807 Mountain Avenue | PO Box 1229 | Berthoud, CO 80513 | O: 970.532.2643 | F: 970.532.0640 | **Berthoud.org**

TOWN OF BERTHOUD PLANNING COMMISSION

TOWN HALL
807 Mountain Avenue
THURSDAY, October 14, 2021
6:00 P.M.

1. Call to Order

2. Roll Call

Jan Dowker, Chairwoman
Sean Murphy, Secretary
Karl Ayers
Abigail Smith
Jeff Butler, Vice Chair
Karen Anderson
Chris Kurtz

All matters listed under Item 3, Consent Agenda, are considered to be routine by the Planning Commission and will be enacted with a single vote. If discussion is deemed necessary on an item, that item should be removed from the consent Agenda and considered separately.

3. Approval of Minutes of the September 23, 2021 Planning Commission Meeting.

4. Public Hearing: Fickel Farm Final Plat, Will Edwards agent.

5. Public Hearing: O'Malley Glen- Farmstead Rezoning, Jim Bunkers agent.

6. Continuation of Public Hearing: Berthoud Engineering Standards.

7. Reports.

8. Adjourn.

The Planning Commission Meeting will be held virtually through Zoom at www.zoom.com/join, and can be accessed by the following Meeting ID number or by using the call-in phone number:
Meeting ID: 878-2570-9669
Call-in Number: 1-669-900-6833

If you require a special accommodation, please contact the Town Clerk 24 hours in advance at (970) 532-2643.

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Planning Commission Minutes – September 23, 2021

1. Call to Order – The Planning Commission convened a regular meeting on September 23, 2021. Chairwoman Dowker called the meeting to order at **6:00 p.m.**

2. Roll Call –	Members present:	Jan Dowker	(Chairwoman)
		Jeff Butler	(Vice Chair)
		Sean Murphy	(Secretary)
		Karl Ayers	(Commissioner)
		Patrick Dillon	(Commissioner)
	Members absent:		
		Chris Kurtz	(Commissioner)
		Abigail Smith	(Commissioner)
	Staff present:	Curt Freese	(Director)
		Adam Olinger	(Planner)
		Jonathan Mitchell	(Permit Technician)

3. Consent Agenda – Minutes from the August 26, 2021 Planning Commission Meeting.

MOTION made by Commissioner Ayers.

SECONDED by Commissioner Butler.

With Commissioner Butler, Commissioner Murphy, Commissioner Ayers, and Commissioner Dillon in favor, THE MOTION CARRIED.

Chairwoman Dowker abstained, as she was absent from the meeting.

4. Public Hearing: Berthoud Design Guidelines

Director Freese introduced Erin Bagnall (Architect) and Stephen Sparn (Architect) with Sopher Sparn Architects LLC who introduced the Town of Berthoud Design Guidelines.

Public Comment was opened at 6:14 p.m.

Public Comment was closed at 6:15 p.m.

Commissioner Murphy spoke about a desire for more goals and additional reinforcement with sustainability.

Commissioner Butler spoke about a desire for more landscaping and gardening while still allowing staff flexibility in guidelines. Butler agreed with Murphy's desire for more sustainability.

Commissioner Ayers spoke about recommendations for more solar and landscaping, among other sustainability options.

MOTION made by Commissioner Butler.

SECONDED by Commissioner Murphy.

With all in favor, THE MOTION CARRIED.

5. Public Hearing: Berthoud Engineering Standards

Director Freese recommended the tabling of the Berthoud Engineering Standards.

MOTION made by Commissioner Murphy to table the Public Hearing for the Berthoud Engineering Standards until October 14, 2021.

SECONDED by Commissioner Ayers.

With all in favor, THE MOTION CARRIED.

6. Reports –

Director Freese shared that over 400 new houses have been permitted in 2021 so far.

Director Freese cancelled the tour for the Planning Commission members due to a lack of staff availability.

Director Freese announced that interviews for two Planning Commission vacancies are Monday, September 27, 2021.

Chairwoman Dowker announced that Habitat for Humanity will be having home blessings for four new homes on Sunday, September 26, 2021.

7. Adjourn –

The meeting was adjourned at 7:43 p.m.

Garden Spot of Colorado
807 Mountain Avenue | PO Box 1229 | Berthoud, CO 80513 | O: 970.532.2643 | F: 970.532.0640 | **Berthoud.org**

STAFF REPORT: FICKEL FARM PUD FOURTH FILING FINAL PLAT

DATE: October 14, 2021

GENERAL INFORMATION		
Applicant:	**Edwards Development**	**Size: 27 acres**
Site Location:	**This property is located south of Hwy 56, east of the existing Fickel Farm neighborhood, north of Pioneer Park and the Mary's Farm subdivision.**	
Applicant's Request:	**The Applicant is requesting Final Plat approval for the creation of 101 new single family attached and detached lots, two tracts for future single-family development, a tract for an expansion of Pioneer Park, and various outlots for open space.**	
Current Zoning:	**PUD (Planned Unit Development)**	

ZONING DISTRICT INFORMATION	
	PUD
Max Density	**N/A**
Min. Lot Size	**N/A**
Min. Lot Width	**30'**
Front Setback	**20' for front loaded (12' for porch), 10' for rear loaded**
Side Setback	**5' (10' corner side); 0' for attached units**
Rear Setback	**10' for front loaded, 5' for rear loaded**
Building Height:	**50'**

SURROUNDING ZONING, LAND USE AND REQUIRED BUFFERS		
Adjacent Zoning	**Adjacent Land Uses**	**Setbacks for Adjacent Zoning /Buffer required if rezoned**
North: PUD, County (RR2)	**Peakview Meadows (Single Family Residential), Rural Residential**	**None**
South: PUD	**Pioneer Park, Mary's Farm (Single Family Residential)**	**None**
East: County (RR2)	**Rural Residential**	**None**
West: PUD	**Fickel Farm Phase 1 & 2 (Single Family Residential)**	**None**

PROPOSAL

The Applicant is requesting Final Plat approval on 54 acres for the creation of 101 single family attached and detached lots. The project received Neighborhood Master Plan approval with a unanimous vote by the PC on May 27, 2021 and by the Town Board on June 8, 2021, as well as Preliminary Plat approval by the PC on July 8, 2021 and by the Town Board on July 27, 2021. Conditions included all alleys remaining private and all lots abutting an alley having alley-loaded garages.

Final Plat:

The Final Plat is the last step in the platting process, where the Applicant finalizes the overall layout and infrastructure laid out in the Neighborhood Master Plan and Preliminary Plat.

Zoning:

The original Fickel Farm was approved as a PUD (Planned Unit Development) in 1995. A PUD is a land use designation wherein the Town and Developer agreed on a project specific zoning/uses and development standards for an entire subdivision. The PUD zoning district was removed from the development code in 2008, but any existing PUD retains its originally approved rights and zoning uses. The PUD was approved earlier this year to allow for 195 units, including the 101 single family attached and detached lots proposed on this Preliminary Plat.

Parks

The park area provided includes the existing Pioneer Park as it was donated with the first two phases of the overall project. Section 30-2-109 requires 1 acre of park per 100 dwelling units, which Pioneer Park more than satisfies.

Open Space

Development Code updates approved in 2019, now require 10% open space. The current proposal has 4.26 acres of open space, which equates to over 15% of the project.

Pedestrian Network

Just like in the Preliminary Plat, the Applicant included a 10’ wide concrete trail connection between Pioneer Park and the Farmstead running through outlots A and D per the condition of approval of the Neighborhood Master Plan. The remainder of the pedestrian connections will be handled by sidewalks.

Utility Network

The project can connect to water, sewer, stormwater facilities (at the applicant's cost), without any issues related to capacity.

PREFERRED LAND USE

The Town's Preferred Land Use Map designates this area Urban Residential, which calls for an alley-loaded product at a higher density than the standard single-family subdivision.

- ✓ The Final Plat is consistent with the Preferred Land Use Map

FINDINGS NECESSARY FOR A FINAL PLAT

1. **Does not change any land use of the proposed plat;**

- ✓ The Final Plat does not change the land use of the Preliminary Plat.

2. **Does not change the number of lots or residential density by more than 5%;**

- ✓ The Final Plat proposes the exact same number of lots as the Preliminary Plat.

3. **Does not contain changes which would render the final plat in nonconformance with requirements of this code;**

- ✓ The Final Plat is fully compliant with the Town of Berthoud Municipal Code

4. **Does not contain significant changes in street alignment and/or access points, or other public elements such as drainage improvements, utility lines, or facilities;**

- ✓ The Final Plat is identical to the Preliminary Plat and did not change the street alignment, access points, or any other public element.

5. **Does not change any measurable standard (other than above) by more than 15%;**

- ✓ The Final Plat is identical to the Preliminary Plat. No standards were changed by more than 15%.

6. **How the Applicant has addressed comments received from the public during the Public Comment portion of the process.**

- ✓ The Applicant has addressed many of the comments received during the public comment period, including reconfiguring the street layout, the inclusion of additional parking spaces, and expansion of Pioneer Park. There was no public comment provided during the Final Plat portion of the project

PUBLIC NOTICE AND COMMENT

Notice of the Public Hearing has been mailed to property owners within 500 feet of the subject property,a legal ad published, and the property was posted as required by the Development Code. In addition, theapplication was sent out to all property owners within 500 feet, with an invitation to comment on the request within one week of receipt for each round of development review. The public comments are included with this packet.

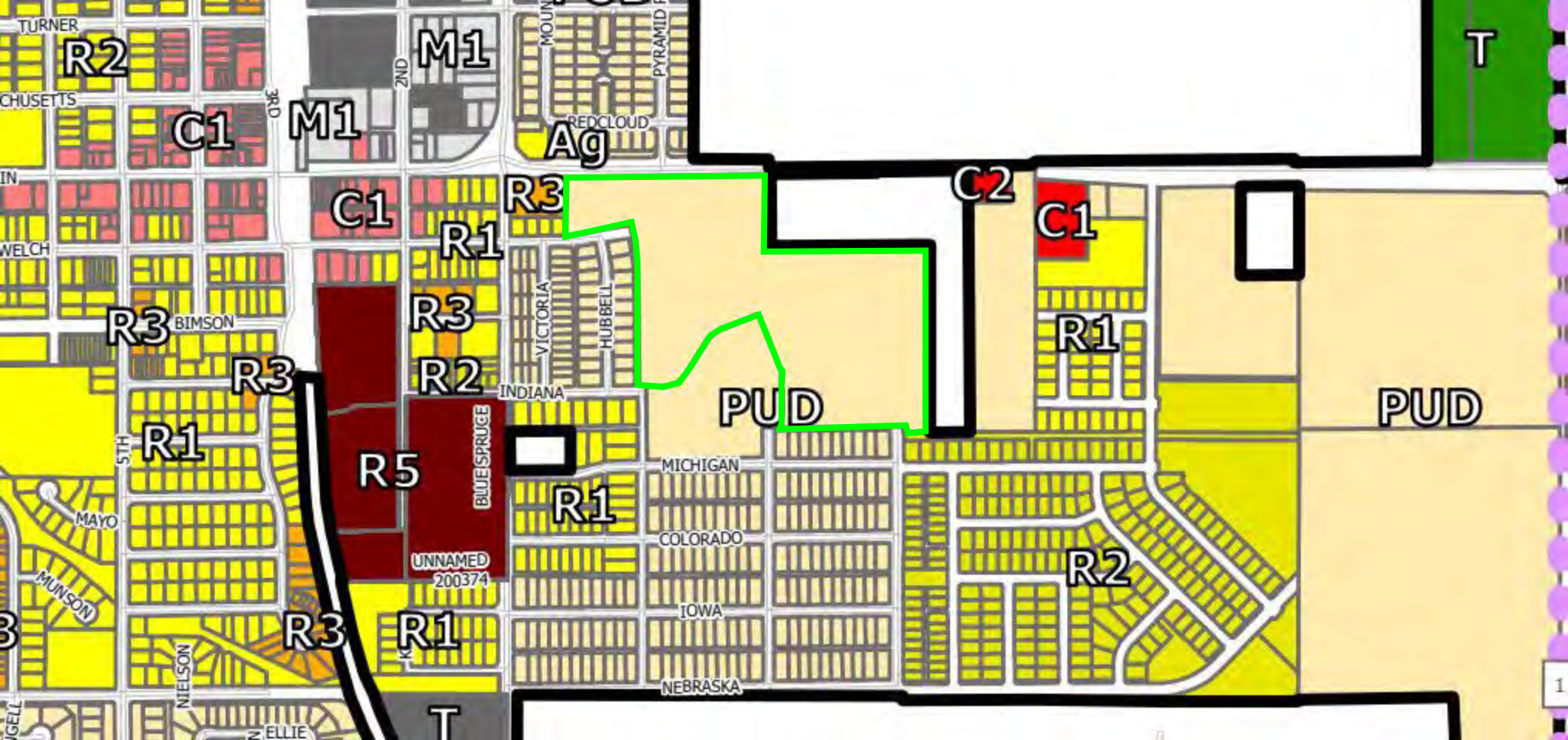
FINDINGS AND RECOMMENDATIONS

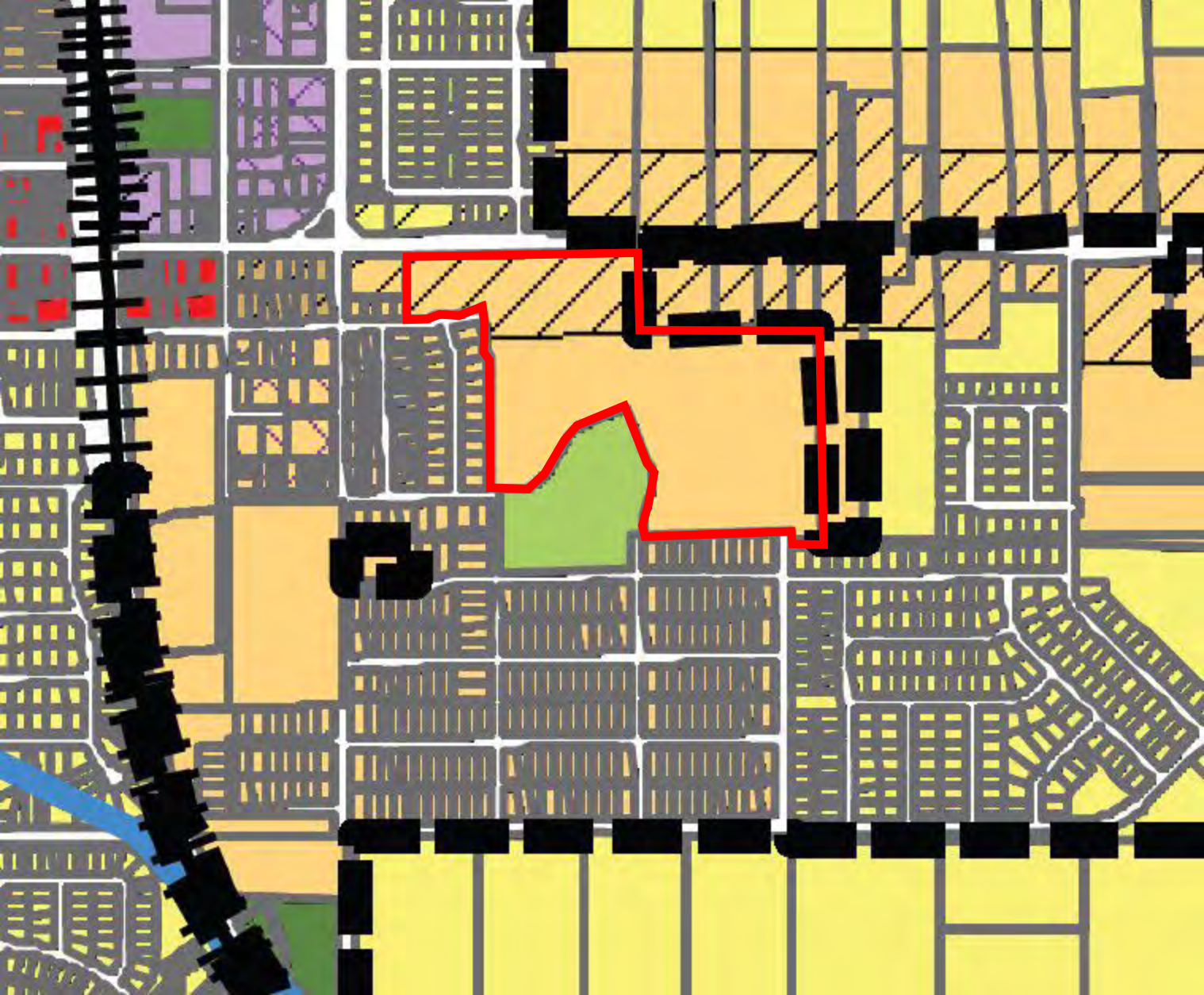
Final Plat

Move to recommend approval of the Fickel Farm PUD 4th Filing Final Plat, finding it is consistent with Section 30-6-108 C (found in this Staff Report) with the following recommendations

1. **All alleys remain private**
2. **All lots abutting an alley have alley-loaded garages**

ZONING AND PREFERRED LAND USE MAP

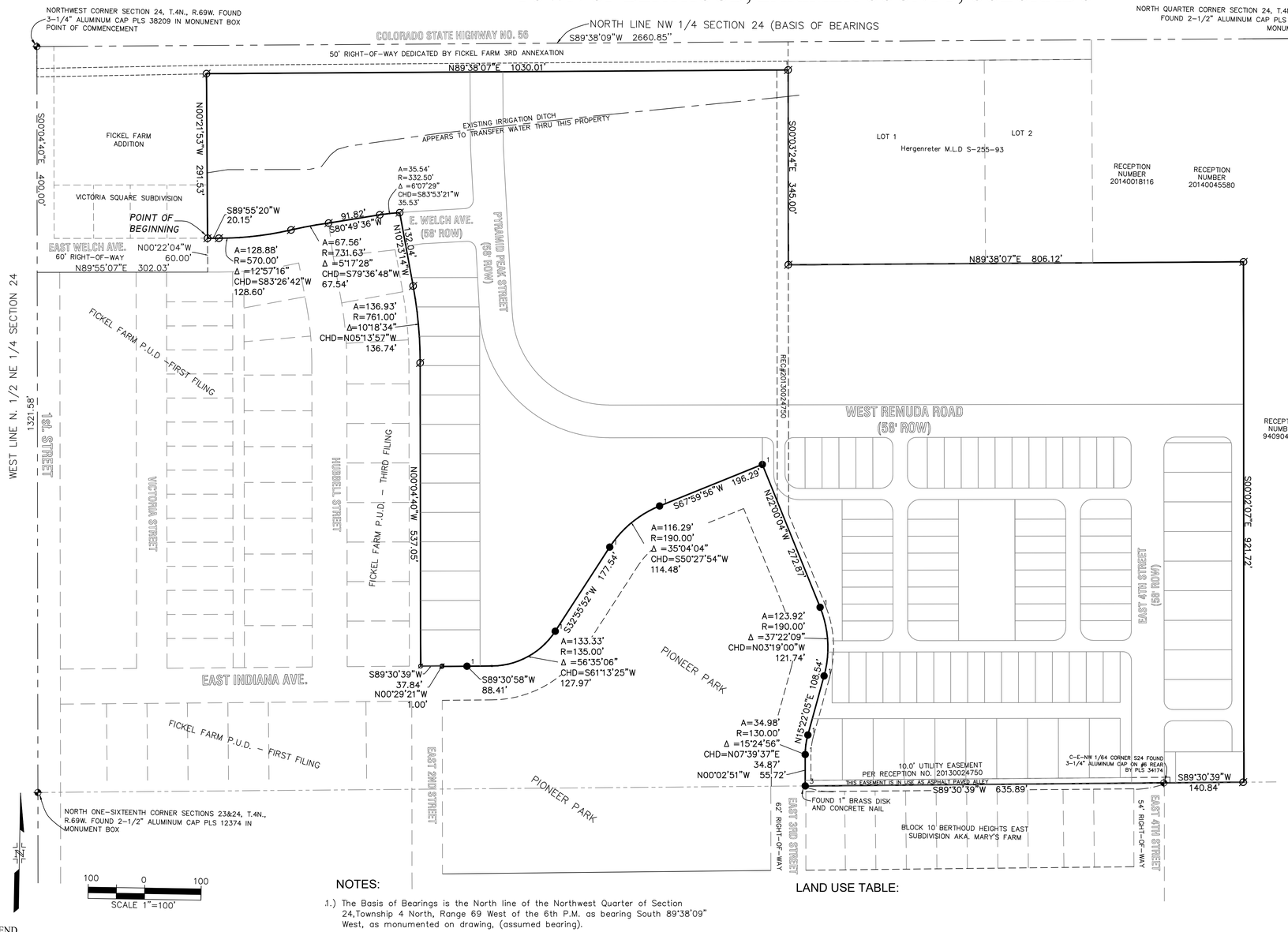

TURNER
R2
M1
2ND
M1
C1
3RD
Ag
REDCLOUD
PYRAMID
T
C2
C1
R3
C1
R1
WELCH
R3
BIMSON
R3
R3
R2
INDIANA
VICTORIA
HUBBELL
PUD
R1
PUD
5TH
R1
R5
BLUE SPRUCE
MICHIGAN
R1
MAYO
COLORADO
UNNAMED
200374
R2
MUNSON
IOWA
R3
R1
NIELSON
NEBRASKA
ELLIE



FINAL PLAT SUBMITTAL

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO



LEGEND

- IINDICATES SECTION LINE
- INDICATES EXISTING EASEMENT
- INDICATES CONTROL CORNER AS DESCRIBED HEREON
- ●1 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 14823
- ●2 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 12374
- ●3 INDICATES FOUND 1" BRASS DISK AND CONCRETE NAIL
- Ø INDICATES SET #4 REAR W/ 1"GREEN PLASTIC STAMPED PLS20676
- UE INDICATES UTILITY EASEMENT

NOTES:

1.) The Basis of Bearings is the North line of the Northwest Quarter of Section 24,Township 4 North, Range 69 West of the 6th P.M. as bearing South 89°38'09" West, as monumented on drawing, (assumed bearing).

2.) Stewart Title Commitment, Inc. (Commitment# 754056 Dated July 19, 2021 AT 8:00 A.M.) was relied upon for information regarding easements, restrictions and right-of-ways for the preparation of this plat.

3) The lineal unit of measurement for this plat is U. S. Survey Feet.

4.) FLOOD ZONE NOTE: Per the Federal Emergency Management Agency (FEMA) Flood Zone Mapping for the is area (Map Number 08069C1387G, Panel 1387 of 1420, Effective Date of February 6, 2013 and Map Number 08069C1391G, Panel 1391 of 1420, Effective Date of February 6, 2013) the subject properties appear to lie within a Flood Zone 'X'.

NOTICE: According to Colorado law, you MUST commence any legal action based on any defect in this survey within Three years after you first discovered such defect. In no event, may any action based upon any defect in this survey be commenced more than TEN years from the date of the certification shown hereon.

LAND USE TABLE:

KNOW ALL MEN BY THESE PRESENTS: That the undersigned, being the owner of FICKEL FARM PUD FOURTH FILING located in the Northwest Quarter of Section 24, Township 4 North, Range 69 West of the 6th Principal Meridian, Town of Berthoud, County of Larimer, State of Colorado, more particularly described as follows;A parcel of land in the Town of Berthoud, County of Larimer, State of Colorado located in the Northwest Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M. more particularly described as follows:
Considering the North line of the Northwest Quarter of said Section 24 was assumed to bear South 89°38'09" West, between the monuments shown and described hereon and with all bearings contained herein relative thereto;
Beginning at the Northwest corner of said Section 24;
thence along the West line of said Northwest Quarter, South 00°04'40" East, a distance of 400.00 feet, to a point on the westerly prolongation of the North line of the Fickel Farm P.U.D. First Filing to the Town of Berthoud;
thence departing said West line, North 89°55'04" East, along said westerly prolongation and the North line of Said Fickel Farm P.U.D. First Filing a distance of 302.03 feet to the Southwest corner of the Victoria Square Subdivision to the Town of Berthoud,
thence North 00°22'04" West, along the East line of said Victoria Square Subdivision, a distance of 60.00 feet to the TRUE POINT OF BEGINNING
thence North 00°21'53" West, along the East line of said Victoria Square Subdivision and the East Line of Fickel Farm Addition to the Town of Berthoud, a distance of 291.53 feet, to a point on the Southerly right of way line of Colorado State Highway 56;
thence North 89°38'07" East, along said Southerly right of way line, a distance of 1,030.01 feet, to a point on the Westerly line of the Hergenreter M.L.D. S-255-93;
thence South 00°03'24" East, along said Westerly line, a distance of 345.00 feet;
thence North 89°38'07" East, along the Southerly line of said Hergenreter M.L.D. and its Easterly prolongation, a distance of 806.12 feet, to a point on the Westerly boundary of that certain parcel of land as described in a deed recorded in reception number 940947786 of Larimer County Records;
thence South 00°02'07" East, along said Westerly boundary line, a distance of 921.72 feet, to a point on the South line of the North One-half of the Northwest Quarter of said Section 24;
thence South 89°30'39" West, along said South line, a distance of 140.84 feet to the Northeast corner of Berthoud Heights East Subdivision;
thence South 89°30'39" West, along the North line of said Berthoud Heights, a distance of 635.89 feet, to a point on the East boundary line of the Pioneer Park, a subdivision of the Town of Berthoud;
thence along the Boundaries of said Pioneer Park the following ten (10) courses and distances;
1. North 00°02'51" West a distance of 55.72 feet;
2. along the arc of a curve to the right having a central angle of 15°24'56", and a radius of 130.00 feet an arc length of 34.98 feet the chord of said curve bears North 07°39'37" East, a chord length of 34.87 feet;
3 North 15°22'05" East a distance of 108.54 feet;
4.along the arc of a curve to the left having a central angle of 37°22'09", and a radius of 190.00 feet an arc length of 123.92 feet the chord of said curve bears North 03°19'00" West, a chord length of 121.74 feet;
5 North 22°00'04" West a distance of 272.87 feet;
6 South 67°59'56" West a distance of 196.29 feet;
7. along the arc of a curve to the left having a central angle of 35°04'04", and a radius of 190.00 feet an arc length of 116.29 feet the chord of said curve bears S50°27'54" West, a chord length of 114.48 feet;
8 South 32°55'52" West a distance of 177.54 feet;
9. along the arc of a curve to the right having a central angle of 56°35'06", and a radius of 135.00 feet an arc length of 133.33 feet the chord of said curve bears South 61°13'25" West, a chord length of 127.97 feet;
10. South 89°30'58" West a distance of 88.41 feet to a point on the Easterly boundary of Fickel Farm P.U.D. – Third Filing;
Thence along the boundaries of said Third Filing the following six (6) courses and distances;
1. North 00°29'21" West a distance of 1.00 feet;
2. South 89°30'39" West a distance of 37.84 feet;
3. North 00°04'40" West a distance of 537.05 feet;
4. along the arc of a curve to the left having a central angle of 10°18'34", and a radius of 761.00 feet an arc length of 136.93 feet the chord of said curve bears North 05°13'57" West, a chord length of 136.74 feet;
5. North 10°23'14" West a distance of 132.04 feet;
6. thence along the arc of a catangent curve to the left having a central angle of 06°07'29", and a radius of 332.50 feet an arc length of 35.54 feet the chord of said curve bears South 83°53'21" West, a chord length of 35.53 feet;
7. South 80°49'36" West a distance of 91.82 feet, to the Northeast corner of Fickel Farm P.U.D. – First Filing;
thence along the Northern Boundaries of said First Filing the following three (3) courses and distances;
1. along the arc of a catangent curve to the left having a central angle of 05°17'28", and a radius of 731.63 feet an arc length of 67.56 feet the chord of said curve bears South 79°36'48" West, a chord length of 67.54 feet,
2. along the arc a reverse curve to the right having a central angle of 12°57'16", and a radius of 570.00 feet an arc length of 128.88 feet the chord of said curve bears South 83°26'42" West, a chord length of 128.60 feet;
3. South 89°55'20" West a distance of 20.15 feet to the TRUE POINT OF BEGINNING;
Containing an area of 1,406,884 square feet, 32.298 acres, more or less
have laid out, platted, and subdivided the above described land, under the name and style of FICKEL FARM PUD FOURTH FILING, and by these presents do dedicate to the Town of Berthoud in fee simple the street and public "rights-of-way" as shown on the plats, and grant to the Town of Berthoud such easements and rights-of-way, and all right, title and interest in real property to the above described lands, including all surface interests and all minerals within or underlying said lands, as are created hereby and depicted or, by note , referenced hereon, along with the right to install, maintain, replace and operate mains, transmission lines, service lines, and appurtenances, either directly or through the various public utilities, as may be necessary to provide such utility, cable television, water, electric, natural gas and sanitary services within this subdivision or property contiguous thereto, through, over, under, and across streets, utility and other easements, and other public places shown on the plat.

By: William J. Edwards
As: Manager
of Berthoud Homes, LLC

State of Wyoming)
)SS
County of Laramie)

The foregoing dedication was acknowledged this _____ day of _____.

2021 A.D., by William J. Edwards as Manager of Berthoud Homes, LLC.

My commission expires: _____.

Notary Public: _____
Whitness my hand and seal

RIGHT TO FARM STATEMENT

The Town of Berthoud has adopted a "Right to Farm" policy. All new and existing residents are expected to read and understand lhe policy. For a copy of the policy, please contact the Town of Berthoud.

APPROVAL STATEMENTS

Approved by the Town of Berthoud, Colorado this _____ day of _____, 2021.

_____
MAYOR–William Karspeck

The foregoing plat is approved for filing and accepted by the Town of Berthoud, Colorado this day of _____, 2021

ATTEST: _____
Town Clerk–Christian R. Samora

SURVEYOR'S STATEMENT

I, Michael J. DeDecker, a Registered Professional Land Surveyor in theState of Colorado, do hereby certify that the survey of FICKEL FARM PUD FOURTH FILING was made under my supervision and the accompanying plat accurately and properly shows said subdivision and is in compliance with the Subdivision Regulations of the Town of Berthoud.

MICHAEL J. DEDECKER P.L.S. 20676
For and on behalf of
DeDecker Land Surveying LLC

COLORADO REG. L.S. 20676 MICHAEL J. DEDECKER PROFESSIONAL LAND SURVEYOR

DATE	RECORD OF ISSUE	BY	CK.
05-10-2020	INITIAL ISSUE	MJD	

DEDECKER LAND SURVEYING
4301 FAWN TRAIL
LOVELAND, COLORADO 80537
C (970) 217-2331 H (970) 663-2013

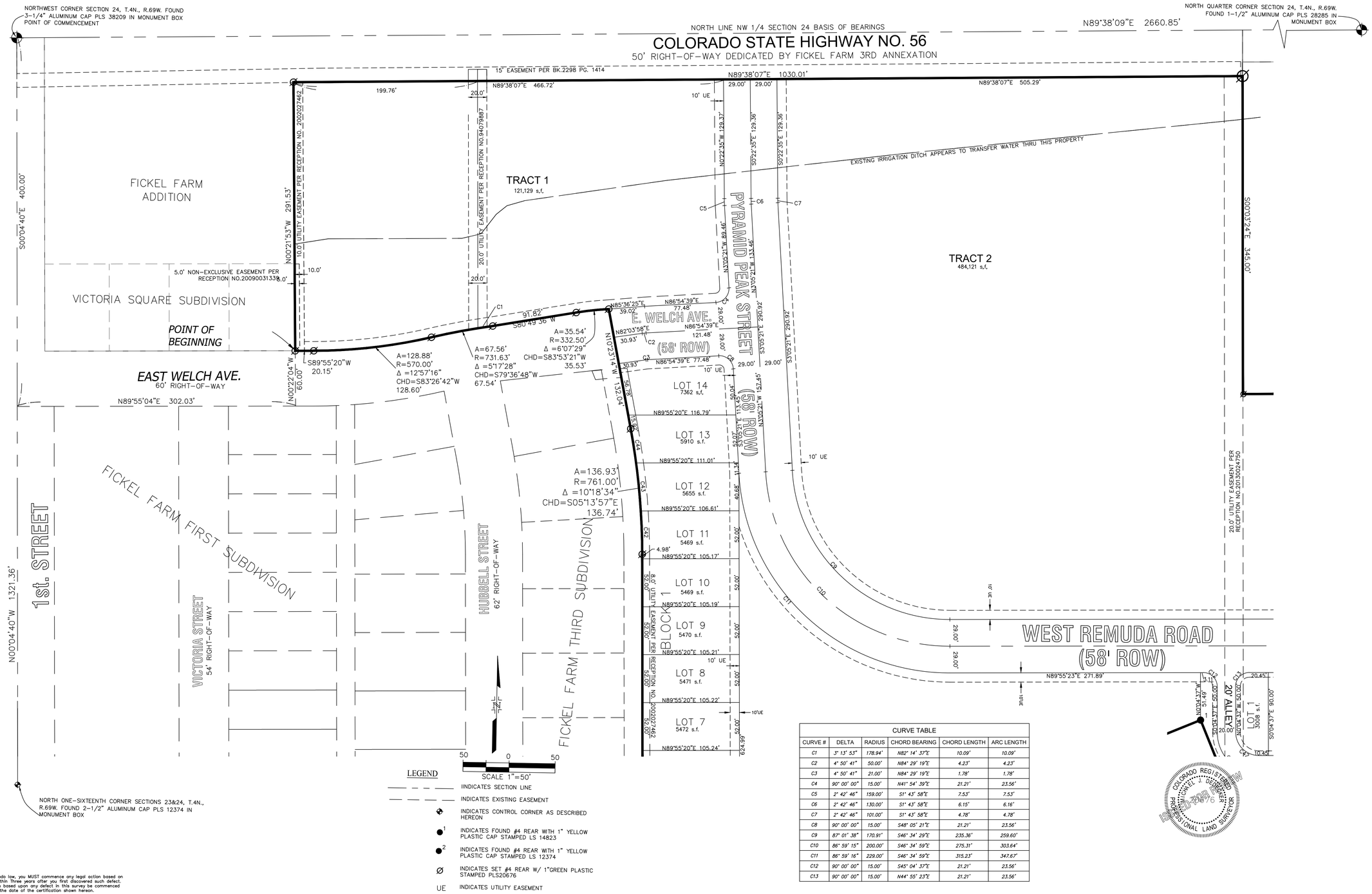
CLIENT AND PROJECT: BERTHOUD HOMES LLC
FICKEL FARM PUD FOURTH FILING

DESCRIPTION: PART OF THE NW 1/4 SECTION 24, T.4N., R.69W. TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

DESIGNED:
DRAWN: MJD
CHECKED:
APPROVED:
DATE: MAY 10, 2020
SCALE: 1"=100'
PROJECT NO. 2020-318
SHEET 1 of 3

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH,
RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO


NORTHWEST CORNER SECTION 24, T.4N., R.69W. FOUND 3-1/4" ALUMINUM CAP PLS 38209 IN MONUMENT BOX POINT OF COMMENCEMENT
NORTH LINE NW 1/4 SECTION 24 BASIS OF BEARINGS
N89°38'09"E 2660.85'
NORTH QUARTER CORNER SECTION 24, T.4N., R.69W. FOUND 1-1/2" ALUMINUM CAP PLS 28285 IN MONUMENT BOX
COLORADO STATE HIGHWAY NO. 56
50' RIGHT-OF-WAY DEDICATED BY FICKEL FARM 3RD ANNEXATION
15' EASEMENT PER BK.2298 PG. 1414
N89°38'07"E 1030.01'
N89°38'07"E 466.72'
N89°38'07"E 505.29'
199.76'
20.0'
29.00'
29.00'
10' UE
EXISTING IRRIGATION DITCH APPEARS TO TRANSFER WATER THRU THIS PROPERTY
FICKEL FARM ADDITION
TRACT 1
121,129 s.f.
TRACT 2
484,121 s.f.
S00°04'40"E 400.00'
S00°03'24"E 345.00'
N00°21'53"W 291.53'
10.01' UTILITY EASEMENT PER RECEPTION NO. 2002027462
20.0' UTILITY EASEMENT PER RECEPTION NO.9407986?
5.0' NON-EXCLUSIVE EASEMENT PER RECEPTION NO.2009003133
10.0'
5.0'
VICTORIA SQUARE SUBDIVISION
POINT OF BEGINNING
EAST WELCH AVE.
60' RIGHT-OF-WAY
S89°55'20"W 20.15'
N00°22'04"W 60.00'
N89°55'04"E 302.03'
A=128.88'
R=570.00'
Δ =12°57'16"
CHD=S83°26'42"W
128.60'
A=67.56'
R=731.63'
Δ =5°17'28"
CHD=S79°36'48"W
67.54'
91.82'
S80°49'35"W
N85°36'25"E 39.02'
N86°54'39"E 77.48'
A=35.54'
R=332.50'
Δ =6°07'29"
CHD=S83°53'21"W
35.53'
N82°03'58"E 30.93'
N86°54'39"E 121.48'
N86°54'39"E 77.48'
30.93'
10' UE
29.00'
29.00'
N10°23'14"W 132.04'
56.78'
15.53'
PYRAMID PEAK STREET
E. WELCH AVE.
(58' ROW)
LOT 14
7362 s.f.
N89°55'20"E 116.79'
LOT 13
5910 s.f.
N89°55'20"E 111.01'
LOT 12
5655 s.f.
N89°55'20"E 106.61'
LOT 11
5469 s.f.
N89°55'20"E 105.17'
LOT 10
5469 s.f.
N89°55'20"E 105.19'
LOT 9
5470 s.f.
N89°55'20"E 105.21'
LOT 8
5471 s.f.
N89°55'20"E 105.22'
LOT 7
5472 s.f.
N89°55'20"E 105.24'
BLOCK 1
52.00'
52.00'
52.00'
52.00'
52.00'
52.00'
52.00'
624.99'
10' UE
8.0' UTILITY EASEMENT PER RECEPTION NO.2002027462
A=136.93'
R=761.00'
Δ =10°18'34"
CHD=S05°13'57"E
136.74'
4.98'
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
N00°22'35"W 129.37'
S00°22'35"E 129.36'
N00°22'35"W 89.47'
N00°22'35"W 132.58'
S00°22'35"E 240.22'
S00°22'35"E 240.32'
S05°05'21"E 113.45'
S00°04'40"E 157.45'
N00°04'40"W 157.45'
S00°04'40"E 157.45'
N00°04'40"W 157.45'
S00°04'40"E 157.45'
N00°04'40"W 157

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH,
RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR
MICHAEL J. DEDECKER
20676

N89°38'07"E 806.12'

