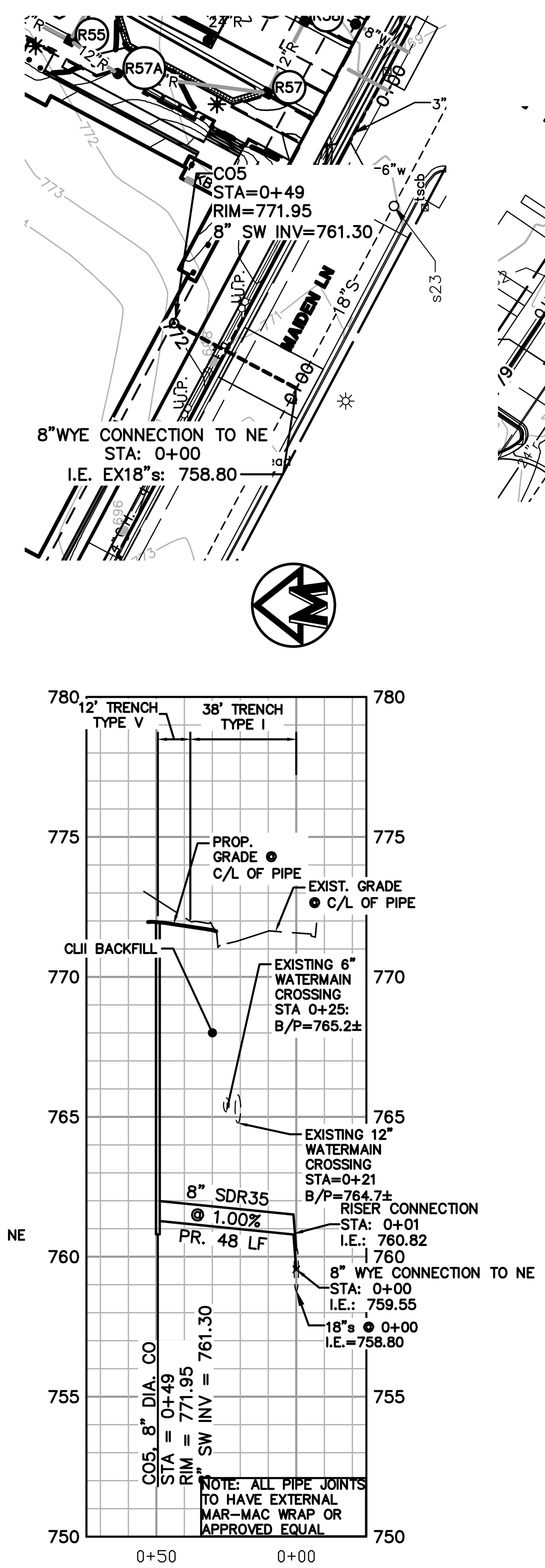

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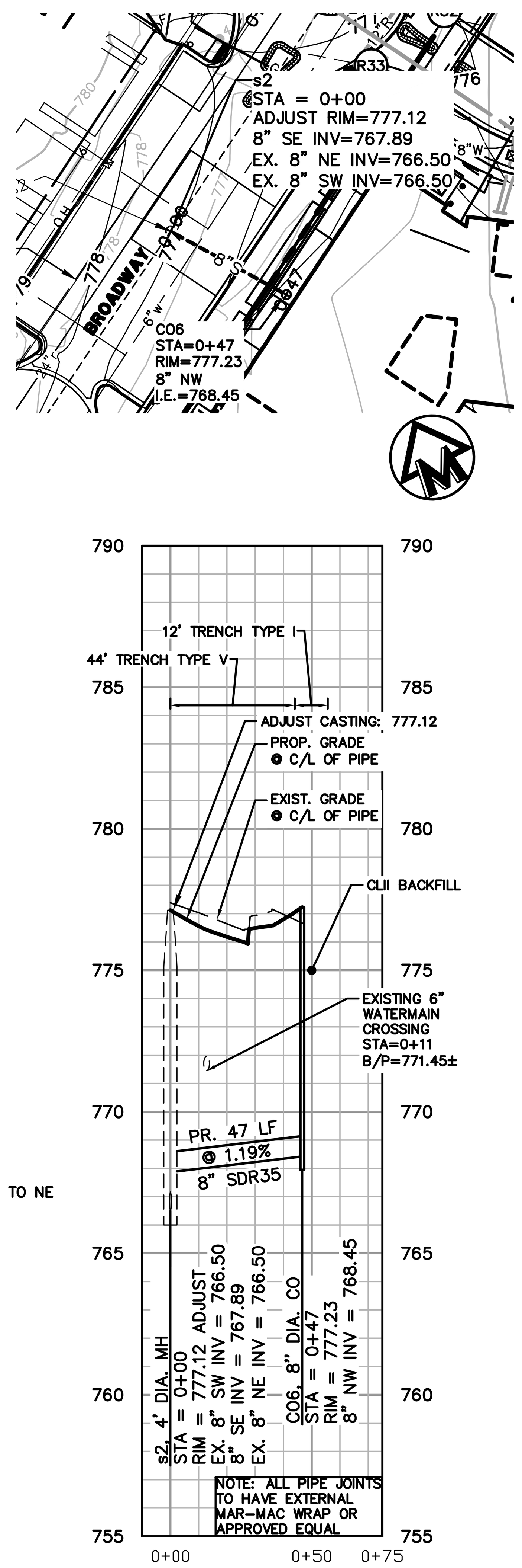

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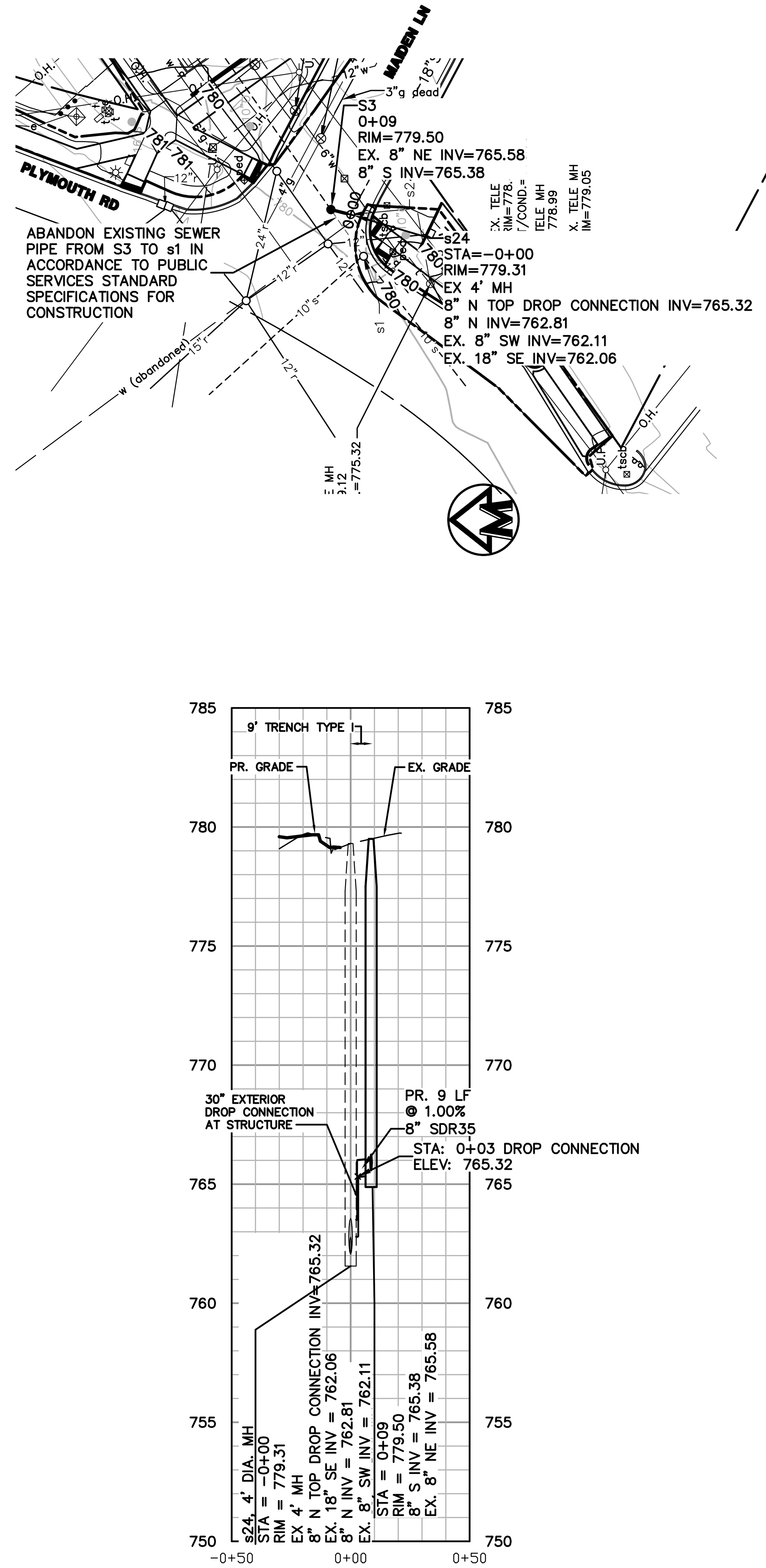

PLYMOUTH RD CONNECTION

SANITARY MITIGATION CALCS BY PHASE

SANITARY SEWER FLOW MITIGATION CALCULATIONS

PHASE A

Design Flow - Phase A

Based on the City of Ann Arbor's sanitary sewer flow evaluation Table 'A', the design dry weather flow rate will be:

88	units	Apartment/Condo <600 sq ft	175	gpd/unit =	15,400 gpd
166	units	Apartment/Condo 600-1200 sq ft	250	gpd/unit =	41,500 gpd
0	units	Apartment/Condo >1200 sq ft	300	gpd/unit =	- gpd
800	sf	Pool @ 1person/50sf	20	gpd/capita =	320 gpd
				Total=	57,220 gpd

Existing Flow - Phase A

Based on the City of Ann Arbor's sanitary sewer flow evaluation Table 'A', the exisiting design dry weather flow rate was:

29768	Sq Ft	Market: Kroger	0.05	gpd/sf gr floor =	1,488 gpd
3957	Sq Ft	Market: Manna Food and Gifts	0.05	gpd/sf gr floor =	198 gpd
1965	Sq Ft	Market: Arbor Party Store	0.05	gpd/sf gr floor =	98 gpd
1965	Sq Ft	Market: Foods of India	0.05	gpd/sf gr floor =	98 gpd
1965	Sq Ft	Wet Store: Cottage Inn Pizza	0.15	gpd/sf gr floor =	295 gpd
1965	Sq Ft	Dry Store: Yourist Pottery snd Studio	0.03	gpd/sf gr floor =	59 gpd
16	Seats	Restaurant: New Star Chineese	30	gpd/seat =	480 gpd
37	Seats	Fast Food: Mr. Pita	20	gpd/seat =	740 gpd
7031	Sq Ft	Non Medical Office: Bank	0.06	gpd/sf gr floor =	422 gpd
1965	Sq Ft	Non Medical Office: Alamo Car Rental	0.06	gpd/sf gr floor =	118 gpd
24		Laundry: Broadway Laundromat	425	gpd/machine =	10,200 gpd
1	ea	Single Family Residence	300	gpd/unit =	300 gpd
1	ea	Cleaners: Armen Cleaners		Per City Records	1,645 gpd
1	ea	Car Wash: Oasis Car Wash		Per City Records	1,719 gpd
				Total=	17,860

Mitigation Flow - Phase A

Mitigation Flow = (Proposed Flow - Existing Flow) * 4(peaking factor) * 1.1(recovery)

Mitigation Peak Flow = 39360 gpd x 4(peaking factor) x 1.1(recovery) = 173,183 gpd

= 120 gpm

PHASE B

Design Flow - Phase B

Based on the City of Ann Arbor's sanitary sewer flow evaluation Table 'A', the design dry weather flow rate will be:

0	units	Apartment/Condo <600 sq ft	175	gpd/unit =	- gpd
15	units	Apartment/Condo 600-1200 sq ft	250	gpd/unit =	3,750 gpd
71	units	Apartment/Condo >1200 sq ft	300	gpd/unit =	21,300 gpd
				Total=	25,050 gpd

Existing Flow - Phase B

Existing Flow credits is provided in Phase A

Mitigation Flow - Phase B

Mitigation Flow = (Proposed Flow - Existing Flow) * 4(peaking factor) * 1.1(recovery)

Mitigation Peak Flow = 25050 gpd x 4(peaking factor) x 1.1(recovery) = 110,220 gpd

= 77 gpm

PHASE C

Design Flow - Phase C

Based on the City of Ann Arbor's sanitary sewer flow evaluation Table 'A', the design dry weather flow rate will be:

115	units	Apartment/Condo <600 sq ft	175	gpd/unit =	20,125 gpd
162	units	Apartment/Condo 600-1200 sq ft	250	gpd/unit =	40,500 gpd
0	units	Apartment/Condo >1200 sq ft	300	gpd/unit =	- gpd
4605	sf	Retail (Dry Store)	0.03	gpd/sf gr floor =	138 gpd
				Total=	60,763 gpd

Existing Flow - Phase C

Existing Flow credits is provided in Phase A

Mitigation Flow - Phase C

Mitigation Flow = (Proposed Flow - Existing Flow) * 4(peaking factor) * 1.1(recovery)

Mitigation Peak Flow = 60763 gpd x 4(peaking factor) x 1.1(recovery) = 267,358 gpd

= 186 gpm

SCALE: 1" = 4' VERT
SCALE: 1" = 40' HOR

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1140 BROADWAY STREET

DETAILED ENGINEERING PLANS
SANITARY LEAD PROFILES

DATE: 01/22/18
SHEET OF 31

JOB No. 16196A

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	5/30/18
PER MUNICIPAL REVIEW	8/9/18
PER MUNICIPAL REVIEW	10/5/18
BROADWAY OUTLET CONTROL REV	10/18/18
PER MUNICIPAL REVIEW	10/26/18

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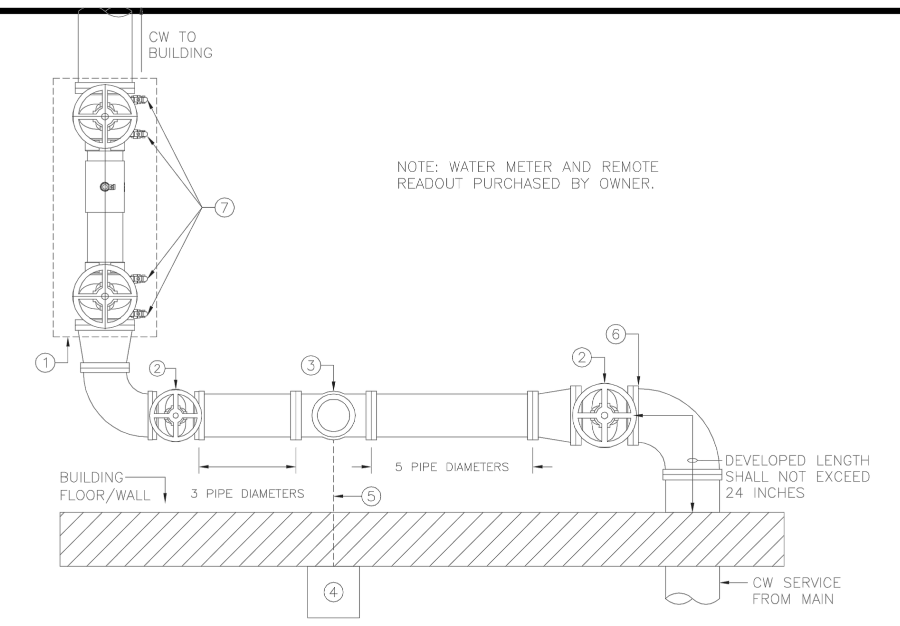
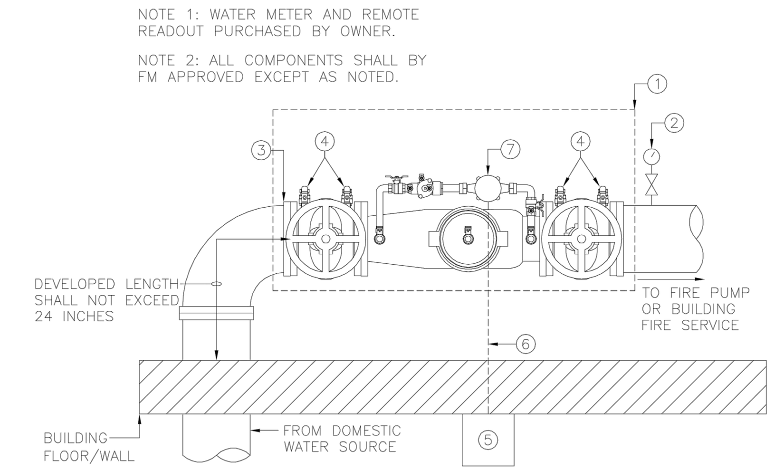