E. WELCH AVE.

N85°36'25"E 39.02'
N86°54'39"E 77.48'
N82°03'58"E 30.93'
N86°54'39"E 121.48'
A=35.54'
R=332.50'
Δ=6°07'29"
CHD=S3°53'21"W
35.53'
N02°13'14"W 132.04'
N86°54'39"E 77.48'
10' UE
29.00'
29.00'
PYRAMID PEAK STREET (58' ROW)
S35°59'55"E 260.27'
S35°59'55"E 260.27'
N35°59'55"W 152.45'
S35°59'55"E 113.45'
10' UE
A=136.93'
R=761.00'
Δ=10°18'34"
CHD=S05°13'57"E
136.74'
FICKEL FARM THIRD SUBDIVISION
N89°55'20"E 116.79'
N89°55'20"E 111.01'
N89°55'20"E 106.61'
N89°55'20"E 105.17'
N89°55'20"E 105.19'
N89°55'20"E 105.21'
N89°55'20"E 105.22'
N89°55'20"E 105.24'
N89°55'20"E 105.26'
N89°55'20"E 105.28'
N89°55'20"E 105.29'
N89°55'20"E 105.31'
N89°55'20"E 105.33'
LOT 14 7362 s.f.
LOT 13 5910 s.f.
LOT 12 5655 s.f.
LOT 11 5469 s.f.
LOT 10 5469 s.f.
LOT 9 5470 s.f.
LOT 8 5471 s.f.
LOT 7 5472 s.f.
LOT 6 5473 s.f.
LOT 5 5474 s.f.
LOT 4 5475 s.f.
LOT 3 5476 s.f.
LOT 2 5477 s.f.
LOT 1 6735 s.f.
BLOCK 1
8.0' UTILITY EASEMENT PER RECEPTION NO. 20020074262
10' UE
N00°04'40"W 537.05'
S00°04'40"E 624.99'
37.84'
67.16'
21.26'
S89°30'58"W 88.41'
S89°30'39"W 37.84'
N00°29'21"W 1.00'
A=133.33'
R=135.00'
Δ=56°35'06"
CHD=N61°13'25"E
127.97'
S67°59'56"W 196.29'
A=116.29'
R=190.00'
Δ=35°04'04"
CHD=N50°27'54"E
114.48'
S32°53'52"W 177.54'
TRACT 3
119,306 s.f.
PIONEER PARK
N22°00'04"W 212.67'
20.0' UTILITY EASEMENT PER RECEPTION NO. 20130024750
TRACT 2
484,121 s.f.
N00°20'07"W 248.25'
10' UE
N89°55'23"E 1124.22'
WEST REMUDA ROAD (58' ROW)
N89°55'23"E 953.90'
N89°55'23"E 271.89'
20' ALLEY
N00°04'37"W 51.49'
5' UE
N89°55'23"E 160.90'
S89°55'23"W 143.90'
BLOCK 2
LOT 1 3008 s.f.
LOT 2 2700 s.f.
LOT 3 2700 s.f.
LOT 4 2700 s.f.
LOT 5 2700 s.f.
LOT 6 3008 s.f.
28' ALLEY
S89°55'23"W 366.00'
N89°55'23"E 359.00'
BLOCK 3
LOT 1 2700 s.f.
LOT 2 2700 s.f.
LOT 3 2700 s.f.
LOT 4 2700 s.f.
LOT 5 2700 s.f.
LOT 6 2700 s.f.
LOT 7 2700 s.f.
LOT 8 2700 s.f.
LOT 9 2700 s.f.
LOT 10 2700 s.f.
LOT 11 2700 s.f.
LOT 12 2700 s.f.
OUTLOT C 2684 s.f.
N89°55'23"E 170.30'
S89°55'23"W 84.00'
OUTLOT E 1070 s.f.
S89°55'23"W 116.03'
LOT 1 6758 ft²
S89°55'23"W 120.00'
LOT 2 6290 s.f.
LOT 3 6290 s.f.
LOT 4 6290 s.f.
LOT 5 6290 s.f.
LOT 6 6290 s.f.
LOT 7 6290 s.f.
LOT 8 6290 s.f.
LOT 9 6298 s.f.
BLOCK 8
S00°04'37"E 446.65'
N00°04'37"W 452.65'
ALLEY
S00°04'37"E 220.00'
N00°04'37"W 641.70'
EAST 4TH STREET (58' ROW)
S00°20'07"E 921.72'
RECEPTION NUMBER 940904786
OUTLOT F 18,350 s.f.
OUTLOT B 25,000 s.f.
BLOCK 4
BLOCK 5
BLOCK 6
BLOCK 7
26' ALLEY
A=123.92'
R=190.00'
Δ=37°22'09"
CHD=S03°19'00"E
121.74'
S89°55'23"W 522.57'
28' ALLEY
BLOCK 9
BLOCK 10
OUTLOT A 20,380 s.f.
N89°55'23"E 240.00'
N89°55'23"E 545.20'
N13°22'05"E 108.64'
N13°22'05"E 29.87'
A=34.98'
R=130.00'
Δ=15°24'56"
CHD=S07°39'37"W
34.87'
N00°02'51"W 55.72'
41.66'
BLOCK 11
LOT 1 6854 S.F.
LOT 2 5930 s.f.
LOT 3 5909 s.f.
LOT 4 5888 s.f.
LOT 5 5866 s.f.
LOT 6 5845 s.f.
LOT 7 5824 s.f.
LOT 8 5802 s.f.
LOT 9 5781 s.f.
LOT 10 5760 s.f.
OUTLOT A
S00°04'37"E 217.91'
N00°04'37"W 105.14'
10' ALLEY
10.0' UTILITY EASEMENT PER RECEPTION NO. 20130024750
S89°30'39"W 635.89'
EXISTING 10' ALLEY
S89°30'39"W 140.84'
EAST 2ND STREET
54' RIGHT-OF-WAY
62' RIGHT-OF-WAY
FOUND 1" BRASS DISK AND CONCRETE NAIL
C-E=NW 1/64 CORNER S24 FOUND 3-1/4" ALUMINUM CAP ON #6 REAR BY PLS 34174
EAST 4TH STREET
54' RIGHT-OF-WAY
BLOCK 10 BERTHOUD HEIGHTS EAST SUBDIVISION AKA MARY'S FARM

CURVE TABLE					
CURVE #	DELTA	RADIUS	CHORD BEARING	CHORD LENGTH	ARC LENGTH
C14	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C15	90° 00' 00"	15.00'	S44° 55' 23"W	21.21'	23.56'
C16	90° 00' 00"	15.00'	N45° 04' 37"W	21.21'	23.56'
C17	90° 00' 00"	15.00'	N44° 55' 23"E	21.21'	23.56'
C18	31° 35' 17"	21.00'	N15° 43' 01"E	11.43'	11.58'
C19	58° 24' 43"	21.00'	N60° 43' 01"E	20.49'	21.41'
C20	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C21	70° 31' 44"	15.00'	S54° 48' 45"E	17.32'	18.46'
C22	19° 28' 16"	15.00'	S9° 48' 45"E	5.07'	5.10'
C24	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C25	90° 00' 00"	15.00'	N44° 55' 23"E	21.21'	23.56'
C27	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C28	90° 00' 00"	15.00'	S44° 55' 23"W	21.21'	23.56'
C29	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C30	90° 00' 00"	15.00'	N44° 55' 23"E	21.21'	23.56'
C31	90° 00' 00"	22.00'	N44° 55' 23"E	31.11'	34.56'
C32	90° 00' 00"	22.00'	S45° 04' 37"E	31.11'	34.56'
C33	90° 00' 00"	22.00'	S45° 04' 37"E	31.11'	34.56'
C34	90° 00' 00"	22.00'	N44° 55' 23"E	31.11'	34.56'
C35	90° 00' 00"	22.00'	S45° 04' 37"E	31.11'	34.56'
C36	90° 00' 00"	22.00'	S44° 55' 23"W	31.11'	34.56'
C37	90° 08' 18"	21.98'	S44° 53' 42"W	31.13'	34.59'
C38	90° 00' 00"	22.00'	N45° 04' 37"W	31.11'	34.56'
C39	90° 00' 00"	22.00'	S44° 55' 23"W	31.11'	34.56'
C40	90° 00' 00"	22.00'	N45° 04' 37"W	31.11'	34.56'
C41	90° 00' 00"	45.00'	S45° 04' 37"E	63.64'	70.69'
C42	90° 00' 00"	25.00'	N45° 04' 37"W	35.36'	39.27'
C43	12° 54' 08"	190.00'	N8° 55' 01"E	42.69'	42.79'
C44	24° 28' 01"	190.00'	N9° 46' 03"W	80.52'	81.14'

50 0 50
SCALE 1"=50'

LEGEND

- IINDICATES SECTION LINE
- INDICATES EXISTING EASEMENT
- INDICATES CONTROL CORNER AS DESCRIBED HEREON
- ●1 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 14823
- ●2 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 12374
- ●3 INDICATES FOUND 1" BRASS DISK WITH CONCRETE NAIL
- Ø INDICATES SET #4 REAR W/ 1"GREEN PLASTIC STAMPED PLS20676
- UE INDICATES UTILITY EASEMENT

NOTICE: According to Colorado law, you MUST commence any legal action based on any defect in this survey within Three years after you first discovered such defect. In no event, may any action based upon any defect in this survey be commenced more than TEN years from the date of the certification shown hereon.

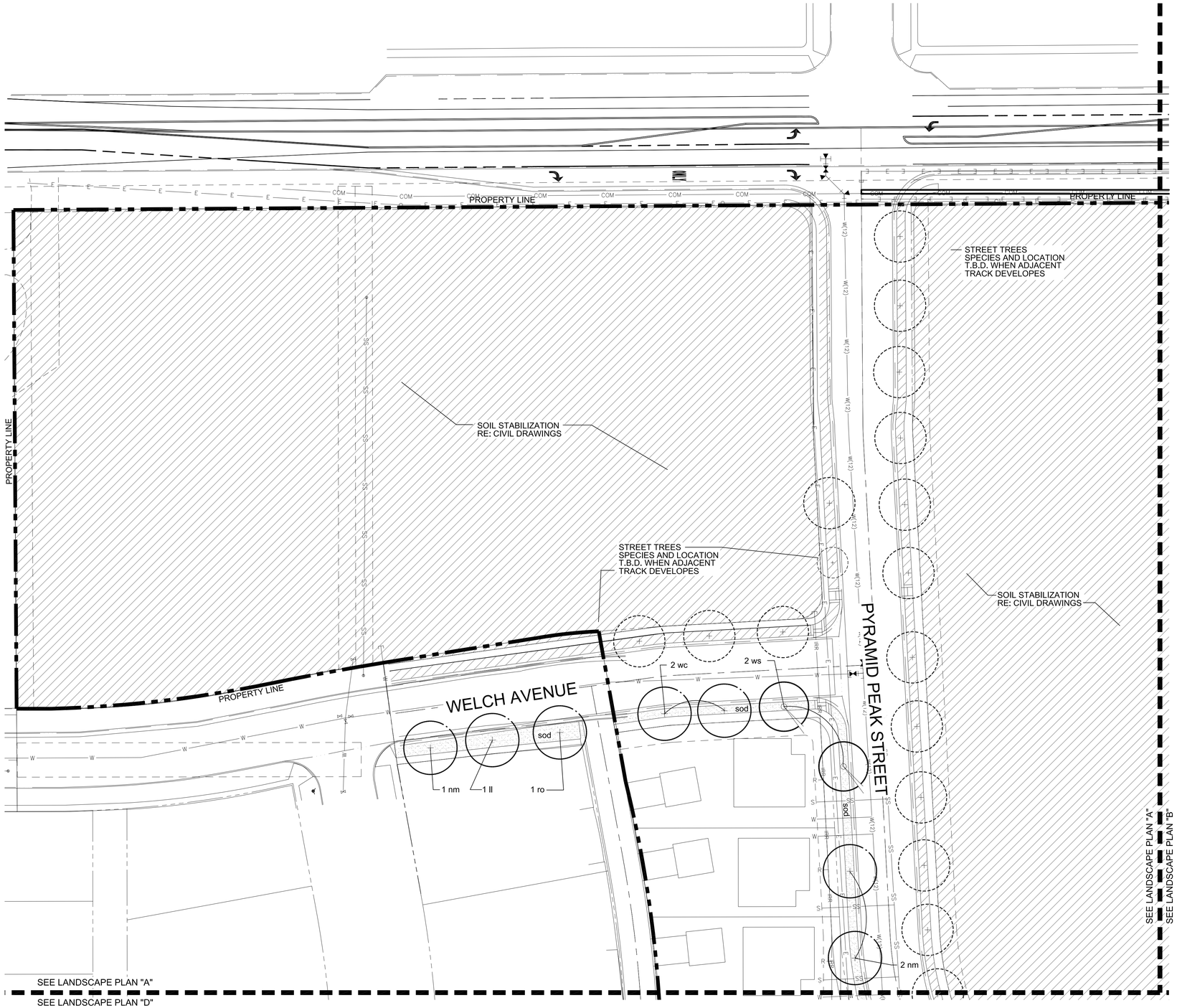
DATE	RECORD OF ISSUE	BY	CK.
03/23/2020	INITIAL ISSUE	MJD	
06/23/2020	CORRECTIONS		

DEDECKER
LAND SURVEYING
4301 FAWN TRAIL
LOVELAND, COLORADO 80537
C (970) 217-2331 H (970) 663-2013

CLIENT AND PROJECT:
BERTHOUD HOMES LLC
FICKEL FARM PUD FOURTH FILING

DESCRIPTION:
PART OF THE NW 1/4 SECTION 24, T 4N., R 69W.
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

DESIGNED:
DRAWN: MJD
CHECKED:
APPROVED:
DATE: MAY 10, 2020
SCALE: 1"=50'
PROJECT NO. 2020-318
SHEET 3 of 3

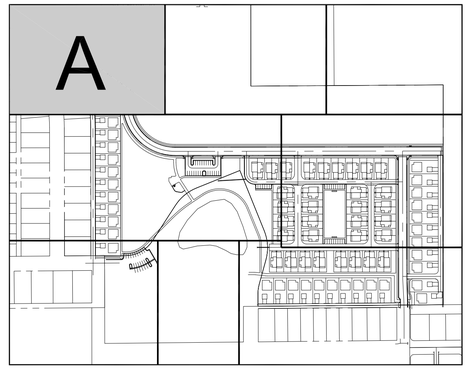


PRELIMINARY LANDSCAPE PLAN "A"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

- FUTURE STREET TREE
- DECIDUOUS TREES
- ORNAMENTAL TREES
- EVERGREEN TREE
- SHRUBS
  ORNAMENTAL GRASSES
- LOCALLY AVAILABLE FESCUE SOD MIX
- NON - IRRIGATED NATIVE GRASS MIX
  MIX RATIO:
  23% BLUE GRAMA
  10% BUFFALO GRASS
  20% GREEN NEEDLEGRASS
  20% SIDE OATS GRAMA
  25 WESTERN WHEATGRASS
  2% SAND DROPSEED
  NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE
- NON-HATCHED PLANTING AREAS — HARDWOOD MULCH
- RE: CIVIL DRAWINGS
- FESCUE SEED MIX
- 4" - 6" COBBLE
- STEEL EDGING WITH PROTECTIVE CAP

STACK lot
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'A'

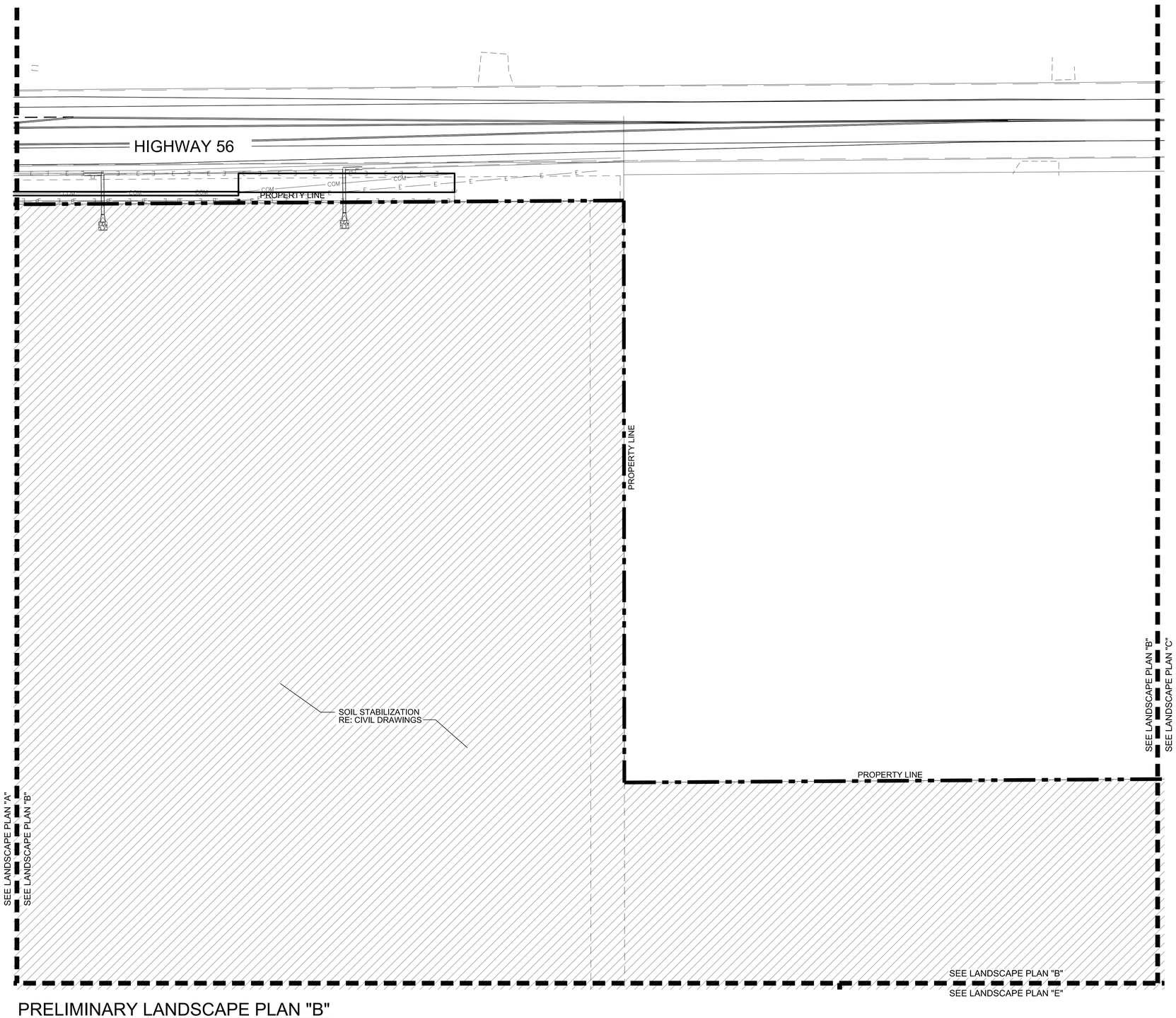
DATE:	REVISION:
	-

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.1

1 of 12

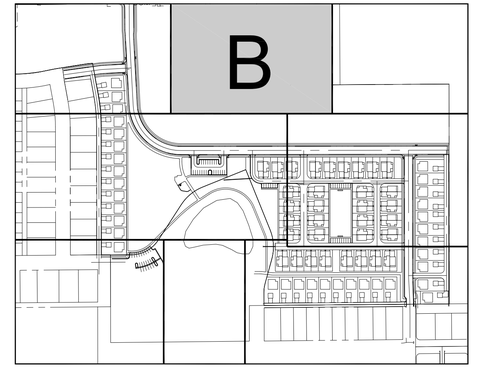


PRELIMINARY LANDSCAPE PLAN "B"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

FUTURE STREET TREE

DECIDUOUS TREES

ORNAMENTAL TREES

EVERGREEN TREE

SHRUBS
ORNAMENTAL GRASSES

LOCALLY AVAILABLE FESCUE SOD MIX

NON - IRRIGATED NATIVE GRASS MIX
MIX RATIO:
23% BLUE GRAMA
10% BUFFALO GRASS
20% GREEN NEEDLEGRASS
20% SIDE OATS GRAMA
25 WESTERN WHEATGRASS
2% SAND DROPSEED

NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE

NON-HATCHED PLANTING AREAS
HARDWOOD MULCH

RE: CIVIL DRAWINGS

FESCUE SEED MIX

4" - 6" COBBLE

STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'B'

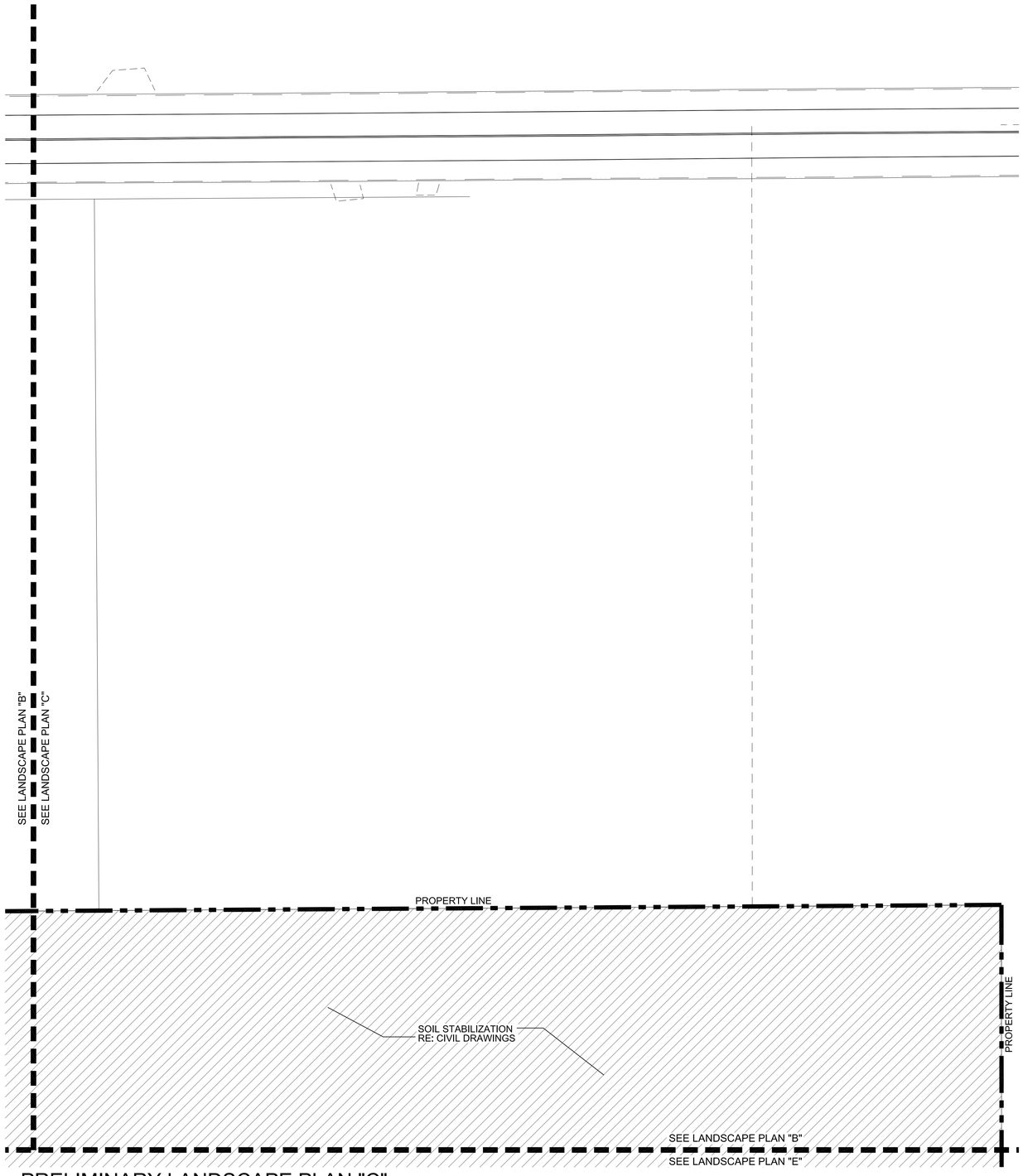
REVISION:	DATE:
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.2

2 of 12

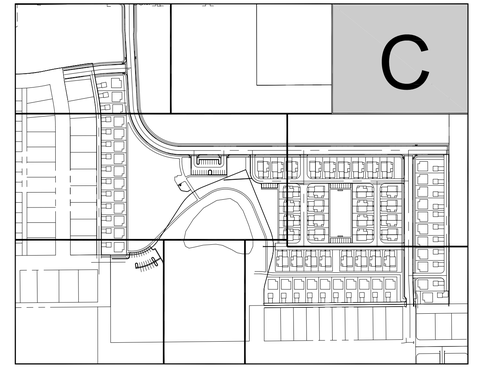


PRELIMINARY LANDSCAPE PLAN "C"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

FUTURE STREET TREE

DECIDUOUS TREES

ORNAMENTAL TREES

EVERGREEN TREE

SHRUBS
ORNAMENTAL GRASSES

LOCALLY AVAILABLE FESCUE SOD MIX

NON - IRRIGATED NATIVE GRASS MIX
MIX RATIO:
23% BLUE GRAMA
10% BUFFALO GRASS
20% GREEN NEEDLEGRASS
20% SIDE OATS GRAMA
25 WESTERN WHEATGRASS
2% SAND DROPSEED

NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE

NON-HATCHED PLANTING AREAS — HARDWOOD MULCH

RE: CIVIL DRAWINGS

FESCUE SEED MIX

4" - 6" COBBLE

STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'C'

REVISION:

DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.3

3 of 12

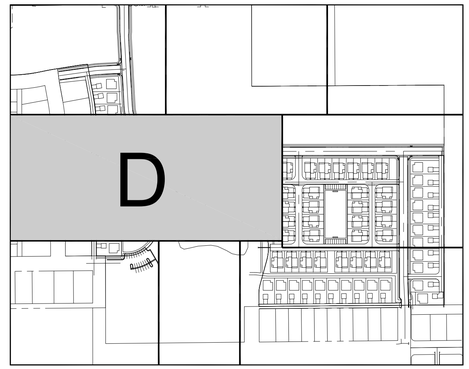
SEE LANDSCAPE PLAN "A"
SEE LANDSCAPE PLAN "D"

1 ws
STREET TREES
SPECIES AND LOCATION
T.B.D. WHEN ADJACENT
TRACK DEVELOPES
SOIL STABILIZATION
RE: CIVIL DRAWINGS
2 ws
3 ll
1 ro
10' CONC.
SIDEWALK
WEST REMUDA ROAD
6' CONC. SIDEWALK
PICKLEBALL COURT
TO BE INSTALLED BY
TOWN OF BERTHOUD
2 XX
HARDWOOD MULCH
3 sp
14 bm
14 kf
1 nm
2 pe
3 ls
6 rs
4 ac
2 ro
4 ac
2 bm
1 ll
PARKING LOT
FESCUE SEED
3 aw
1 ll
2 bm
3 pe
1 ro
1 sc
1 wc
1 ob
1 wh
SEE LANDSCAPE PLAN "D"
SEE LANDSCAPE PLAN "E"
12' X 14' SHELTER W/
PICNIC TABLE
(3) "U" SHAPED BIKE RACKS
TREE BED W/
HARDWOOD MULCH
COMMERCIAL GRADE
PLAYGROUND
PLAYGROUND CLEAR ZONE
PROPERTY LINE
10' CONC.
SIDEWALK
2 kc
2 ob
FESCUE SEED
1 ob
6' CONCRETE TRAIL
PIONEER PARK
NATIVE SEED
3 ap
2 kc
3 ap
1 kc
PROPERTY LINE
SEE LANDSCAPE PLAN "D"
SEE LANDSCAPE PLAN "F"

PRELIMINARY LANDSCAPE PLAN "D"

NORTH

0' 15' 30' 60' 90'
SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

- FUTURE STREET TREE
- DECIDUOUS TREES
- ORNAMENTAL TREES
- EVERGREEN TREE
- SHRUBS
  ORNAMENTAL GRASSES
- LOCALLY AVAILABLE FESCUE SOD MIX
- NON - IRRIGATED NATIVE GRASS MIX
  MIX RATIO:
  23% BLUE GRAMA
  10% BUFFALO GRASS
  20% GREEN NEEDLEGRASS
  20% SIDE OATS GRAMA
  25 WESTERN WHEATGRASS
  2% SAND DROPSEED
  NOTE: EROSION CONTROL BLANKET
  TO BE INSTALLED WHERE APPLICABLE
- NON-HATCHED PLANTING AREAS — HARDWOOD MULCH
- RE: CIVIL DRAWINGS
- FESCUE SEED MIX
- 4" - 6" COBBLE
- STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'D'

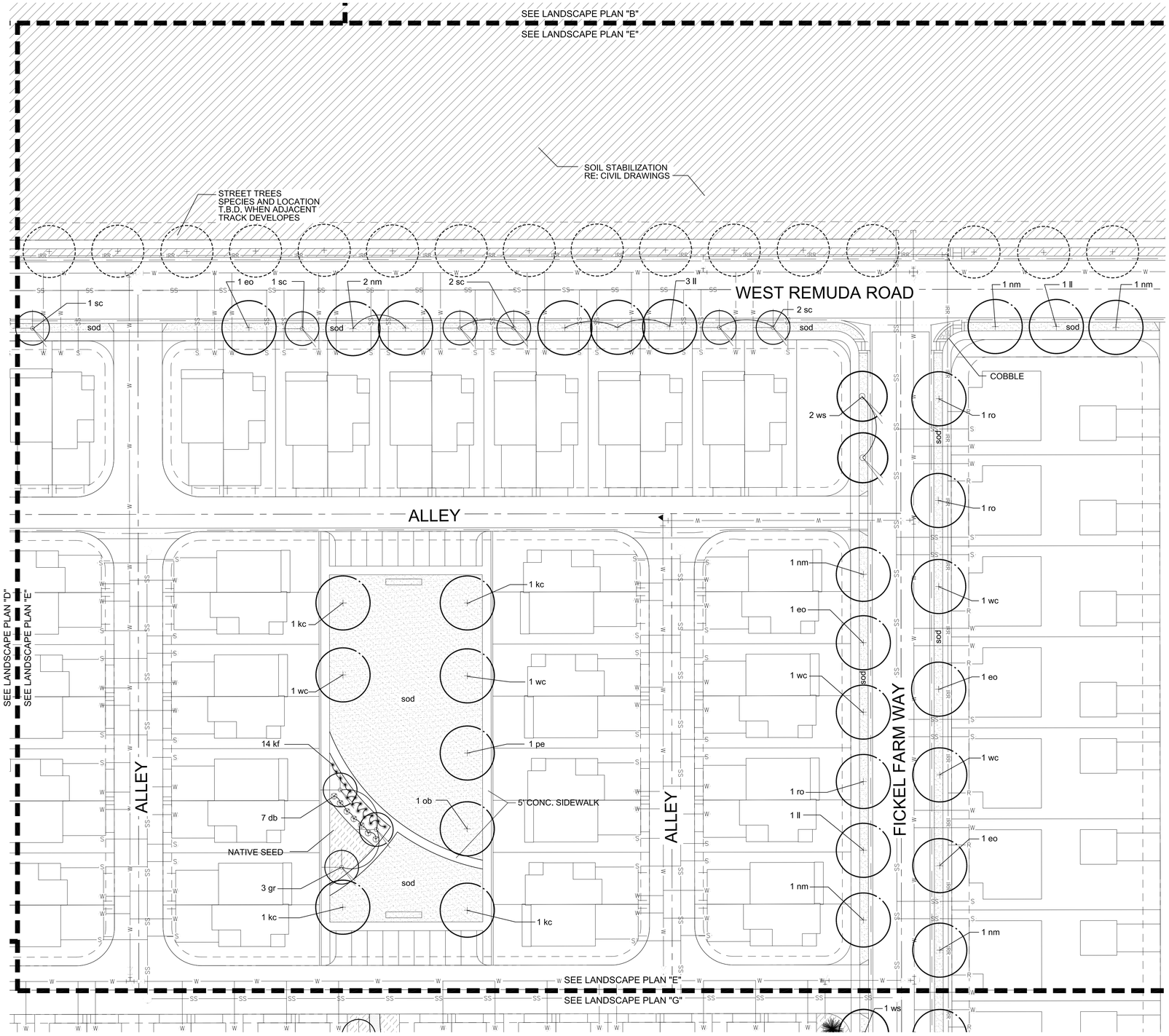
REVISION:	DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.4

4 of 12

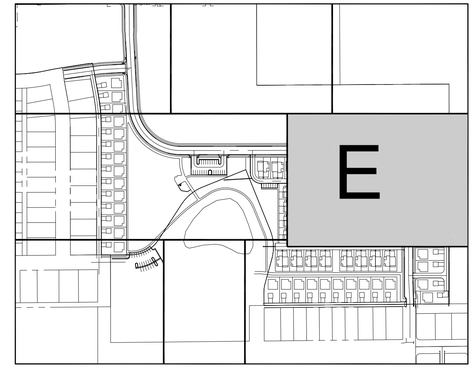


PRELIMINARY LANDSCAPE PLAN "E"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

FUTURE STREET TREE

DECIDUOUS TREES

ORNAMENTAL TREES

EVERGREEN TREE

SHRUBS
ORNAMENTAL GRASSES

LOCALLY AVAILABLE FESCUE SOD MIX

NON - IRRIGATED NATIVE GRASS MIX
MIX RATIO:
23% BLUE GRAMA
10% BUFFALO GRASS
20% GREEN NEEDLEGRASS
20% SIDE OATS GRAMA
25 WESTERN WHEATGRASS
2% SAND DROPSEED

NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE

NON-HATCHED PLANTING AREAS — HARDWOOD MULCH

RE: CIVIL DRAWINGS

FESCUE SEED MIX

4" - 6" COBBLE

STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'E'

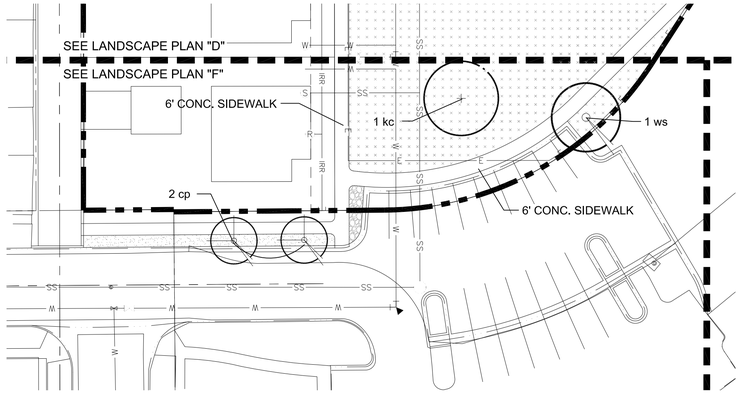
REVISION:	DATE:

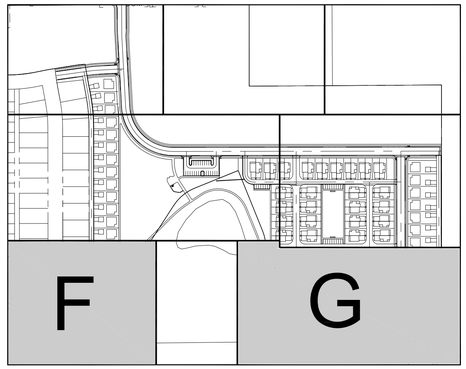
Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.5

5 of 12





KEYMAP

SCALE 1" = 300' - 0"

PROPOSED PLANT MATERIAL SCHEDULE

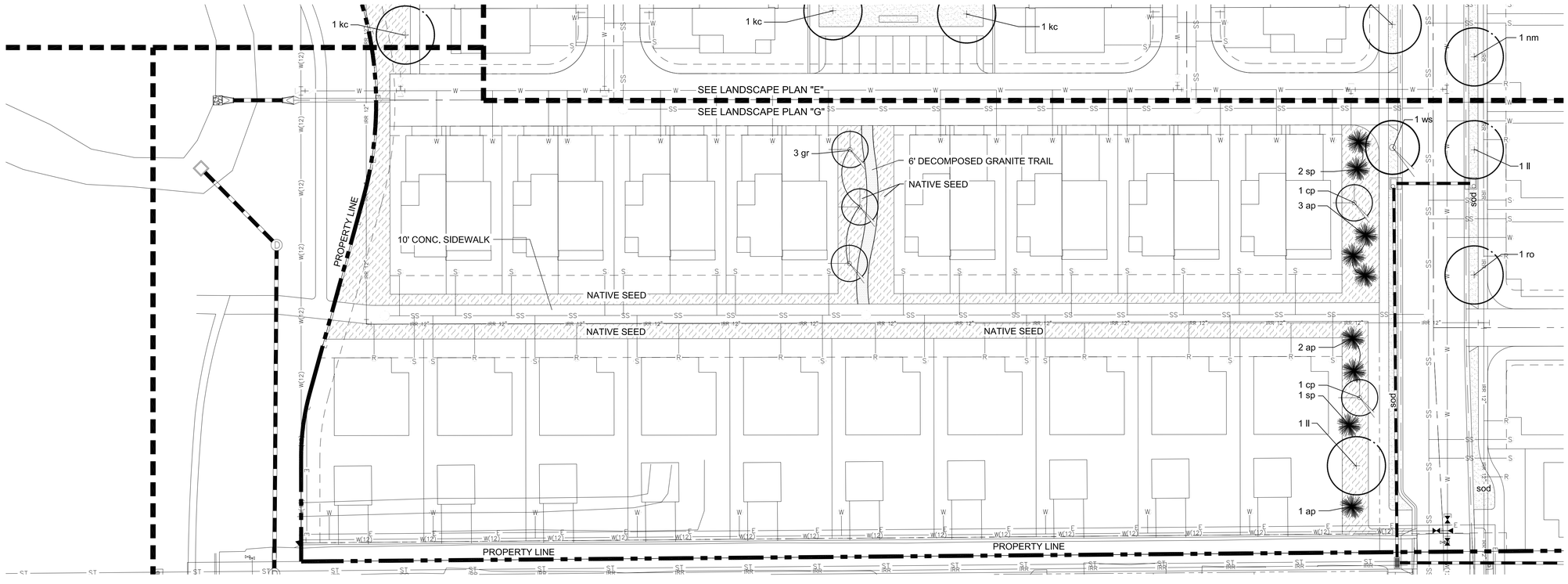
QTY.	SYMBOL	COMMON NAME	BOTANICAL NAME	SIZE	CONDITION	REMARKS
DECIDUOUS TREES						
11	nm	NORWAY MAPLE	ACER PLATANOIDES	2" CAL.	B&B	SINGLE STEM
14	ll	LITTLE LEAF LINDEN	TILIA CORDOTA	2" CAL.	B&B	SINGLE STEM
9	ro	RED OAK	QUERCUS RUBRA	2" CAL.	B&B	SINGLE STEM
10	kc	KENTUCKY COFFEE TREE	GYMNOCLADUS DIOICUS 'EXPRESSO'	2" CAL.	B&B	SINGLE STEM
6	pe	PROSPECTOR ELM	ULMUS WILSONIANA 'PROSPECTOR'	2" CAL.	B&B	SINGLE STEM
5	ob	OHIO BUCKEYE	AESCULUS GLABRA	2" CAL.	B&B	SINGLE STEM
7	wc	WESTERN CATALPA	CATALPA SPECIOSA	2" CAL.	B&B	SINGLE STEM
4	eo	ENGLISH OAK	QUERCUS ROBUR	2" CAL.	B&B	SINGLE STEM
13	ws	WHITE SWAMP OAK	QUERCU ALBA	2" CAL.	B&B	SINGLE STEM
ORNAMENTAL TREES						
7	sc	SPRING SNOW CRABAPPLE	MALUS x 'SPRINGSNOW'	2" CAL.	B&B	SINGLE STEM
4	cp	CHANTICLEER PEAR	PYRUS CALLERAYANA 'CHANTICLEER'	2" CAL.	B&B	SINGLE STEM
1	wh	WASHINGTON HAWTHORN	CRATAEGUS PHAENOPYRUM	2" CAL.	B&B	SINGLE STEM
6	gr	GOLDEN RAINTREE	KOELREUTERIA PANICULATA	2" CAL.	B&B	SINGLE STEM
EVERGREEN TREES						
12	ap	AUSTRIAN PINE	PINUS NIGRA	6' HT.	B&B	
9	sp	SOUTHWESTERN WHITE PINE	PINUS STROBIFORMIS	6' HT.	B&B	
SHRUBS						
8	ac	ALPINE CURRANT	RIBES ALPINUM	5 GAL.	CONT.	
7	db	DWARF BURNING BUSH	EUONYMUS ALATUS 'COMPACTUS'	5 GAL.	CONT.	
6	rs	RUSSIAN SAGE	PEROVSKIA ARTIPILCIFOLISA	5 GAL.	CONT.	
3	ls	LITTLE PRINCESS SPIREA	SPIREA JAPONICA 'LITTLE PRINCESS'	5 GAL.	CONT.	
3	aw	ANTHONY WATERER SPIREA	SPIREA JAPONICA 'ANTHONY WATERER'	5 GAL.	CONT.	
20	bm	BLUE MIST SPIREA	CARYOPTERIS X CLANDONENSIS	5 GAL.	CONT.	
ORNAMENTAL GRASSES						
28	kf	KARL FOERSTER FEATHER REED	CALAMAGROSIC ACUTI ' KARL FORESTER'	1 GAL.	CONT.	