1. U.L APPROVED REDUCED PRESSURE ZONE ASSEMBLY, AS REQUIRED BY CITY OF ANN ARBOR. BASED ON ZURN WILKINS MODEL 375. IF THE MAKE OR MODEL OF THE PROPOSED REDUCED PRESSURE DETECTOR ASSEMBLY CHANGES, THE DOMESTIC WATER BACKFLOW PREVENTION DRAWING/DETAIL SHALL BE RESUBMITTED TO THE CITY.
2. HIGH PERFORMANCE BUTTERFLY VALVE.
3. WATER METER (OBTAINED FROM CITY OF ANN ARBOR, INSTALLED BY CONTRACTOR).
4. REMOTE READOUT (OBTAINED FROM CITY OF ANN ARBOR, INSTALLED BY CONTRACTOR).
5. 1/2" EMT CONDUIT WITH 3 WIRE PHONE CABLE. CABLE FURNISHED BY CITY OF ANN ARBOR. CONTRACTOR SHALL FURNISH AND INSTALL CONDUIT AND INSTALL CABLE. CONTACT CITY FOR MAX. CABLE LENGTH.
6. TERMINATION OF DUCTILE IRON PIPE SHALL BE THREADED AND EQUIPPED WITH SCREW-ON MACHINE TIGHTENED, DUCTILE IRON FLANGE COMPLYING WITH ANSI/AWWA C110 AND C115.
7. ALL CONNECTIONS, VALVES, AND FITTINGS REQUIRED TO PROPERLY TEST THE BACKFLOW PREVENTION DEVICE SHALL BE PART OF THE MANUFACTURER BACKFLOW ASSEMBLY.

1 DOMESTIC WATER SERVICE SYSTEM DETAIL

NOT TO SCALE



1. U.L. AND F.M. APPROVED REDUCED PRESSURE DETECTOR ASSEMBLY. BASED ON ZURN WILKINS MODEL 375ASTDA. IF THE MAKE OR MODEL OF THE PROPOSED REDUCED PRESSURE DETECTOR ASSEMBLY CHANGES, THE FIRE WATER BACKFLOW PREVENTION DRAWING/DETAIL SHALL BE RESUBMITTED TO THE CITY.
2. PRESSURE GAUGE AND BALL VALVE.
3. TERMINATION OF DUCTILE IRON PIPE SHALL BE THREADED AND EQUIPPED WITH SCREW-ON MACHINE TIGHTENED, DUCTILE IRON FLANGE COMPLYING WITH ANSI/AWWA C110 AND C115.
4. ALL CONNECTIONS, VALVES, AND FITTINGS REQUIRED TO PROPERLY TEST THE BACKFLOW PREVENTION DEVICE SHALL BE PART OF THE MANUFACTURER BACKFLOW ASSEMBLY.
5. REMOTE READOUT (OBTAINED FROM CITY OF ANN ARBOR, INSTALLED BY CONTRACTOR).
6. 1/2" EMT CONDUIT WITH 3 WIRE PHONE CABLE. CABLE FURNISHED BY CITY OF ANN ARBOR. CONTRACTOR SHALL FURNISH AND INSTALL CONDUIT AND INSTALL CABLE. CONTACT CITY FOR MAX. CABLE LENGTH.
7. A CITY SUPPLIED BYPASS METER SHALL BE PROVIDED IN LIEU OF THE MANUFACTURER PROVIDED BYPASS METER.

2 FIRE SERVICE SYSTEM DETAIL

NOT TO SCALE

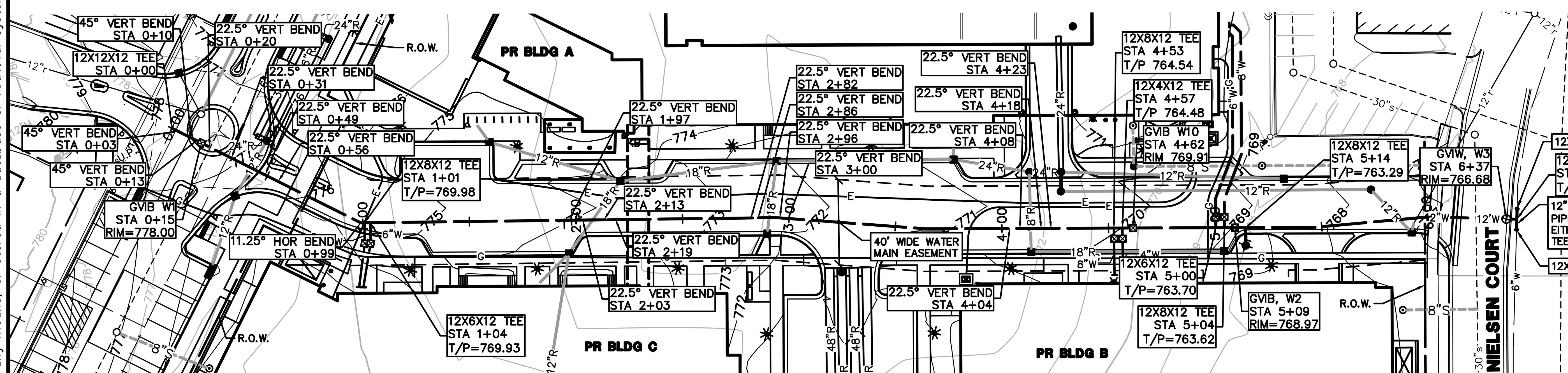
NOTE:
ALL WATERMAIN SHALL HAVE NITRILE GASKETS AND DOUBLE WRAP POLY

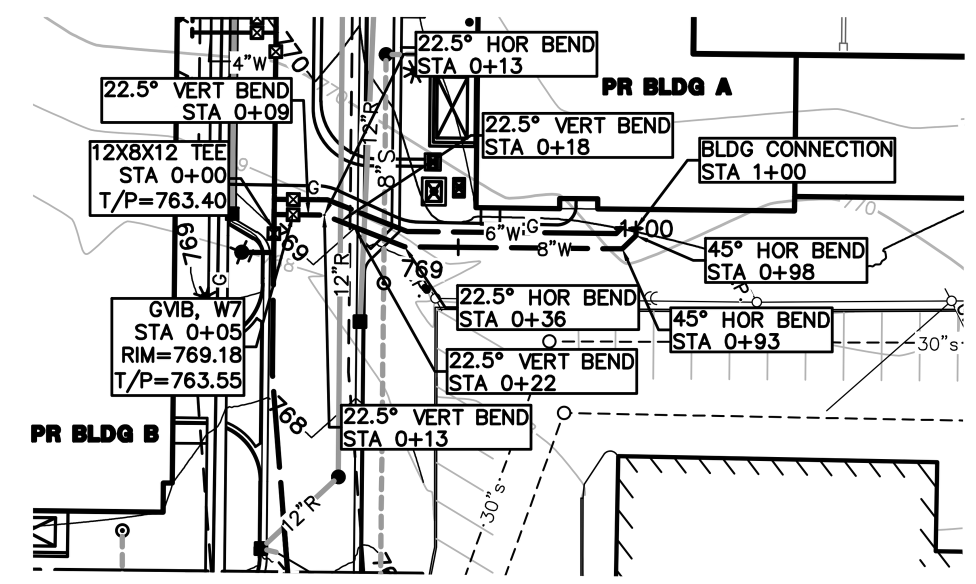
LEGEND

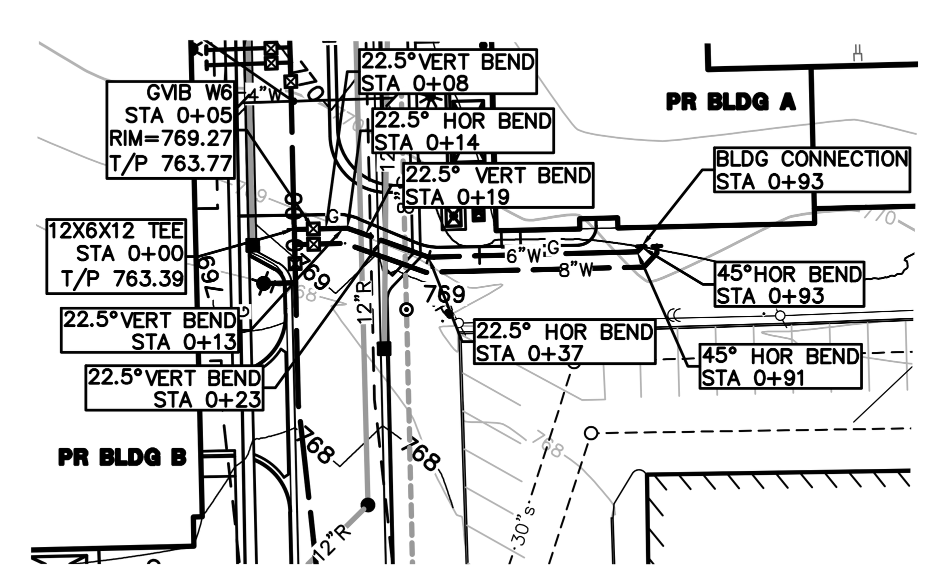
- EXIST. CONTOUR
- PROP. CONTOUR
- EXIST. SPOT ELEVATION
- PROP. SPOT ELEVATION
- EXIST. WATER MAIN
- PROP. WATER MAIN
- EXIST. HYDRANT
- PROP. HYDRANT
- EXIST. GATE VALVE IN BOX
- PROP. GATE VALVE IN BOX
- EXIST. GATE VALVE IN WELL
- PROP. GATE VALVE IN WELL
- EXIST. CURB STOP & BOX
- PROP. CURB STOP & BOX
- REDUCER
- EXIST. STORM SEWER
- PROP. STORM SEWER
- EXIST. CATCH BASIN OR INLET
- PROP. CATCH BASIN OR INLET
- EXIST. SANITARY SEWER
- PROP. SANITARY SEWER
- EXIST. CLEANOUT
- PROP. CLEANOUT