PRELIMINARY LANDSCAPE PLAN "F"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



PRELIMINARY LANDSCAPE PLAN "G"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Final Landscape Plan 'F and G'

REVISION:								
DATE:								

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.6

6 of 12

GENERAL PLANTING NOTES:

1. PRIOR TO BEGINNING ANY WORK ON THE SITE THE LANDSCAPE CONTRACTOR SHALL CONTACT THE OFFICE OF THE GENERAL CONTRACTOR AND LANDSCAPE ARCHITECT FOR SPECIFIC INSTRUCTIONS RELEVANT TO THE SEQUENCING OF WORK.
2. LANDSCAPE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS AND SERVICE NECESSARY TO FURNISH AND INSTALL PLANTINGS AND MATERIALS AS SPECIFIED HEREIN AND AS SHOWN ON PLANS.
3. NO MATERIAL SUBSTITUTIONS SHALL BE MADE WITHOUT THE LANDSCAPE ARCHITECTS APPROVAL IN WRITING. ALTERNATE MATERIALS OF SIMILAR SIZE AND CHARACTER MAY BE CONSIDERED IF SPECIFIED PLANT MATERIALS CANNOT BE OBTAINED.
4. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REVISE PLANT MATERIAL LIST AS DEEMED NECESSARY.
5. ALL PLANT LOCATIONS ARE APPROXIMATE. ADJUST AS NECESSARY TO AVOID CONFLICTS.
6. QUANTITIES OF MATERIALS SHOWN ON THE PLANTING PLAN TAKE PRECEDENCE OVER QUANTITIES SHOWN ON THE PLANT MATERIAL SCHEDULE. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFY ALL QUANTITIES ON THE PLANTING PLAN(S).
7. LANDSCAPE CONTRACTOR SHALL LOCATE ALL UTILITIES BEFORE COMMENCEMENT OF WORK. VERIFY EXACT LOCATION OF ALL UTILITIES BY CONTACTING APPROPRIATE UTILITY COMPANIES. LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR THE REPAIR / REPLACEMENT FOR ANY DAMAGE CAUSED TO UTILITIES.
8. FINISH GRADE SHALL BE ADJUSTED FOR TURF THICKNESS.
9. ALL PLANT MATERIALS SHALL HAVE BACKFILL, CAREFULLY PLACED AROUND BASE AND IDES OF BALL TO TWO-THIRDS ($\frac{2}{3}$) DEPTH OF BALL THEN THOROUGHLY SOAKED WITH WATER TO ALLOW SETTLEMENT. ALL WIRE, BURLAP FASTENERS, TOP ONE-THIRD ($\frac{1}{3}$) OF BURLAP AND LOOSE BURLAP SHALL BE REMOVED AT THIS TIME THE REMAINDER OF HE PIT SHALL THEN BE BACKFILLED, ALLOWING FOR THE DEPTH OF THE MULCH SAUCER AND SETTLEMENT OF BACKFILL. BACKFILL SHALL THEN BE THOROUGHLY WATERED ONCE AGAIN.
10. AFTER PLANTING IS COMPLETED REPAIR INJURIES TO ALL PLANTS AS REQUIRED. LIMIT AMOUNT OF PRUNING TO A MINIMUM NECESSARY TO REMOVE DEAD OR INJURED TWIGS AND BRANCHES. PRUNE IN SUCH A MANNER AS NOT TO CHANGE THE NATURAL GROWING HABIT OR SHAPE OF THE PLANT. MAKE ALL CUTS FLUSH, LEAVING NO STUBS. CENTRAL LEADERS SHALL NOT BE REMOVED. IF THE CENTRAL LEADER OF A PLANT IS DEAD THE PLANT SHALL BE REPLACED.
11. PLANT SPECIFIED GROUND COVERS WITHIN ONE FOOT OF TRUCK OF TREES AND SHRUBS PLANTED WITHIN THE AREA. PLANTING ARRANGEMENTS SHALL BE TRIANGULAR WITH PROPER SPACING BETWEEN PLANTS.
12. COMMERCIAL GRADE $\frac{3}{16}$ INCH BY 4" POWDER COATED STEEL EDGING WITH ROLLED EDGE SHALL BE USED TO SEPARATE ALL TURF AREAS FROM PLANTING BEDS. PLACE EDGING FLUSH WITH GRADE AND STAKE TO GROUND PER MANUFACTURES RECOMMENDATIONS.
13. LANDSCAPE CONTRACTOR TO PROVIDE THE LANDSCAPE CONTRACTOR A SAMPLE OF PROPOSED STEEL EDGING FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
14. USE SHREDDED CEDAR AND ROCK MULCH IN ALL PLANTING BEDS AS INDICATED ON PLAYS. USE SHREDDED CEDAR IN ALL TREE SAUCERS. LANDSCAPE CONTRACTOR SHALL PROVIDE A 1 CUBIC FOOT SAMPLE OF PROPOSED MULCH TO LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL.
15. PLACE FOUR INCHES OF MULCH IN ALL SHRUB BEDS, PLACE FOUR INCHES OF MULCH IN ALL GROUND COVER, PERENNIAL BEDS AND PLACE 4 INCHES OF MULCH AT ALL TREE SAUCERS.
16. PLANTING BEDS RECEIVING MULCH MULCH ARE TO BE FREE OF WEEDS AND GRASS. TREAT BEDS WITH A PRE-EMMERGENT HERBICIDE PRIOR TO PLANTING AND MULCH PLACEMENT. DO NOT APPLY HERBICIDE IN PERENNIAL OR ANNUAL BEDS.
17. LANDSCAPE CONTRACTOR TO REMOVE TREE STAKES AND ALL DEAD WOOD ON TREES AND SHRUBS ONE YEAR AFTER SUBSTANTIAL COMPLETION IS GRANTED ON THE COMPLETE PROJECT.
18. REPORT ANY DISCREPANCIES IN THE PLANTING PLAN TO THE LANDSCAPE ARCHITECT PRIOR TO STARTING CONSTRUCTION.

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

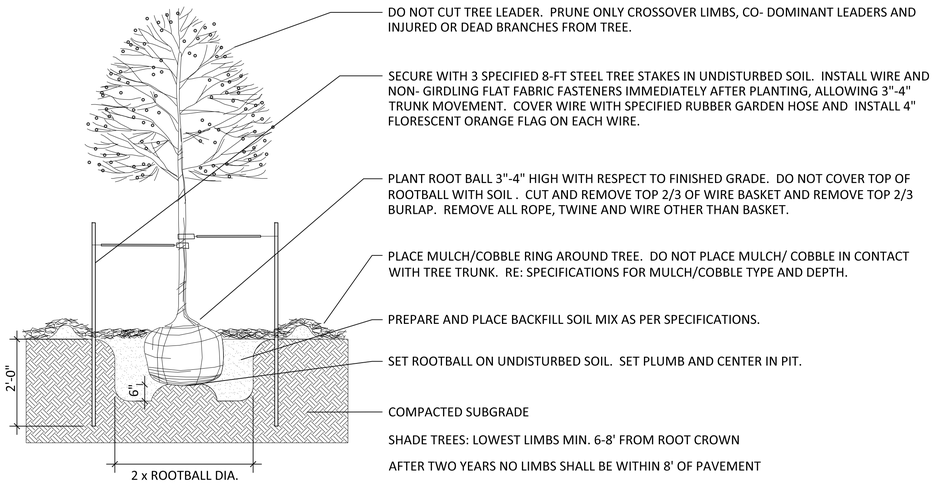
Landscape Notes

REVISION:	DATE:
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

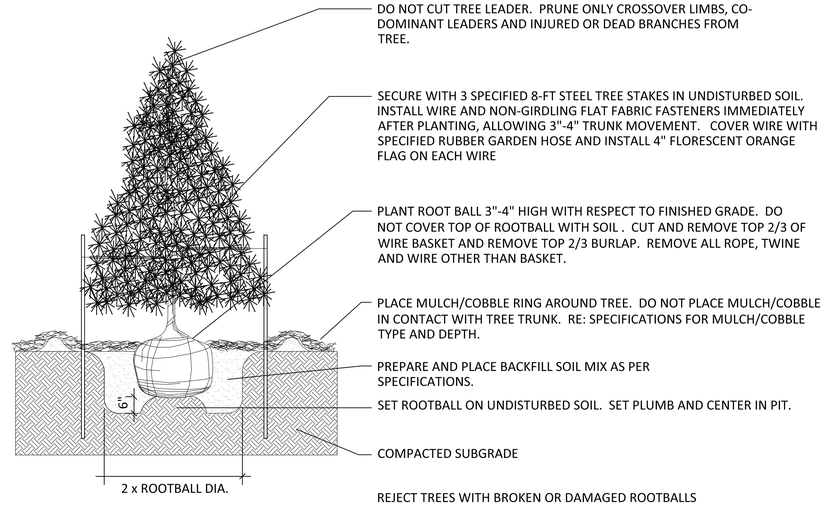
SHEET

L1.7



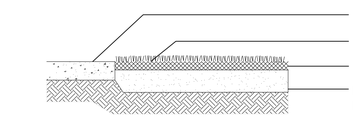
1 DECIDUOUS TREE

NOT TO SCALE

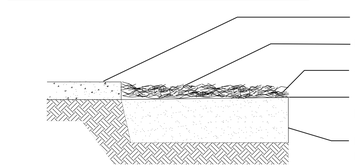


2 EVERGREEN TREE PLANTING

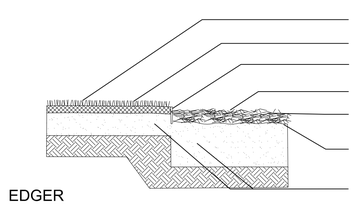
NOT TO SCALE



SOD ADJACENT TO WALKS AND CURBS



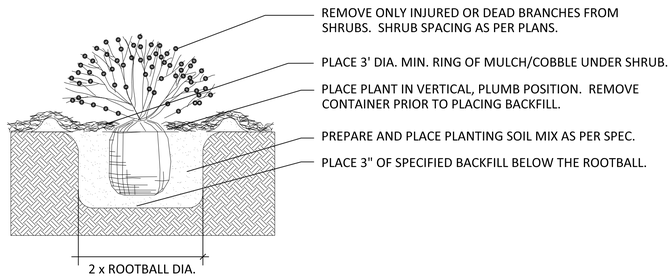
MULCH ADJACENT TO WALKS AND CURBS



EDGER

3 EDGE TREATMENT

NOT TO SCALE



4 SHRUB PLANTING

NOT TO SCALE

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

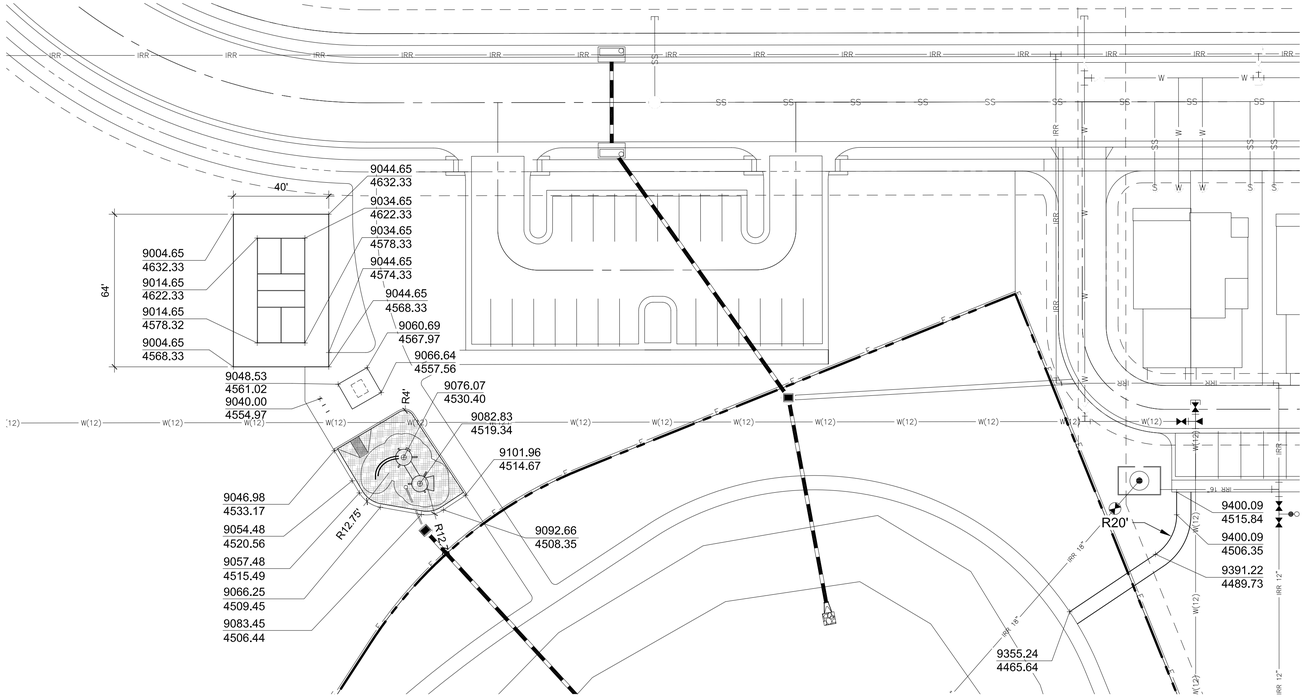
Landscape Details

REVISION:								
DATE:								

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

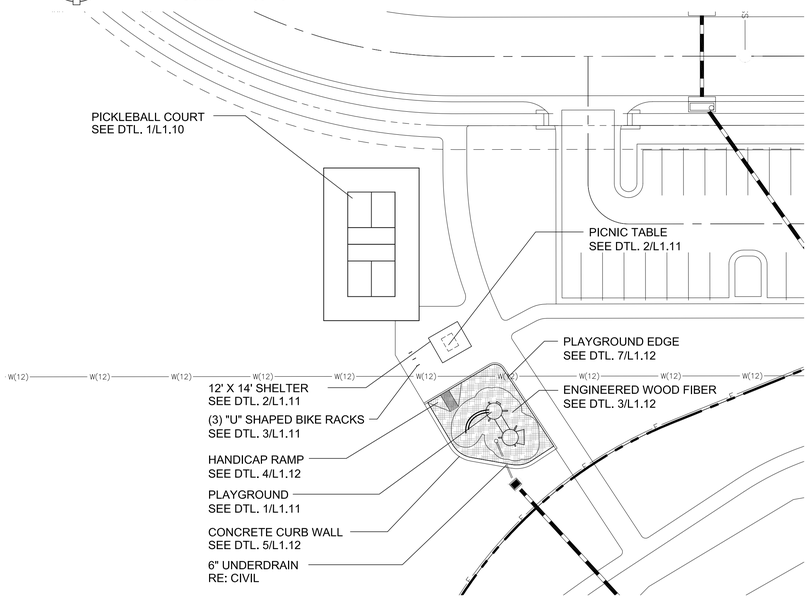
L1.8



'A' - PARK LAYOUT PLAN

0' 15' 30' 60'

SCALE 1" = 30' - 0"

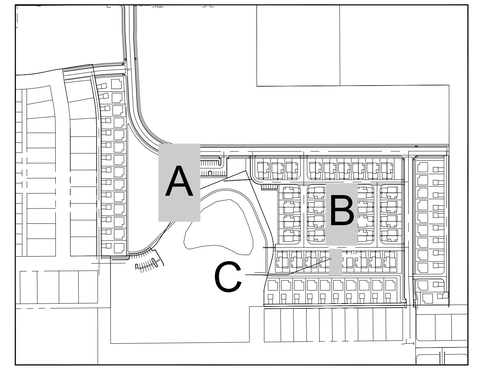


'A' - PARK MATERIAL PLAN

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Layout Plan

REVISION:

DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	1" = 30'

SHEET

L1.9

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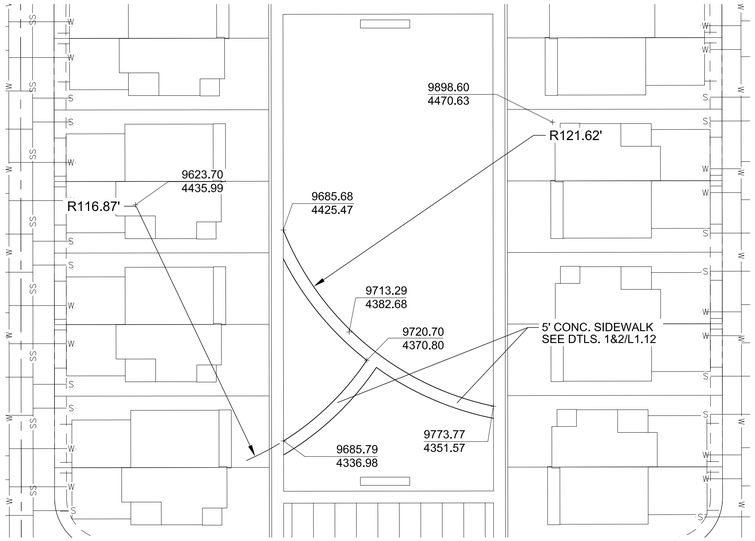
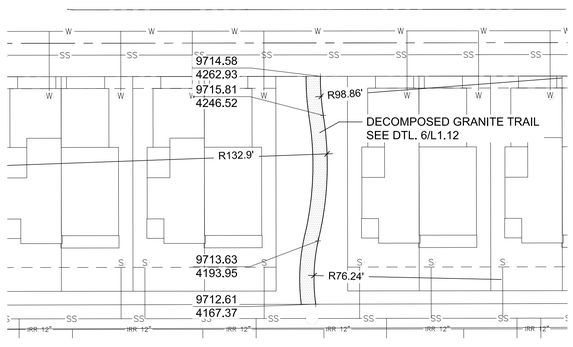


'B' - GREENWAY SIDEWALK LAYOUT PLAN

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"

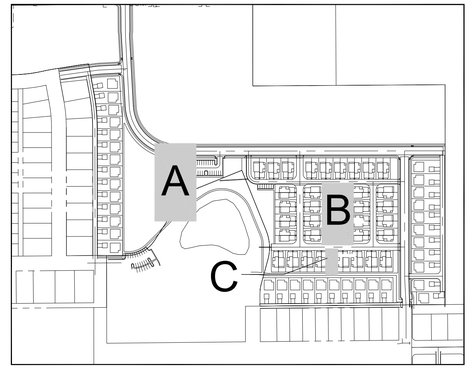


'C' - DECOMPOSED GRANITE TRAIL LAYOUT PLAN

NORTH

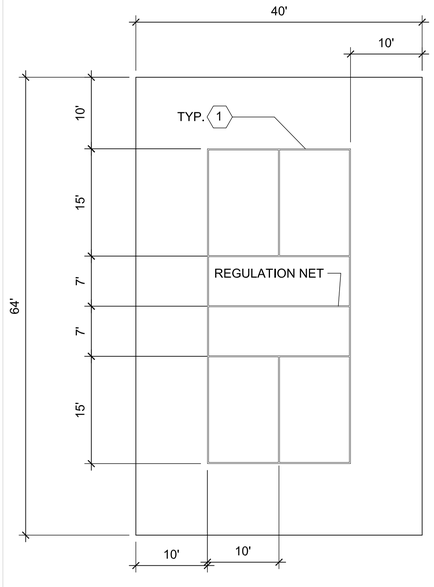
0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"



1 ALL STANDARD REGULATION LINES TO BE 2" WIDE

NOTES:

1. 6" DEPTH POST TENSION CONCRETE CONSTRUCTION WITH MEDIUM BROOM FINISH.
2. POST TENSION SLAB TO BE DESIGN BUILD. CONTRACTOR SHALL SUBMIT ENGINEERED DRAWINGS TO THE TOWN OF BERTHOUD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
3. PRIOR TO ACCEPTANCE A LETTER OF CONSTRUCTION COMPLIANCE SIGNED BY A STATE LICENSED ENGINEER WILL BE SUBMITTED TO THE CITY OF THORNTON.
4. COORDINATE & ADJUST TENSIONING CABLE SPACING TO AVOID BASKETBALL GOAL AND BENCH ANCHORS.
5. COLOR OF COURT T.B.D. BY TOWN OF BERTHOUD
6. SURFACE, NET, STRIPPING BY:
   STAR PLAYGROUNDS
   9892 TITAN ROAD
   UNIT 1
   LITTLETON, CO 80125
   PH: 303.791.7626

1 PICKEL BALL COURT

1" = 10' - 0"

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Layout Plan

REVISION:	DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	SEE PLAN

SHEET

L1.10

10 of 12

STAR PLAYGROUND
CONTACT: ERIN STAR
PHONE: 303.791.7626

BERLINER COMBI 155 PLAYGROUND
TO BE INSTALLED BY TOWN OF BERTHOUD

1 PLAYGROUND

NOT TO SCALE

STAR PLAYGROUND
CONTACT: ERIN STAR
PHONE: 303.791.7626

MANUFACTURE: RCP SHELTER
STYLE: ALL HIP STEEL
MODEL NO: TS-H1220-04
COLOR: T.B.D. BY TOWN OF BERTHOUD
TO BE INSTALLED BY TOWN OF BERTHOUD

2 12' x 14' PICNIC SHELTER

NOT TO SCALE

STAR PLAYGROUND
CONTACT: ERIN STAR
PHONE: 303.791.7626

MANUFACTUR: MADRAX
COLOR: BLACK
STYLE: U BIKE RACK
MODEL NO. U238-SF-P
TO BE INSTALLED BY TOWN OF BERTHOUD

3 "U" SHAPED BIKE RACK

NOT TO SCALE

STAR PLAYGROUND
CONTACT: ERIN STAR
PHONE: 303.791.7626

6' FAIRWAY PICNIC TABLE
MANUFACTURE: THOMAS STEELE - FAIRWAY TABLE
MODEL NO: FWTP-8HCS-RPC-P
TO BE INSTALLED BY TOWN OF BERTHOUD

4 PICNIC TABLE

NOT TO SCALE

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Playground Details

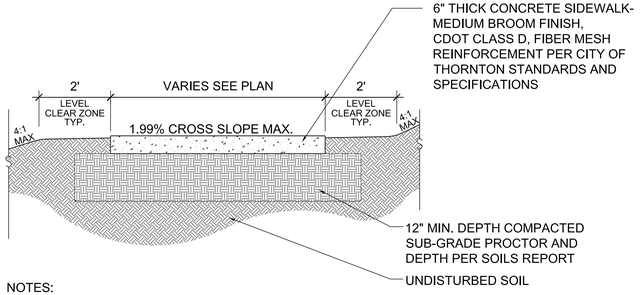
REVISION:	DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	VARIES

SHEET

L1.11

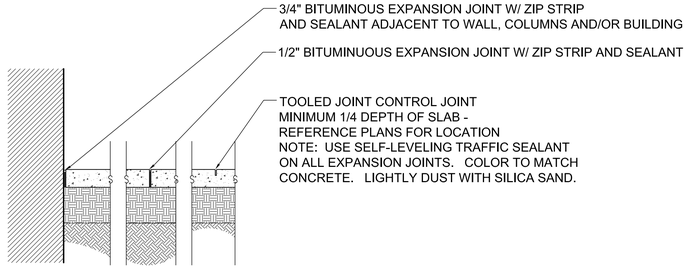
11 of 12



NOTES:
1. SAW CUT JOINTS 10' O.C. MAX.
2. EXPANSION JOINTS 100' O.C. MAX.
3. EXPANSION JOINT LOCATIONS ADJACENT TO STRUCTURES AND INTERSECTIONS OF CONCRETE.
4. SEE JOINT DETAIL FOR SAW CUT AND EXPANSION JOINTS
5. 4.99% MAXIMUM SLOPE IN THE DIRECTION OF TRAVEL

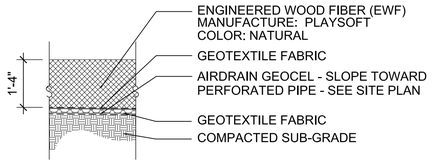
1 CONCRETE SIDEWALK

1/2" = 1' - 0"



2 CONCRETE JOINTS

1/2" = 1' - 0"

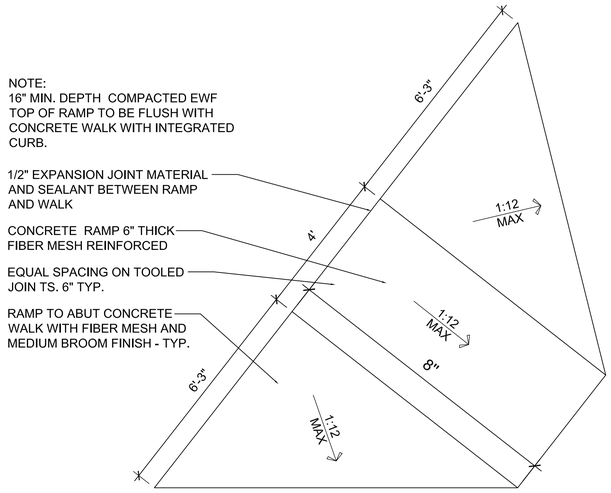


NOTE:
1. EWF - SHALL MEET ASTM F 1292-99 " STANDARD SPECIFICATIONS FOR IMPACT ATTENUATION OF EQUIPMENT
2. MAXIMUM FALL HEIGHT - 12'-0"
3. EWF SHALL MEET ASTM F 1951 "STANDARD SPECIFICATON DETERMINATION OF ACCESSIBILITY OF SURFACE SYSTEMS

3 ENGINEERED WOOD FIBER (EWF)

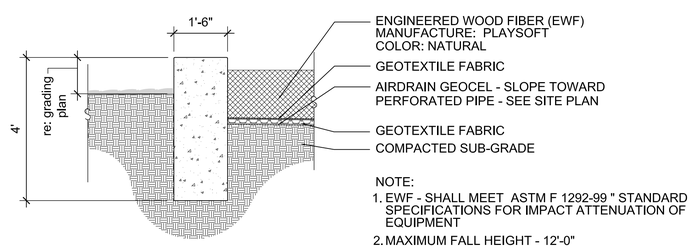
1/2" = 1' - 0"

NOTE:
16" MIN. DEPTH COMPACTED EWF TOP OF RAMP TO BE FLUSH WITH CONCRETE WALK WITH INTEGRATED CURB.



4 PLAYGROUND HANDICAP RAMP

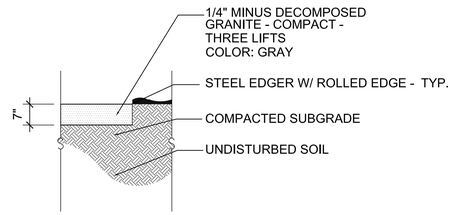
1/2" = 1' - 0"



NOTE:
1. EWF - SHALL MEET ASTM F 1292-99 " STANDARD SPECIFICATIONS FOR IMPACT ATTENUATION OF EQUIPMENT
2. MAXIMUM FALL HEIGHT - 12'-0"
3. EWF SHALL MEET ASTM F 1951 "STANDARD SPECIFICATON DETERMINATION OF ACCESSIBILITY OF SURFACE SYSTEMS
3. RE: STRUCTURAL FOR REINFORCING

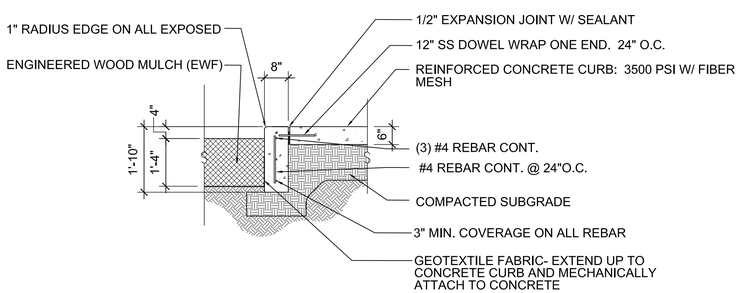
5 PLAYGROUND CONCRETE CURB WALL

1/2" = 1' - 0"



6 DECOMPOSED GRANITE TRAIL

1/2" = 1' - 0"



7 PLAYGROUND / SIDEWALK EDGE CONDITION

1/2" = 1' - 0"

5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm Final Plat

Playground Details

REVISION:
DATE:

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	8/2/21
Scale:	VARIES

SHEET

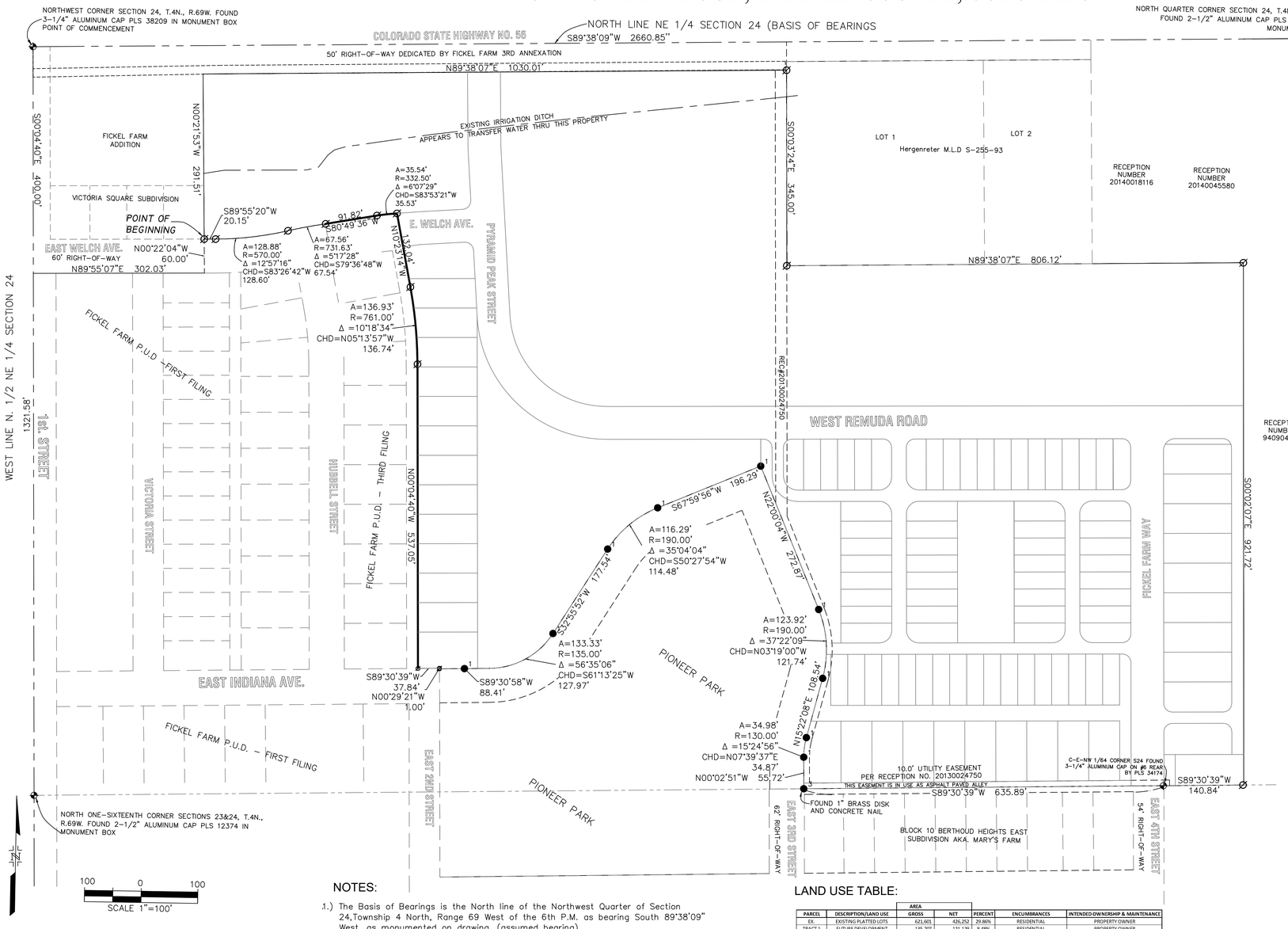
L1.12

12 of 12

APPROVED PRELIMINARY PLAT

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO



LEGEND

- IINDICATES SECTION LINE
- INDICATES EXISTING EASEMENT
- INDICATES CONTROL CORNER AS DESCRIBED HEREON
- ●1 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 14823
- ●2 INDICATES FOUND #4 REAR WITH 1" YELLOW PLASTIC CAP STAMPED LS 12374
- ●3 INDICATES FOUND 1" BRASS DISK AND CONCRETE NAIL
- Ø INDICATES SET #4 REBAR W/ 1"GREEN PLASTIC STAMPED PLS20676
- UE INDICATES UTILITY EASEMENT

NOTES:

1.) The Basis of Bearings is the North line of the Northwest Quarter of Section 24,Township 4 North, Range 69 West of the 6th P.M. as bearing South 89°38'09" West, as monumented on drawing, (assumed bearing).

2.) Stewart Title Commitment, Inc. (Commitment# 754056) was relied upon for information regarding easements, restrictions and right-of-ways for the preparation of this plat.

3) The lineal unit of measurement for this plat is U. S. Survey Feet.

4.) FLOOD ZONE NOTE: Per the Federal Emergency Management Agency (FEMA) Flood Zone Mapping for the is area (Map Number 08069C1387G, Panel 1387 of 1420, Effective Date of February 6, 2013 and Map Number 08069C1391G, Panel 1391 of 1420, Effective Date of February 6, 2013) the subject properties appear to lie within a Flood Zone 'X'.

NOTICE: According to Colorado law, you MUST commence any legal action based on any defect in this survey within Three years after you first discovered such defect. In no event, may any action based upon any defect in this survey be commenced more than TEN years from the date of the certification shown hereon.

LAND USE TABLE:

PARCEL	DESCRIPTION/LAND USE	AREA GROSS	AREA NET	PERCENT	ENCUMBRANCES	INTENDED OWNERSHIP & MAINTENANCE
EX.	EXISTING PLATTED LOTS	621,601	426,252	29.86%	RESIDENTIAL	PROPERTY OWNER
TRACT 1	FUTURE DEVELOPMENT	135,707	121,129	8.48%	RESIDENTIAL	PROPERTY OWNER
TRACT 2	FUTURE DEVELOPMENT	542,501	488,898	34.24%	RESIDENTIAL	PROPERTY OWNER
BLOCK 1	14 LOTS	88,854	80,452	5.64%	RESIDENTIAL	PROPERTY OWNER
BLOCK 2	6 LOTS	27,330	16,846	1.18%	RESIDENTIAL	PROPERTY OWNER
BLOCK 3	12 LOTS	48,775	32,707	2.29%	RESIDENTIAL	PROPERTY OWNER
BLOCK 4	8 LOTS	27,810	22,252	1.56%	RESIDENTIAL	PROPERTY OWNER
BLOCK 5	8 LOTS	27,810	22,252	1.56%	RESIDENTIAL	PROPERTY OWNER
BLOCK 6	8 LOTS	27,810	22,252	1.56%	RESIDENTIAL	PROPERTY OWNER
BLOCK 7	8 LOTS	35,640	22,196	1.55%	RESIDENTIAL	PROPERTY OWNER
BLOCK 8	9 LOTS	82,097	56,606	3.96%	RESIDENTIAL	PROPERTY OWNER
BLOCK 9	8 LOTS	24,000	21,600	1.51%	RESIDENTIAL	PROPERTY OWNER
BLOCK 10	8 LOTS	24,000	21,600	1.51%	RESIDENTIAL	PROPERTY OWNER
BLOCK 11	10 LOTS	64,997	59,459	4.16%	RESIDENTIAL	PROPERTY OWNER
BLOCK 12	2 LOTS	17,597	13,060	0.91%	RESIDENTIAL	PROPERTY OWNER
OUTLOT C	OPEN SPACE	7,727	2,684		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
OUTLOT E	OPEN SPACE	6,641	1,070		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
EX.	EXISTING PIONEER PARK	273,748	273,748			TOWN OF BERTHOUD
TRACT 3	FUTURE DEVELOPMENT	134,686	117,363			TOWN OF BERTHOUD
OUTLOT A	OPEN SPACE	31,555	23,691		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
OUTLOT B	OPEN SPACE	27,000	25,000		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
OUTLOT D	OPEN SPACE	2,693	1,097		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
OUTLOT F	OPEN SPACE	21,623	18,548		UTILITY, DRAINAGE EASEMENT	HOME OWNERS ASSOCIATION
	TOTAL Square feet	2,302,202	1,427,681	100.00%		
	Acres	52.85	32.78			
	Density (units per acre)	4.48	7.23			

KNOW ALL MEN BY THESE PRESENTS: That the undersigned, being the owner of FICKEL FARM PUD FOURTH FILING located in the Northwest Quarter of Section 24, Township 4 North, Range 69 West of the 6th Principal Meridian, Town of Berthoud, County of Larimer, State of Colorado, more particularly described as follows;A parcel of land in the Town of Berthoud, County of Larimer, State of Colorado located in the Northwest Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M. more particularly described as follows:
Considering the North line of the Northwest Quarter of said Section 24 was assumed to bear South 89°38'09" West, between the monuments shown and described hereon and with all bearings contained herein relative thereto;
Beginning at the Northwest corner of said Section 24;
thence along the West line of said Northwest Quarter, South 00°04'40" East, a distance of 400.00 feet, to a point on the westerly prolongation of the North line of the Fickel Farm P.U.D. First Filing to the Town of Berthoud;
thence departing said West line, North 89°55'04" East, along said westerly prolongation and the North line of Said Fickel Farm P.U.D. First Filing a distance of 302.03 feet to the Southwest corner of the Victoria Square Subdivision to the Town of Berthoud,
thence North 00°22'04" West, along the West line of said Victoria Square Subdivision, a distance of 60.00 feet to the TRUE POINT OF BEGINNING
thence North 00°21'53" West, along the East line of said Victoria Square Subdivision and the East Line of Fickel Farm Addition to the Town of Berthoud, a distance of 291.53 feet, to a point on the Southerly right of way line of Colorado State Highway 52;
thence North 89°38'07" East, along said Southerly right of way line, a distance of 1,030.01 feet, to a point on the Westerly line of the Hergenreter M.L.D. S-255-93;
thence South 00°03'24" East, along said Westerly line, a distance of 345.00 feet;
thence North 89°38'07" East, along the Southerly line of said Hergenreter M.L.D. and its Easterly prolongation, a distance of 806.12 feet, to a point on the Westerly boundary of that certain parcel of land as described in a deed recorded in reception number 940947786 of Larimer County Records;
thence South 00°02'07" East, along said Westerly boundary line, a distance of 921.72 feet, to a point on the South line of the North One-half of the Northwest Quarter of said Section 24;
thence South 89°30'39" West, along said South line, a distance of 140.84 feet to the Northeast corner of Berthoud Heights East Subdivision;
thence South 89°30'39" West, along the North line of said Berthoud Heights, a distance of 635.89 feet, to a point on the East boundary line of the Pioneer Park, a subdivision of the Town of Berthoud;
thence along the Boundaries of said Pioneer Park the following ten (10) courses and distances;
1. North 00°02'51" West a distance of 55.72 feet;
2. along the arc of a curve to the right having a central angle of 15°24'56", and a radius of 130.00 feet an arc length of 34.98 feet the chord of said curve bears North 07°39'37" East, a chord length of 34.87 feet;
3 North 15°22'05" East a distance of 108.54 feet;
4.along the arc of a curve to the left having a central angle of 37°22'09", and a radius of 190.00 feet an arc length of 123.92 feet the chord of said curve bears North 03°19'00" West, a chord length of 121.74 feet;
5 North 22°00'04" West a distance of 272.87 feet;
6 South 67°59'56" West a distance of 196.29 feet;
7. along the arc of a curve to the left having a central angle of 35°04'04", and a radius of 190.00 feet an arc length of 116.29 feet the chord of said curve bears South 50°27'54" West, a chord length of 114.48 feet;
8 South 32°55'52" West a distance of 177.54 feet;
9. along the arc of a curve to the right having a central angle of 56°35'06", and a radius of 135.00 feet an arc length of 133.33 feet the chord of said curve bears South 61°13'25" West, a chord length of 127.97 feet;
10. South 89°30'58" West a distance of 88.41 feet to a point on the Easterly boundary of Fickel Farm P.U.D. – Third Filing;
Thence along the boundaries of said Third Filing the following six (6) courses and distances;
1. North 00°29'21" West a distance of 1.00 feet;
2. South 89°30'39" West a distance of 37.84 feet;
3. North 00°04'40" West a distance of 537.05 feet;
4. along the arc of a curve to the left having a central angle of 10°18'34", and a radius of 761.00 feet an arc length of 136.93 feet the chord of said curve bears North 05°13'57" West, a chord length of 136.74 feet;
5. North 10°23'14" West a distance of 132.04 feet;
6. thence along the arc of a cotangent curve to the left having a central angle of 06°07'29", and a radius of 332.50 feet an arc length of 35.54 feet the chord of said curve bears South 83°53'21" West, a chord length of 35.53 feet;
7. South 80°49'36" West a distance of 91.82 feet, to the Northeast corner of Fickel Farm P.U.D. – First Filing;
thence along the Northern Boundaries of said First Filing the following three (3) courses and distances;
1. along the arc of a cotangent curve to the left having a central angle of 05°17'28", and a radius of 731.63 feet an arc length of 67.56 feet the chord of said curve bears South 79°36'48" West, a chord length of 67.54 feet,
2. along the arc a reverse curve to the right having a central angle of 12°57'16", and a radius of 570.00 feet an arc length of 128.88 feet the chord of said curve bears South 83°26'42" West, a chord length of 128.60 feet;
3. South 89°55'20" West a distance of 20.15 feet to the TRUE POINT OF BEGINNING;
Containing an area of 1,406,894 square feet, 32.298 acres, more or less
have laid out, platted, and subdivided the above described land, under the name and style of FICKEL FARM PUD FOURTH FILING, and by these presents do dedicate to the Town of Berthoud in fee simple the street and public "rights-of-way" as shown on the plats, and grant to the Town of Berthoud such easements and rights-of-way, and all right, title and interest in real property to the above described lands, including all surface interests and all minerals within or underlying said lands, as are created hereby and depicted or, by note , referenced hereon, along with the right to install, maintain, replace and operate mains, transmission lines, service lines, and appurtenances, either directly or through the various public utilities, as may be necessary to provide such utility, cable television, water, electric, natural gas and sanitary services within this subdivision or property contiguous thereto, through, over, under, and across streets, utility and other easements, and other public places shown on the plat.

By: William J. Edwards
As: Manager
of Berthoud Homes, LLC

State of Wyoming)
)SS
County of Laramie)

The foregoing dedication was acknowledged this _____ day of _____.

2021 A.D., by William J. Edwards as Manager of Berthoud Homes, LLC.

My commission expires: _____.

Notary Public: _____
Whitness my hand and seal

RIGHT TO FARM STATEMENT

The Town of Berthoud has adopted a "Right to Farm" policy. All new and existing residents are expected to read and understand lhe policy. For a copy of the policy, please contact the Town of Berthoud.

APPROVAL STATEMENTS

Approved by the Board of Trustees of the Town of Berthoud, Colorado this _____ day of _____, 2021.

MAYOR

The foregoing zoning map is approved for filing and accepted by the Town of Berthoud, Colorado this _____ day of _____, 2021

ATTEST: _____
Town Clerk

SURVEYOR'S STATEMENT

I, Michael J. DeDecker, a Registered Professional Land Surveyor in theState of Colorado, do hereby certify that the survey of FICKEL FARM PUD FOURTH FILING was made under my supervision and the accompanying plat accurately and properly shows said subdivision and is in compliance with the Subdivision Regulations of the Town of Berthoud.

COLORADO REGISTERED MICHAEL J. DEDECKER 20676 PROFESSIONAL LAND SURVEYOR

MICHAEL J. DEDECKER P.L.S. 20676
For and on behalf of
DeDecker Land Surveying LLC

DATE	RECORD OF ISSUE	BY	CK.
05-10-2020	INITIAL ISSUE	MJD	

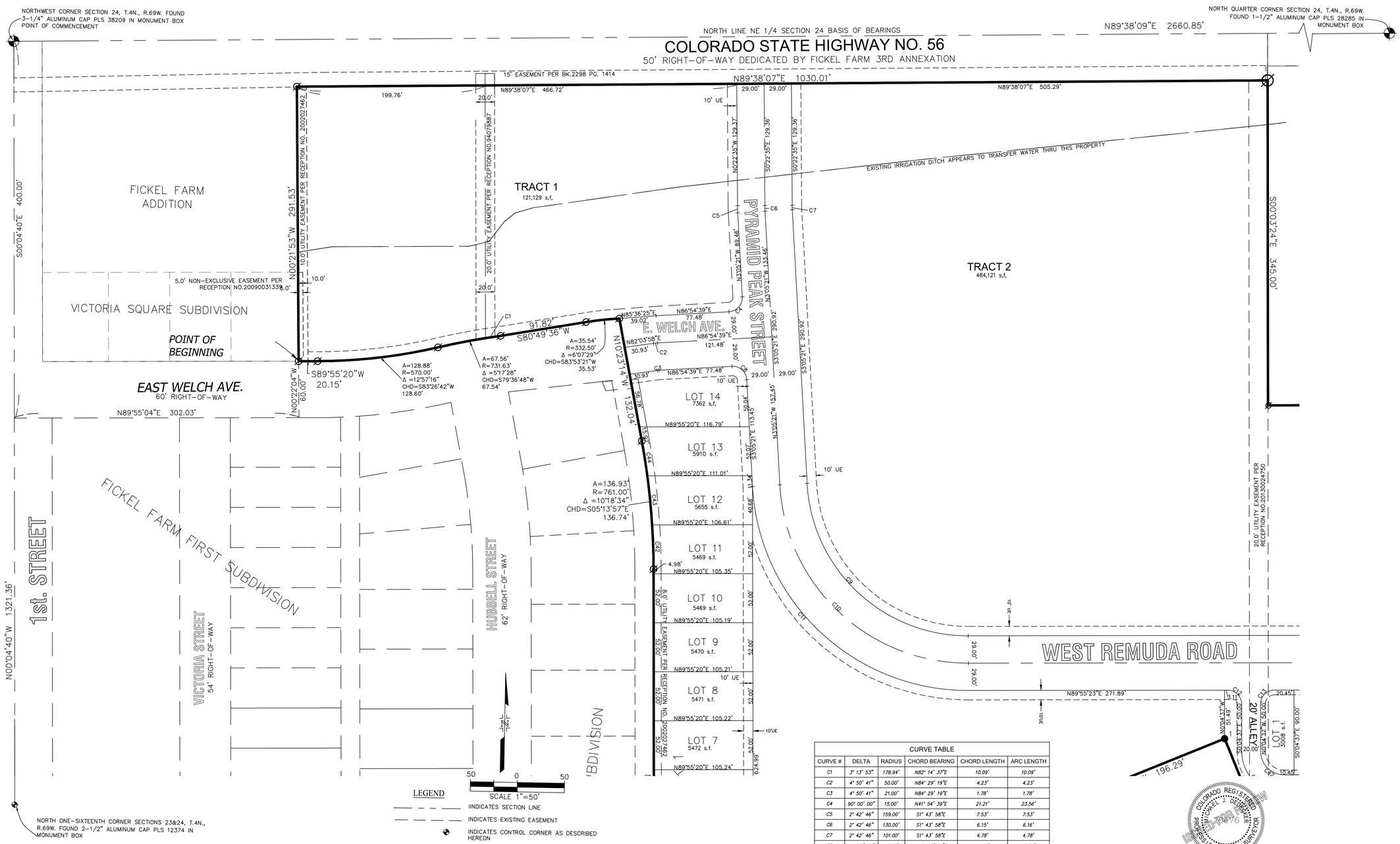
DEDECKER LAND SURVEYING
4301 FAWN TRAIL
LOVELAND, COLORADO 80537
C (970) 217-2331 H (970) 663-2013

CLIENT AND PROJECT: BERTHOUD HOMES LLC
FICKEL FARM PUD FOURTH FILING
DESCRIPTION: PART OF THE NW 1/4 SECTION 24, T.4N., R.69W. TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

DESIGNED:
DRAWN: MJD
CHECKED:
APPROVED:
DATE: MAY 10, 2020
SCALE: 1"=100'
PROJECT NO. 2020-318
SHEET 1 of 3

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH,
RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO



CURVE TABLE					
CURVE #	DELTA	RADIUS	CHORD BEARING	CHORD LENGTH	ARC LENGTH
C1	3° 13' 53"	178.94'	N82° 14' 37"E	10.09'	10.09'
C2	4° 50' 41"	50.00'	N84° 29' 19"E	4.23'	4.23'
C3	4° 50' 41"	21.00'	N84° 29' 19"E	1.78'	1.78'
C4	90° 00' 00"	15.00'	N41° 54' 39"E	21.21'	23.56'
C5	2° 42' 46"	159.00'	S1° 43' 58"E	7.53'	7.53'
C6	2° 42' 46"	130.00'	S1° 43' 58"E	6.15'	6.16'
C7	2° 42' 46"	101.00'	S1° 43' 58"E	4.78'	4.78'
C8	90° 00' 00"	15.00'	S48° 05' 21"E	21.21'	23.56'
C9	87° 01' 38"	170.91'	S46° 34' 29"E	235.36'	259.60'
C10	86° 59' 15"	200.00'	S46° 34' 59"E	275.31'	303.64'
C11	86° 59' 16"	229.00'	S46° 34' 59"E	315.23'	347.67'
C12	90° 00' 00"	15.00'	S45° 04' 37"E	21.21'	23.56'
C13	90° 00' 00"	15.00'	N44° 55' 23"E	21.21'	23.56'

COLORADO REG. IS. FRED C. DEDECKER 20676 PROFESSIONAL LAND SURVEYOR

NOTICE: According to Colorado law, you MUST commence any legal action based on any defect in this survey within Three years after you first discovered such defect. In no event, may any action based upon any defect in this survey be commenced more than TEN years from the date of the certification shown hereon.

DATE	RECORD OF ISSUE	BY	CK.
05-10-2020	INITIAL ISSUE	MJD	

DEDECKER
LAND SURVEYING
430 FAWN TRAIL
LOVELAND, COLORADO 80537
C (970) 217-2331 H (970) 663-2013

CLIENT AND PROJECT:
BERTHOUD HOMES LLC
FICKEL FARM PUD FOURTH FILING

DESCRIPTION:
PART OF THE NW 1/4 SECTION 24, T.4N., R.69W.
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

DESIGNED:	
DRAWN:	MJD
CHECKED:	
APPROVED:	
DATE:	MAY 10, 2020
SCALE:	1"=50'
PROJECT NO.	2020-318
SHEET	2 of 3

FICKEL FARM PUD FOURTH FILING

A PORTION OF SECTION 24, TOWNSHIP 4 NORTH,
RANGE 69 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

COLORADO REGISTERED
MICHAEL J. DEDECKER
PROFESSIONAL LAND SURVEYOR
PLS 37676

N89°38'07"E 806.12'

E. WELCH AVE.

N85°36'25"E 39.02'
N86°54'39"E 77.48'
N86°54'39"E 121.48'
N82°03'56"E 30.93'
A=35.54'
R=332.50'
Δ =6°07'29"
S83°53'21"W 35.53'
N10°23'14"W 132.04'
N86°54'39"E 77.48'
10' UE
29.00'
28.00'
C1
C2
C3
C4

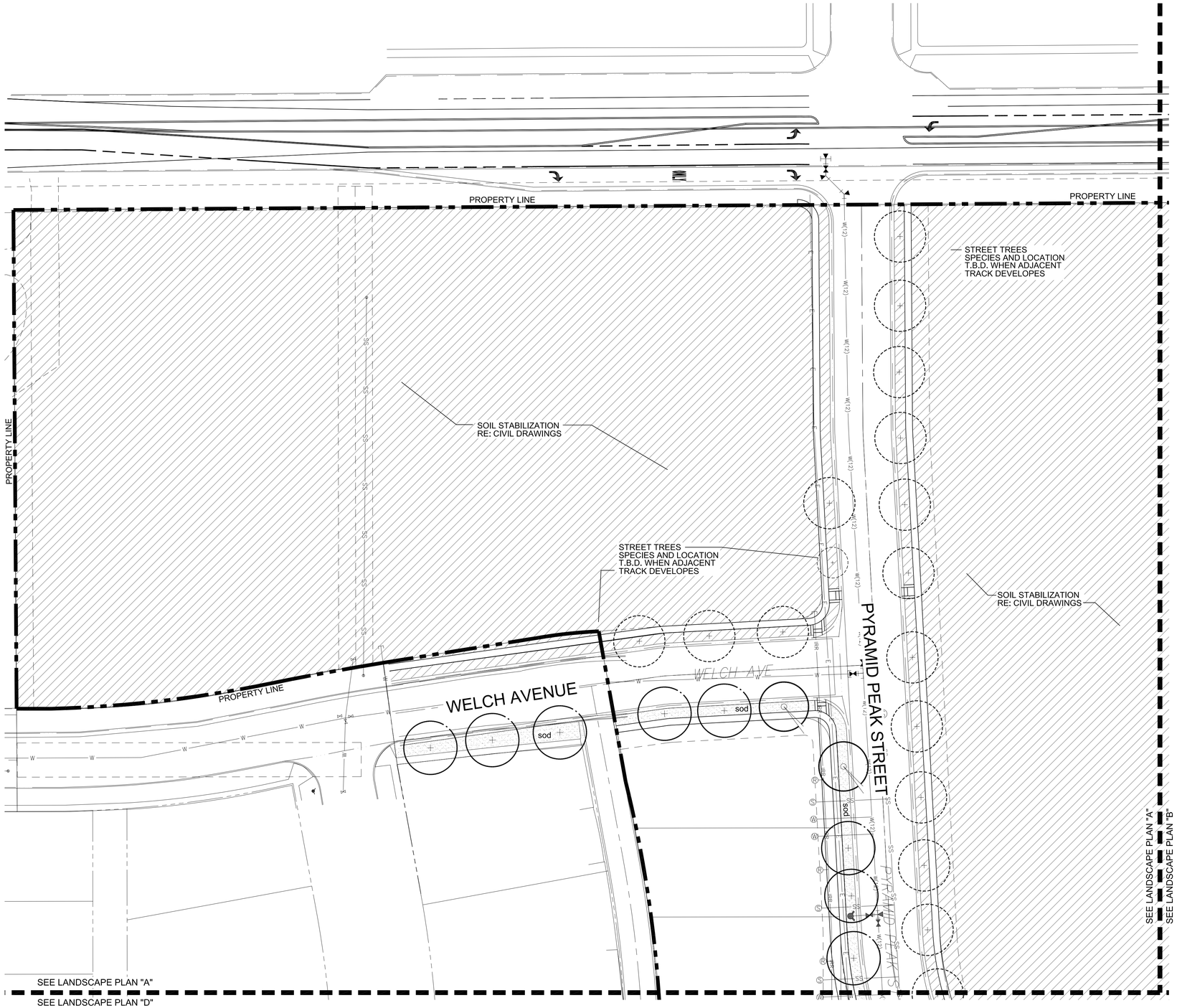
PYRAMID PEAK STREET

S35°59'52"E 292.12'
N35°59'52"W 152.45'
S35°59'52"E 292.12'
S00°02'21"E 113.45'

LOT 14 7362 s.f.
LOT 13 5910 s.f.
LOT 12 5655 s.f.
LOT 11 5469 s.f.
LOT 10 5469 s.f.
LOT 9 5470 s.f.
LOT 8 5471 s.f.
LOT 7 5472 s.f.
LOT 6 5473 s.f.
LOT 5 5474 s.f.
LOT 4 5475 s.f.
LOT 3 5476 s.f.
LOT 2 5477 s.f.
LOT 1 6735 s.f.

N89°55'20"E 116.79'
N89°55'20"E 111.01'
N89°55'20"E 106.61'
N89°55'20"E 105.35'
N89°55'20"E 105.19'
N89°55'20"E 105.21'
N89°55'20"E 105.22'
N89°55'20"E 105.24'
N89°55'20"E 105.26'
N89°55'20"E 105.28'
N89°55'20"E 105.29'
N89°55'20"E 105.31'
N89°55'20"E 105.33'

10' UE
8.0' UTILITY EASEMENT PER RECEPTION NO. 2002027462
10'UE
64.32'
64.07'
50.04'
15.96'
56.78'
30.93'
11.34'
40.68'
4.98'
52.00'
52.00'
52.00

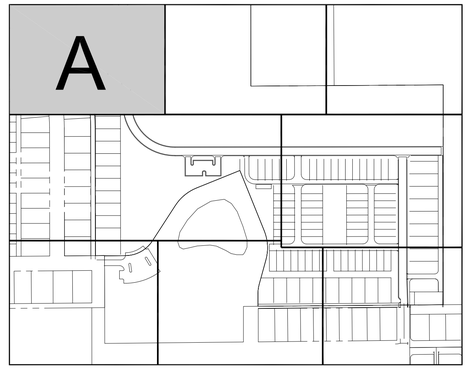


PRELIMINARY LANDSCAPE PLAN "A"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

- FUTURE STREET TREE
- DECIDUOUS TREES
- ORNAMENTAL TREES
- EVERGREEN TREE
- SHRUBS
  ORNAMENTAL GRASSES
- LOCALLY AVAILABLE FESCUE SOD MIX
- NON - IRRIGATED NATIVE GRASS MIX
  MIX RATIO:
  23% BLUE GRAMA
  10% BUFFALO GRASS
  20% GREEN NEEDLEGRASS
  20% SIDE OATS GRAMA
  25 WESTERN WHEATGRASS
  2% SAND DROPSEED
  NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE
- NON-HATCHED PLANTING AREAS — HARDWOOD MULCH
- RE: CIVIL DRAWINGS
- FESCUE SEED MIX
- 4" - 6" COBBLE
- STEEL EDGING WITH PROTECTIVE CAP

STACK lot
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

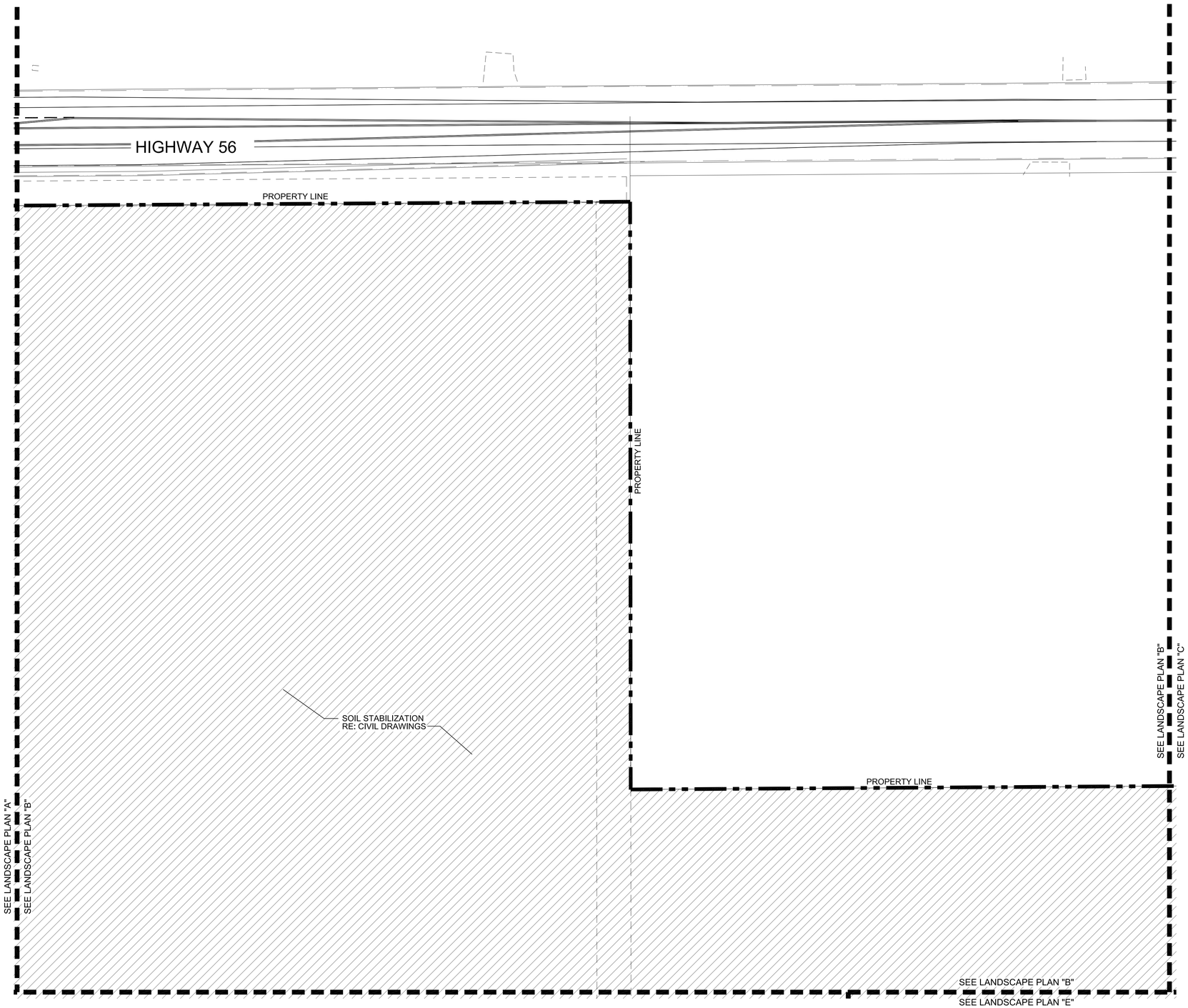
Preliminary Landscape Plan 'A'

DATE:	REVISION:
1/6/2021	SECOND SUBMITTAL
6/24/21	THIRD SUBMITTAL

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.1

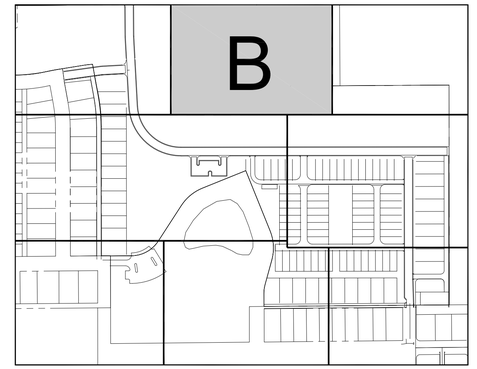


PRELIMINARY LANDSCAPE PLAN "B"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

FUTURE STREET TREE

DECIDUOUS TREES

ORNAMENTAL TREES

EVERGREEN TREE

SHRUBS
ORNAMENTAL GRASSES

LOCALLY AVAILABLE FESCUE SOD MIX

NON - IRRIGATED NATIVE GRASS MIX
MIX RATIO:
23% BLUE GRAMA
10% BUFFALO GRASS
20% GREEN NEEDLEGRASS
20% SIDE OATS GRAMA
25 WESTERN WHEATGRASS
2% SAND DROPSEED

NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE

NON-HATCHED PLANTING AREAS

HARDWOOD MULCH

RE: CIVIL DRAWINGS

FESCUE SEED MIX

4" - 6" COBBLE

STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

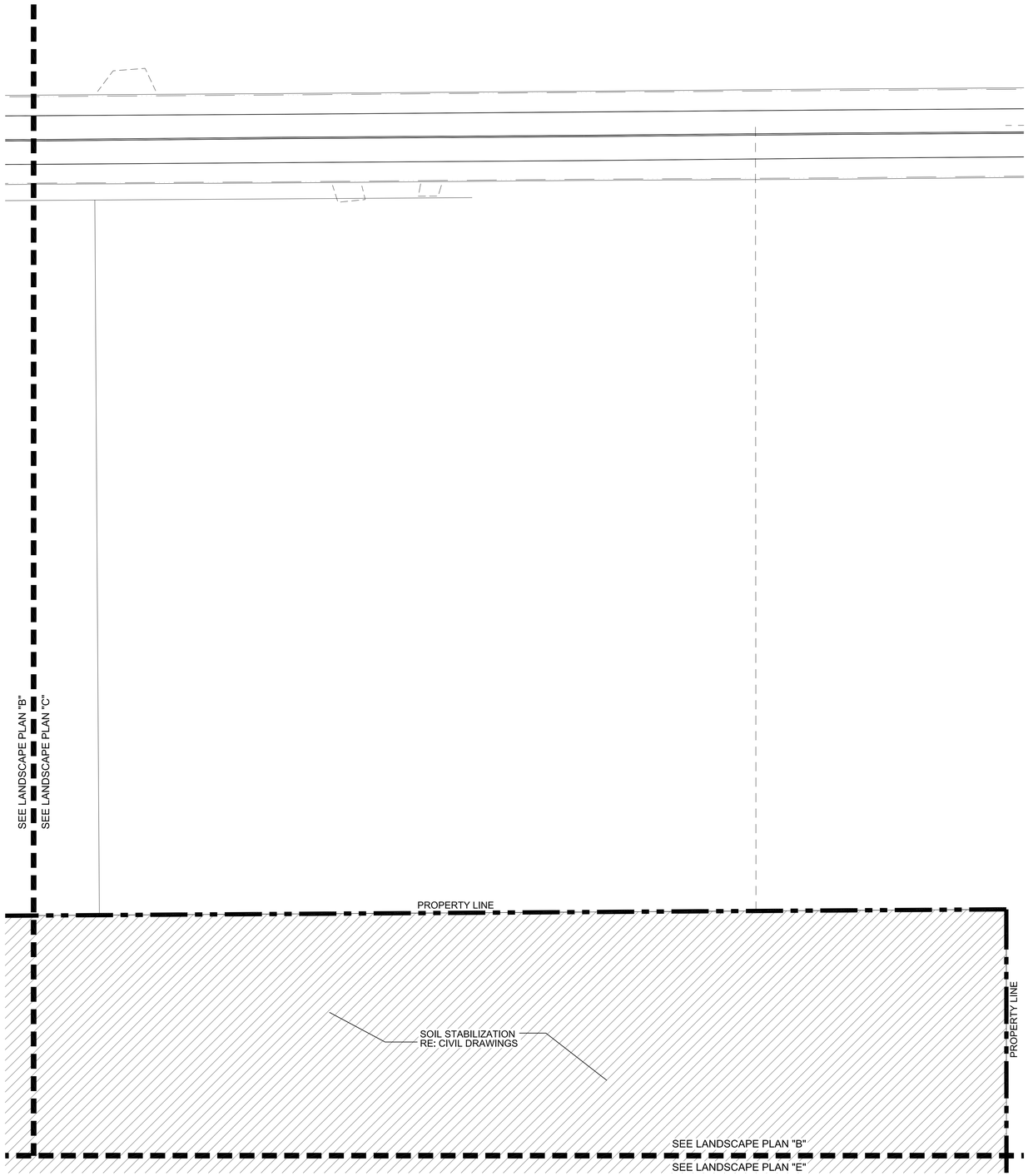
Preliminary Landscape Plan 'B'

REVISION:	DATE:
SECOND SUBMITTAL	1/6/2021
THIRD SUBMITTAL	6/24/21

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.2

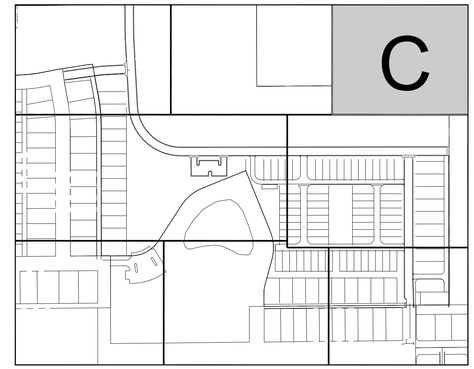


PRELIMINARY LANDSCAPE PLAN "C"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

- FUTURE STREET TREE
- DECIDUOUS TREES
- ORNAMENTAL TREES
- EVERGREEN TREE
- SHRUBS
  ORNAMENTAL GRASSES
- LOCALLY AVAILABLE FESCUE SOD MIX
- NON - IRRIGATED NATIVE GRASS MIX
  MIX RATIO:
  23% BLUE GRAMA
  10% BUFFALO GRASS
  20% GREEN NEEDLEGRASS
  20% SIDE OATS GRAMA
  25 WESTERN WHEATGRASS
  2% SAND DROPSEED
  NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE
- NON-HATCHED PLANTING AREAS — HARDWOOD MULCH
- RE: CIVIL DRAWINGS
- FESCUE SEED MIX
- 4" - 6" COBBLE
- STEEL EDGING WITH PROTECTIVE CAP

STACK Lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

Preliminary Landscape Plan 'C'

DATE:	REVISION:
1/6/2021	SECOND SUBMITTAL
6/24/21	THIRD SUBMITTAL

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.3

3 of 8

SEE LANDSCAPE PLAN "A"

SEE LANDSCAPE PLAN "D"

STREET TREES
SPECIES AND LOCATION
T.B.D. WHEN ADJACENT
TRACK DEVELOPES

SOIL STABILIZATION
RE: CIVIL DRAWINGS

WEST REMUDA ROAD

10' CONC.
SIDEWALK

6' CONC. SIDEWALK

PICKLEBALL COURT
TO BE INSTALLED BY
TOWN OF BERTHOUD

SHRUB BED W/
HARDWOOD MULCH

PARKING LOT

FESCUE SEED

SEE LANDSCAPE PLAN "D"

SEE LANDSCAPE PLAN "E"

12' X 14' SHELTER W/
PICNIC TABLE

(3) "U" SHAPED BIKE RACKS

TREE BED W/
HARDWOOD MULCH

COMMERCIAL GRADE
PLAYGROUND

PLAYGROUND CLEAR ZONE

PROPERTY LINE

10' CONC.
SIDEWALK

NATIVE SEED

6' DECOMPOSED GRANITE TRAIL

PROPERTY LINE

FESCUE SEED

PIONEER PARK

SEE LANDSCAPE PLAN "D"

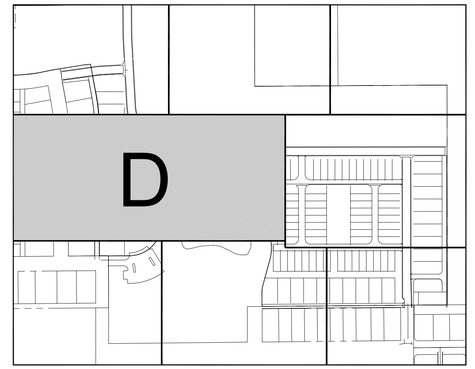
SEE LANDSCAPE PLAN "F"

PRELIMINARY LANDSCAPE PLAN "D"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"



KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

- FUTURE STREET TREE
- DECIDUOUS TREES
- ORNAMENTAL TREES
- EVERGREEN TREE
- SHRUBS
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- LOCALLY AVAILABLE FESCUE SOD MIX
- NON - IRRIGATED NATIVE GRASS MIX
  MIX RATIO:
  - 23% BLUE GRAMA
  - 10% BUFFALO GRASS
  - 20% GREEN NEEDLEGRASS
  - 20% SIDE OATS GRAMA
  - 25 WESTERN WHEATGRASS
  - 2% SAND DROPSEED

  NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE
- NON-HATCHED PLANTING AREAS — HARDWOOD MULCH
- RE: CIVIL DRAWINGS
- FESCUE SEED MIX
- 4" - 6" COBBLE
- STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

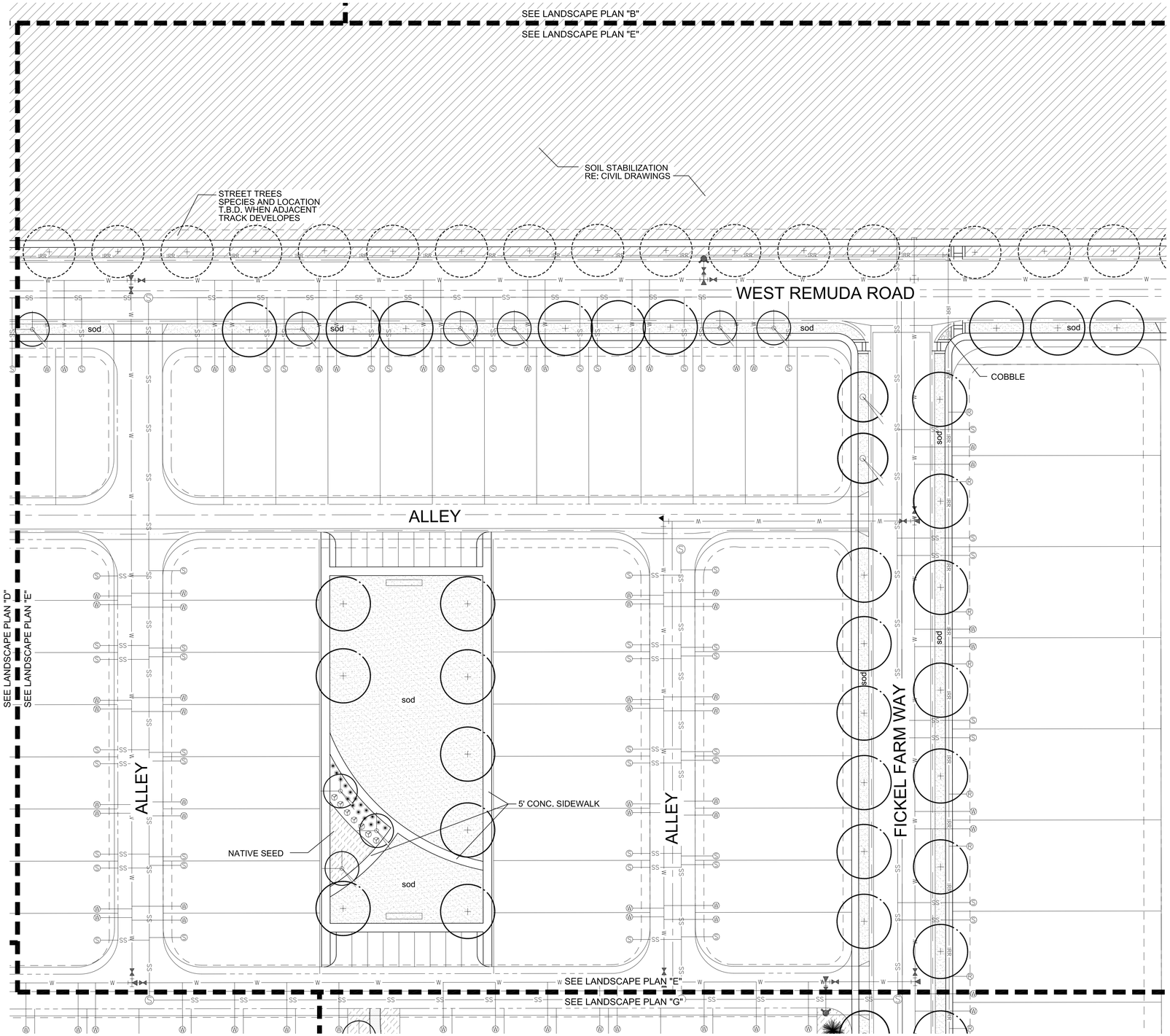
Preliminary Landscape Plan 'D'

DATE:	REVISION:
1/6/2021	SECOND SUBMITTAL
6/24/21	THIRD SUBMITTAL

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.4



PRELIMINARY LANDSCAPE PLAN "E"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"

KEYMAP

SCALE 1" = 300' - 0"

LANDSCAPE LEGEND:

FUTURE STREET TREE

DECIDUOUS TREES

ORNAMENTAL TREES

EVERGREEN TREE

SHRUBS
ORNAMENTAL GRASSES

LOCALLY AVAILABLE FESCUE SOD MIX

NON - IRRIGATED NATIVE GRASS MIX
MIX RATIO:
23% BLUE GRAMA
10% BUFFALO GRASS
20% GREEN NEEDLEGRASS
20% SIDE OATS GRAMA
25 WESTERN WHEATGRASS
2% SAND DROPSEED
NOTE: EROSION CONTROL BLANKET TO BE INSTALLED WHERE APPLICABLE

NON-HATCHED PLANTING AREAS — HARDWOOD MULCH

RE: CIVIL DRAWINGS

FESCUE SEED MIX

4" - 6" COBBLE

STEEL EDGING WITH PROTECTIVE CAP

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

Preliminary Landscape Plan 'E'

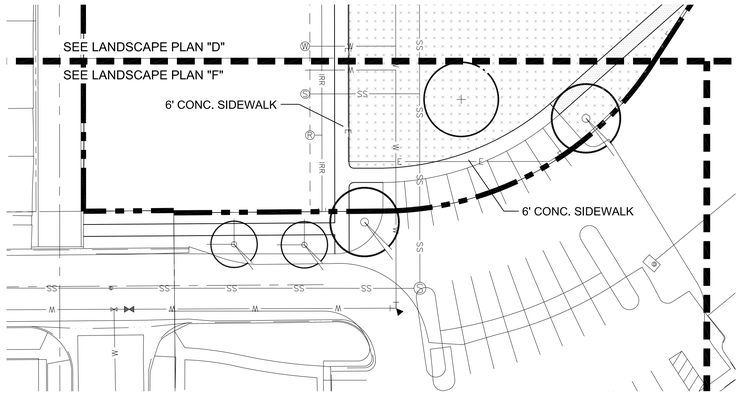
REVISION:	DATE:
SECOND SUBMITTAL	1/6/2021
THIRD SUBMITTAL	6/24/21

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.5

5 of 8

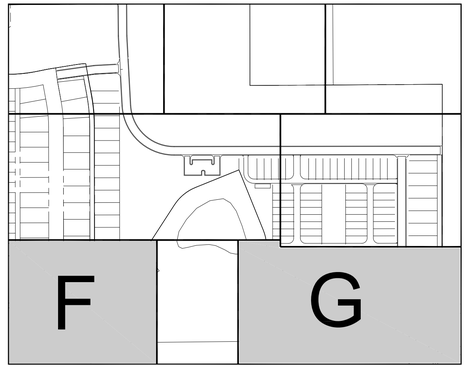


PRELIMINARY LANDSCAPE PLAN "F"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"

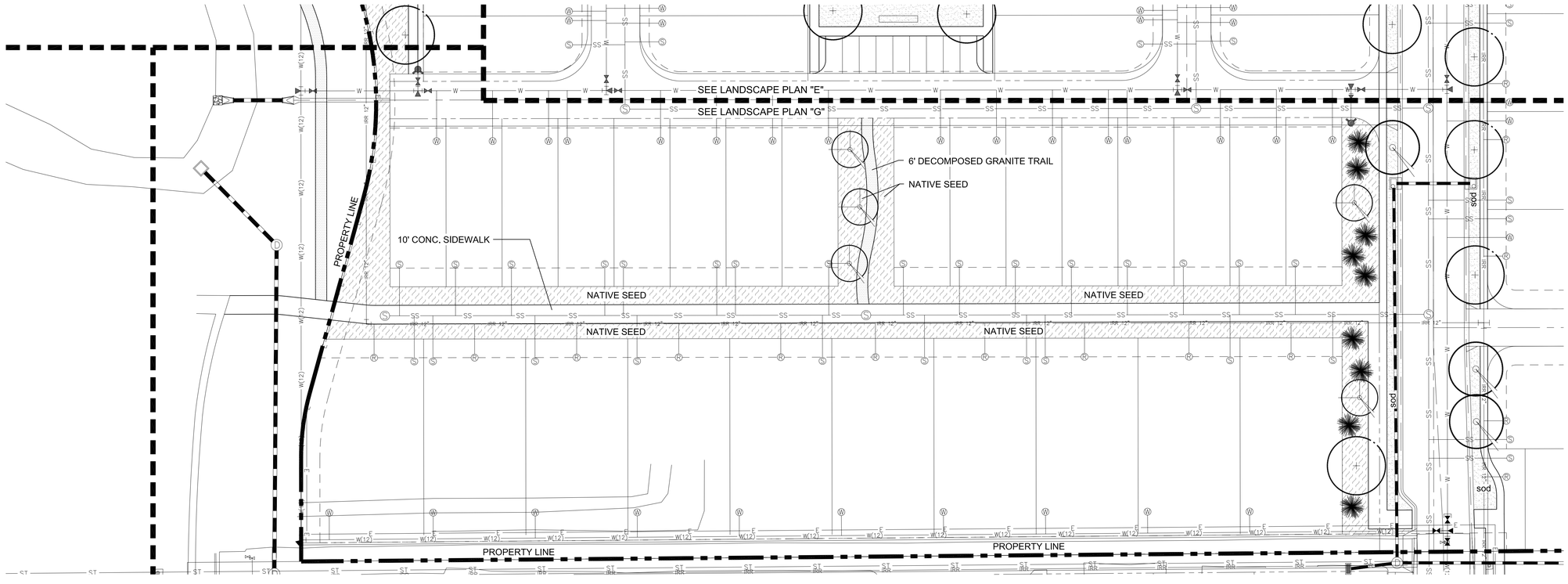


KEYMAP

SCALE 1" = 300' - 0"

PROPOSED PLANT MATERIAL SCHEDULE

COMMON NAME	BOTANICAL NAME	SIZE	CONDITION	REMARKS
DECIDUOUS TREES				
NORWAY MAPLE	ACER PLATANOIDES	2" CAL.	B&B	SINGLE STEM
LITTLE LEAF LINDEN	TILIA CORDOTA	2" CAL.	B&B	SINGLE STEM
RED OAK	QUERCUS RUBRA	2" CAL.	B&B	SINGLE STEM
KENTUCKY COFFEE TREE	GYMNOCLADUS DIOICUS 'EXPRESSO'	2" CAL.	B&B	SINGLE STEM
PROSPECTOR ELM	ULMUS WILSONIANA 'PROSPECTOR'	2" CAL.	B&B	SINGLE STEM
OHIO BUCKEYE	AESCULUS GLABRA	2" CAL.	B&B	SINGLE STEM
WHITE SWAMP OAK	QUERCU ALBA	2" CAL.	B&B	SINGLE STEM
ORNAMENTAL TREES				
SPRING SNOW CRABAPPLE	MALUS x 'SPRINGSNOW'	2" CAL.	B&B	SINGLE STEM
CHANTICLEER PEAR	PYRUS CALLERAYANA 'CHANTICLEER'	2" CAL.	B&B	SINGLE STEM
WASHINGTON HAWTHORN	CRATAEGUS PHAENOPYRUM	2" CAL.	B&B	SINGLE STEM
TATARIAN MAPLE	ACER TATARUICUM	2" CAL.	B&B	SINGLE STEM
EVERGREEN TREES				
AUSTRIAN PINE	PINUS NIGRA	6' HT.	B&B	
SOUTHWESTERN WHITE PINE	PINUS STROBIFORMIS	6' HT.	B&B	
SHRUBS				
ALPINE CURRANT	RIBES ALPINUM	5 GAL.	CONT.	
DWARF KOREAN LILAC	SYRINGAMEYERI 'PALIBIN'	5 GAL.	CONT.	
DWARF BURNING BUSH	EUONYMUS ALATUS 'COMPACTUS'	5 GAL.	CONT.	
RED TWIG DOGWOOD	CORNUS ALBA 'SIBIRICA'	5 GAL.	CONT.	
RUSSIAN SAGE	PEROVSKIA ARTIPILCIFOLISA	5 GAL.	CONT.	
LITTLE PRINCESS SPIREA	SPIREA JAPONICA 'LITTLE PRINCESS'	5 GAL.	CONT.	
ANTHONY WATERER SPIREA	SPIREA JAPONICA 'ANTHONY WATERER'	5 GAL.	CONT.	
BLUE MIST SPIREA	CARYOPTERIS X CLANDONENSIS	5 GAL.	CONT.	
LITTLE LIME HYRANGEA	HYRANGEA PANICULATA 'LITTLE LIME'	5 GAL.	CONT.	
PAWNEE BUTTE SANDCHERRY	PRUNUS BESSEYI 'PAWNEE BUTTES'	5 GAL.	CONT.	
PINK BEAUTY POTENTILLA	POTENTILLA FRUTICOSA 'PINK BEAUTY'	5 GAL.	CONT.	
GROW LOW FRAGRANT SUBMAC	RHUS AROMATICA 'GRO LOW'	5 GAL.	CONT.	
ORNAMENTAL GRASSES				
KARL FOERSTER FEATHER REED	CALAMAGROSIC ACUTI ' KARL FORESTER'	1 GAL.	CONT.	
DWARF FOUNTAIN GRASS	PENNISETUM ALOPECUROIDES 'HAMELN'	1 GAL.	CONT.	
DWARF FOUNTAIN 'HARDY LITTLE BUNNY	PENNISETUM ALOPECUROIDES 'LITTLE BUNNY'	1 GAL.	CONT.	
BLOOD GRASS	IMPERATA CYLINDRICA 'RUBRA'	1 GAL.	CONT.	