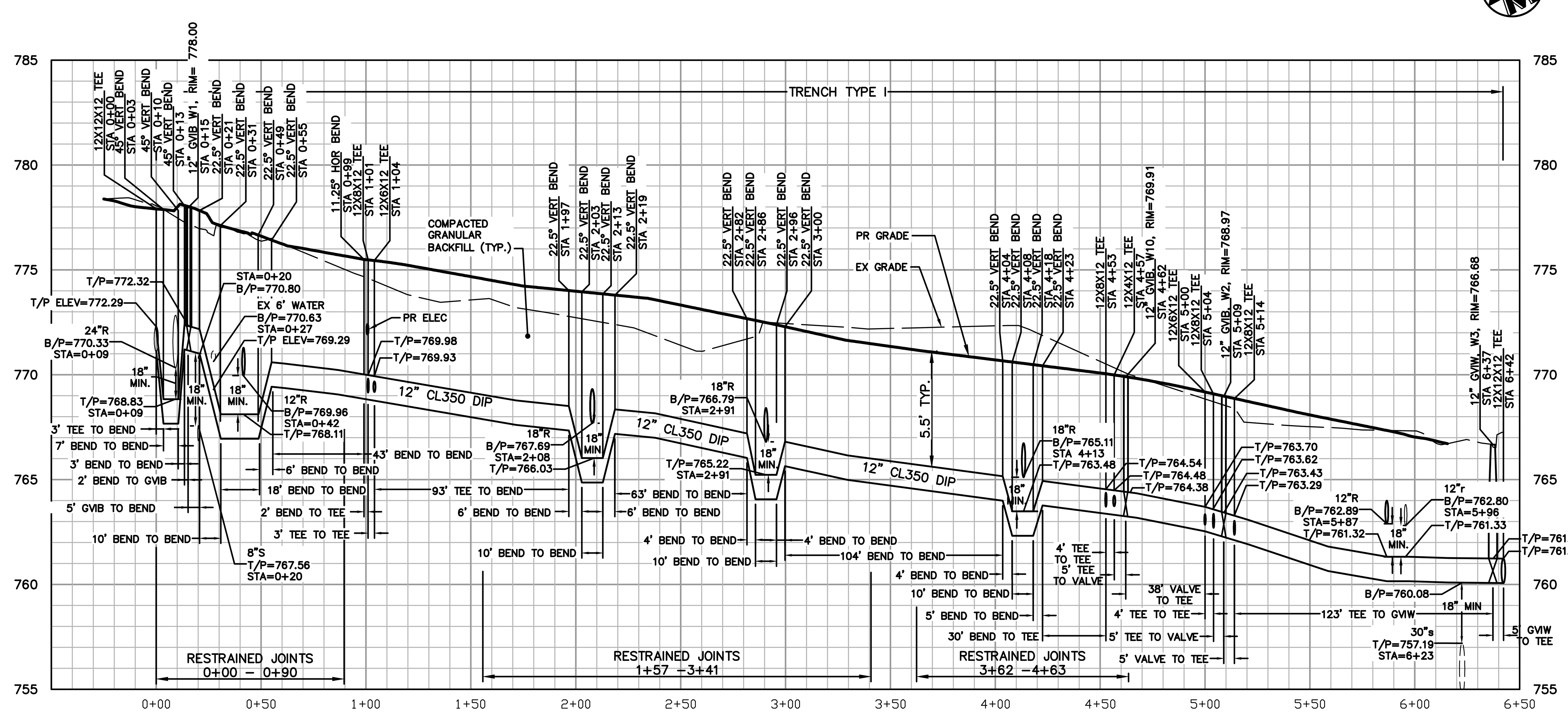
SCALE: 1' = 4' VERT; 1" = 40' HOR

0 40 80 120

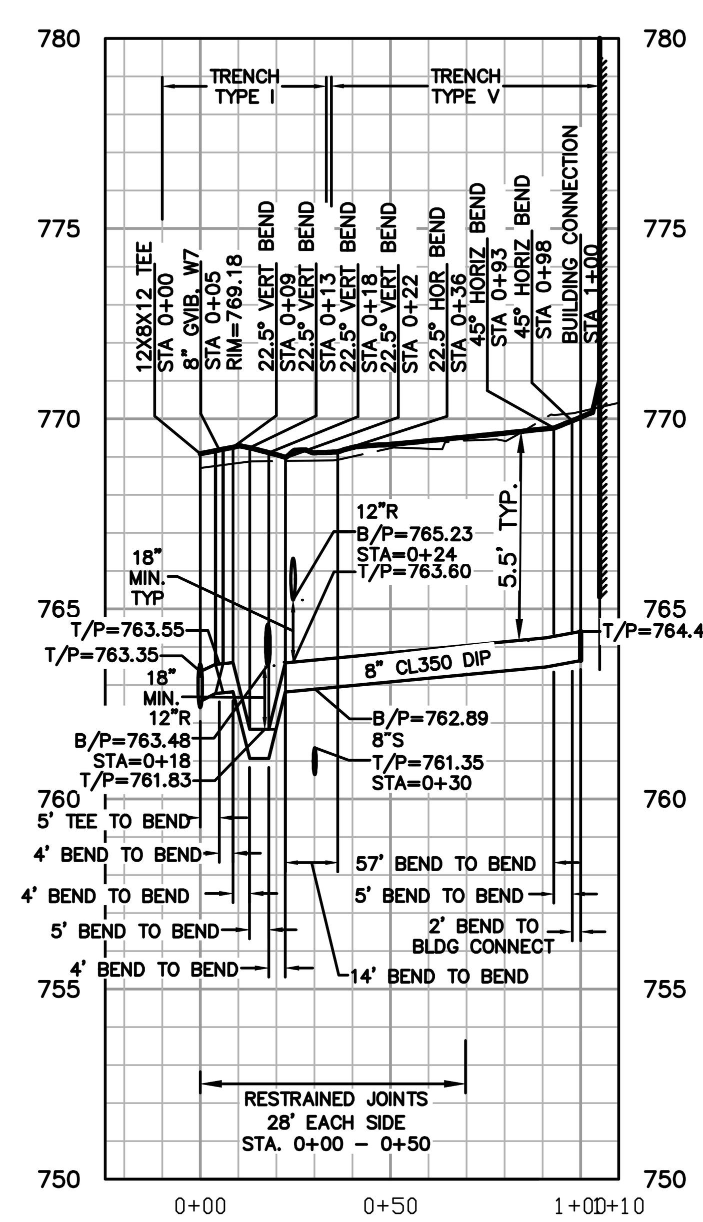




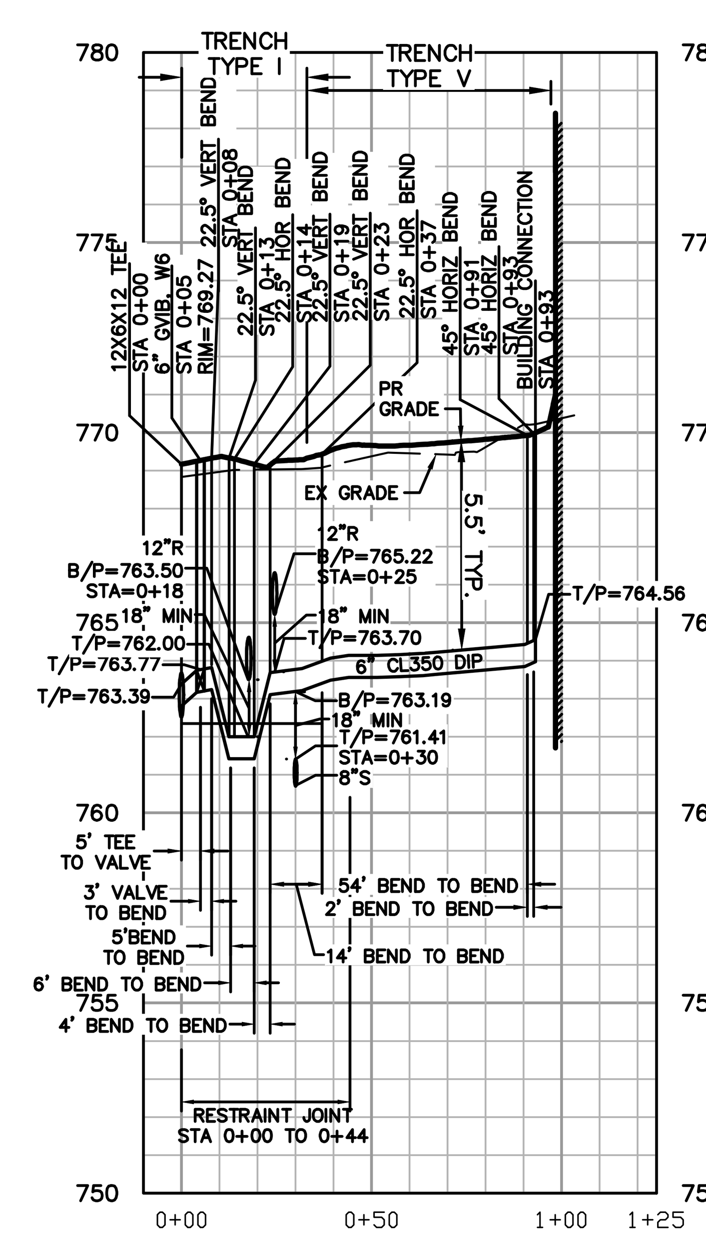




BROADWAY TO NIELSEN CT



BLDG A 8 In FIRE



BUILDING A 6 In DOMESTIC

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1140 BROADWAY STREET

DETAILED ENGINEERING PLANS
WATER MAIN PROFILES

26

DATE: 1/22/18	
SHEET 22 OF 31	
CADD:	
ENG: HTH	
PM: TJC	
TECH:	
16196PW1.dwg	

JOB No. **16196A**

REVISIONS:	REV. DATE
PER MUNICIPAL REVIEW	3/16/18
PER MUNICIPAL REVIEW	5/30/18
PER MUNICIPAL REVIEW	8/9/18
PER MUNICIPAL REVIEW	10/5/18
PER MUNICIPAL REVIEW	10/26/18

WATER MAIN QUANTITIES

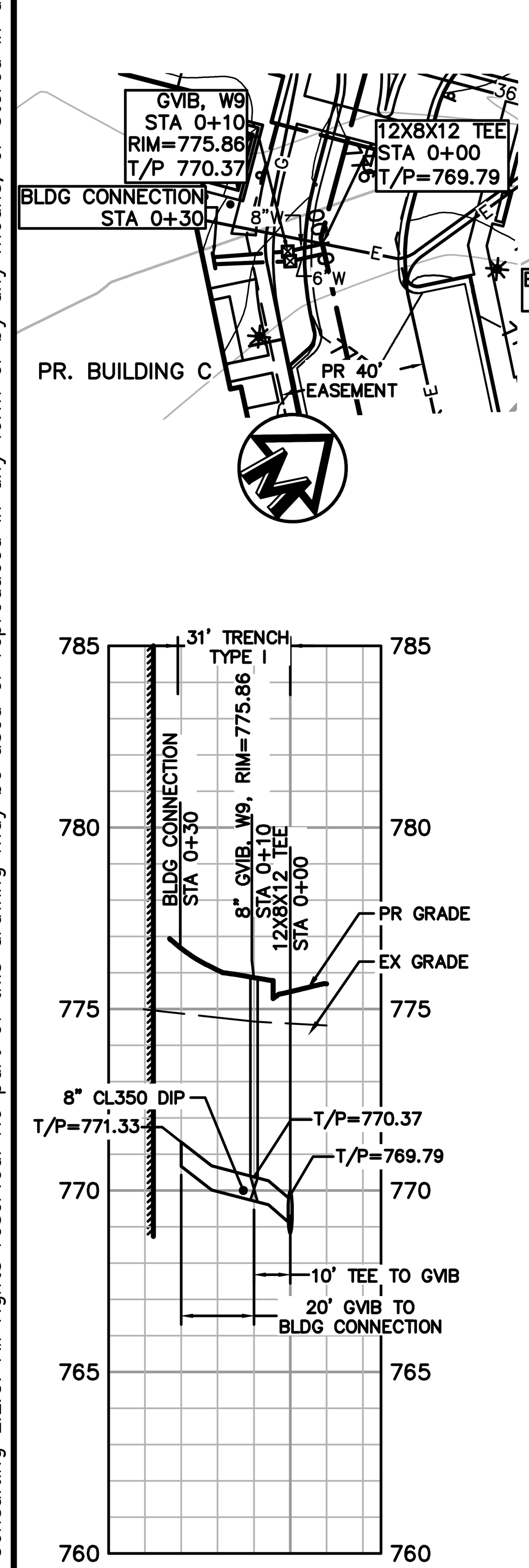
Description	Quantity	Unit
12" Gate Valve in Box	3	Ea
12" Gate Valve in Well	1	Ea
8" Gate Valve in Box	3	Ea
6" Gate Valve in Box	2	Ea
4" Gate Valve in Box	1	Ea
12" Ductile Iron Pipe, CL350	642	L.F.
8" Ductile Iron Pipe, CL350	321	L.F.
6" Ductile Iron Pipe, CL350	123	L.F.
4" Ductile Iron Pipe, CL350	22	L.F.
Hydrant Assembly	4	Ea
12"x12"x12" TEE	2	Ea
12"x8"x12" TEE	7	Ea
12"x6"x12" TEE	2	Ea
12"x4"x12" TEE	1	Ea
45 Degree Bend, 12"	3	Ea
22.5 Degree Bend,12"	16	Ea
11.25 Degree Bend, 12"	1	Ea
45 Degree Bend, 8"	6	Ea
22.5 Degree Bend, 8"	17	Ea
11.25 Degree Bend, 8"	2	Ea
45 Degree Bend, 6"	2	Ea
22.5 Degree Bend, 6"	4	Ea