PRELIMINARY LANDSCAPE PLAN "G"

NORTH

0' 15' 30' 60' 90'

SCALE 1" = 30' - 0"

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

Preliminary Landscape Plan 'F and G'

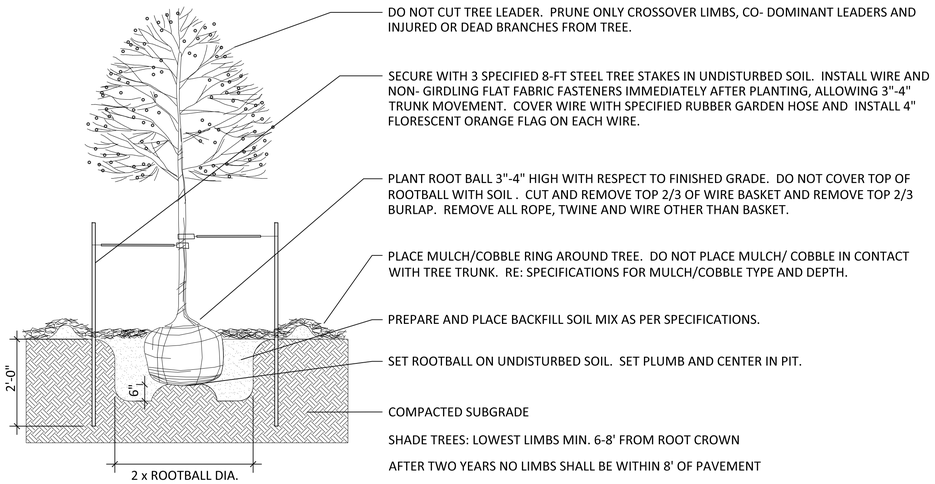
DATE:	REVISION:
1/6/2021	SECOND SUBMITTAL
6/24/21	THIRD SUBMITTAL

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

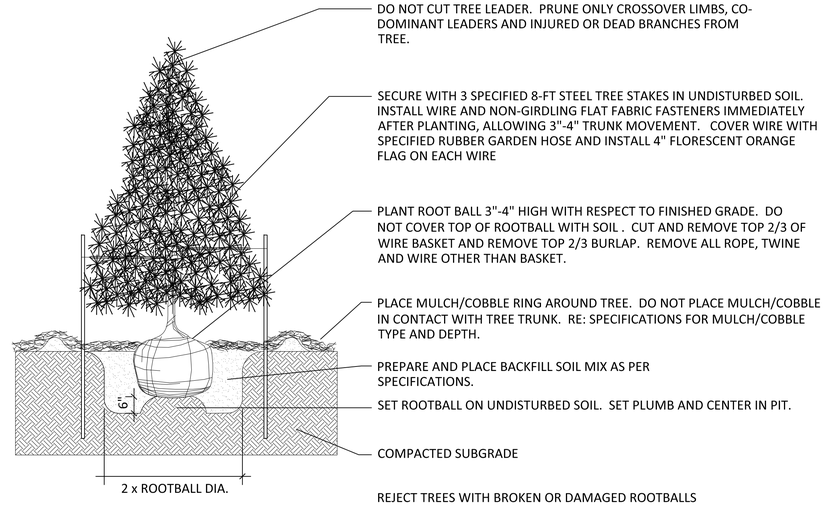
L1.6

6 of 8



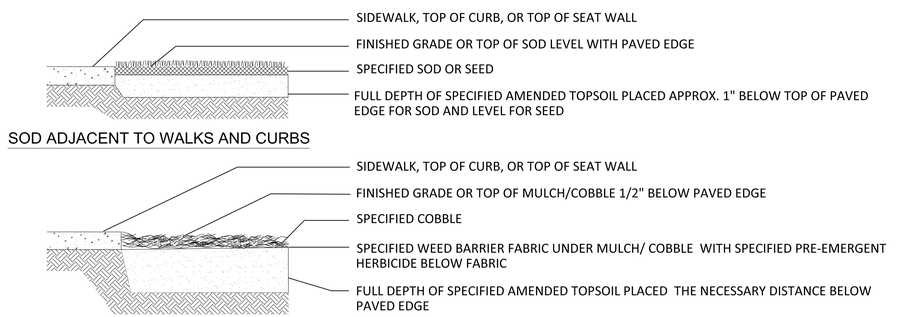
1 DECIDUOUS TREE

NOT TO SCALE



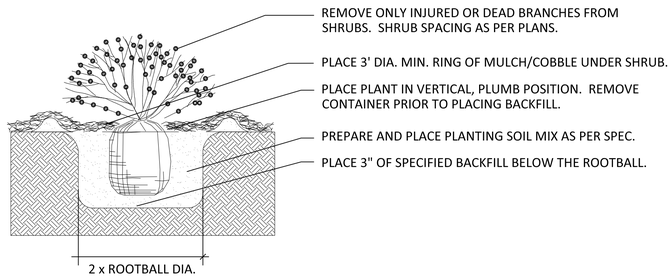
2 EVERGREEN TREE PLANTING

NOT TO SCALE



3 EDGE TREATMENT

NOT TO SCALE



4 SHRUB PLANTING

NOT TO SCALE

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

Landscape Details

REVISION:	DATE:
SECOND SUBMITTAL	1/6/2021
THIRD SUBMITTAL	6/24/21

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.7

BERLINER COMBI 155 PLAYGROUND
TO BE INSTALLED BY TOWN OF BERTHOUD

1 PLAYGROUND

NOT TO SCALE

4 POST STEEL HIP SHELTER
COLOR: T.B.D.
TO BE INSTALLED BY TOWN OF BERTHOUD

2 12' x 14' PICNIC SHELTER

NOT TO SCALE

MANUFACTUR: T.B.D.
COLOR: T.B.D.
TO BE INSTALLED BY TOWN OF BERTHOUD

3 "U" SHAPED BIKE RACK

NOT TO SCALE

6' FAIRWAY PICNIC TABLE
TO BE INSTALLED BY TOWN OF BERTHOUD

4 PICNIC TABLE

NOT TO SCALE

STACK lot
5639 south curtice street littleton, colorado 80120
p. 303.808.4523

Berthoud Homes LLC
Fickel Farm PUD Forth Filing

Park Details

DATE:	REVISION:
1/6/2021	SECOND SUBMITTAL
6/24/21	THIRD SUBMITTAL

Project Mgr:	JAH
Drawn By:	SDW
Checked By:	JAH
Date:	6/10/20
Scale:	1" = 30'

SHEET

L1.8

8 of 8

CivilWorx

Parking Study

Fickel Farm PUD 4th Filing

Berthoud, CO

Prepared for:

Berthoud Homes LLC

506 Shoshoni Street
Cheyenne, Wyoming 82009

Revised May 27, 2021

TABLE OF CONTENTS

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A. Location 1
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III. Parking Analysis 2
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B. Typical Guest Parking Requirements 3
C. Proposed Parking 3
IV. Conclusions 5

I. Introduction

With the development of the Fickel Farms project the developer is proposing an open concept twin home (duplex) area with private roads (alleys) to service the units with a good portion of the units fronting on open space in place of the typical roads in front of the units. The twin homes will be equipped with two car garages and will have short driveways that do not allow for parking. The units will be serviced via 20- to 28-foot-wide private roads. This concept leads to a very aesthetically pleasing neighborhood with less pavement and more open spaces, but if not well planned can lead to parking issues.

II. Location and Project Description

A. Location

The Fickel Farm 4th Filing project site (referred herein as "the site") is located south of US Highway 56 and west of County Road 1 (the County Line Road) on the east side of Berthoud.

The site is located within a portion of section 24, Township 4 North, Range 69 West of the 6th Principal Meridian in the Town of Berthoud, County of Laramie, State of Colorado

VICINITY MAP
SCALE: 1" = 1000'

B. Proposed Project Description

The Fickel Farm project is approximately 33 acres in total, the first phase of construction is roughly 15 acres and is being developed into residential homes. The remaining area will be developed in the future and is being platted as tracts. The 1st phase will consist of 101 lots.

The area for the parking study consists of 87 lots on the southeast side of the site. See the exhibit below for the layout of the lots.

III. Parking Analysis

A. Berthoud Code.

The Town of Berthoud municipal code states the following:

- 30-1-116-A-303 Parking area (off-street) means all off-street areas and spaces designed, used, required or intended to be used for the parking, storage, maintenance, service, repair, display or operation of motor vehicles, including driveways or access ways in and to such areas, but not including any outdoor storage area used principally as a "recreational vehicle, boat or truck storage" use, storage areas for landscaping and other bulk items or public streets and rights-of-way.
- 30-1-116-A-304 Parking garage means an off-street parking area within a building
- 30-2-106-C-1 Table 2.2 Required Parking. Residential zoning districts require 2 off-street parking spaces per unit.
- 30-2-116-C-5 - Garages. …. Resident garages or *parking* that is internal to the development is encouraged. On-street *parking* should be made available for visitors.

From this review the required parking per dwelling per the Town of Berthoud code is 2 per unit and all garage units are counted toward this off-street parking requirement. In addition to this the on-street parking is meant to be visitor parking.

B. Typical Guest Parking Requirements

The Town of Berthoud does not include a typical guest parking requirement in their code, but from review of other codes from around the Country it appears that the typical requirement on the guest parking varies from 0.15 stalls to 0.30 stalls required per dwelling unit. In order to be conservative for this study we have assumed 0.5 stalls per dwelling unit. In this case with 87 dwellings we would need 44 parking spaces for this portion of the development.

C. Proposed Parking

Each of the homes in the study area will be constructed with 2 car garages and the ones along the south and east side will also include driveways that can provide an additional two stalls for guests and/or owners. For the sake of this study, we will ignore the driveway parking as that is specific to each unit and not open to all residents.

The remainder of the proposed site parking was analyzed based on the following criteria:

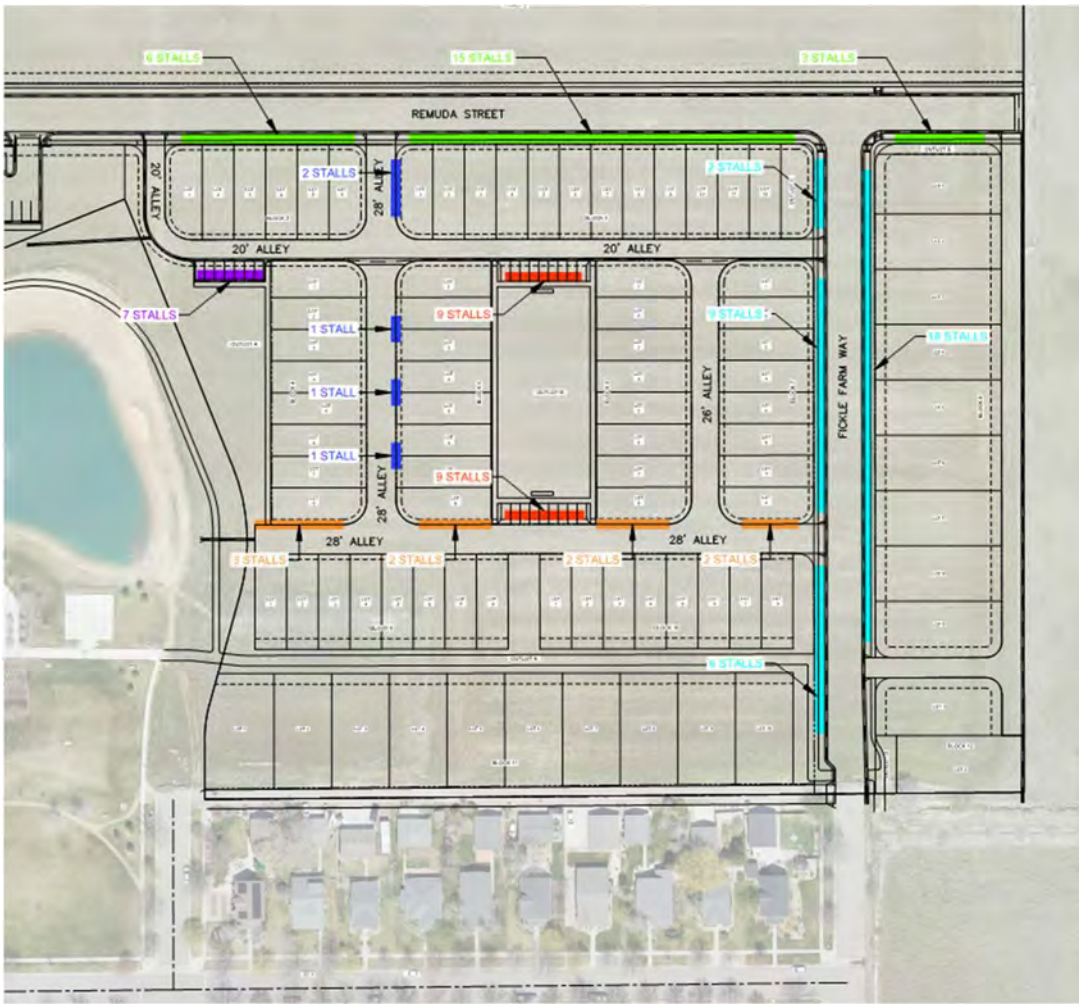
- Parallel parking stalls are 24’ long
- Perpendicular parking stalls are 9’ wide and 18’ long.

Based on these criteria the table below summarizes the available parking for the area.

Table 1 - Parking Summary

Location	Parking Information	
	Type of Stalls	# of Stalls
South Side of Remuda Street (green)	Parallel	24
Fickel Farms Way (cyan)	Parallel	35
East – West 28" Alley (orange)	Parallel	9
North – South 28' Alley (blue)	Parallel	5
Adjacent to Outlot F (purple)	Perpendicular	7
Adjacent to Outlot B (red)	Perpendicular	18
Totals		98

The exhibit below shows the parking areas as noted above.



IV. **Conclusions**

The southeast (alley load) area of the Fickel Farms project meets the requirements from the Town of Berthoud of 2 parking spaces per dwelling unit with the garages, has 42 driveway spaces and additionally provides 98 stalls for guest visits to the homes which is well above the conservatively calculated 44 stalls for this project.

APPROVED NEIGHBORHOOD MASTER PLAN

LAND USE CHART

PLANNING AREA I.D.	LAND USE	AREA SF. (net)	AREA AC. (net)	UNITS
A	Single Family Detached / Attached Front Load	121,129 sf.	2.78 ac.	14
B	Single Family Detached / Attached Front Load	488,989 sf.	11.23 ac.	56
C	Single Family Detached Alley Load	80,452 sf.	1.85 ac.	14
D	Duplex Alley Load	16,846 sf.	0.39 ac.	6
E	Duplex Alley Load	32,707 sf.	0.75 ac.	12
F	Duples Alley Load	22,292 sf.	0.51 ac.	8
G	Duplex Allley Load	22,292 sf.	0.51 ac.	8
H	Duplex Alley Load	22,292 sf.	0.51 ac.	8
I	Duplex Alley Load	22,196 sf.	0.51 ac.	8
J	Single Family Detached Alley Load	56,606 sf.	1.30 ac.	9
K	Duplex Alley Load	21,600 sf.	0.50 ac.	8
L	Duplex Alley Load	21,600 sf.	0.50 ac.	8
M	Single Family Detached Alley Load	59,455 sf.	1.36 ac.	10
N	Single Family Detached Alley Load	13,060 sf.	0.30 ac.	2
		1,001,520 sf.	22.99 ac.	168

North

0' 100' 200' 300'

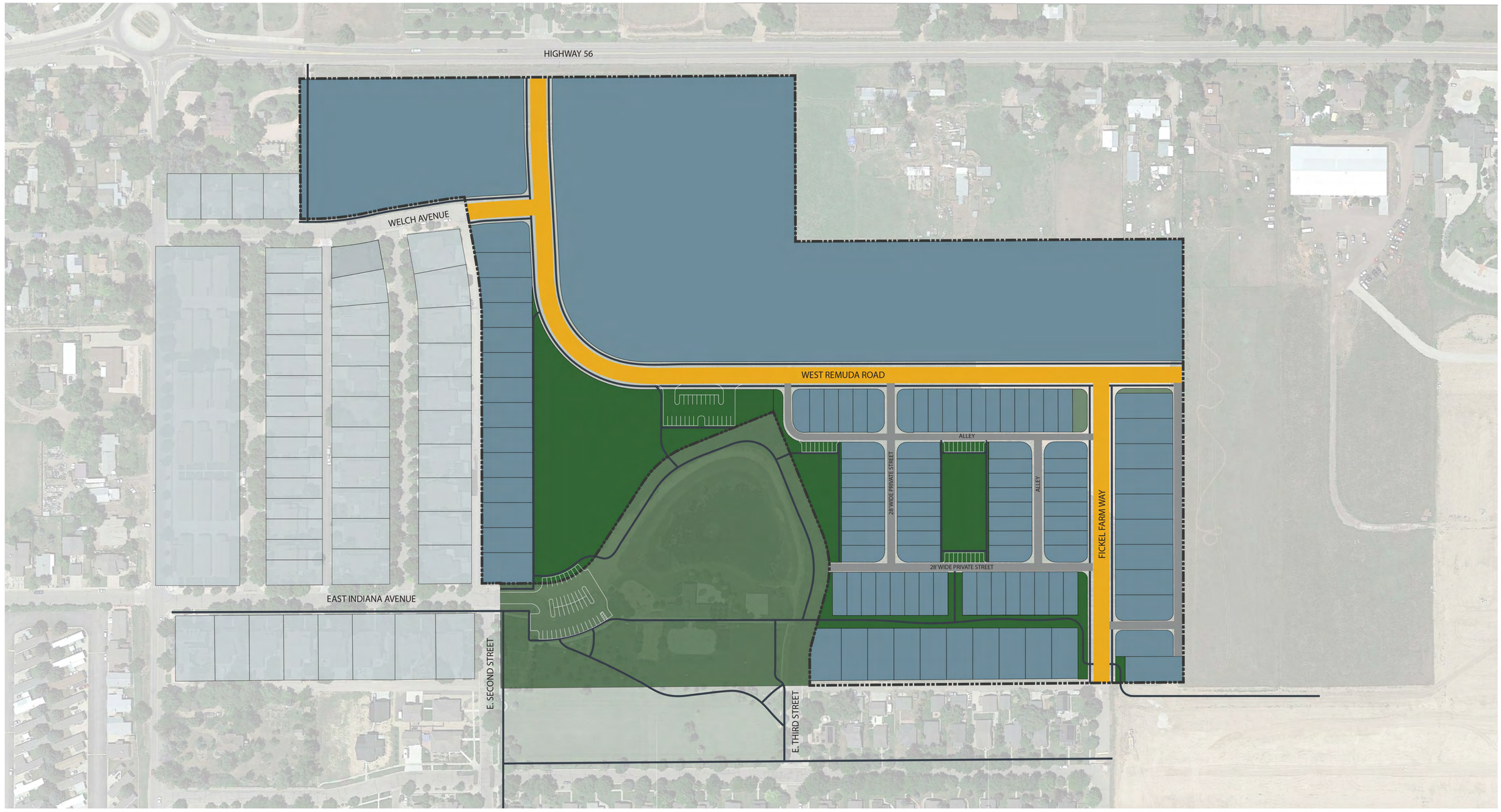
Scale 1" = 100'-0"

Fickel Farm - Neighborhood Masterplan

LAND USE PLAN

STACKlot

May 11, 2021



LEGEND:

Proposed Local Street

North

0′ 100′ 200′ 300′

Scale 1" = 100'-0"

Fickel Farm - Neighborhood Masterplan

STREET NETWORK PLAN

STACKlot

May 11, 2021

OPEN SPACE CHART

OPEN SPACE I.D.	AREA SF. (net)	AREA AC. (net)	PROVIDED ELEMENT	ELEMENTS
1	117,362.91 sf.	2.69 ac.	Community Lawn	2 Elements
2	18,548.00 sf.	0.43 ac.	-	-
3	25,000.00 sf.	0.57 ac.	Greenway	1 Element
4	23,691.00 sf.	0.54 ac.	-	-
5	1,097.00 sf.	0.03 ac.	-	-
	185,698.91 sf.	4.26 ac.		3 Elements

Fickel Farm - Neighborhood Masterplan

OPEN SPACE PLAN

STACKlot

May 11 , 2020

Trail Legend

- Sidewalk
- Existing Concrete / Decomposed Granite Trails
- Proposed 8' Wide Concrete Trail
- Existing Sidewalk

North

0' 100' 200' 300'

Scale 1" = 100'-0"

Fickel Farm - Neighborhood Masterplan

TRAIL PLAN

STACKlot

May 11, 2021

Fickel Farm - Neighborhood Masterplan

PARK PLAN

STACKLot

May 11, 2021

Product Type

- Type 1 - Single Family Detached Front / Alley Load
- Type 2 - Single Family Detached Alley Load
- Type 3 - Duplex Alley Load

KEY — Subdivision Standards Elements

- Community Gardens - One Element
- Entryway - One Element
- Useable Open Space over 1 acre - Two Elements
- Alley Loaded Streets maintained by Town - One Element
- Playground - One Element

Six Elements Provided

North

0′ 100′ 200′ 300′

Scale 1″ = 100′-0″

Fickel Farm - Neighborhood Masterplan

SUBDIVISION IDENITY PLAN

STACKlot

January 6th, 2021

TRACT 1

TRACT 2

TRACT 3

WELCH AVE

WATER END PLUG

CONNECTION TO EXISTING WATER MAIN

EXISTING FIRE HYDRANT

WATER SERVICE (TYP)

FIRE HYDRANT

SANITARY SERVICE (TYP)

IRRIGATION SERVICE (TYP)

SANITARY MAIN

PYRAMID PEAK ST

EXISTING 12" WATER MAIN

SANITARY MANHOLE (TYP)

WEST REMUDA STREET

CONNECTION TO EXISTING 12" WATER MAIN

WATER MAIN

FIRE HYDRANT

CONNECTION TO EXISTING SANITARY MANHOLE

CONNECTION TO EXISTING WATER MAIN

E INDIANA AVE

2ND STREET

BURIED ELECTRIC

24" STORM DRAIN

STORM DRAIN

FLARED END SECTION (TYP)

CONNECTION TO EXISTING 12" IRRIGATION MAIN

EXISTING 12" WATER MAIN

FIRE HYDRANT

PIONEER PARK POND

CONNECTION TO EXISTING 12" WATER MAIN

24" STORM DRAIN

STORM OUTLET (TYP)

EXISTING STORM OUTFALL

EXISTING 12" IRRIGATION MAIN

PIONEER PARK

CONNECTION TO EXISTING 18" HDPE

3RD STREET

SANITARY END PLUG

WATER END PLUG

FIRE HYDRANT

CONNECTION TO EXISTING WATER MAIN

BLOCK 1

BLOCK 2

BLOCK 3

BLOCK 4

BLOCK 5

BLOCK 6

BLOCK 7

BLOCK 8

BLOCK 9

BLOCK 10

BLOCK 11

BLOCK 12

ALLEY A

ALLEY B

ALLEY C

ALLEY D

ALLEY E

ALLEY F

OUTLOT A

OUTLOT B

OUTLOT C

OUTLOT D

OUTLOT E

FICKEL FARM WAY

WATER MAIN

SANITARY MAIN

IRRIGATION MAIN

FIRE HYDRANT

SANITARY END PLUG

WATER END PLUG

WATER END PLUG

FIRE HYDRANT

STORM DRAIN

CONNECTION TO EXISTING 18" HDPE

CONNECTION TO EXISTING 12" WATER MAIN

Fire Hydrant & Light Pole

CONNECTION TO EXISTING SANITARY MANHOLE

H20 Valve (typ)

LEGEND

MAPPING / SITE

- PROPERTY BOUNDARY
- RIGHT-OF-WAY
- LOT LINES
- EASEMENTS
- CURB AND GUTTER

PROPOSED UTILITIES

- SANITARY SEWER MAIN
- SANITARY SERVICE
- SANITARY SEWER MANHOLE
- WATER LINE MAIN
- WATER SERVICE
- IRRIGATION MAIN
- IRRIGATION SERVICE
- FIRE HYDRANT
- THRUST BLOCK
- GATE VALVE
- STORM DRAIN PIPE
- STORM DRAIN MANHOLE
- STORM DRAIN INLET
- FLARED END SECTON
- RIPRAP

EXISTING UTILITIES

- WATER LINE MAIN
- SANITARY SEWER MAIN
- IRRIGATION MAIN
- STORM DRAIN PIPE
- SANITARY SEWER MANHOLE
- STORM DRAIN MANHOLE
- OVERHEAD ELECTRIC
- GAS LINE
- ELECTRIC BOX

NOTES

1. MINIMUM HORIZONTAL EDGE TO EDGE SEPARATION BETWEEN SANITARY SEWER & WATER MAINS IS 10 FEET.
2. WATER MAINS CROSSING OVER A SANITARY OR STORM SEWER SHALL MAINTAIN AN 18" VERTICAL EDGE TO EDGE CLEARANCE. WATER MAINS CLOSER THAN 18" OR UNDER SEWERS SHALL BE ENCASED.
3. ALL PROPOSED SANITARY , WATER AND IRRIGATION LINES ARE 8" UNLESS NOTED OTHERWISE ON THE PLANS.
4. ALL PROPOSED SANITARY AND WATER MAINS ARE C900 PVC PIPE UNLESS OTHERWISE NOTED.
5. ALL PROPOSED IRRIGATION MAINS ARE PURPLE C-900 PIPE UNLESS OTHERWISE NOTED.
6. ALL PROPOSED STORM SEWER MAINS ARE 18" REINFORCED CONCRETE PIPE (RCP) UNLESS OTHERWISE NOTED AND SHALL BE CLASS III RCP UNLESS OTHERWISE NOTED.
7. ALL SANITARY SEWER SERVICES ARE 4" DIAMETER UNLESS SPECIFIED OTHERWISE.
8. ALL WATER SERVICES ARE 3/4" DIAMETER UNLESS SPECIFIED OTHERWISE.
9. ALL IRRIGATION SERVICES ARE 1" DIAMETER UNLESS SPECIFIED OTHERWISE.
10. MINIMUM COVER ON WATER MAINS IS 5'.
11. ALL EXISTING UTILITIES TO FIELD VERIFIED PRIOR TO CONSTRUCTION.
12. EXISTING UNDERGROUND AND OVERHEAD PUBLIC AND PRIVATE UTILITIES AS SHOWN ARE INDICATED ACCORDING TO THE BEST INFORMATION AVAILABLE TO THE ENGINEER.

0' 40' 80' 160'

SCALE: 1" = 80'
U.S. SURVEY FEET

CivilWorx
4025 Automation Way
Suite B2
Fort Collins, CO 80525
(970) 698-6046
CivilWorxeng.com

NO.	BY	DATE	REVISIONS

CAUTION

The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

FICKEL FARM PUD 4TH FILING

MASTER UTILITY PLAN

DATE SUBMITTED: 06/23/2020

PREPARED FOR: BERTHOUD HOMES, LLC

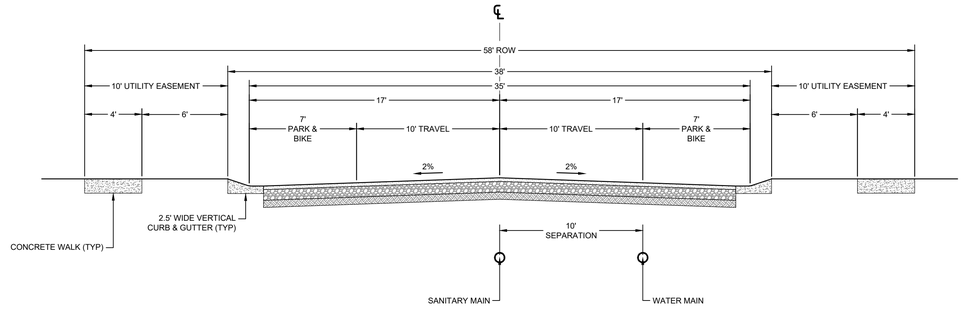
PRELIMINARY PLANS NOT FOR CONSTRUCTION

SHEET NUMBER
UT01
3 OF 5 SHEETS

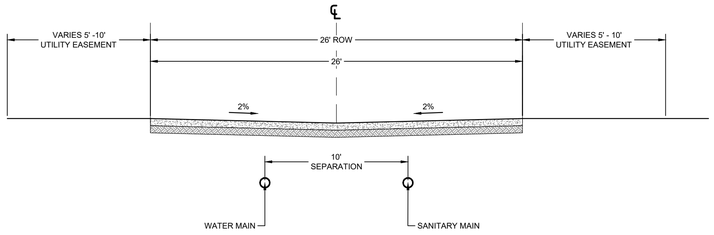
SCALE
VERTICAL: N/A
HORIZONTAL: 1" = 80'

JOB NUMBER
C18005

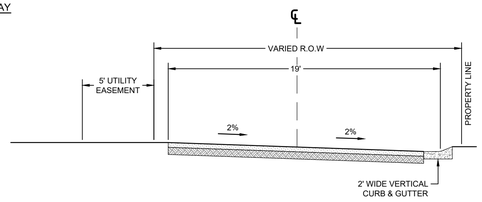
| JustinBeckner | D:\CivilWorx\CivilWorx Dropbox\CivilWorx\Projects\C18005 - Ficket Farms\Cadd\Of\Preliminary\Master Utility Plans.dwg | 12/22/2020 4:44 PM |



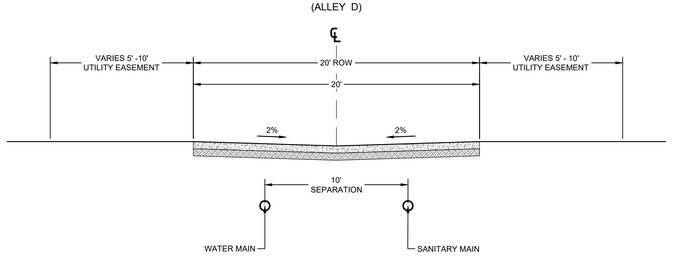
LOCAL STREET - 58' RIGHT OF WAY



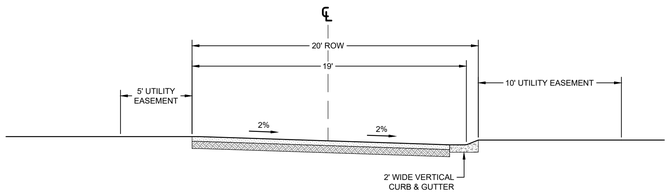
ALLEY SECTION - 26' RIGHT OF WAY
(ALLEY D)



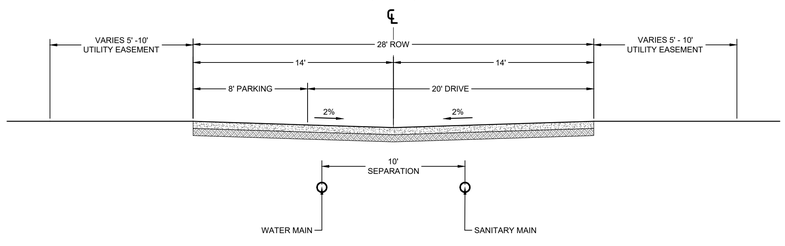
ALLEY SECTION - 20' MIN RIGHT OF WAY
(ALLEY E)



ALLEY SECTION - 26' RIGHT OF WAY
(ALLEY D)

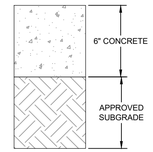


ALLEY SECTION - 20' RIGHT OF WAY
(ALLEY A)

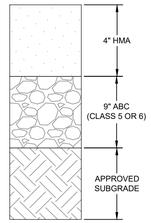


28' PRIVATE STREET
(ALLEY B & C)

ALLEY
TYPICAL SECTION DETAIL



COLLECTOR STREET
TYPICAL SECTION DETAIL



RESIDENTIAL STREETS

NOTES:

1. FINAL PAVEMENT SECTIONS ARE TO BE PROVIDED BY A GEOTECHNICAL ENGINEER IN CONFORMANCE WITH TOWN OF BERTHOUD STANDARDS AFTER UTILITY INFRASTRUCTURE HAS BEEN INSTALLED AND SUBGRADE PREPARED. THE PAVEMENT SECTIONS AS SHOWN ON THIS DRAWING ARE FOR BIDDING PURPOSES AND WERE TAKEN FROM THE EARTH ENGINEERING CONSULTANTS REPORT ENTITLED "PRELIMINARY SUBSURFACE EXPLORATION REPORT FICKEL FARM DEVELOPMENT SOUTH OF LCR8 AND EAST OF 1ST STREET - BERTHOUD, COLORADO", DATED FEBRUARY 29, 2008, EEC PROJECT NO. 1182059.

CivilWorx
4025 Automation Way
Suite B2
Fort Collins, CO 80525
(970) 698-6046
CivilWorxeng.com

NO.	BY	DATE	REVISIONS

CAUTION
The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

FICKEL FARM PUD 4TH FILING
TYPICAL SECTIONS

DATE SUBMITTED: 06/23/2020

PREPARED FOR: BERTHOUD HOMES, LLC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

SHEET NUMBER
TS01
5 OF 5 SHEETS

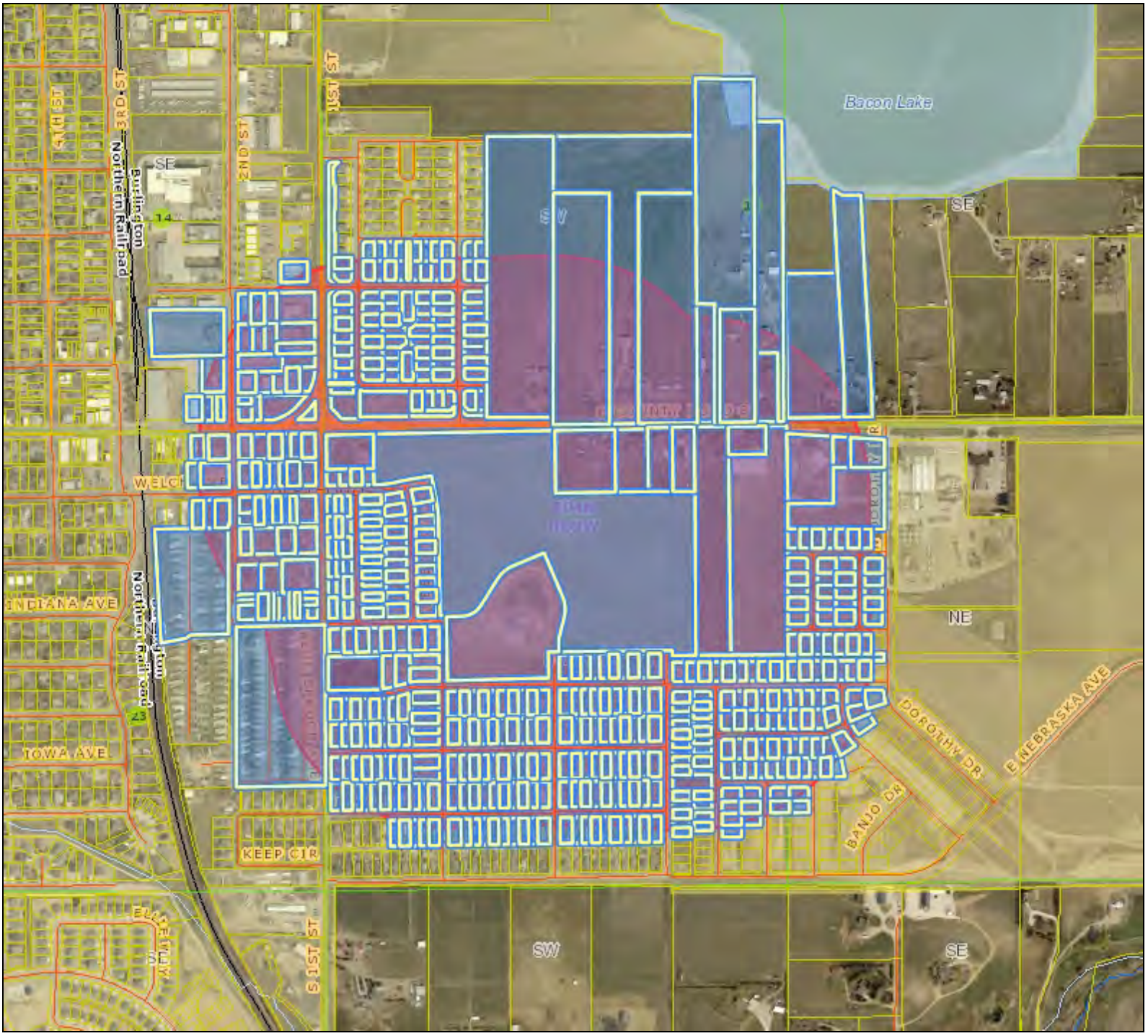
SCALE
VERTICAL: N/A
HORIZONTAL: N/A

JOB NUMBER
C18005

| JustinBeckner | D:\CivilWorx\CivilWorx Dropbox\CivilWorx\Projects\C18005 - Fickel Farms\Cad\DP\Preliminary\TS_Typical Sections.dwg | 5/5/2021 10:11 AM |

PUBLIC COMMENT

Larimer County Web Map



Legend

- Subdivisions
- Tax Parcels
- PLSS Township and Range
- PLSS Sections
- PLSS Quarter Sections
- Major Rivers and Streams
- Rivers and Streams
- County Boundary
- Rocky Mountain National Park
- Incorporated Areas
- Other

Notes

0.1 0 0.1 Miles

Date Prepared: 2/18/2021 5:03:21 PM

Scale 1: 9,515

This map was created by Larimer County GIS using data from multiple sources for informal purposes only. This map may not reflect recent updates prior to the date of printing. Larimer County makes no warranty or guarantee concerning the completeness, accuracy, or reliability of the content represented.

From: E DAVIS
To: Curt Freese; Adam Olinger
Subject: Fickel Farm Phase 3 & 4
Date: Thursday, August 20, 2020 8:14:08 PM

As a neighbor, I am concerned about this development and the expected traffic flow. Please send me the full submittal that includes the streets connecting to these new clusters of homes and any upgrades to them.

I would also like to get information on what to expect for Phase 4 and any upgrades to the park or pond area.

Thanks in advance,
Erni Davis
107 East 2nd Street

From: Lisa Plante
To: Curt Freese; Adam Olinger
Subject: Fikel Farm Phase III
Date: Friday, August 21, 2020 9:37:17 AM

Hi,

I received a neighborhood notice re Fickel Farm Phase III, as I live nearby in Peakview Meadows. Per the notice, it says I can request the full submittal by emailing you. Are there electronic versions of the submittal that you can email me?

Thank you,

Lisa Plante
Homeowner
685 Pyramid Peak St
Berthoud, CO 80513

cell: 720-841-5560
email: lpkusa@yahoo.com

From: Dillon Walker
To: Curt Freese
Cc: Adam Olinger
Subject: Fickle farm phase 3
Date: Saturday, August 22, 2020 3:47:27 PM

This email is in regards to a neighborhood notice I received in the mail. I would like to request that if you approve Fickel Farm phase 3 development that you increase Pioneer parks size to accommodate the increase number of residence to the area. The playground equipment is out of dated and small. New playground equipment would be nice to accommodate kids of all ages. It would be nice to have a dog park in the area and a walking path around the pond at the park.

Thanks
Dillon Walker
Sent from my iPhone

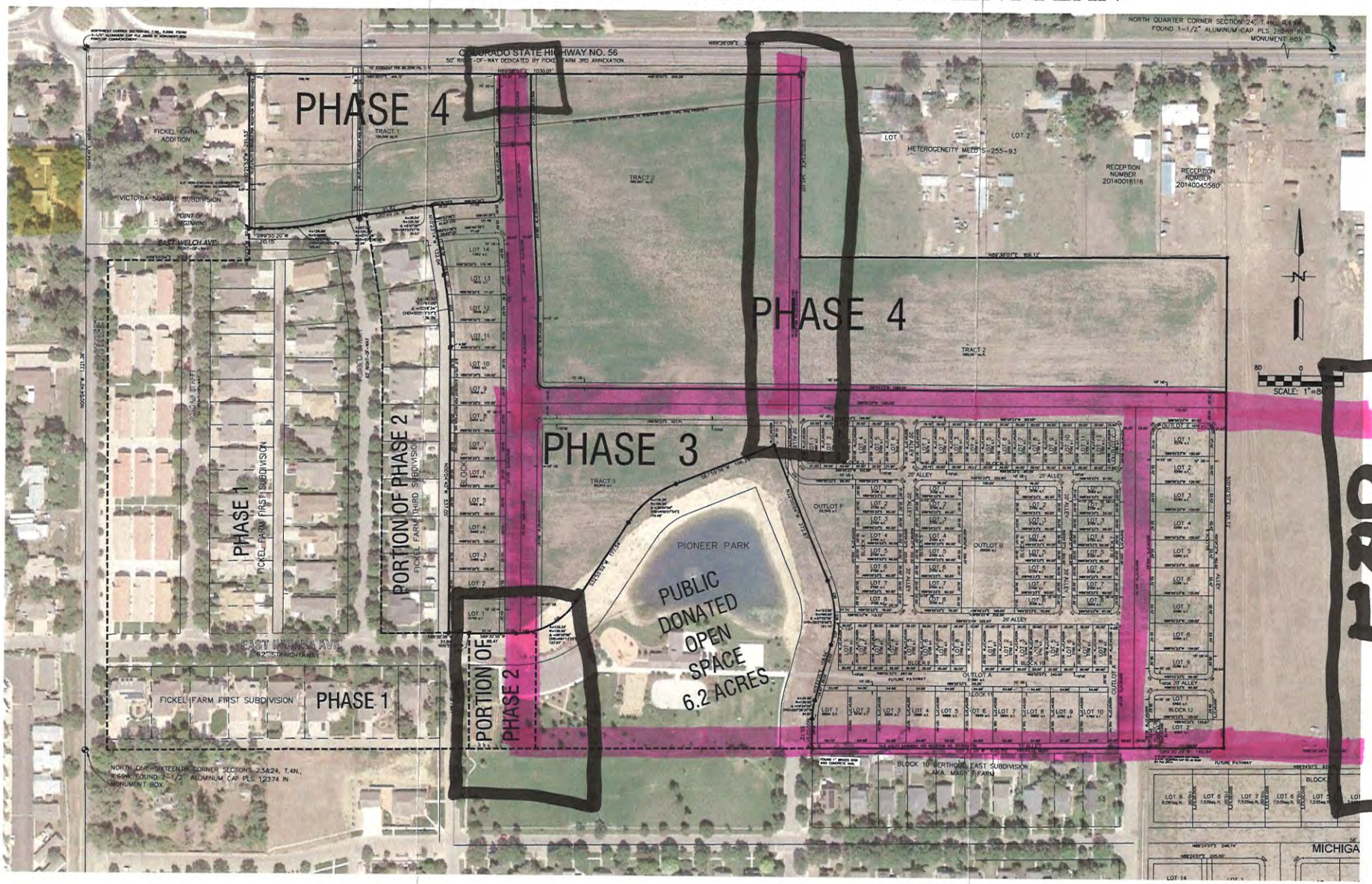
A resident stopped by and spoke with staff about his desire that the roads be constructed before any houses get built, and additional roads be put in place off of Hwy 56 (shown in pink in the map below). The resident also originally expressed desire to see the east/west roads extend to County Line Rd in the east, but later understood that County Line Rd is much further away than he originally suspected.

LOUIS GERVASI
110 WELCH AVE
720-771-5277

ROADS FIRST

CONNECT

FICKEL FARMS OVERALL DEVELOPMENT PLAN



DEDECKER LAND SURVEYING
650 E. 4TH ST. #E
LOVELAND, COLORADO 80537
C (970) 217-2531 H (970) 663-2013

CLIENT AND PROJECT:
DEDECKER HOMES, LLC
FICKEL FARMS OVERALL DEVELOPMENT PLAN
PART OF THE NW 1/4 SECTION 24, T.4N., R.69W.
TOWN OF BERTHOUD, LARIMER COUNTY, COLORADO

RESPONSIBLE:
CHECKED:
APPROVED:
DATE: JULY 30, 2020
SCALE: 1"=100'
PROJECT NO.
SHEET 2 OF 2

DATE	RECORD OF ISSUE	BY	CK.

From: lynnfda@aol.com
To: Adam Olinger
Subject: Fickel Farm filing - comments
Date: Sunday, August 30, 2020 12:30:15 PM

Hello Mr. Olinger -

We are submitting this email to provide comments in response to the the recently mailed notice on the subject filing.

Before listing our comments, we note that in some recent development filings our existing neighborhood has been erroneously labeled on maps as part of Mary's Farm. We don't know if this is an oversight by the town, or by the developer. We noted this in particular with some filings for the Farmstead development. Please ensure that our neighborhood (labeled on the map included with the current filing as Fickel Farms Phase 1 and Portion of Phase 2) is correctly labeled on all current & future maps of this part of Berthoud.

We do appreciate the mailed notices concerning this development application. However, there is once again an issue of signage on the property advising the general public - and reminding the adjoining neighborhoods - about the proposal. There is one sign for the public out on CO 56, and it is only partially visible because of all the weeds. In addition, it appears that vandals have again removed some screws so the sign is not secured at the top. (We have heard that the town has had similar vandalism problems for signs posted at other proposed developments.) Consistent with previous comments on signs for developments within Berthoud, we believe there should be at least signs at the end of Welch and at the current north ends of 3rd and 4th Streets NE. It wouldn't hurt to have signs also along the two affected alleyways, which would help to remind neighbors and others of the extent of the project. The alleyway signs need not as big as the more expensive metal-framed sign on the CO 56 side. The signs at the ends of Welch and 3rd and 4th Streets could be larger and mounted on the barriers at the ends of those streets.

Application Form

1. The Project Name has a typo: "Forth" should be "Fourth". How can one assess the competence of the filers if they don't even spell check their own project name?

2. Project Information: The number of units is listed as "Phase 1: 101" and "Phase 2:74". The letter accompanying the application (from Mr. Wiens of StackLot, see below) only addresses 101 units. The accompanying map (see comments below) lists "Phase 3" and "Phase 4" of the original PUD as applying to the vacant land available for development. On that map, there are lots platted for "Phase 3", and the platted lots total to 101 units in 12 "blocks." Where are the 74 units for "Phase 2" of this application and where are they to be placed? How do phases 1 & 2 in this application correlate with phases 3 & 4 of the original PUD? Is this application only addressing the 101 units in its phase 1 (presumably "Phase 3" of the original PUD), or is it addressing more?

Presumably, the 2700 sq.ft. lots are the duplexes in blocks 2-7, 9 & 10. And presumably the 6567 sq.ft. lot sizes are those single family ones on the southern and eastern peripheries of the property. What size are the lots (presumably single family units) on the western periphery? They obviously will be smaller than the maximum size, and larger than the duplex lots.

Memorandum: traffic study

1. We are sure that the algorithms used for determining are well-established and documented. However, to us as uninformed lay persons in this area, the analysis seems very short-sighted. The current analysis only addresses the 101 units for phase 1 of this application. It doesn't include the mysterious "phase 2" listed in the application. Nor does it provide a speculative maximum impact from full build-out of the entire development based on the maximum density allowed under the existing PUD for the entire

property. While this type of study and report may be legal and all that is required, it provides a piecemeal and misleading traffic impact from the project as a whole. Does this piecemeal procedure lead to a certain level of road and intersection improvements applicable only to the 101 units of phase 1, with additional upgrades and improvements for the additional traffic that will occur as further build-out takes place?

2. Again, being unfamiliar with the algorithms used, as ordinary citizens we question whether 7% (AM) and 9% (PM) of daily trips during peak hours is sufficient. Having lived in suburbia on the East Coast, we are acutely aware of the high amounts of traffic in and out of housing areas during morning and evening "rush hours." Berthoud does not have the employment infra-structure to accommodate all the future residents of this development. This project is not touted as a "55 and over" neighborhood, so we would anticipate that the residents would mostly be working families, and families with children - some of whom may be teenagers who drive. Many - probably most - of the employed residents will be commuting to jobs elsewhere and likely leaving during the peak travel times. However, even those working in Berthoud could be using the evaluated routes during peak times. While there no doubt will be traffic in and out all during the day, assigning only 16% of total trips to the "rush hours" just seems way too small. It would help regular citizens to know what peak hour ranges were used in the analysis so we can better comment. Of course if the peak hour ranges are very narrow and out of sync with real commuting times, the estimated number of trips will be small.

3. The trip distribution addresses State Highway 56 (SH56) east and west, and County Line Road (CLR) north and south. It also addresses E. Nebraska. We note that the proposed project does not abut County Line Road. Access to CLR is only via the Farmstead development or SH56. So any impact on CLR north really begins with impact on SH56 east. Any impact on CLR south really is an impact on the Farmstead (and Mary's Farm) neighborhoods. The impact on Nebraska through Mary's Farm to South 1st would likely be minor. Traffic heading out of this proposed development toward South 1st more likely would occur on E. Michigan, E. Indiana and E. Welch, given the street alignments of NE 2nd and NE 4th as they connect to Welch & and Indiana, and to Michigan, respectively. In addition, egress from the shared alley (and the homes will be alley loaded) on the west periphery of the project is onto Welch at the north end and Indiana on the south end. The trip distribution impact does not at all address these potential impacts on Michigan, Indiana and Welch.

4. Under the PUD which is the zoning basis for this project, space along CO 56 and elsewhere could be devoted to commercial businesses and/or to apartments. Again, this study only addresses the immediate application and does not acknowledge that future traffic will be affected by more than the current project.

<u>Letter from Mr. Wiens dated June 25, 2020, to Mr. Curt Freese</u>

1. We find the first paragraph of this letter a bit disingenuous. The lack of communication with the community with respect to the Farmstead project and some of the plans for that project led to great community outcry. In the absence of that outcry, we doubt the complaints the applicant addresses in the second paragraph would have been factored into the applicant's thinking and plans.

2. We are only aware of one announced public meeting (at Grace Church) of the applicant, as cited in paragraph two. The applicant may have been scheduled to speak at a meeting of the Berthoud Concerned Citizens group; however, if so, we were not able to attend that meeting. Beyond those "neighborhood meetings," there may have been meetings with individual residents of Mary's Farm concerning the Farmstead project. We are unaware of any meetings with individual residents of the existing Fickel Farm community.

3. We are grateful that comments, submitted previously concerning how the plans to complete Fickel Farm should be consistent with the existing community, have at least been recognized. The proposed project addressed in this filing will affect both Mary's Farm and the existing Fickel Farm communities.

4. The applicant, and sometimes the town, continues to subsume the existing Fickel Farm subdivision under discussions of the Mary's Farm subdivision. The applicant and the town need to acknowledge that there are two existing subdivisions affected by the project plans. While the concerns or issues posed by

the project may be largely the same for both subdivisions, the discussions become "muddy" when things are only addressed as applying to Mary's Farm. There is the appearance that the existing Fickel Farm subdivision doesn't exist, or we are not worthy of consideration.

5. Concerning the connection of existing and proposed streets to CO 56, see our comments below on the map. We have fears about the potential loss of a portion of Pioneer Park to the planned alignment of streets.

6. Hurray! No Metro District! While a Metro District would not affect residents of the existing Fickel Farm subdivision, or Mary's Farm, we have concerns about how Metro Districts have been misused in other developments. If we want the residents of the new subdivision to be truly happy with living in Berthoud, their future taxes can be kept lower by avoiding payment of exorbitant Metro District taxes.

7. The applicant addresses community trails at the end of paragraph two, and also later in the letter. The applicant can hardly "complete" a trail system around Pioneer Park when the promised trail system coming out of Farmstead has not even been started. That was supposed to have been constructed early on in the development of Farmstead. Is the applicant now tying building of the Farmstead segment to the building of the Fickel Farm segment? The only "trail" that exists now is the sidewalk through around Pioneer Park, including the sidewalks paralleling the existing streets around the park.

8. The letter only addresses 101 units, as does the map. However, the application also mentions another 74 units. (See comments above on the application.)

9. The letter addresses planned product types. We will comment more on that below with our comments stemming from the map.

10. The letter indicates that the planned trails through this project and Farmstead will connect <u>three</u> parks. There appears to be no "park" included in the current project, other than that it abuts Pioneer Park. Where will the other two parks be located? Presumably at least one will be in the Farmstead development. Will there be another in the as-yet-unplanned completion of Fickel Farm? If the applicant wants to highlight connecting parks, there should be some discussion about what parks, where they are or will be located. It doesn't help to simply provide ephemeral promises, which may not be kept.

11. Finally, the applicant proposes to donate a portion of the project to an increase in space for Pioneer Park, and to include other open spaces in the project. This is to be lauded. However, we comment below on the map of the project and whether the space being donated to <u>increase</u> the size of Pioneer Park is actually intended to compensate for loss of Pioneer Park space elsewhere.

<u>Map</u>

Our comments here address matters that are not evident from the other documents, or expand on comments raised for those other documents.

1. We appreciate that the layout of the proposed lots has taken past comments into account. In particular, the placement of the single family homes around the periphery transitions the lots from the existing neighborhoods (existing Fickel Farm, Mary's Farm, and to some extent Farmstead) single family homes into the duplexes in the middle.

2. The map shows a proposed 14 lots on the western periphery (Block A). These are designated as single family home lots. However, they are smaller and more numerous than the existing Fickel Farm single family residences with which they will share an alley. They are also smaller than the single family lots on the southern periphery (Block 11, which share an alley with Mary's Farm residences). Is it intended that these new residences are to be more similar in size and design to the cottage homes on the west side of Victoria Street, rather than the residences on the east side of Hubbell Street?

3. Is the space (Outlot A)in front of the lots in Block 11 a "green alley?" Is this where the promised trail through this project and around Pioneer Park will go?

4. We appreciate the fact that all the homes are alley-loaded, consistent with the existing homes in Fickel Farm and Mary's Farm. However, there are only three streets through the project, which provide precious little parking for visitors. Unless there is alley space for visitors, the duplex homes on the interior would have no visitor parking spaces. The plan must be modified to provide adequate parking spaces for visitors.

5. We have great concern for the alignment of 2nd Street (NE?) within this project. This is the street that provides an exit for the entire area directly onto CO 56 (see comments above about traffic). Our concern from this map is the southern end of the new street. Will it dead-end at the city-owned land for Pioneer Park? If it is not a deadend (which itself is problematic), how will it connect with Indiana and existing 2nd Street? If it cuts through to Indiana, it will exit the new project right into the Pioneer Park parking lot, or very nearly so. If the plan is to realign existing 2nd Street, the only possibility under the current layout is to angle through the northwest portion of Pioneer Park, and to wipe out the community garden and trees that form the entrance to the park. It would be inconsistent with Berthoud's pride in its trees to destroy this corner of Pioneer Park. (We note that the Planning Commission recently took a stance that preserves at least street trees for the development they approved at the corner of N. 6th Street and Franklin Avenue.) It is nice that Tract 3 would be an addition to Pioneer Park. But it appears that under a street alignment that removes a section of Pioneer Park, Tract 3 is little more than compensation, not an addition.

We recommend that the applicant eliminate two or three of the lots in Block 1 and angle the alignment of 2nd NE within the project to match up with the alignment of existing 2nd NE, and in a way that minimizes impact on the existing alley's southern end. This may require that the southern-most lot in Block 1 be an odd shape - perhaps for a larger single family home, or that there be a additional small outlot.

6. As noted in our comments on the traffic study, the project does have an outlet to Welch. While this is useful, this egress was not addressed in the traffic study.

Thank you for the opportunity to comment on this application for development.

(Mr.) Lynn & Jeanne Larsen
205 Hubbell Street
Berthoud

From: Catherine Scott
To: Adam Olinger
Subject: Fickel Farms Overall Development Plan
Date: Sunday, August 30, 2020 3:46:16 PM

Fickel Farms Overall Development Plan

General comments by Catherine Scott 8.30.20

I hope the intention is that all of the lots that are along alleys will have alley loaded garages. This enables for more attractive front elevations on the houses, traditional sidewalk and street trees without sidewalks broken by garage aprons and the visual nuisance of parked vehicles. *(I assume that this will be happening along 4th street as part of the Farmstead development, and am perplexed by the fact that the design of many of the houses on Lemonade Drive did not take advantage of the alley for this purpose).*

I would be very pleased to see the style of the houses similar to the houses in Farmstead that are along Lemonade drive – they are small, quite attractive, and I am pleased that Alpine builders did not include the fake masonry which builders seem to love, but which I think often is detrimental to the look of houses. I favor the farmhouse look they have provided. Variety of color is great too, rather than the overall beige/grey look. *(in general, I am pleasantly surprised that the house styles in Farmstead are attractive, have a "Colorado" look and offer more variety than is seen in some other local new developments). Also, the new fences are nice looking..*

I am pleased to see the provided pedestrian pathway between Pioneer Park and Farmstead which is part of the Fickel Farms development is no longer proposed along the alley behind the existing Mary's Farm houses along Michigan. The new proposed location is much better. I do think this pathway should be required to be paved.

I believe the developer should be required to improve and repave the existing alley mentioned above. It was in horrible shape prior, but now is in absolutely deplorable shape as a result of heavy equipment used when the piping infrastructure was placed in the adjacent field last year.

Because of the proposed very small lots, there will be a huge increase in residents using Pioneer Park. The developer should be required to enlarge the park and add amenities that neighboring residents favor – *perhaps a survey is in order?* For example, I would love to see some pickle ball courts.

Because of prior approval, over in Farmstead the developer was not required to provide open space and amenities per the current codes. As a result, many additional Farmstead folks will use Pioneer Park because the small park supposedly being provided in Farmstead will be off in left field and underutilized by residents. Some of this should be made up for with the Fickel Farms project – especially as it is the same developer!

Lastly, I would appreciate being kept in the loop as this project goes forward. I am NOT on Facebook, swore off of it years ago, and hope that notices regarding meetings will be sent to residents in a timely manner other than on Facebook.

Thank you,

Catherine Scott

109SE 2nd Street, Berthoud

970-412-7273

CatherineScottStudio@yahoo.com.

From:	Colton Schwader
To:	Curt Freese; Adam Olinger
Subject:	Fickel Farm Phase III Comments
Date:	Monday, August 31, 2020 9:48:21 AM

Good morning Gentlemen,

I received the mailer which was sent out regarding comments for the proposed Fickel Farm Phase III. My wife and I are Northern Colorado natives but have just recently relocated to the Farmstead. Our particular lot is on the North of E. Michigan Ave meaning we have the trail which connects or will connect to pioneer park. I provide this information to serve as background and to settle the bias I may have as well as the perspective which structures the below comments.

Please note, I have very little knowledge in any sort of town or urban planning and development and likely am not assessing the "bigger" picture; I simply hope that my concerns and observations can help with any decision making processes.

1.) View: Looking at the proposal, it appears that the eastern most row of homes will obstruct views of the mountains and sunset from our property as well as the trail. I recognize the subjective nature of this remark and understand the minimal weight that it does and/or should bear but I would be amiss if I didn't mention it at the least.
2.) Traffic Safety: The current turn off of 56 south onto Dorothy is unwieldy. In its current state, the turn lane is much too short given that it is right in the path of acceleration. The turn coming from I-25 is entirely non-existent. I feel that as it stands, it is only a matter of time before a driver behind a turning vehicle doesn't recognize the stopped car waiting to turn or the deceleration to make a timely and safe change into the turn lane. This is relevant because when the obstructions are removed from Michigan, it will likely become one of the main ways to access this proposed area. It also bears relevance in that any proposed connection to 56 may result in a similar situation. I think lowering the speed limit in this corridor would increase safety as more and more homeowners move in.
3.) Construction Access: I am not sure in which way construction vehicles will access the area. The obstacles on Michigan, to my knowledge, exist to prevent construction vehicles from driving on roads in the existing Fickel/Mary's Farm neighborhood due to community concern that the roads are not adequate to support such heavy and sustained traffic. Any access from Farmstead would make sense however the developer clearly suffers from an inability to adequately install asphalt roads as evidenced by the countless potholes and sinking spots that already exist. Any access off 56 will be affected by points mentioned above.
4.) Repetition: It seems as though all of the lots are intended to be alley loaded. I do not have anything inherently against this but it causes concerns that buildings will become repetitive and boring. If you have not yet been through the Farmstead to see how the builders are coming along, you may be disappointed to see how repetitious certain colors are becoming (gray and white) along with other repeating patterns like 3-4 ranches in a row, exact same floor plan/elevation being built within 2 lots of each other etc. There are a couple of homes which are exactly the same color and other places where 4 homes are all white. My concern with this is that this repetition will extend into the Fickel Farm Phase III proposal area and mixed with a very limited design space of alley loaded, will be detrimental overall to the desired aesthetics of the area. I will be sending a follow up email addressing these concerns in more specificity.
5.) Pioneer Park: Pioneer park is unique to Berthoud in that it isn't surrounded by structures on all sides. I recognize once more that this is subjective and bears little weight however I feel

like the current proposal will begin to "swallow" pioneer park and detract from its open appearance.
6.) Trails: Not completely related to this proposal but I would hope that any trails tying into Pioneer park (currently planned Farmstead as well as future planned trails) are constructed with natural materials such as Breeze or Decomposed Granite. It would be sad to see concrete pathing throughout.
7.) Non-Potable Irrigation: I understand the Farmstead, at some point soon, will be receiving irrigation from the pond at Pioneer Park. Is this proposal also set to tie into that system? If so, will it affect the current residents at all? Can the pond support this?

All in all, I hope that this expanded construction doesn't take priority from or overwhelm what is occuring at the Farmstead. Given that it is the only area in Berthoud and essentially Northern Colorado which is not in a Metro District, Berthoud has a unique opportunity to attract a lot of families and aid in the future development of the town and community. It would be a shame to see it squandered by a drive to expand at the cost of vision and character.

Very Respectfully,
Colton Schwader
Resident - 524 E. Michigan Ave

From:	Marilyn S
To:	Curt Freese; Adam Olinger
Subject:	Development Comment
Date:	Wednesday, September 2, 2020 2:56:50 PM

Good afternoon,
I am writing to you in response to the Fickel Farm Phase III development proposal. I live in Mary's Farm, just a few blocks south of the proposed development area. I am hopeful that the applicant will consider my comments for this particular proposal and that you and your colleagues will consider my comments for this proposal AND future proposals to come.

There is currently a lot of development activity underway near our home at the new Farmstead development. Only a portion of the total homes slated for this development have been built and occupied, and already, my neighbors, husband, and I have noticed a significant increase in foot traffic and pet activity in our neighborhood. There has also been a significant increase in the amount of people using Pioneer Park. I am concerned that the Fickel Farm Phase III development will further impact the residents of this area, many of whom have resided in Mary's Farm since the '90s.

I am hopeful that you will consider three requests:

1. That the applicant be required to incorporate numerous green areas within the development. These green areas can be used for residents to walk and play in and for dogs to relieve themselves (rather than on homeowners' lawns and sidewalks). Ideally, the applicant would consider incorporating a small park - this doesn't need to be as large as Pioneer Park, but *something* would be nice so that not all of the demand for outdoor space falls on Pioneer Park and existing residents' front lawns.

2. That the applicant reduce the total number of new residential units from 101 to less than 60. This step would help to reduce the density of people in one area, thereby improving residents' quality of life. The reclaimed land can be used for either the aforementioned green spaces or to increase lot sizes of some homes in the proposed development (which, in turn, could be sold at a much higher price tag).

3. That the applicant be required to include entrances/exits into the new development via Colorado State Hwy 56 and NOT through the existing neighborhoods. We have a very strong community of children who ride their bikes and play in our neighborhood and an increase in traffic to and from the newly developed homes is very concerning to me. I believe very strongly that the residents of the proposed Phase III development should enter and exit via the main road, Hwy 56.

I would like to leave you with one more thought. I urge you to consider setting aside more public land using tax dollars. Numerous communities (Boulder is a good example) have successfully done this and they now have beautiful areas dedicated to public use scattered throughout their city. I am very concerned that all of the land for sale in Berthoud is going to developers who then work to squeeze in as many homes and/or retail units as possible. We will lose the character of Berthoud if we don't protect it. PLEASE consider taking a more aggressive approach in terms of setting aside public open space, and when developments are proposed, PLEASE take a more aggressive approach in limiting the density allowed in a

single area (for example, 60 homes approved where 100 may have been proposed). Our future truly rests in your hands in many ways!

Thank you,
Marilyn

--
Marilyn Seely
720.217.7822
Marilyn.Seely@gmail.com

From: Bob Rummer
To: Adam Olinger; Curt Freese
Subject: Re: Fickel Farm Phase III Comments
Date: Tuesday, September 8, 2020 11:21:11 AM

Revised Comments on Fickel Farm Phase III

I would like to submit the following revision of my comments from Aug 21, 2020. Planning has responded to clarify several points and I would hate to have people waste time addressing concerns that are not valid. If possible, please replace my earlier response with this one.

First, I would like to commend the developer for the planned transition between Mary's Farm and the new development with the single family units abutting the existing neighborhood. It is also good to see the accommodation in Outlot A for the pathway connecting to Pioneer Park. The park is a major neighborhood asset and having additional connectivity to it will be valuable.

I have two primary concerns about the Neighborhood Master Plan concept that is presented:
a) The overall concept is an alley-loaded high-density plan. While Berthoud has implemented some examples of this approach in Prairiestar, this plan pushes that concept even further. There are alleys being accessed by alleys. I believe that in the existing models of this approach every alley accesses a residential street. Note that the Larimer County Urban Area Street Standards state that alleys should be "Secondary Access only unless approved by the local entity engineer" (Fig. 7-9L, Fig. 7-10L). Traffic volumes for alleys are to be less than 200-250 ADT. Given the number of units it seems like this plan could be pushing the limits of acceptable access that "accommodates expected traffic and services." I would urge careful consideration of traffic volume and access as proposed in this plan.
b) Second concern is that the Neighborhood Master Plan shows the utility easement for the alley abutting the north edge of Mary's Farm as within the alley ROW. The LCUASS for all types of alleys show the easement as adjacent to the alley ROW. While the shown easement may be for sanitary or water main, I would like to make sure that development plan is considering provision of other utility services outside of the existing alleyway.

Thank you for consideration of these comments.

Bob Rummer
306 E Michigan Ave
Berthoud, CO

On Thu, Sep 3, 2020 at 8:17 AM Bob Rummer <bjrummer@gmail.com> wrote:

> Perfect. Thanks for the information Adam.
>
> Bob
>
> On Thu, Sep 3, 2020 at 7:53 AM Adam Olinger <aolinger@berthoud.org> wrote:
>
> > Good morning Bob,

The Fickle Farm Phase III project is only at the Neighborhood Master Plan stage of development, which is concept in nature and is more of a “big picture” image for the potential development. The more intricate details, such as alley construction, engineering, etc, will all be dissected in further detail at the next step, the Preliminary Plat, should the Town Board of Trustees approve this submittal. Also, as a side note, Berthoud only follows the Loveland LCUASS standards (and not the Ft Collins standards). I hope this helps answer your questions.

Best,

Adam Olinger

Planner I

Town of Berthoud

807 Mountain Avenue

Berthoud CO, 80513

Office: 970-344-5808 // aolinger@berthoud.org

From: Bob Rummer <bjrummer@gmail.com>
Sent: Wednesday, September 2, 2020 12:11 PM
To: Adam Olinger <aolinger@berthoud.org>
Subject: Re: Fickel Farm Phase III Comments

Adam,

I looked at the other references that you sent. Thanks for pointing me to the LCUASS. My primary questions about the proposed development are obviously what is planned to happen with the alley on the north edge of Mary's Farm. I don't see any details in the materials online. Maybe you can answer a couple of specific questions for me before I submit revised comments:

a) The development plan shows them taking care of the 10' of alley ROW on their side of the alley centerline. Are they going to rebuild the whole width of the alley for this project?

b) Have they detailed what the alley cross-section and surface will be (center drain, concrete, aggregate)?

c) The LCUASS states that a utility easement will be provided adjacent to the alley (for Ft Collins). Does that apply to Berthoud? If so they seem to be showing the utility easement under the alley on the plan. Basically using their 10' part of the alley ROW for the utility

easement. Do I have that right?

Bob Rummer

On Tue, Aug 25, 2020 at 8:33 AM Bob Rummer <bjrummer@gmail.com> wrote:

> Adam,
>
> Thanks for the prompt reply and direction to the updated code information. I will check that out as well as the Prairie Star neighborhood.
>
> Bob Rummer
>
> On Tue, Aug 25, 2020 at 8:30 AM Adam Olinger <aolinger@berthoud.org> wrote:
>
> > Good morning,
> >
> > Thank you for providing us with your comments regarding the Fickle Farm Phase III project. We at the Town of Berthoud strives to encourage citizen engagement and to provide a transparent development process. To that end, your comments will be part of the public record and available to members of the Planning Commission and Town Board. We will also send your comments to the developer/applicant before this is scheduled for a public meeting, so they may have a chance to prepare for, or address your specific concerns at this early stage of development. To that end, often development requests will change from the initial submittal, as the developer addresses Staff and public concerns. However, the developer/applicant also has the legal ability to move forward if the request satisfies the technical conditions of the Berthoud Municipal Code.
> >
> > We believe there may be some confusion regarding your comments pertaining to the Berthoud Municipal Code. In 2019, the Town adopted the Larimer County Urban Area Street Standards (LCUASS, found here https://www.larimer.org/engineering/standards-and-guides/urban-area-street-standards) when regarding street and roadway layouts. Under LCUASS, alleys are

always listed as public (not private) throughways. Also, the language you referenced in Section 30-2-105 16. of the Berthoud Municipal Code was removed in the October 2019 Municipal Code updates (found here: https://www.berthoud.org/home/showdocument?id=16027). Moreover, a street layout like this is not the first of its kind in Berthoud, as the Prairiestar subdivision north of 287 has a similar layout for some of their homes, specifically south of the roundabout intersection at Cooperland Blvd and Prairiestar Dr. The other text from the Berthoud Municipal Code that you referenced in Section 30-6-110 Conveyance Plat is not applicable to this project, as this is in the PUD equivalent of the Neighborhood Master Plan stage. If approved, this will only move on to the Preliminary Plat and eventually Final Plat stages.

When this project is scheduled for public hearing, legal notices will be sent out with the day and time. We strongly encourage you to attend any public meeting, or send in additional comments if you are unable to do so. Again, please send any other comments in care of cfreese@berthoud.org or aolinger@berthoud.org, or call us at 970-532-2643.

Best regards,

Adam Olinger

Planner I

Town of Berthoud

807 Mountain Avenue

Berthoud CO, 80513

Office: 970-344-5808 // aolinger@berthoud.org

From: Bob Rummer <bjrummer@gmail.com>
Sent: Friday, August 21, 2020 12:16 PM
To: Curt Freese <CFreese@berthoud.org>; Adam Olinger <aolinger@berthoud.org>
Subject: Fickel Farm Phase III Comments

I reviewed the Neighborhood Notice of the Development Plan for Phase III.

First, let me state that I appreciate the transition from larger lots to the core of the

development that is proposed where it abuts Mary's Farm (Michigan Ave). I also like the inclusion of the pathway in Outlot A.

My primary concern is about the proposal for "alley-loaded" high-density residential.

In this development plan the only vehicular access to most of these lots is through a narrow (20' ROW) alley. There is no street in front of the units, unlike other "alley-loaded" subdivision designs. This means that deliveries, service, visitors, and emergency access will be using the alleys. The only off-street parking will be the resident's garages or parking pads or people squeezing against the side of the alley. I do not believe that the proposed design is consistent with the Municipal Code intent to "accommodate expected traffic and services."

The minimum design standard in the Code for a local residential street is 22' of travelway to accommodate 2-way traffic, plus 8' of parking for one side (14' for two sides). In effect this development plan proposes "streets" that are at least 10' narrower than what is considered adequate design to accommodate local residential access.

Municipal Code on Review Criteria

3.C. ii **Access**. All lots created by a Conveyance Plat shall have frontage and access to an existing or proposed public street.

Per definitions in the Code, alleys are not public streets. And the intent is clear that alleys can not be the only means of vehicular access.

12. **Alley** means a public or private minor or secondary way which is used primarily for vehicular service access to the back or side of properties that otherwise abut a street, as described in Section 30- 2-105.

The residential alley design standards in the Municipal Code are not adequate to accommodate this type of use. Aggregate base doesn't hold up to trash truck traffic on our soils. No provision for adequate storm drainage means potholes and weak alley surfaces in wet conditions. Snow removal is problematic.

I appreciate your consideration of these comments.

Bob Rummer

306 E Michigan Ave

Berthoud, CO

Adam Olinger

From: Lynn Larsen <lynnfda@aol.com>
Sent: Tuesday, December 29, 2020 2:17 PM
To: Adam Olinger; Curt Freese
Subject: Fickel Farm

Hello -

I realize that the first public comment period for the expansion of our Fickel Farm subdivision is past, and that the next public comment period has not been announced. However, since the sign about the expansion is up along CO56, I am taking the liberty of commenting now. I trust this comment will be considered and included in the Planning Commission package for the next submission by the developer.

My comment expands and alters my previous expression of concern about how E. 2nd St. will be extended from Indiana to CO56.

Currently, E. 2nd St. ends at Indiana, but it seems to extend through the alley that runs from Indiana to Welch. This alley serves the folks who live on the east side of Hubbell St. Those folks have have told us that drivers often use the alley as an extension of E. 2nd St., and also "race" down the alley. They too have concerns about how the alignment of the extension of E. 2nd St. will impact traffic through their alley.

Current depictions of the anticipated plats for expansion of Fickel Farm show houses backing onto the aforementioned alley, and E. 2nd St. experiencing a significant "jog" to the east at Indiana. I previously have expressed concerns about this "jog," including what I perceive to be negative impacts on the northwest portion of Pioneer Park. I have a new idea that I would hope the staff & Planning Commission would consider concerning the extension of E. 2nd St. I doubt the developers will be pleased. I have already made this suggestion to them.

My suggestion is this: "jog" E. 2nd St. only slightly to the east and run it north parallel to the existing alley with a modest tree lawn separation between the alley and the street. This would reduce the eastward "jog" to a minor one, and not impact at all on Pioneer Park. Traffic moving north from Indiana on E. 2nd St., would almost not notice the "jog." Of course, this would require some "jiggering" of the housing plats, and would probably lose a few lots.

To address the issue of traffic through the alley, the alley should be closed at the Indiana end, and instead have a "driveway" from that end of the alley over to the parallel extension of E. 2nd St. Traffic exiting the south end of the alley would be slightly inconvenienced by having to turn east to E. 2nd St., but that might be an inconvenience they would accept if it keeps traffic out of the alley. Existing plans already show Welch being extended over to the extension of E. 2nd St., so legitimate alley users would have an additional traffic flow option at the north end in any case.

I hope that staff and the Planning Commission will seriously consider this proposal and work with the developers to alter plans to accommodate this change. This proposal will minimize the impact on the alley and improve traffic flow on E. 2nd St. from Mary's Farm through Fickel Farm and out to CO56.

Lynn Larsen
205 Hubbell St., Berthoud
Sent from my iPad

From:	Srlmarshall
To:	Curt Freese; Adam Olinger
Subject:	Comment to Fickel Farm Phase III Proposal
Date:	Sunday, March 7, 2021 9:27:32 PM

To Whom it May Concern:

As the owner of both 401 and 405 E. County Road 8 properties, I would like to bring to your attention the existing irrigation ditch which is located between my properties and the Berthoud Bed and Breakfast. I did not see the ditch on the maps that I received in the letter dated February 24, 2021. My properties are zoned as agricultural in which this ditch is the carrier ditch to my properties. What are the plans moving forward with the existing ditch?

Thank you for time.

Sincerely,

William Hergenreter

From: Sandra
To: Adam Olinger
Subject: Fickel Farm Phase III
Date: Wednesday, March 3, 2021 10:34:45 AM

Hopefully, alley south of development & north of Michigan Ave will be paved, as all other alleys in area are.

From: Bob Rummer
To: Adam Olinger; Curt Freese
Subject: Fickel Farm Phase III--comments
Date: Monday, March 8, 2021 10:07:42 AM

Community Development Department

I would like to offer the following comments on the proposed update of the ODP for Fickel Farm Phase III.

a) I appreciate seeing the parking areas included in the revision to help accommodate visitors for the 101 new homes proposed. I question whether there are enough spaces given that some of the parking will also be shared by the public using Pioneer Park. How did the developer determine the number of spaces?

b) My primary concern with this development remains the plan for alley-loaded units. I understand that there are existing developments in Berthoud using this approach and Planning feels these are allowed. This plan pushes that concept even further. There are alleys being accessed by alleys. I believe that in the existing models of this approach every alley accesses a residential street. Note that the Larimer County Urban Area Street Standards state that alleys should be "Secondary Access only unless approved by the local entity engineer" (Fig. 7-9L, Fig. 7-10L). Traffic volumes for alleys are to be less than 200-250 ADT. Given the number of units it seems like this plan could be pushing the limits of acceptable access that "accommodates expected traffic and services." I would urge careful consideration of traffic volume and access as proposed in this plan.

In general I think this plan is bad town development. We already have traffic problems on E Michigan because the street is not wide enough to accommodate 2-way traffic plus parking on both sides. The LCUASS says that residential local streets should be 34' wide to allow 2-way traffic and parking on 2 sides. E Michigan is only 30' wide. This is a quality-of-life issue for residents that will continue to get worse as the Fickel development proceeds. Eventually you will have to make the 300 block of E Michigan parking on one side only.

The alley-loaded concept in this development plan will create congested access issues that impact residents of the adjacent neighborhoods as well as future residents of the development.

Bob Rummer
306 E Michigan Ave

From: Lynn Larsen
To: Adam Olinger
Subject: Fickel Farm III
Date: Monday, March 8, 2021 8:15:07 PM

Hi Adam -

I have provided comments before, but now I can comment on the plan that we received recently.

On the plus side:

— E. 2nd street will not be extended, thus eliminating the previously feared negative impact on Pioneer Park.

— Pioneer park will be expanded.

— Much of the project will have alley-loaded housing, consistent with the existing Fickel Farm & Mary's Farm neighborhoods.

On the negative side:

— It is not evident how the new development will solve the problem of traffic on E. 2nd St. continuing down the alley to the north at unacceptable speeds. The additional houses on the east side of the alley in Area C will make this an even more dangerous problem

— The developer, like so many these days, is trying to cram as many dwellings as possible into the space. E.g., in Area C, there will be 14 homes in about the same space as 10 across the alley and 11 on the west side of Hubbell St. I continue to be astonished that Colorado building and fire codes permit so little distance between adjacent homes. As so often is the case, I guess it will take a disaster for our governments and developers to rethink this matter.

— The green alleys are a nice touch and may be desirable for some residents. However, such developments (alley-loaded lots facing green alleys) leave no space for visitors. We recently visited a friend in a similar development. We were just barely able to park in the driveway and still were in fear of the rear of our car being damaged by alley traffic trying to squeeze by. The planned parking at the park/green space is entirely insufficient to solve the visitor parking issue.

Neutral (?) comment:

— It appears the developer is considering the sidewalks & green alleys to become part of a new trail system for our east-of-the-tracks community. The promised trail on the north edge of Farmstead still has not been built, and the seeming connections in Fickel Farm III don't appear to be planned as wide, paved (or crushed rock) extensions of that trail. As I have commented once before to the PORT committee, all the trails on the west side of town are great, but there seems to be little concern or planning for the east side of town. The Farmstead and Fickel Farm III developments would be ideal times to begin to provide east-side additions to the entire Berthoud trail system. With the unfulfilled promise for a trail in Farmstead, and the lack of clarity in the Fickel Farm III plans, I have little faith that the town or east-side developers really care about providing this amenity to our area.

Thank you for the opportunity to comment.

Lynn Larsen
205 Hubbell St., Berthoud

From: Linda Misencik
To: Curt Freese; Adam Olinger
Cc: Mark Misencik
Subject: Fwd: Fickle Farm Phase III
Date: Wednesday, March 10, 2021 11:08:20 AM

> To the Planning Commission,
>
> Re: Comments concerning development of Fickle Farm Phase III
>
> It has come to our attention that there may be an area of concern with the current plan to develop Parcel #9424000012. It has to do with the traffic pattern coming off of Welch Avenue and East Second Street.
>
> It would seem logical that traffic flowing north on East Second Street would tend to use the garage entrance alley on the east side of the houses that line Hubbell Street as a short cut to obtain access to Welch Avenue and then to Highway 56 east, then to 25. This would save time by bypassing the roundabout when going up South 1st Street.
>
> Also, traffic traveling west on Highway 56 would tend to avoid the roundabout to get to the southwest residential area of Mary's Farm. Again, a shortcut would be taking West Remuda Road to Welch and then taking the first left going south down the back alley way to East Second Street.
>
> Currently traffic is light in the alley, which is likely to change. Vehicles of nonresidents tend to speed down the alley, since there is no speed limit sign.
>
> A short list of foreseeable problems:
>
> Visibility is limited coming out of the garages into the alley.
> There is a slight curve at the north end of the alley that limits visibility even more.
> Children do live on houses on the east side of Hubbell Street.
>
> Suggestions to alleviate possible problems:
>
> Gate the entrance to the alley.
> Make the alley one way.
> Residential access only.
>
> Thank you for your attention to this matter,
>
> Mark G. Misencik
>
> 204 Hubbell Street, Berthoud
>
> Sent from my iPad

Many of the families in Fickle and Marys Farms have a certain amount of a reasonable pride within the community. If an addition to the area prevailed to the Fickle Farm Masterplan, we would stand firm in expectation and convictions toward our new neighbor. But when pressure persist with more questions that effect a continuation. No relief, with an exceptionable very few answers that lack any remedy.

What would any real estate agent use to promote this property of the Masterplan? Likely it could be just a cheap buy or maybe a lower price but a much lower value when selling!

The following information is dubious and a concern of questioning of any logical visible plan.