NOTE:
ALL WATERMAIN SHALL HAVE NITRILE GASKETS AND DOUBLE WRAP POLY

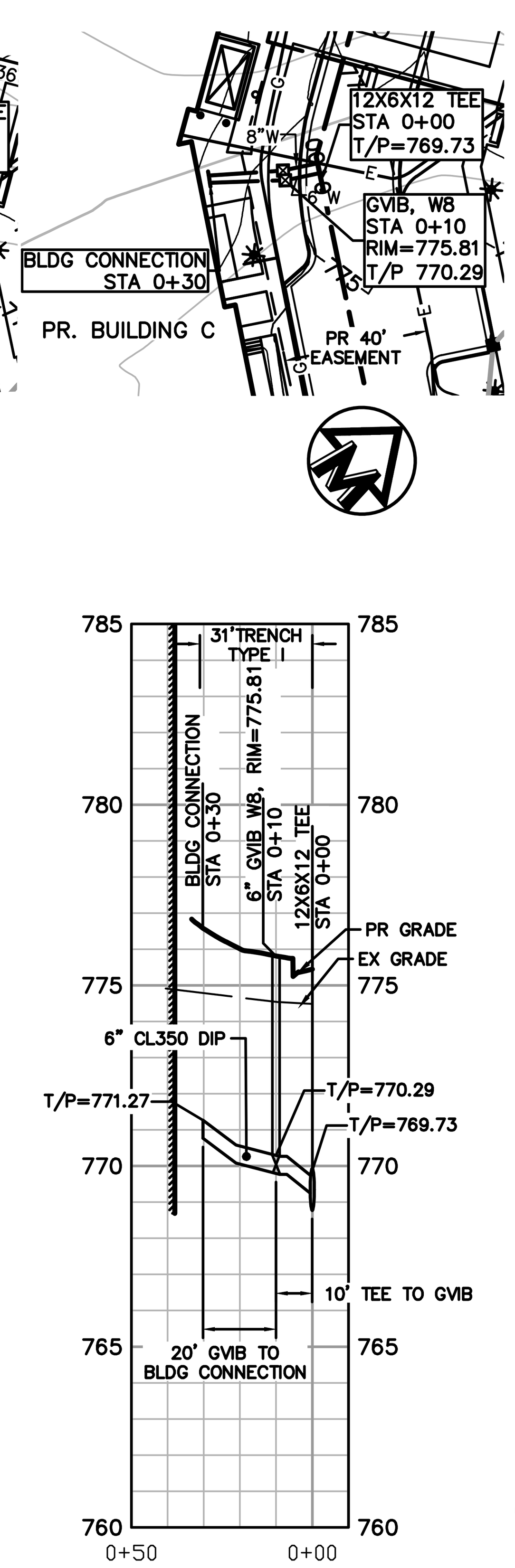
SCALE: 1" = 40'
0 40 80 120

LEGEND

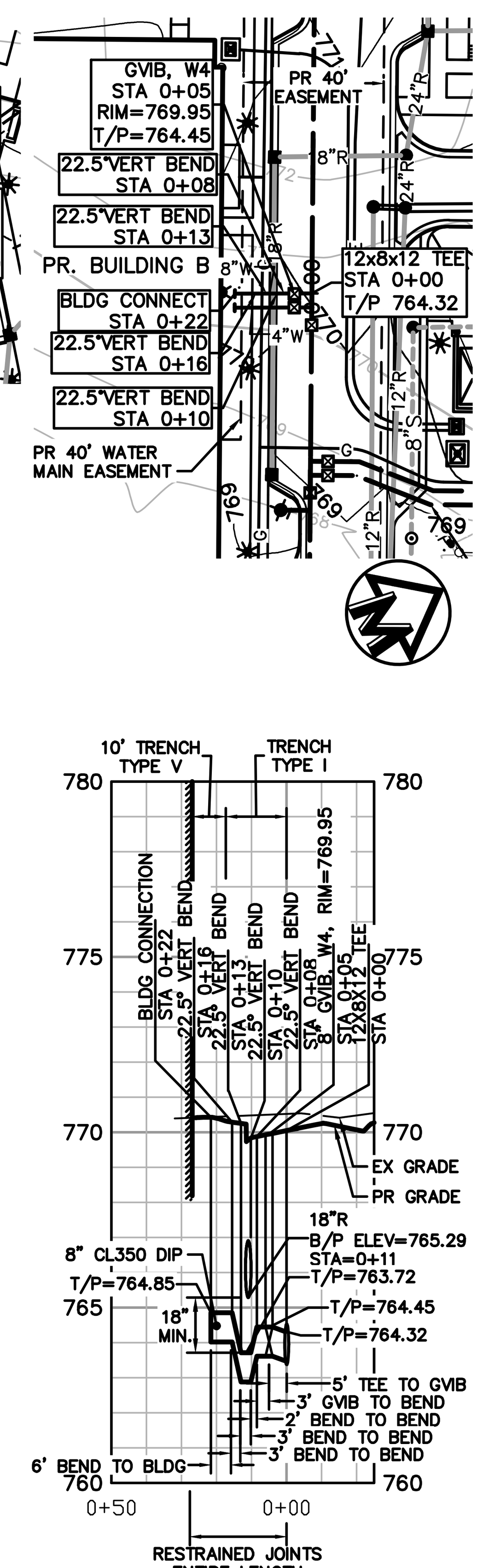
838	EXIST. CONTOUR
838	PROP. CONTOUR
×836.2	EXIST. SPOT ELEVATION
36.60	PROP. SPOT ELEVATION
W	EXIST. WATER MAIN
W	PROP. WATER MAIN
	EXIST. HYDRANT
	PROP. HYDRANT
	EXIST. GATE VALVE IN BOX
	PROP. GATE VALVE IN BOX
	EXIST. GATE VALVE IN WELL
	PROP. GATE VALVE IN WELL
	EXIST. CURB STOP & BOX
	PROP. CURB STOP & BOX
	REDUCER
r	EXIST. STORM SEWER
	PROP. STORM SEWER
	EXIST. CATCH BASIN OR INLET
	PROP. CATCH BASIN OR INLET
s	EXIST. SANITARY SEWER
	PROP. SANITARY SEWER