1. One street that accommodated spaces of parking with a numbered automobiles.

2. More alleys than there are streets. Why, for what logical reason?

3. No lawns for the children, but more parks, not lawns.

4. No curbs but just alleys.

5. No storm sewers

6. No basements and no storage space.

7. No attached garage or even unattached!

8. Maybe one mail box for several families. or it could be the only postal service to the development by the persons picking up the mail from the post office.

9. With the occupying of the streets of many cars, no room for a dirable deliveries.

10. Duplexes will be built on atop of one another because less room side by side.

11. A person wishing to plant a tree in a yard would not be able too accommodated such a chore, no space - period!

OVER -

12. How would the town or county remove the accumulated snow on a crowded street of automobiles?

William R. Reavey

From: Lynn Larsen
To: Adam Olinger
Subject: Fickel Farm III
Date: Monday, March 8, 2021 8:15:07 PM

Hi Adam -

I have provided comments before, but now I can comment on the plan that we received recently.

On the plus side:

— E. 2nd street will not be extended, thus eliminating the previously feared negative impact on Pioneer Park.

— Pioneer park will be expanded.

— Much of the project will have alley-loaded housing, consistent with the existing Fickel Farm & Mary's Farm neighborhoods.

On the negative side:

— It is not evident how the new development will solve the problem of traffic on E. 2nd St. continuing down the alley to the north at unacceptable speeds. The additional houses on the east side of the alley in Area C will make this an even more dangerous problem

— The developer, like so many these days, is trying to cram as many dwellings as possible into the space. E.g., in Area C, there will be 14 homes in about the same space as 10 across the alley and 11 on the west side of Hubbell St. I continue to be astonished that Colorado building and fire codes permit so little distance between adjacent homes. As so often is the case, I guess it will take a disaster for our governments and developers to rethink this matter.

— The green alleys are a nice touch and may be desirable for some residents. However, such developments (alley-loaded lots facing green alleys) leave no space for visitors. We recently visited a friend in a similar development. We were just barely able to park in the driveway and still were in fear of the rear of our car being damaged by alley traffic trying to squeeze by. The planned parking at the park/green space is entirely insufficient to solve the visitor parking issue.

Neutral (?) comment:

— It appears the developer is considering the sidewalks & green alleys to become part of a new trail system for our east-of-the-tracks community. The promised trail on the north edge of Farmstead still has not been built, and the seeming connections in Fickel Farm III don't appear to be planned as wide, paved (or crushed rock) extensions of that trail. As I have commented once before to the PORT committee, all the trails on the west side of town are great, but there seems to be little concern or planning for the east side of town. The Farmstead and Fickel Farm III developments would be ideal times to begin to provide east-side additions to the entire Berthoud trail system. With the unfulfilled promise for a trail in Farmstead, and the lack of clarity in the Fickel Farm III plans, I have little faith that the town or east-side developers really care about providing this amenity to our area.

Thank you for the opportunity to comment.

Lynn Larsen
205 Hubbell St., Berthoud

3-1-21

Community Development Dept

Fickel Farm Phase III

I am asking that you Post Welch Ave from 1st to 8th St with weight Limit Signs. I am sick And tired of Dump trucks and construction Vehicles using Welch Ave As a Truck Route. Please make the developer Pay for the signs and cost of enforcement. the city Also needs to have Large Fines for Driving on a Posted Street.

John Vancil
155 Welch Ave
Berthoud, Colo 80513

March 8, 2021

Town of Berthoud
Community Development Department

RE: Fickel Farm Phase III

Hello, Community Development Department officials:

The following are comments pertaining to the above cited project.

1. In general, the proposal seems to be too high-density.

2. Specifically, I would prefer to see the **elimination** of the duplexes targeted for Sections D and F; I would prefer to see single-family detached housing in Sections K and L.

3. Regarding ingress and egress, I would hope that the Berthoud Master Plan envisions the **extension of West Remuda Road** to the east to connect with County Line Road (?) to direct traffic off of Welch Avenue extended.

4. While the **expansion of Pioneer Park**, as depicted, is welcomed, the elimination of Sections D & F, could provided for additional space and add additional buffer between existing Fickel Farm homes and the proposed Phase III ones. One would hope funds exist in the town's coffers to acquire this extra square-footage from the developer because this project and the homes currently under construction to the southeast of it will increase demand on Pioneer Park. Once its boundaries are constrained it would be difficult to reclaim more land for park expansion.

Thank you for providing the opportunity to comment and for your time in considering them.

Respectfully,

A Fickel Farm resident

Garden Spot of Colorado
807 Mountain Avenue | PO Box 1229 | Berthoud, CO 80513 | O: 970.532.2643 | F: 970.532.0640 | **Berthoud.org**

STAFF REPORT: O'MALLEY GLEN- FARMSTEAD REZONING

DATE: October 14, 2021

GENERAL INFORMATION		
Applicant:	**Larry Bebo**	**Size: Approx. 6.78 acres**
Site Location:	**619 E Hwy 56, 731 E Hwy 56, and the vacant property to the south**	
Applicant's Request:	**The Applicant is requesting a Final Plat to create six lots in place of three existing lots, all to remain zoned R-2 (Limited Multi-Family)**	
Current Zoning:	**C-2 (General Commercial), PUD (Planned Unit Development), R-1 (Single Family Residential)**	
Zoning Requested:	**C-1 (Neighborhood Commercial)**	

ZONING DISTRICT INFORMATION	
	C-1
Max Density	**24 Dwelling units per acre**
Min. Lot Width	**25'**
Front Setback	**0'**
Side Setback	**0'; 20' to a different zoning district**
Rear Setback	**0'; 20' to a different zoning district**
Building Height:	**50'**

SURROUNDING ZONING, LAND USE AND REQUIRED BUFFERS		
Adjacent Zoning	**Adjacent Land Uses**	**Setbacks for Adjacent Zoning /Buffer required if rezoned**
North: RR2 (Larimer County)	**Rural residential**	**None**
South: R-1	**Single-Family Residential in various stages of construction**	**20' with a landscape buffer**
East: PUD	**Dorothy Dr, Industrial Use**	**None**
West: PUD	**Industrial Use**	**20'**

PROPOSAL

The Applicant is requesting approval to Rezone approximately 6.78 acres of land from C-2 (General Commercial), PUD (Planned Unit Development), and R-1 (Single Family Residential) to C-1 (Neighborhood Commercial).

Background:

The properties were originally created by the Bebo MRD S-76-87 AMD Final Plat, which was platted through Larimer County in 1999. These properties were then annexed to the Town of Berthoud in 2007 and 2008, respectively. The northwestern property, which currently houses an event center, was rezoned to C-2 when it was annexed in 2008. The remaining properties were zoned PUD in 2007 shortly after their annexation. In 2012, the O'Malley Glen PUD was amended to include portions of the "Green Acres" property directly to the east, which includes what is now the Farmstead up to County Line Road. The PUD zoning allowed for residential uses on these properties, however, none of these properties were identified for any further development on the Final Development Plan. Because of this, these properties do not have a well established zoning district and would have many legal questions should they wish to develop in the future. In addition, sometime after its initial construction the event center's parking lot was improperly expanded onto the separate property to the south. This south property was then rezoning to R-1 during the Farmstead's 2019 rezoning. Staff is currently processing an administrative minor subdivision to adjust the lot lines to place the parking lot on the same property as the event center, which would bring it into compliance with the code, but the rezoning would still be needed to make the minor subdivision legal.

Zoning:

The properties are currently zoned C-2 (General Commercial), PUD (Planned Unit Development), and R-1 (Single Family Residential). The applicant is requesting to rezone all of the properties to C-1 (Neighborhood Commercial). There are currently two properties with existing uses; one property has an event center, another property has a residential house, and the third property is vacant. The C-1 zoning designation would bring the existing event center into compliance with the municipal code, and would set a stronger zoning designation to the property with the house and the vacant lot.

Variance:

Should the rezoning be approved, it would trigger the 20' side setback to the property to the west, as it would be in a different zoning district. There are currently two existing structures built well within this setback (2.5 ft and 6.5 ft, respectively), so a variance will be required to make them conform to their new district.

FUTURE LAND USE

The Town's Future Land Use Map designates this area as Urban Residential and Suburban Residential.

- ✓ The C-1 (General Commercial) zoning district would allow for urban and suburban residential uses to occur should the properties develop further, while also allowing for the existing uses to continue.

CRITERIA NECESSARY FOR A ZONING MAP AMENDMENT

1. **To correct a manifest error in an ordinance establishing the zoning for a specific property.**

✓ The PUD lots were zoned in error, as they weren't included in the rest of the PUD's Overall Development Plan. Currently they do not have any specific uses allowed within their zoning.

2. **To rezone an area or extend the boundary of an existing district because of changed or changing conditions in a particular area or in the Town generally**

x. This zoning map amendment request was not brought forth due to changing conditions in this particular area of the Town.

3. **The land to be rezoned was zoned in error and as presently zoned is inconsistent with the policies and goals of the Town Comprehensive Plan**

✓ The land was zoned without any specific uses, thus it is not consistent with the Town's Comprehensive Plan.

4. **The proposed rezoning is necessary to provide land for a community-related use that was not anticipated at the time of the adoption of the Town Comprehensive Plan, and the rezoning will be consistent with the policies and goals of the Comprehensive Plan; or**

x. The proposed rezoning will not be providing land for a community-related use.

5. **The area requested for rezoning has changed or is changing to such a degree that it is in the public interest to encourage development or redevelopment of the area; or**

✓ As the area around these properties has developed, it will make sense for two of these properties to develop if/when their property owner chooses to.

6. **A rezoning to Planned Unit Development overlay district is requested and approved per provisions of this Code**

✓ This is no longer applicable, as the Planned Unit Development overlay district is no longer a part of the code.

FINDINGS NECESSARY FOR A VARIANCE

1. **Such relief may be granted without substantial detriment to the neighborhood or the public good and without substantially impairing the intent and purposes of this code**

✓ As the buildings have already stood for many years, this variance will not provide any substantial detriment to the neighborhood or public good.

2. **Provided that there are exceptional circumstances applying to the specific piece of property which do not generally apply to the remaining property in the same zoning area or neighborhood**

✓ There are exceptional circumstances that apply to this property as it has two existing buildings that were built on the property prior to the establishment of this setback.

3. **That the requested variance shall not authorize any permanent use not permitted in the zoning district**

✓ This request will not be authorizing any permanent use not permitted in the zoning district.

4. **If the hardship on which the request for variance is based, in whole or in part, is self-inflicted, that will be a highly significant fact which is a material element bearing on the issue, and will weigh heavily against the owner or applicant seeking the variance**

✓ When the buildings were built, they conformed to the district's setback standards and only would become non-conforming if the rezoning is approved. Staff does not believe that the correction of the zoning of this property qualifies as a self-inflicted hardship.

5. **In circumstances where the property owners affected most directly, e.g. neighbors, concur in writing with the variance that fact shall be given significant (but not conclusive) weight in favor of the request**

x. Staff did not receive any public comment regarding the variance request.

PUBLIC NOTICE AND COMMENT

Notice of the Public Hearing has been mailed to property owners within 500 feet of the subject property,a legal ad published, and the property was posted as required by the Development Code. In addition, theapplication was sent out to all property owners within 500 feet, with an invitation to comment on the request within one week of receipt for each round of development review. The public comments are included with this packet.

FINDINGS AND RECOMMENDATIONS

Zoning Map Amendment

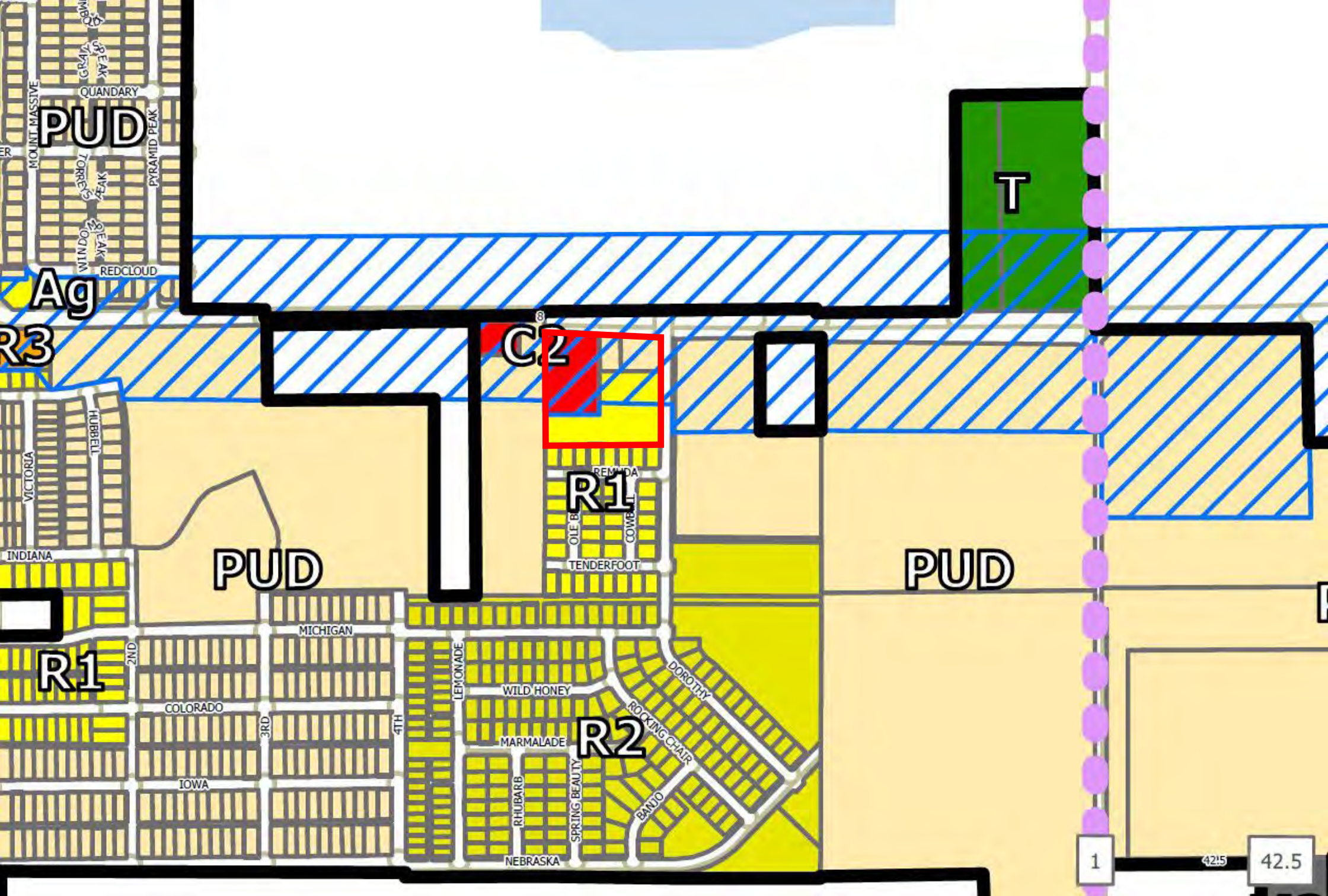
Staff recommends a motion to approve the O'Malley Glen- Farmstead Zoning Map Amendment, finding it is consistent with Section 30-3-110 C (found in this Staff Report), conditioned on the following:

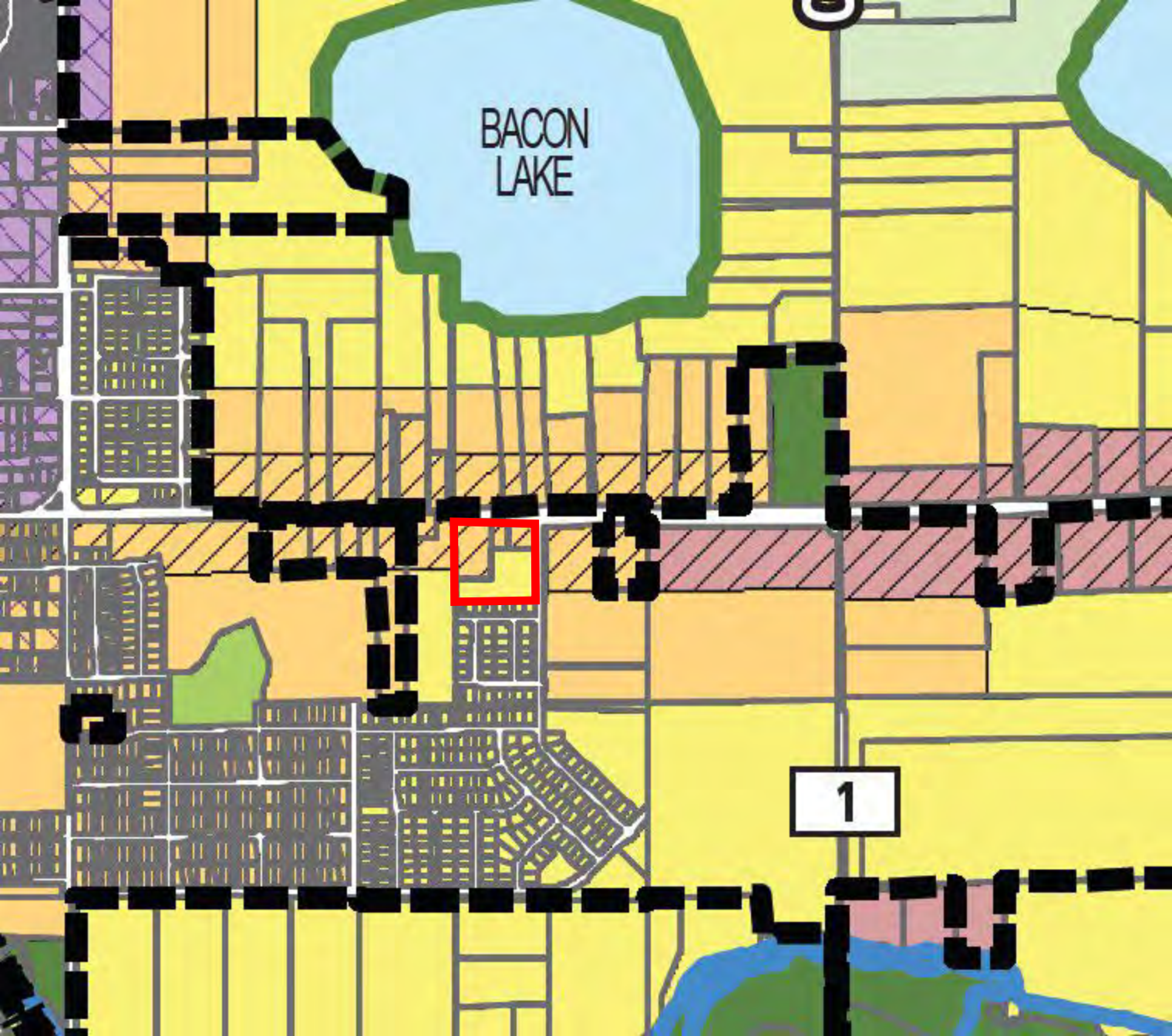
1. **Sidewalks, trails, tree lawns, and street trees are installed to the Town's standards along the individual property's frontage prior to any new construction permits.**
2. **The Variance for 619 E Highway 56 is approved.**

Variance

Staff recommends a motion of approval of an 18 ft. west side setback Variance at 619 E Highway 56, finding that the request satisfies all of the applicable requirements specified in Section 30-3-108 (found in this Staff Report).

ZONING AND PREFERRED LAND USE MAP


PUD
QUANDARY
MOUNT MASSIVE
PYRAMID PEAK
TORRES PEAK
WINDOM PEAK
REDCLOUD
Ag
R3
C2
T
VICTORIA
HUBBELL
INDIANA
PUD
R1
REMUDA
OLE B
COWBELL
TENDERFOOT
PUD
MICHIGAN
2ND
R1
COLORADO
3RD
4TH
IOWA
LEMONADE
WILD HONEY
MARMALADE
R2
DOROTHY
ROCKING CHAIR
BANJO
RHUBARB
SPRING BEAUTY
NEBRASKA
1
42.5


BACON
LAKE
1

ZONING MAP AMENDMENT SUBMITTAL

ZONING MAP FOR THE
O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION

BEING A ZONING MAP FOR THE O'MALLEY GLEN–FARMSTEAD MINOR SUBDIVISION, SITUATE IN THE NORTHEAST QUARTER OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 69 WEST OF THE 6TH P.M., TOWN OF BERTHOUD, COUNTY OF LARIMER, STATE OF COLORADO.

GENERAL NOTES:

1. Land Title Guarantee Company (Old Republic National Title Insurance Company) Order No. FCIF25177227 was relied upon for information regarding easements, restrictions & rights of way. No further easement and/or right of way research, other than may be shown on this Plat, was requested by the client or performed by Intermill Land Surveying, Inc. for the preparation of this survey.

2. Control Monumentation as shown hereon.

   (Meas.): Indicates Measured Bearing and/or Distance from field survey.

   (Calc.): Indicates Calculated Bearing and/or Distance.

   (PR): Indicates a Prorated Bearing and/or Distance.

   (Rec.): Indicates Record Bearing and/or Distance per the following Final Plats and Maps:

   - Map of O'MALLEY GLEN , Town of Berthoud, County of Larimer, State of Colorado as filed for record July 20, 2007 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 20070055548.
   - Map of O'MALLEY GLEN SECOND ANNEXATION, Town of Berthoud, County of Larimer, State of Colorado as filed for record December 31, 2008 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 20080082246.
   - Final Plat of THE FARMSTEAD, Town of Berthoud, County of Larimer, State of Colorado as filed for record April 1, 2019 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 20190016179.
   - Final Plat of BEBO M.R.D. #S–76–87, County of Larimer, State of Colorado as filed for record November 30, 1993 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 93090124.

3. This Zoning Map does not constitute a monumented boundary survey of the subject properties. Refer to the Final Plat of O'MALLEY GLEN – FARMSTEAD MINOR SUBDIVISION to the Town of Berthoud, County of Larimer, State of Colorado for additional information pertaining to boundary monumentation for the aforesaid Final Plat of O'MALLEY GLEN – FARMSTEAD MINOR SUBDIVISION.

4. **RIGHT TO FARM STATEMENT:** The Town of Berthoud has adopted a "Right to Farm" policy. All new and existing residents are expected to read and understand the policy. For a copy of the policy, please contact the Town of Berthoud.

5. **SITE SPECIFIC DEVELOPMENT PLAN:** This Zoning Map may constitute a site specific development plan as defined in Article 68 of Title 24, C.R.S., as amended, and Chapter 30 of the Berthoud Development Code available at the Berthoud Town Hall, 807 Mountain Avenue, Berthoud, Colorado 80513.

6. **BASIS OF BEARINGS STATEMENT:** Basis of Bearings for this Plat are based on the record bearing of Meas.: North 89°42'45" East 2656.96' (Meas.) / (Rec.: N89°42'45"E 2656.96') on the North line of the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., County of Larimer, State of Colorado. Record bearing derived from the Final Plat of The Farmstead, Town of Berthoud, County of Larimer, State of Colorado as filed for record April 1, 2019 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception Number 20190016179. Note: Monumentation of said line as shown hereon.

7. According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event, may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

APPROVAL CERTIFICATES:

Approved by the Town of Berthoud, Colorado, this _____ day of _____, A.D., 20____ .

_____
Mayor

Approved by the Board, Town of Berthoud, Colorado, this _____ day of _____, A.D., 20 ____ .

_____
Board

Approved by the Planning Commission, Town of Berthoud, Colorado, this _____ day of _____, A.D., 20 ____ .

_____
Planning Commission

LAND SURVEYOR'S CERTIFICATE:

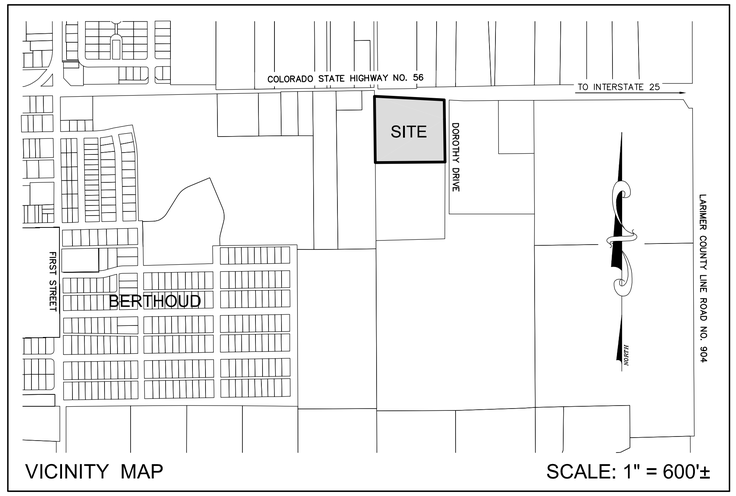
I, Robert George Persichitte, a Registered Professional Land Surveyor in the State of Colorado, do hereby state that this Zoning Map was prepared by me or under my direct supervision and that all information shown is correct to the best of my own knowledge.

PREPARED BY AND ON BEHALF OF:

INTERMILL LAND SURVEYING, INC.
1301 North Cleveland Avenue
Loveland, Colorado 80537
P: (970) 669–0516

Robert George Persichitte
Colorado PLS No. 34174
Date:

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR
REVIEW PRINT ONLY - NOT A FINALIZED DOCUMENT UNTIL MAP CONTAINS AN ORIGINAL DATE AND SIGNATURE.



VICINITY MAP SCALE: 1" = 600'±

In witness whereof, we have hereunto set our hands and seal this_____day of_____, 20____.

OWNER(S): LAWRENCE L. BEBO and JACQUELYN D. BEBO

_____ _____
Lawrence L. Bebo Jacquelyn D. Bebo

STATE OF COLORADO)
)SS
COUNTY OF LARIMER)

The foregoing certificate of ownership was acknowledged before me this _____day of_____, 20____, by Lawrence L. Bebo and Jacquelyn D. Bebo.

Witness my hand and official seal.

My commission expires _____

_____
Notary Public

OWNER(S): LEAD HOLDING COMPANY, LLC, a Colorado limited liability company

_____
By:
Printed Name
As: _____ for Lead Holding Company, LLC, a Colorado limited liability company

STATE OF _____)
)SS
COUNTY OF _____)

The foregoing certificate of ownership was acknowledged before me this _____ day of _____, 20____, by _____ as _____ for Lead Holding Company, LLC, a Colorado limited liability company.

Witness my hand and official seal.

My commission expires _____

_____
Notary Public

OWNER(S) / APPLICANT(S):
LAWRENCE L. BEBO / JACQUELYN D. BEBO
735 East State Highway 56, Berthoud, Colorado 80513

OWNER(S) / APPLICANT(S):
LEAD HOLDING COMPANY, LLC
619 East County Road 8, Berthoud, Colorado 80513

PROPERTY DESCRIPTION FOR ZONING: LOT 1, O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION

EXISTING ZONING: PLANNED UNIT DEVELOPMENT DISTRICT (P.U.D.) and SINGLE FAMILY DISTRICT (R1)

PROPOSED ZONING: GENERAL COMMERCIAL DISTRICT (C1)

That portion of O'MALLEY GLEN ANNEXATION and Tract 1, THE FARMSTEAD, all being situate in the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., Town of Berthoud, County of Larimer, State of Colorado being more particularly described as follows:

Considering the North line of the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., County of Larimer, State of Colorado as bearing North 89°42'45" East and with all bearings contained herein relative thereto:

Beginning at the North One–Quarter corner of said Section 24; thence along the West line of the Northwest Quarter of the Northeast Quarter of said Section 24 South 00°03'24" East 48.46 feet, more or less, to the Northwest corner of O'MALLEY GLEN SECOND ANNEXATION to the Town of Berthoud, County of Larimer, State of Colorado; said Northwest corner of said O'MALLEY GLEN SECOND ANNEXATION also being a point on the Southerly Right–of–Way line for Colorado State Highway No. 56; thence departing said West line of the Northwest Quarter of the Northeast Quarter of said Section 24 and along the North line of said O'MALLEY GLEN SECOND ANNEXATION and along the North line of said O'MALLEY GLEN ANNEXATION and along said Southerly Right–of–Way line for Colorado State Highway No. 56 South 86°35'48" East 380.66 feet to the TRUE POINT OF BEGINNING; thence continuing along said North line of said O'MALLEY GLEN ANNEXATION and along said Southerly Right–of–Way line for Colorado State Highway No. 56 South 86°35'48" East 174.84 feet, more or less, to a point on the West right–of–way line for Dorothy Drive; thence departing said North line of said O'MALLEY GLEN ANNEXATION and departing said Southerly Right–of–Way line for Colorado State Highway No. 56 and along said West right–of–way line for Dorothy Drive and along the East line of said Tract 1, THE FARMSTEAD South 00°11'36" West 514.26 feet, more or less, to the Southeast corner of said Tract 1, THE FARMSTEAD; thence departing said East line of said Tract 1, THE FARMSTEAD and along the South line of said Tract 1, THE FARMSTEAD North 89°49'46" West 191.80 feet; thence departing said South line of said Tract 1, THE FARMSTEAD North 00°03'05" West 353.93 feet, more or less, to a point on the North line of Tract 1, THE FARMSTEAD to the Town of Berthoud, County of Larimer, State of Colorado; thence along said North line of said Tract 1, THE FARMSTEAD South 89°53'01" East 19.52 feet; thence departing the North line of said Tract 1, THE FARMSTEAD North 00°03'58" west 170.17 feet, more or less, to a point on the North line of said O'MALLEY GLEN ANNEXATION and a point on said Southerly Right–of–Way line for Colorado State Highway No. 56; said point being the TRUE POINT OF BEGINNING.

Containing 96,935.4 Square Feet (2.22 Acres), more or less, and being subject to all easements and/or rights–of–way now in use or of record.

Note: The above described parcel is a portion of a parcel of land as described in that certain Warranty Deed as filed for record November 1, 2013 in the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 20130082035.

PROPERTY DESCRIPTION FOR ZONING: LOT 2, O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION

EXISTING ZONING: PLANNED UNIT DEVELOPMENT DISTRICT (P.U.D.)

PROPOSED ZONING: GENERAL COMMERCIAL DISTRICT (C1)

That portion of O'MALLEY GLEN ANNEXATION, being situate in the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., Town of Berthoud, County of Larimer, State of Colorado being more particularly described as follows:

Considering the North line of the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., County of Larimer, State of Colorado as bearing North 89°42'45" East and with all bearings contained herein relative thereto:

Beginning at the North One–Quarter corner of said Section 24; thence along the West line of the Northwest Quarter of the Northeast Quarter of said Section 24 South 00°03'24" East 48.46 feet, more or less, to the Northwest corner of O'MALLEY GLEN SECOND ANNEXATION to the Town of Berthoud, County of Larimer, State of Colorado; said Northwest corner of said O'MALLEY GLEN SECOND ANNEXATION also being a point on the Southerly Right–of–Way line for Colorado State Highway No. 56; thence departing said West line of the Northwest Quarter of the Northeast Quarter of said Section 24 and along the North line of said O'MALLEY GLEN SECOND ANNEXATION and along said Southerly Right–of–Way line for Colorado State Highway No. 56 South 86°35'48" East 260.37 feet, more or less, to the Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION; said Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION also being the Northwest corner of said O'MALLEY GLEN ANNEXATION and the TRUE POINT OF BEGINNING; thence along the North line of said O'MALLEY GLEN ANNEXATION and along said Southerly Right–of–Way line for Colorado State Highway No. 56 South 86°35'48" East 120.29 feet; thence departing said North line of said O'MALLEY GLEN ANNEXATION and departing said Southerly Right–of–Way line for Colorado State Highway No. 56 South 00°03'58" East 170.17 feet, more or less, to a point on the North line of Tract 1, THE FARMSTEAD to the Town of Berthoud, County of Larimer, State of Colorado; thence along said North line of said Tract 1, THE FARMSTEAD North 89°53'01" West 120.37 feet, more or less, to a point on the East line of said O'MALLEY GLEN SECOND ANNEXATION; thence departing said North line of said Tract 1, THE FARMSTEAD and along said East line of said O'MALLEY GLEN SECOND ANNEXATION North 00°01'53" East 177.07 feet, more or less, to the Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION; said Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION also being a point on the North line of said O'MALLEY GLEN ANNEXATION and a point on the Southerly Right–of–Way line for Colorado State Highway No. 56 and the TRUE POINT OF BEGINNING.

Containing 20,872.8 Square Feet (0.48 Acres), more or less, and being subject to all easements and/or rights–of–way now in use or of record.

Note: The above described parcel is a portion of a parcel of land as described in that certain Warranty Deed as filed for record November 1, 2013 in the Office of the Clerk and Recorder of Larimer County, Colorado at Reception No. 20130082035.

PROPERTY DESCRIPTION FOR ZONING: LOT 3, O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION

EXISTING ZONING: SINGLE FAMILY DISTRICT (R1) and GENERAL COMMERCIAL DISTRICT (C2)

PROPOSED ZONING: GENERAL COMMERCIAL DISTRICT (C1)

That portion of O'MALLEY GLEN SECOND ANNEXATION and Tract 1, THE FARMSTEAD, all being situate in the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., Town of Berthoud, County of Larimer, State of Colorado being more particularly described as follows:

Considering the North line of the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., County of Larimer, State of Colorado as bearing North 89°42'45" East and with all bearings contained herein relative thereto:

Beginning at the North One–Quarter corner of said Section 24; thence along the West line of the Northwest Quarter of the Northeast Quarter of said Section 24 South 00°03'24" East 48.46 feet, more or less, to the Northwest corner of said O'MALLEY GLEN SECOND ANNEXATION; said Northwest corner of said O'MALLEY GLEN SECOND ANNEXATION also being a point on the Southerly Right–of–Way line for Colorado State Highway No. 56 and along the West line of said O'MALLEY GLEN SECOND ANNEXATION and along the West line of said Tract 1, THE FARMSTEAD; said West line of said O'MALLEY GLEN SECOND ANNEXATION and said West line of said Tract 1, THE FARMSTEAD also being the West line of the Northwest Quarter of the Northeast Quarter of said Section 24 South 00°03'24" East 545.59 feet, more or less, to the Southwest corner of said Tract 1, THE FARMSTEAD; thence departing said West line of said Tract 1, THE FARMSTEAD also departing said West line of the Northeast Quarter of said Section 24 and along the South line of said Tract 1, THE FARMSTEAD South 89°49'46" East 360.45 feet; thence departing said South line of said Tract 1, THE FARMSTEAD North 00°03'05" West 353.93 feet, more or less, to a point on the North line of said Tract 1, THE FARMSTEAD; thence along said North line of said Tract 1, THE FARMSTEAD North 89°53'01" West 100.85 feet, more or less, to a point on the East line of said O'MALLEY GLEN SECOND ANNEXATION; thence departing said North line of said Tract 1, THE FARMSTEAD and along said East line of said O'MALLEY GLEN SECOND ANNEXATION North 00°01'53" East 177.07 feet, more or less, to the Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION; said Northeast corner of said O'MALLEY GLEN SECOND ANNEXATION also being a point on the Southerly Right–of–Way line for Colorado State Highway No. 56; thence departing said East line of said O'MALLEY GLEN SECOND ANNEXATION and along the North line of said O'MALLEY GLEN SECOND ANNEXATION and along said Southerly Right–of–Way line for Colorado State Highway No. 56 North 86°35'48" West 260.37 feet, more or less, to the Northwest corner of said O'MALLEY GLEN SECOND ANNEXATION and the TRUE POINT OF BEGINNING.

Containing 175,454.8 Square Feet (4.03 Acres), more or less, and being subject to all easements and/or rights–of–way now in use or of record.

REVISIONS: BY: DATE:
2. Revise Per Baseline Survey Comments Received On 07/21/2021. JEB 07/27/2021
1. Revise Per HOC Comments. JEB 07/01/2021

INTERMILL LAND SURVEYING, INC.
1301 NORTH CLEVELAND AVENUE LOVELAND, COLORADO 80537 BUS. (970)-669-0516 / FAX (970)-635-9775

CLIENT: LARRY and JACKIE BEBO

TITLE: ZONING MAP FOR THE O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION TO THE TOWN OF BERTHOUD, COUNTY OF LARIMER, STATE OF COLORADO

DRAWN BY: RGP
CHECKED BY: _____
APPROVED BY: _____
DATE: 04–08–2020
SCALE: N/A

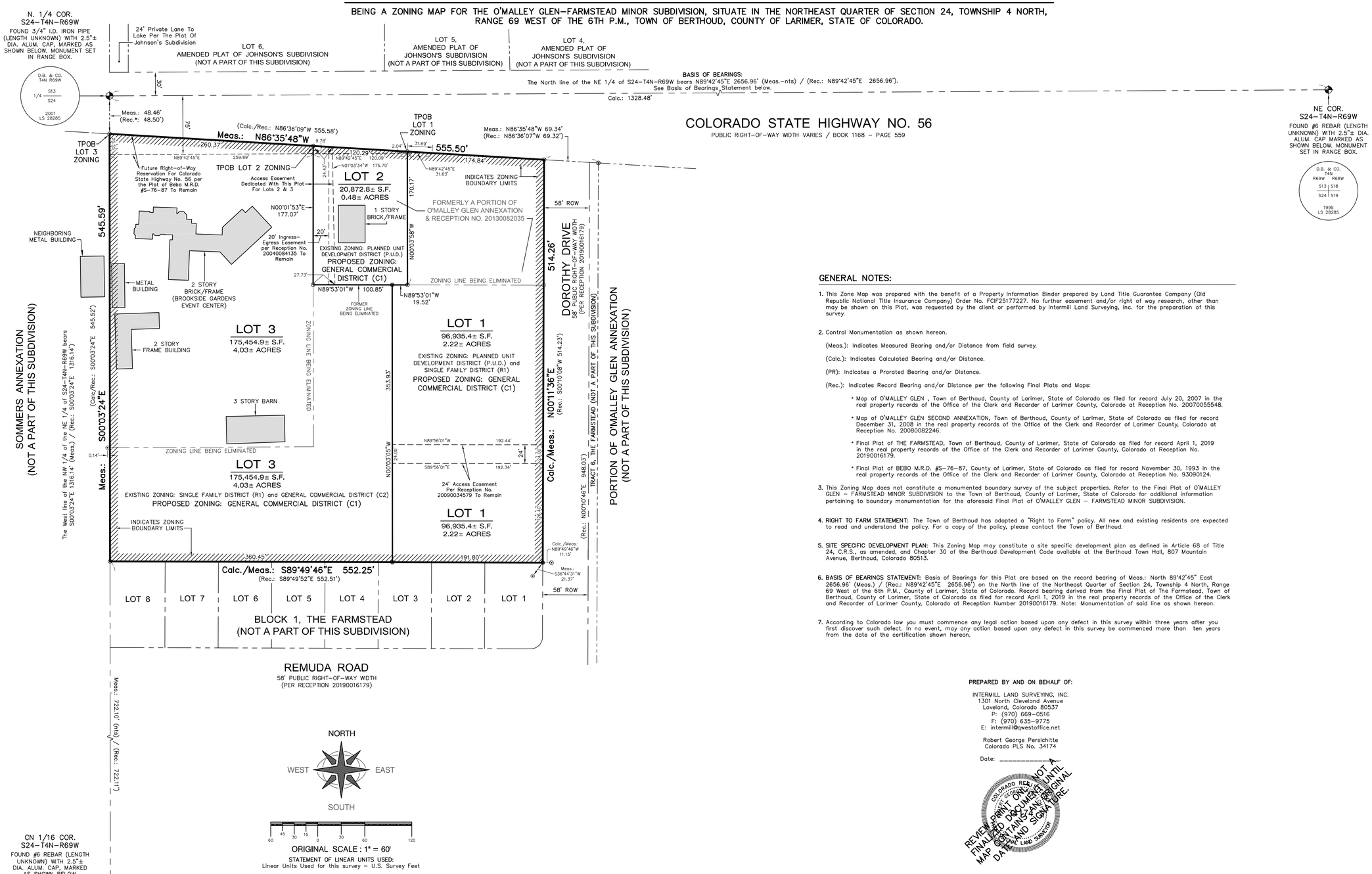
PROJECT NO.: P-08-6486

SHEET	OF
1	2

I:\Intermill\P-08-6486-Bebo-Brookside\Dwg\ZONING MAP 04082020.dwg

ZONING MAP FOR THE
O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION

BEING A ZONING MAP FOR THE O'MALLEY GLEN–FARMSTEAD MINOR SUBDIVISION, SITUATE IN THE NORTHEAST QUARTER OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 69 WEST OF THE 6TH P.M., TOWN OF BERTHOUD, COUNTY OF LARIMER, STATE OF COLORADO.



ORIGINAL SCALE : 1" = 60'

STATEMENT OF LINEAR UNITS USED:
Linear Units Used for this survey – U.S. Survey Feet

GENERAL NOTES:

1. This Zone Map was prepared with the benefit of a Property Information Binder prepared by Land Title Guarantee Company (Old Republic National Title Insurance Company) Order No. FCIF25177227. No further easement and/or right of way research, other than may be shown on this Plat, was requested by the client or performed by Intermill Land Surveying, Inc. for the preparation of this survey.

2. Control Monumentation as shown hereon.

   (Meas.): Indicates Measured Bearing and/or Distance from field survey.