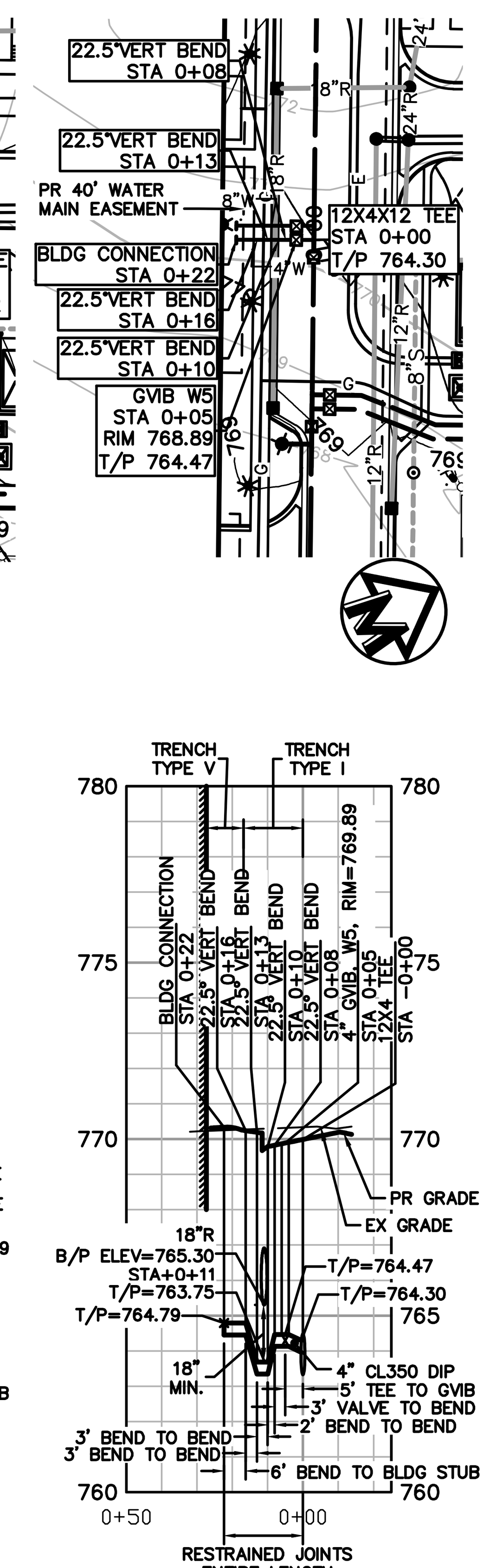
BLDG C 8 in FIRE



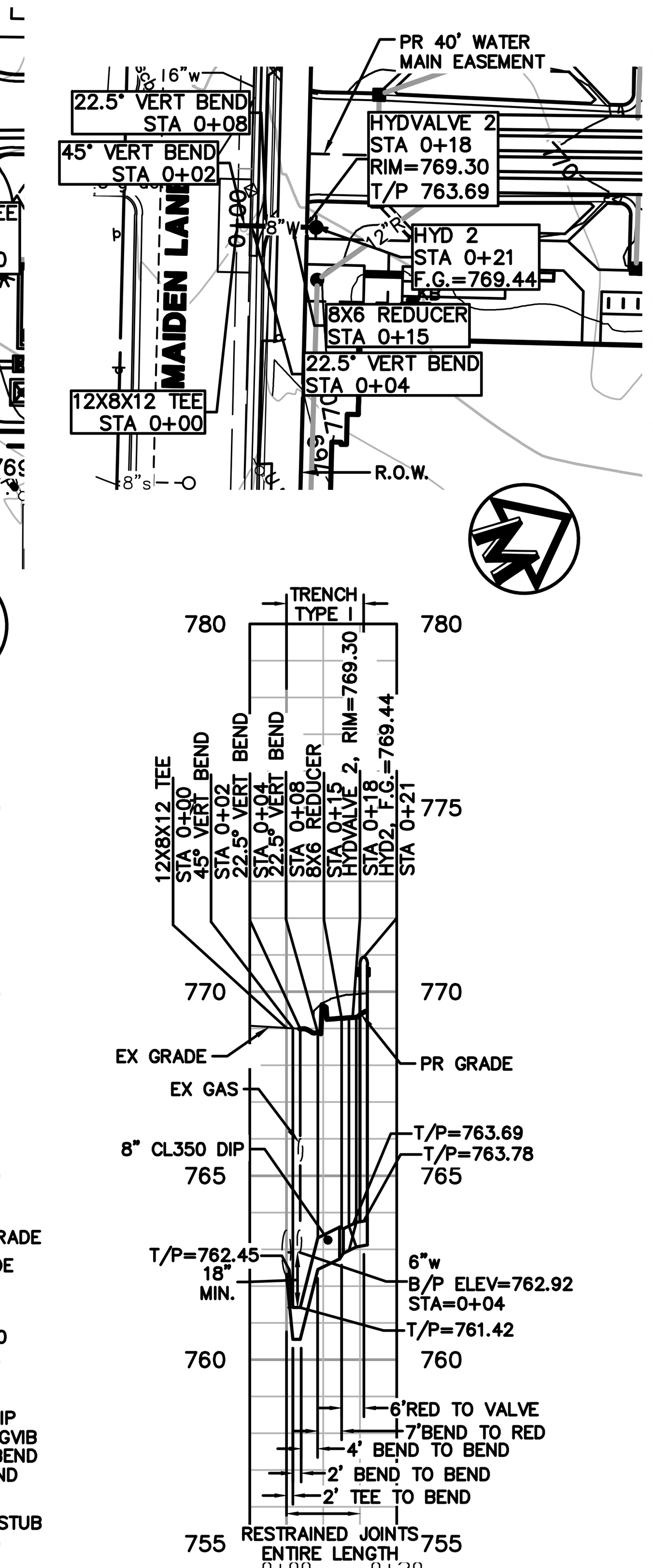
BLDG C 6 in DOMESTIC



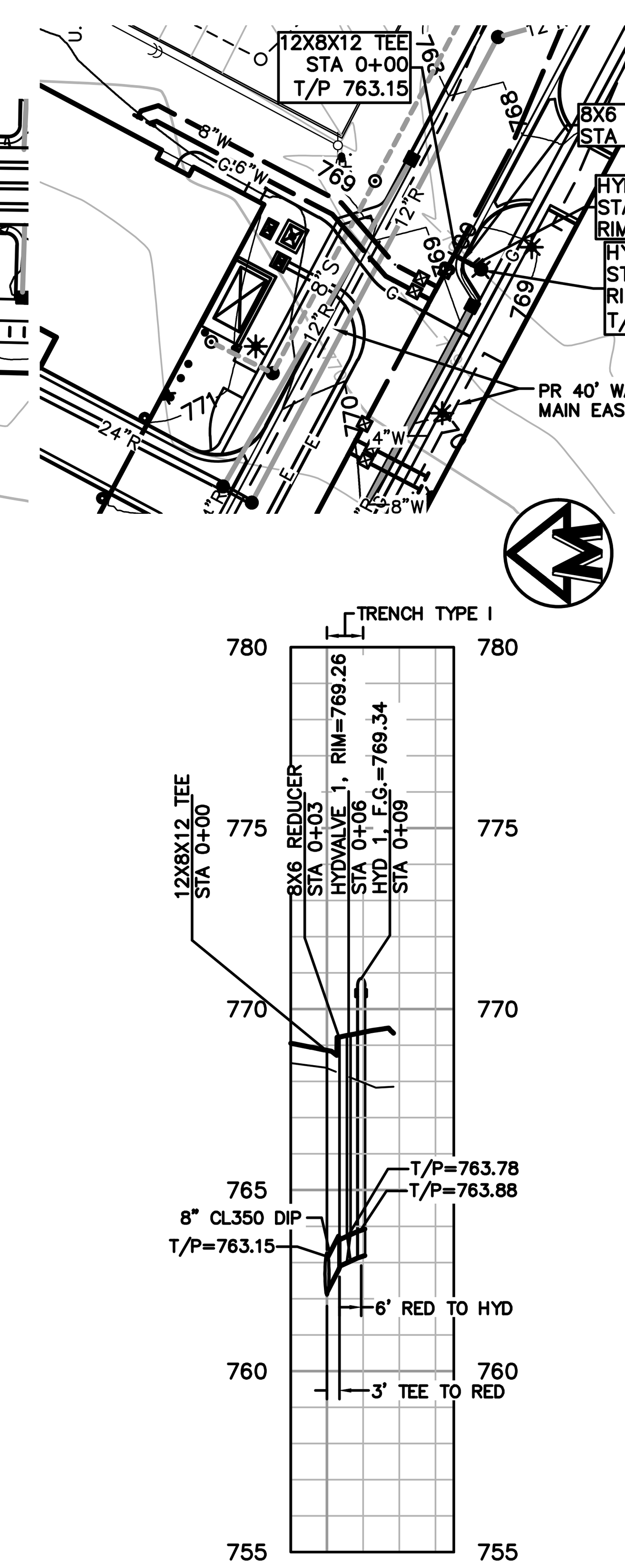
BLDG B 8 in FIRE LEAD



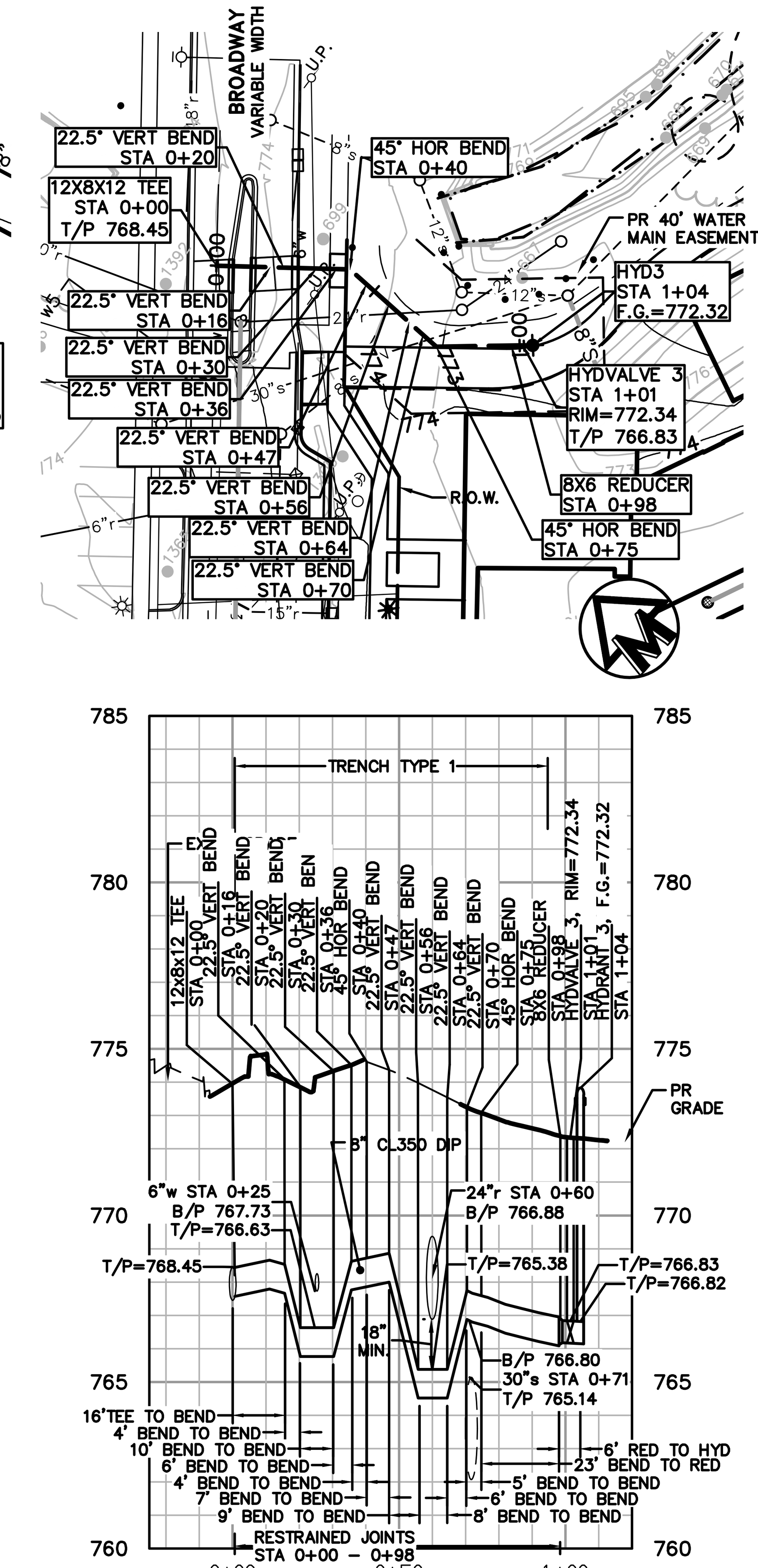
BLDG B 4 in DOMESTIC



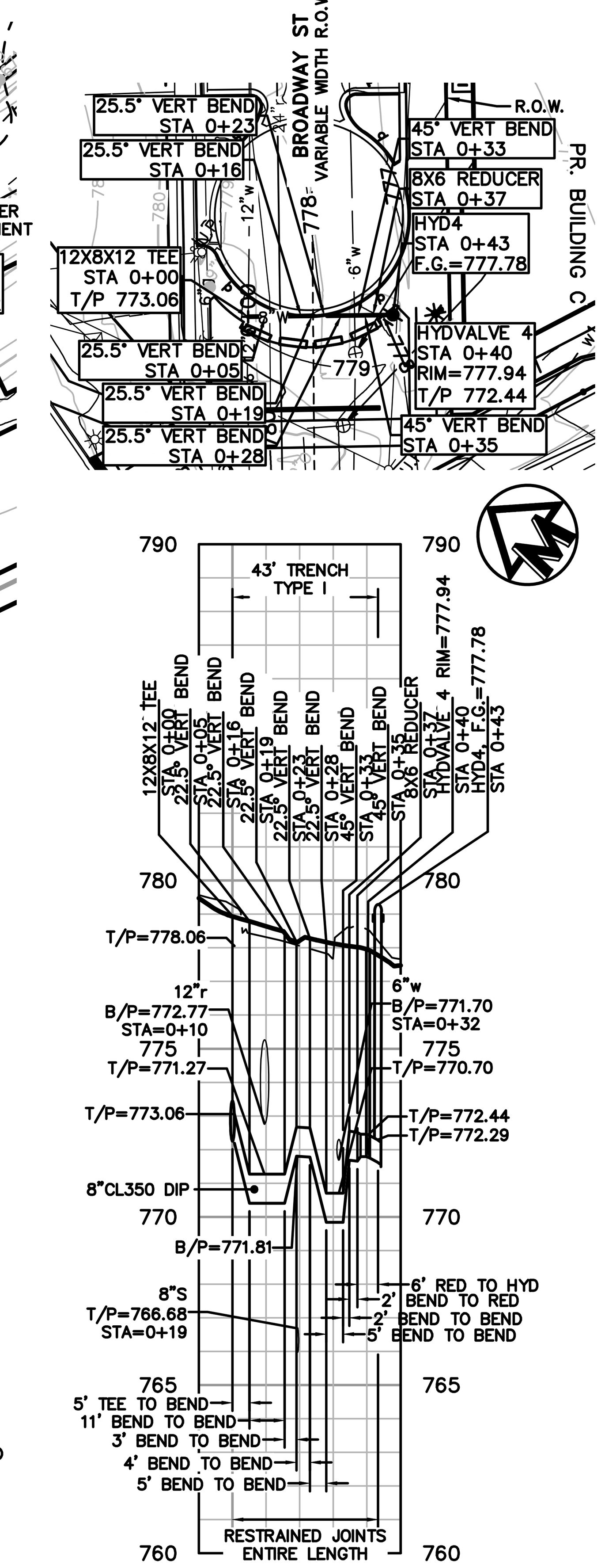
HYDRANT 2



HYDRANT 1



HYDRANT 3



HYDRANT 4

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JOB No. 16196A

PER MUNICIPAL REVIEW 10/26/18

REVISIONS:	REV. DATE	
PER MUNICIPAL REVIEW	3/16/18	CADD:
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PER MUNICIPAL REVIEW	10/2/18	TECH:

DATE: 1/22/18
SHEET 23 OF 31
16196PWI.dwg