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4. **RIGHT TO FARM STATEMENT:** The Town of Berthoud has adopted a "Right to Farm" policy. All new and existing residents are expected to read and understand the policy. For a copy of the policy, please contact the Town of Berthoud.

5. **SITE SPECIFIC DEVELOPMENT PLAN:** This Zoning Map may constitute a site specific development plan as defined in Article 68 of Title 24, C.R.S., as amended, and Chapter 30 of the Berthoud Development Code available at the Berthoud Town Hall, 807 Mountain Avenue, Berthoud, Colorado 80513.

6. **BASIS OF BEARINGS STATEMENT:** Basis of Bearings for this Plat are based on the record bearing of Meas.: North 89°42'45" East 2656.96' (Meas.) / (Rec.: N89°42'45"E 2656.96') on the North line of the Northeast Quarter of Section 24, Township 4 North, Range 69 West of the 6th P.M., County of Larimer, State of Colorado. Record bearing derived from the Final Plat of The Farmstead, Town of Berthoud, County of Larimer, State of Colorado as filed for record April 1, 2019 in the real property records of the Office of the Clerk and Recorder of Larimer County, Colorado at Reception Number 20190016179. Note: Monumentation of said line as shown hereon.

7. According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event, may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

PREPARED BY AND ON BEHALF OF:

INTERMILL LAND SURVEYING, INC.
1301 North Cleveland Avenue
Loveland, Colorado 80537
P: (970) 669–0516
F: (970) 635–9775
E: intermill@qwestoffice.net

Robert George Persichitte
Colorado PLS No. 34174

Date: _____

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR
REVIEW PRINT ONLY – NOT A FINALIZED DOCUMENT UNTIL MAP CONTAINS ORIGINAL DATE AND SIGNATURE.

REVISIONS:	BY:	DATE:
2. Revise Per Baseline Survey Comments Received On 07/21/2021.	JEB	07/27/2021
1. Revise Per TRC Comments.	JEB	07/01/2021

INTERMILL LAND SURVEYING, INC.
1301 NORTH CLEVELAND AVENUE LOVELAND, COLORADO 80537 BUS. (970)–669–0516 / FAX (970)–635–9775

CLIENT: LARRY and JACKIE BEBO

TITLE: ZONING MAP FOR THE O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION TO THE TOWN OF BERTHOUD, COUNTY OF LARIMER, STATE OF COLORADO

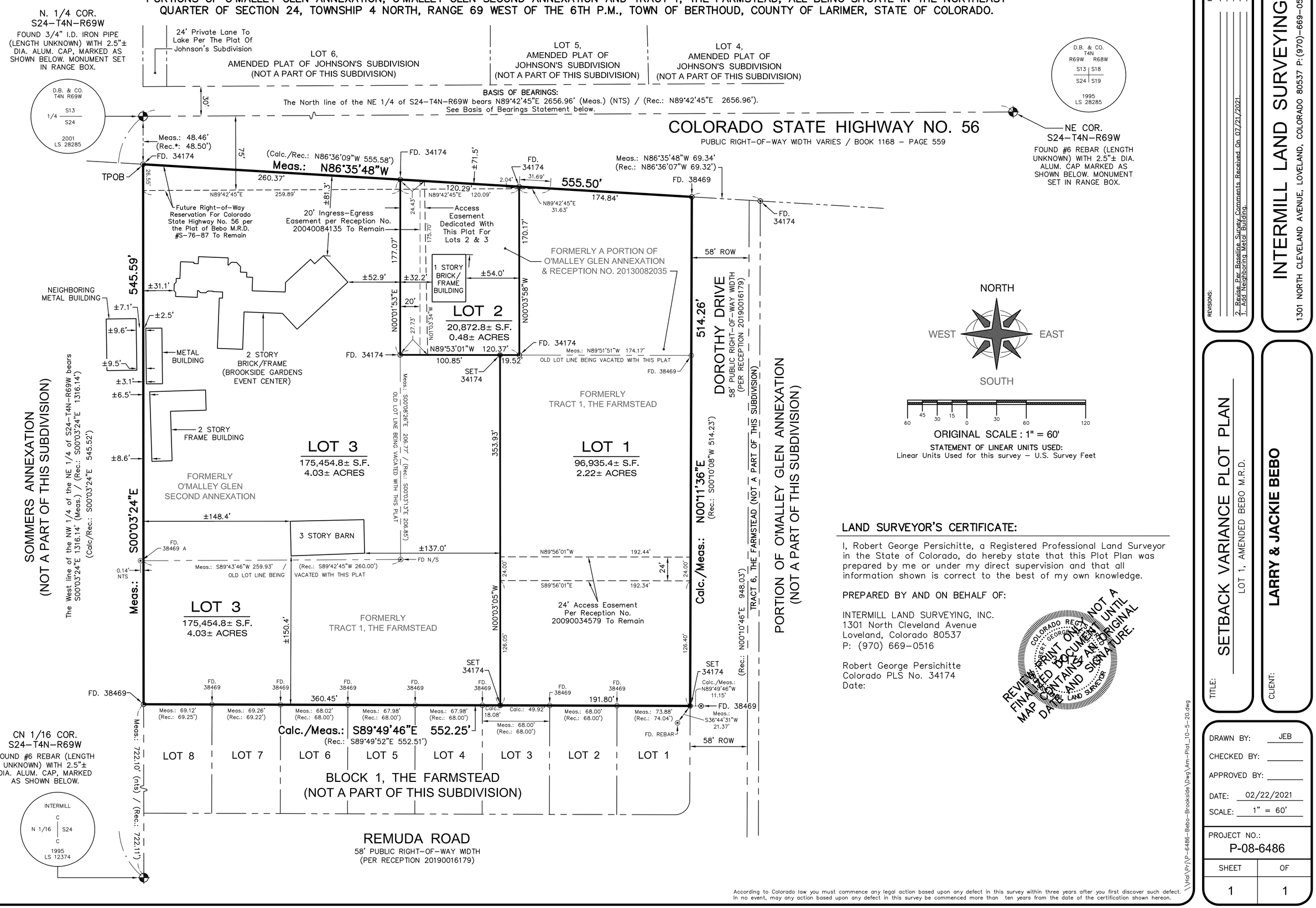
DRAWN BY:	RGP
CHECKED BY:	
APPROVED BY:	
DATE:	04–08–2020
SCALE:	1" = 60'
PROJECT NO.:	P-08-6486
SHEET	OF
2	2

\Work\P\P-08-6486-Bebo-Brewster\Dwg\ZONING MAP - O6082D.dwg

VARAINCE SUBMITTAL

O'MALLEY GLEN - FARMSTEAD MINOR SUBDIVISION
SIDE YARD SETBACK VARIANCE REQUEST PLOT PLAN

PORTIONS OF O'MALLEY GLEN ANNEXATION, O'MALLEY GLEN SECOND ANNEXATION AND TRACT 1, THE FARMSTEAD, ALL BEING SITUATE IN THE NORTHEAST QUARTER OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 69 WEST OF THE 6TH P.M., TOWN OF BERTHOUD, COUNTY OF LARIMER, STATE OF COLORADO.



LAND SURVEYOR'S CERTIFICATE:

I, Robert George Persichitte, a Registered Professional Land Surveyor in the State of Colorado, do hereby state that this Plot Plan was prepared by me or under my direct supervision and that all information shown is correct to the best of my own knowledge.

PREPARED BY AND ON BEHALF OF:

INTERMILL LAND SURVEYING, INC.
1301 North Cleveland Avenue
Loveland, Colorado 80537
P: (970) 669–0516

Robert George Persichitte
Colorado PLS No. 34174
Date:

REVIEWED PRINT ONLY UNTIL FINAL SIGNED DOCUMENT CONTAINS ORIGINAL MAP SEAL AND SIGNATURE. DATE

According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event, may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

\\Vtol\Pr\P-6486-Bebo-Brookside\Dwg\Vm-Plat_10-5-20.dwg

REVISIONS:
2. Revise Per Baseline Survey Comments Received On 07/21/2021. — BY: JEB — DATE: 07/27/2021
1. Add Neighboring Metal Building. — BY: JEB — DATE: 07/02/2021

INTERMILL LAND SURVEYING, INC.
1301 NORTH CLEVELAND AVENUE, LOVELAND, COLORADO 80537 P:(970)–669–0516 F:(970)–635–9775

TITLE: SETBACK VARIANCE PLOT PLAN
LOT 1, AMENDED BEBO M.R.D.

CLIENT: LARRY & JACKIE BEBO

DRAWN BY:	JEB
CHECKED BY:	
APPROVED BY:	
DATE:	02/22/2021
SCALE:	1" = 60'
PROJECT NO.:	P-08-6486
SHEET	OF
1	1

Garden Spot of Colorado
807 Mountain Avenue | PO Box 1229 | Berthoud, CO 80513 | O: 970.532.2643 | F: 970.532.0640 | Berthoud.org

TO: **Planning Commission**

DEPT. **Community Development**

TITLE **Curt Freese, Community Development Director**

PLANNING COMMISSION INFORMATION SHEET

MEETING DATE: **OCTOBER 14, 2021**

ITEM: **ENGINEERING AND INFRASTRUCTURE STANDARDS**

ATTACHMENTS: **Draft Engineering and Infrastructure Standards**

The Board set infrastructure as one of its top goals in its 2021 Strategic Plan, with touchstones of sustainability, community identity and resiliency. To achieve the goal of quality infrastructure that is sustainable and resilient, Staff developed a set of Engineering and Infrastructure Standards and Specifications. These standards provide specific design requirements and best management practices for the construction of public infrastructure which occurs with development.

BACKGROUND:

The Town has never had specific engineering standards for the design of infrastructure (sewers, water lines etc.), but has instead relied on a collection of other jurisdiction'sstandards (Larimer County Street Standards, Denver Water and Sewer Standards, etc.). In 2019, the Town hired JVA to develop strong standards, and draft standards were developed, but were delayed as a result of staffing changes. In 2021, the Town Engineer Noah Nemmers with Baseline Engineering, and the Community Development Department restarted the project and made additions to ensure that the foundation of Berthoud's infrastructure is resilient and installed properly.

ENSURING RESILIANCY

The draft Engineering and Infrastructure Standards and Specifications are broken into five main categories (Streets, Sanitary Sewer, Water Utilities, Storm Utilities and Drainage, and Dry Utilities) with detailed construction plan requirements, construction requirements, including design diagrams. The requirements now provide developers with exact details on how the Town desires their infrastructure to be designed and built, instead of many times relying on project specific design proposed by the developer's engineering team.

Baseline Engineering and Town Staff drafted a number of additions beyond the original JVA document which include:

- ✓ Required Street Frontage improvements for every development (Developers will be responsible for improving all adjoining streets, such as widening, turn lanes.
- ✓ Developers will be required to evaluate and provide a pavement condition index score of all roads affected and will be responsible for a portion of the cost to improve any inferior or insufficient roads impacted by their development.
- ✓ Developers will be required to provide traffic control devices and studies, including consideration of roundabouts at Town Staff's discretion.
- ✓ All utilities will be required to be stubbed to future undeveloped property.
- ✓ New pavement standards have been included, including requiring fly ash with the subgrade, as Staff and Baseline have observed issues when fly ash is not used, due to Berthoud's expansive soils
- ✓ New Development Agreement Standards set by code, instead of by specific agreement. The standards will require all improvements (trails, amenities, sidewalks, and landscaping) are installed before any building permits are issued

SUGGESTED ACTION:

Recommend approval to the Town Board.

TOWN OF BERTHOUD

ENGINEERING AND INFRASTRUCTURE DESIGN STANDARDS AND CONSTRUCTION SPECIFICATIONS

DRAFT

DRAFT FOR REVIEW

OCTOBER 2021

www.berthoud.org

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DRAFT

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CHAPTER 100 INTRODUCTION AND GENERAL PROVISIONS

101 INTRODUCTION

101.1 General Provisions

_____.

101.2 Purpose

A. The purpose of these Standards and Specifications is to provide minimum standards for safety, health, and general welfare of the Town by regulating the design, construction , choice of materials, location, maintenance and use of all Public and Private Improvements. These include, but are not limited to, sanitary sewer systems, water supply systems, private utility service lines for water and sewer, storm drainage systems, streets, landscape areas, open spaces, parks and recreation facilities, traffic signals and devices, parking lots and appurtenances thereto. All equipment and material used in the construction of public and private improvements shall be new unless approved by the Town.

B. These Standards and Specifications represent minimum requirements and design values. Additional requirements or higher design values, commensurate with conditions, may be required by the Town Engineer or Town Engineering Department when they are in the best interest of the Town.

101.3 Scope

A. The provisions of these Standards and Specifications shall apply to the planning, design, construction, enlargement, alteration, moving, removal, conversion, demolition, repair, and excavation of any Public or Private Improvements specifically regulated herein. These Standards and Specifications present the minimum standards for construction of Public and Private Improvements completed by Responsible Parties. These Standards and Specifications shall relate to the Town's capital improvement projects, unless specifically noted in the contract documents. With the exception of maintenance practices, the Town shall follow these Standards and Specifications where practicable.

B. In the case of those improvements that are required by the Town and are not specifically covered in these Standards and Specifications, the Responsible Party shall follow applicable local, state, and federal guidelines, or standards promulgated by professional organizations. The Town Engineering shall be consulted for guidance on proper references.

102 DEFINITIONS AND ABBREVIATIONS

102.1 Definitions

Refer to Chapter 30 of the Berthoud Development Code for a complete list of definitions. The following definitions are specific to these Standards and Specifications:

Approved Construction Drawings – Plans that were reviewed for compliance with Town of Berthoud Codes. The Engineer of record is responsible for adequacy of design and ensuring that the Improvements meet all Town of Berthoud Codes and these Standards and Specifications.

As-Built Plans – A modified version of the full set of the Approved Construction Drawings with actual physical documentation of any changes based on field measurements and certified by a Professional Engineer (PE) or Professional Land Surveyor (PLS).

Best Management Practices – Practice or combination of practices that is determined to be effective and practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to reach water quality goals.

Conditional Acceptance – An acknowledgement by the Town that, to the best of the Town's knowledge, all Improvements have been completed in accordance with the Approved Plans and Construction Drawings and these Standards and Specifications. Also referred to as Initial Acceptance.

Contractor – A person, partnership, corporation, subcontractor or other legally formed entity or organization that undertakes to construct, install, alter, move, demolish, repair, replace, excavate or add to any Public or Private Improvements covered by these Standards and Specifications.

Impermeable Surface – An area of land that does not allow the penetration of water or liquid to dissipate into the underlying soil due to man-made coverings over the soil (examples may include, but are not limited to, asphalt paving, concrete paving, roofs, etc.)

Landowner – Any owner of a legal or equitable interest in real property, and including the heirs, successors and assigns of such ownership interests.

Letter of Completion – Letter notifying the Responsible Party that the Private Improvements were constructed in accordance with the Approved Plans and Construction Drawings, and these Standards and Specifications.

May – Permissive.

Plan – The maps and supporting documentation for a development which includes, but is not limited to, lots, blocks, easements, right-of-way, pedestrian ways, park and school sites, open space areasand conservation areas in accordance with the requirement of this code.

Planning Area Boundary – The area surrounding the Town that the Town will consider annexing and developing. The Planning Area Boundary is delineated on the Future Land Use Map in the Berthoud Comprehensive Plan.

Private Improvements – Improvements under private ownership or control and/or maintained by the private owners, including but not limited to, portions of water systems, sewer systems, street systems and storm drainage systems, the construction of which are governed by these Standards and Specifications.

Service Area – An area, whether inside or outside Town limits, that receives water and/or sanitary sewer utility service from the Town of Berthoud.

Shall – Mandatory.

Stop Work Order – Official written notice from the Town to cease any and all construction or development activities on a site or lot due to a violation of, including but not limited to, the approved plans, the Town Code, the Standards and Specifications, building codes, and storm water runoff regulations. This notice will also include, but shall not be limited to, the restriction on issuance of building permits, certificates of occupancy, and additional provisions of utility services until the identified violations are corrected and approved by the Town.

Town Code – The latest, officially adopted version of the Berthoud Town Code.

Town Engineer –The Town of Berthoud Town Engineer or an authorized designee.

Warranty Period – Shall be the time frame during which the Responsible Party is held liable for all work performed and materials utilized prior to Final Acceptance by the Town of Berthoud.

102.2 Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AC	Asbestos Cement
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AISC	American Institute of Steel Construction
ALCC	Associated Landscape Contractors of Colorado
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
AWG	American Wire Gauge
BMP	Best Management Practice
CBR	California Bearing Ratio
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
cfs	cubic feet per second
CI	Cast Iron
CP	Colorado Testing Procedures
CP-L	Colorado Lab Testing Procedures
CPSC	Consumer Product Safety Commission
CRS	Colorado Revised Statute
CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
DI	Ductile Iron

DRC	Dry-Rodded Condition
DU/Ac	Dwelling Units per Acre
DUE	Dwelling Unit Equivalent
EDLA	Equivalent Daily Load Application
EGL	Energy Grade Line
ESAL	Equivalent Single Axel Load
ET	Evapotranspiration
EURV	Excess Urban Runoff Volume
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
fps	Feet per second
Gal	gallons
gpd	Gallons per day.
gpm	Gallons per minute.
GRC	Galvanized Rigid Conduit.
GVW	Gross Volume Weight
HDPE	High Density Polyethylene
HGL	Hydraulic Grade Line
HMA	Hot Mix Asphalt
IMSA	International Municipal Signal Association
IPC	International Plumbing Code
IPEMA	International Play Equipment Manufacturers Association
ISA	International Society of Arboriculture
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
LABCAT	Laboratory for Certification of Asphalt Technicians
lbs	pounds
PLS	Professional Land Surveyor
MAPC	Manual of Accident Prevention in Construction
MGD	Million gallons per day
MHFD	Mile High Flood District (Formerly the Urban Drainage and Flood Control District)

MUTCD	Manual on Uniform Traffic Control Devices
NEC	National Electrical Code
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PC	Point of Curvature
PCC	Portland Cement Concrete
PE	Professional Engineer
PG	Performance Grade
PI	Point of Intersection
PRC	Point of Reverse Curve
PRV	Pressure Reducing Valve
psi	Pounds per square inch
PT	Point of Tangency
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RAP	Reclaimed Asphalt Pavement
RCP	Reinforced Concrete Pipe
ROW	Right-of-way
RPS	Roller Pass Study
SDR	Standard Dimension Ratio
sf	Square Foot
SZFL	School Zone Flashing Light
SMA	Stone Mastic Asphalt
SN	Structural Number
SWMP	Stormwater Management Plan
SUE	Subsurface Utility Engineering
UL	Underwriters Laboratories, Inc.
UDFCD	See MHFD
USGS	United States Geological Survey
USACE	United State Army Corps of Engineers
VCA	Voids in the Coarse Aggregate

VFA	Voids Filled with Asphalt
VMA	Voids in the Mineral Aggregate
VTM	Voids in the Total Mix
WMA	Warm Mix Asphalt
WQCD	Water Quality Control Division
WQCV	Water Quality Capture Volume

102.3 Terms

A. Whenever, in these Standards and Specifications, the words "as ordered", "as directed", "as required", "as permitted", "as allowed", or words or phrases of like meaning are used, it shall be understood that the order, direction, requirement, permission, or allowance of the Town is intended.

B. Similarly, the words "approved", "reasonable", "suitable", "acceptable", "properly", "satisfactory", or words of like meaning, unless otherwise specified herein, shall mean approved, reasonable, suitable, acceptable, proper, or satisfactory in the judgment of the Town.

C. Whenever, in these Standards and Specifications, the words “Town Engineer” are used, it shall be understood that the Town employee named therein shall be whoever is designated by the Town Manager or Town Engineer.

103 GENERAL CONDITIONS

103.1 Authority by the Town

A. Engineering Services:

The Responsible Party shall procure at its sole expense all engineering services necessary and appropriate in conjunction with the development of the property, which shall fully conform to the Town’s applicable ordinances, and these Standards and Specifications. Professional services shall be performed by engineers, surveyors, landscape architects, or other professionals duly licensed by the State of Colorado as may be appropriate.

B. The Responsible Party shall pay all installation charges for water, sanitary, sewer, lighting, communication, electric, and/or gas services required by the appropriate service provider for the property/project. Payment for street lights shall be made in a timely fashion to ensure that street lights within and adjacent to residential lots are installed prior to the certificate of occupancy of the adjacent lots. At the discretion of the Town Engineer, the Town may withhold inspections and/or conditional acceptance if the street lights have not been installed prior to certificate of occupancy.

C. Variances

A variance may be granted by The Town Engineer in situations where it is not practical to carry out the provisions of these Standards and Specifications. The Town Engineer shall first determine that conditions exist to make impracticable the procedures set forth in these Standards and Specifications. A variance may be granted provided that it is in compliance with the intent and purpose of these Standards and Specifications. A variance shall not lessen any design requirements or degrees of integrity set forth in this document, and it shall result in a level of safety, service, and quality equal to or greater than the minimum requirements described in these Standards and Specifications. The Responsible Party shall provide a

written request for variance. If approved by the Town, a variance will be issued in writing by the Town Engineer, stating what the variance is, and the reason for approval.

D. Alternate Materials and Methods of Construction

1. The provisions of these Standards and Specifications are not intended to prevent the use of any material or method of construction not specifically prescribed by these procedures, provided any alternate in the Standards and Specifications is approved in writing by the Town Engineer, and thus authorized by the Town.

2. The Town Engineer shall require that sufficient evidence or proof be submitted to substantiate any request that may be made regarding the alternate method or material. The details of any action granting approval of an alternate shall be recorded and filed with the Town.

E. Tests

1. The Responsible Party shall employ at its sole expense a professionally qualified, independent third-party testing company to perform all testing of materials or construction that may be required by the Town to ensure compliance with these Standards and Specifications. The Responsible Party shall furnish the Town with certified copies of test results, and agrees to release and authorize full access to the Town and its designated representatives to all work-up materials, procedures, and documents used in preparing the test results.

2. Whenever there is insufficient evidence of compliance with any of the provisions of these Standards and Specifications or evidence that any material or construction does not conform to the requirements herein, The Town Engineer may require that test results shall be provided to establish compliance, at the expense of the Responsible Party. Such tests shall be as specified by these Standards and Specifications or by other recognized test standards approved by The Town Engineer. If there are no recognized and accepted test methods for the proposed alternate, The Town Engineer shall determine test procedures. All tests shall be made by an agency approved prior to testing by The Town Engineer.

F. Organization and Enforcement

1. The Town Engineer shall have the power to enforce all provisions of these Standards and Specifications. The Town Engineer may appoint a project manager, construction inspector, landscape architect, technical officer or inspector, or other employee to act as an authorized representative. Said authorized representative may be a Town employee or approved consultant.

2. Whenever any work is being done contrary to the provisions of these Standards and Specifications or approved plans, the Town Engineer may order the work stopped by a written notice which shall be served on any persons engaged in the doing or causing of such work to be done, and any such persons shall forthwith stop such work until authorized by the Town Engineer to proceed.

G. No Waiver of Legal Rights

1. The Town shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work from showing the true amount and character of the work performed and materials furnished by the Responsible Party, or from showing that any such measurement, estimate or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to these Standards and Specifications.

H. Control of Work

1. Authority of Town Engineer

   The Town Engineer shall have the authority to stop work whenever such stoppage is deemed reasonably necessary to protect public's health, safety and welfare. The Town Engineer shall resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these Standards and Specifications.

2. Authority and Duties of Inspector

   a. Inspectors are authorized to inspect all work completed and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter, or waive any requirements of these Standards and Specifications. The Inspector shall notify the Responsible Party of any failure of the work or materials nonconformity of these Standards and Specifications. The Inspector shall have the authority to reject materials until any questions at issue can be resolved by The Town Engineer.

   b. The Inspector shall, in no case, act as foreman or perform other duties for the Responsible Party or interfere with the management of the work done by the Responsible Party. Any "advice" which the Inspector may give the Responsible Party shall not be construed as binding upon the Town in any way or release the Responsible Party from fulfilling all of the terms of these Standards and Specifications.

   c. The presence or absence of the Inspector shall not relieve, in any degree, the responsibility or the obligation of the Responsible Party to follow these Standards and Specifications.

   d. The Town Engineer, or an authorized designee, shall, at all times, be provided reasonable and safe access to inspect the work whenever it is in preparation or progress.

3. Responsible Party's Responsibility for Work:

   In case of suspension of work for any cause whatsoever, the Responsible Party, before leaving the job site, shall take such precautions as may be necessary to prevent damage to the work, provide for proper drainage and erect any necessary barricades, signs, or other facilities, at the Responsible Party's expense, as required by applicable standards.

4. Removal of Unacceptable Work:

   Work which does not conform to the plans and these Standards and Specifications, and which results in an inferior or unsatisfactory product, shall be considered unacceptable work. Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be immediately removed and replaced or corrected by, and at the expense of, the Responsible Party. This expense includes total and complete restoration of any disturbed surface to original or better than the original condition which existed before the repairs or replacement, regardless of improvements on lands where the repairs or replacement are required.

5. Requirements of Other Jurisdictions:

   Where proposed construction will affect other agencies or utility providers such as CDOT, adjacent cities and counties, railroads, ditch companies, Xcel, Little Thompson Water District, Poudre Valley REA, Central Weld Water District, etc., said construction shall be subject to the review and approval of said agencies. Generally, where more than one

requirement is imposed, the more restrictive requirement shall govern. Exceptions must be authorized by the Town Engineer in writing.

103.2 Utility Location Requirements for Design

A. Per the provisions of the Colorado Revised Statutes Section 9-1.5-101 (also referred to as Colorado Senate Bill 18-167), projects that meet all of the following four (4) criteria are required to meet Quality Level B for design utility locations as identified in the subsurface utility engineering (SUE) standard ASCE 38.

1. Project involves a construction Contract with a public entity.
2. Project involves primarily horizontal construction and does not involve primarily the construction of buildings.
3. Anticipated excavation footprint exceeds two (2) feet in depth and is a contiguous 1000 square feet (excluding fencing and signing projects) OR involves utility boring.
4. Project requires the design services of a licensed PE.

B. For all projects that fall under SUE the following requirements must be initiated as part of the project design.

1. A thorough subsurface utility engineering investigation that takes the results of any comprehensive geophysical services for known and unknown utilities and integrates the results of the geophysics with existing records and physical evidence in a risk based depiction
2. Test holes where needed for utility locations
3. Utility location data that is transmitted to the Design Engineer in order to make informed design decisions and the Quality Level of each utility is marked on the plan set.
4. All of the utility investigation must take place under the direct responsible charge of a licensed Professional Engineer with training and a working knowledge of surface geophysics, engineering surveying, utility construction and design principles, utility conflict identification resolution, and utility risks as they pertain to the project.

C. The Standards and Specifications are not intended to alter the requirements of or to conflict with the Colorado Revised Statues Section 9-1.5-101.

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CHAPTER 200 DRAWINGS AND DESIGN REVIEW SUBMITTALS

201 CONSTRUCTION PLANS

201.1 Purpose Statement

In addition to any other requirements for the issuance of a construction permit pursuant to the Town Code, the developer shall submit to the Town Planning Department, prior to or contemporaneously with the application for construction permit, plans, specifications, engineering calculations, traffic reports, stormwater reports, utility reports, geotechnical reports and other data as required to allow the Town Engineer to determine compliance with these Standards and Specifications. All such reports, plans, computations, and specifications shall be prepared and designed by a professional engineer licensed in the State of Colorado, in accordance with the rules and laws of the Colorado Board of Registration of Professional Engineers. All park construction plans shall be prepared and designed by a professional landscape architect.

The Town Planning Department may waive the submission of plans, specifications, calculations, or other analysis, if in the Town Engineer's judgment, the nature of the work applied for is such that reviewing of plans is not necessary to obtain compliance with these Standards and Specifications.

201.2 Construction Plan Requirements

Construction plans shall be checked for conformance with Town minimum design standards prior to approval by the Town. This approval shall be for conformance to Town design standards and other requirements; engineering and landscaping design or needs shall remain the responsibility of the professional design engineer or landscape professional. Preliminary construction plans and all required reports shall be submitted in an electronic format to the Town Planning Department for review and one (1) 24” x 36” hard copy. Once all review comments have been addressed and the plans are final, one (1) set of plans, signed and sealed by a professional engineer, or as appropriate by a landscape architect, shall be submitted and retained. One (1) set of construction plans shall be 24" x 36" in size and one (1) sets shall be 11”x17” in size. The approval of all required reports and construction plans is valid for one (1) year. The final construction drawings shall be submitted in electronic “pdf”, AutoCAD™, and hard copy format.

A. General Requirements

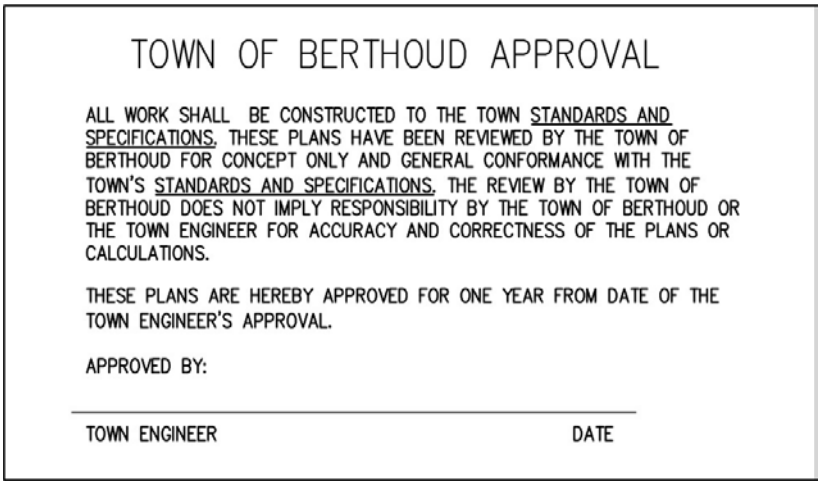
1. Plans and specifications shall be drawn to scale and shall have sufficient clarity to indicate the location, nature, and extent of the work proposed and show in detail that it shall conform to the provisions of these Standards and Specifications and all relevant laws, ordinance, rules and regulations.
2. The following items shall be shown on all plans:
    a. Cover Sheet, including Title Block (lower right-hand corner preferred).
    b. Scale (1"=50' horizontal and 1"=5' vertical for plans and profiles are a minimum).
    c. Legend including all line types and symbols.
    d. Revision number and date.
    e. Name of professional engineer or landscape architect and firm.
    f. Professional engineer's (PE) number, signature, landscape architect as applicable, and stamp.
    g. Town of Berthoud General Notes.
    h. Horizontal and vertical coordinate systems.
    i. Sheet number(s).

3. Town of Berthoud Waiver Statement: The following statement shall be included on the cover page of all plan sets:

   a. TOWN OF BERTHOUD WAIVER STATEMENT

      ALL WORK SHALL BE CONSTRUCTED TO THE TOWN STANDARDS AND SPECIFICATIONS. THESE PLANS HAVE BEEN REVIEWED BY THE TOWN OF BERTHOUD FOR CONCEPT ONLY AND GENERAL CONFORMANCE WITH THE TOWN'S STANDARDS AND SPECIFICATIONS. THE REVIEW BY THE TOWN OF BERTHOUD DOES NOT IMPLY RESPONSIBILITY BY THE TOWN OF BERTHOUD OR THE TOWN ENGINEER FOR ACCURACY AND CORRECTNESS OF THE PLANS OR CALCULATIONS.

4. The Town of Berthoud Approval Block shall be included on all plan sheets



TOWN OF BERTHOUD APPROVAL

ALL WORK SHALL BE CONSTRUCTED TO THE TOWN STANDARDS AND SPECIFICATIONS. THESE PLANS HAVE BEEN REVIEWED BY THE TOWN OF BERTHOUD FOR CONCEPT ONLY AND GENERAL CONFORMANCE WITH THE TOWN'S STANDARDS AND SPECIFICATIONS. THE REVIEW BY THE TOWN OF BERTHOUD DOES NOT IMPLY RESPONSIBILITY BY THE TOWN OF BERTHOUD OR THE TOWN ENGINEER FOR ACCURACY AND CORRECTNESS OF THE PLANS OR CALCULATIONS.

THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF THE TOWN ENGINEER'S APPROVAL.

APPROVED BY:

TOWN ENGINEER DATE

B. Plan Details

1. Key Map
2. Legend of symbols
3. North arrow, pointed to the top of the page, or to the right side of the page
4. Property lines - Indicate lots with lot number and block number to be served by solid lines
5. Survey monuments
6. Ownership or subdivision information
7. Street names, ROW, and easements with width dimensions
8. The location of existing utility lines - water, gas, telephone, storm drain, irrigation ditches, sanitary sewers, and other pertinent details, such as houses, curbs, water courses, cable television, etc.
9. Vicinity map
10. All bench marks
11. If irrigation ditches are involved, an approval block for the ditch company shall be provided.

C. Profile Details

1. Vertical and horizontal grids with scales and stationing.
2. Ground surface existing (dashed) and proposed (solid)

a. Existing utility lines
b. Bench marks (NAVD 88 datum) and project bench mark noted
c. Existing manhole inverts and rim elevations

D. Overall Utility Plan (Single Sheet)

1. The location of proposed and existing utility lines - water, gas, telephone, storm drain, irrigation ditches, sanitary sewers, and other pertinent details, such as houses, curbs, water courses, cable television, etc.

E. Water Construction Plan

In addition to the above general plan and profile details, all water supply construction plans shall include the following items at a minimum:

1. Proposed water mains (Include Profile):
   a. Size
   b. Length
   c. Materials, types of joints, and proposed depth
   d. Location dimensions. Other information including elevation at/of top of valve nut, rim elevation of valve box, meter box, etc. may be required.
2. Fittings (size and type), for example:
   a. Tees
   b. Crosses
   c. Reducers
   d. Bends
   e. Plugs
   f. Blow-offs
   g. Kickblocks
3. Valves (size and type)
4. Fire Hydrants
5. Irrigation tap locations and meter sizes with spot elevations.
6. Plan, profile, and complete details for offsite transmission mains, pump stations, valves, vaults, tanks, service locations, etc.
7. Complete material list included in drawings
8. Crossings Details (clearance, sleeving, if needed)
9. Detail Sheets with all pertinent Details

F. Sanitary Sewer Construction Plans

In addition to the general plan and profile details, sanitary sewer construction plans shall include the following:

1. Proposed sanitary sewers (Profile Sheets):
   a. Diameters
   b. Materials and types of joints
   c. Gradients

d. Length between manholes

2. Proposed manholes and cleanouts:
   a. Stationing and other number designation
   b. Elevation of inverts in and out of manhole
   c. Elevation of manhole rim
3. Location control dimension
4. Manhole stub-outs
5. Proposed future extensions
6. Proposed wye and riser connection for services
7. Proposed service connections or stub-ins
8. Proposed underdrain
9. Proposed concrete encasement
10. Proposed cutoff walls

G. Storm Drainage Construction Plan

In addition to the above general plan and profile details, storm drainage construction plans shall include the following:

1. Drainage area plan; an overall plan of the area under study showing:
   a. North arrow
   b. Contours on site and off site
   c. Location and elevation of Town or USGS bench marks
   d. USGS datum
   e. Property lines
   f. Boundary lines (counties, districts, tributary area, etc.)
   g. Streets and street names and approximate grades
   h. Subdivision (name and location by section)
   i. Existing irrigation ditches
   j. Existing drainage ways including gutter flow directions
   k. Drainage sub-area boundaries
   l. Easements required
   m. Proposed curbs and gutters and gutter flow directions
   n. Proposed cross pans and flow directions
   o. Proposed piping and open drainage ways
   p. Flow volumes for the minor and major storm runoff conditions. (Identify at inlets and outfalls)
   q. Path of 100-year storm runoff flows delineated
   r. Critical minimum finished floor elevations for protection from 100-year runoff
   s. Proposed inlet locations and inlet sizes
   t. Floodplain information, indicating land in floodplain, and land not in floodplain

u. Path of the emergency overflow spillway
v. High water line and overland flow path for all inlets in sags and for all culverts under inlet control conditions
w. Area grading plans for final stage
x. Plant material protection plan
y. Riprap size

2. Proposed pipes
   a. Plan showing stationing
   b. Profile (include minor and major storm HGLs)
   c. Size, lengths between manholes, and type material
   d. Grades, capacity
   e. Inlet and outlet details
   f. Manhole details (station number and invert elevations)
   g. Typical bedding detail
   h. Utility Crossings
3. Proposed open channels and detention facilities
   a. Plan showing stationing
   b. Profile (include the minor and major HGLs)
   c. Grades, capacities, water quality capture volume water surface elevation, major water surface elevation, top of pond elevation, and spillway details
   d. Typical cross sections for both channels and basins
   e. Lining details
4. Proposed special structures (manholes, headwalls, trash racks, etc.)
   a. Plan
   b. Elevation
   c. Details of design and appurtenances
5. Retaining Walls
   a. Retaining walls four (4) feet or greater are required to be designed and stamped by a registered professional engineer and must be approved and permitted through the Town.
   b. Retaining walls must have sufficient resistance against overturning and sliding, and they must possess adequate structural strength against bending outward.
   c. The retaining wall submittal package shall be in accordance with the following outline and contain the applicable information listed:
      i. Plans.
      ii. Spot elevations.
      iii. All proposed retaining walls should show top and bottom of wall elevations every 10 feet or on both sides of a step.
      iv. Sections.
      v. Details to include geofabric, drainage, foundation, etc.
      vi. Calculations.

vii. A Geotechnical Report – type of soils, specific weight, allowable bearing pressure, etc.

viii. Loading diagram - include surcharge loads and slopes.

ix. Factor of Safety against overturning shall be a minimum of 1.5 for granular soils (i.e. sand) and 2 for cohesive soils (i.e. clay).

x. Factor of Safety against sliding shall be a minimum of 2 which includes the passive resultant.

xi. For multiple tiered walls loads from upper wall need to be applied to the lower wall. In addition, the walls need to be analyzed as a single unit for bearing failure and slope stability.

H. Storm Water Management Plan (SWMP)

1. Development or redevelopment projects which disturb one (1) or more acres will require both sediment and erosion control plans and a CDPS General Permit for stormwater discharges associated with construction activities at least 10 calendar days prior to the commencement of construction activities. In fill lots or sites less than one acre of disturbance will require a sediment and erosion control plan.

2. A copy of the approved SWMP and site maps must be available at all times on the construction site unless otherwise approved by CDPHE or the Town.

3. The SWMP and site maps shall be continuously updated to reflect new or revised BMPs due to changes in design, construction, operation, or maintenance of the construction site. Updates must be made within 72 hours following the change in BMPs.

4. The Responsible Party shall inspect the construction site (including all BMPs, storage containers, and construction equipment) a minimum of every 14 calendar days and within 24 hours after a precipitation event or snow melt that cause's surface erosion. Inspections shall continue until an Inactivation Notice is filed with CDPHE and copied to the Town.

5. The Responsible Party shall keep a record of all inspections on site and available for review by CDPHE or Town staff. Inspection reports must identify any incidents of noncompliance with the terms and conditions of the Permit.

6. For all instances of noncompliance based on environmental hazards and chemical spills and releases, all needed information must be provided orally to CDPHE spill reporting line (24-hour number for environmental hazards and chemical spills and releases: 1-877-518-5608) within 24 hours from the time the Owner/Contractor comes aware of the circumstances.

I. Street Construction Plans

In addition to the above general plan and profile details, all street construction plans shall conform to Larimer County Urban Area Street Standards (LCUASS).

J. Irrigation Plans (see also Chapter 800)

1. Existing irrigation graphically distinguished from proposed irrigation.

2. Improvements or site conditions that will materially affect the successful operation of the system, such as buildings, sidewalks, slopes, swales, plant groupings, ditches, etc.

3. Point of connection and size of tap and meter.

4. Irrigation material schedule including pipe type and size, head type, arc and nozzle, valve type and size, etc.

5. Trench depth schedule from top of pipe.
6. Label size of all pipe on plan.
7. Indication at each zone valve of zone number, valve size, and gpm.
8. All miscellaneous details required to construct the system.
9. Irrigation schedule on plans demonstrating ability of system to comply with these Standards and Specifications.
10. Plan and details for a physical delineation between privately maintained landscaping and Town maintained landscaping. The delineation may be a fence, wall, mow strip, or planter as approved by the Town Engineer.
11. Existing and design water pressure.
12. Confirmation that system provides head to head coverage.
13. Turf and planting beds irrigated with different zones.
14. Pressure loss calculation sheet.

K. Park Construction, Mountain Avenue Main Street Corridor, common open space, detention ponds and Town owned property Landscape Plan see section 30.6-108 in the Town of Berthoud Development Code for submittal requirements.

1. Scale 1"=30' minimum.
2. Existing and proposed (design) contours maximum of two (2) foot intervals, including spot elevations.
3. Existing plant material, including material to be removed and plant material protection zone, if applicable, noting methods of protection. Indicate size and species.
4. Plant material schedule indicating graphic representation, alphabetized common name and botanical name including: genus, species, variety or cultivar, size, quantity, and plant material totals.
5. Proposed plant material shown at mature size. Plants with one (1) irrigation zone shall have similar water demand requirements.
6. All miscellaneous improvements and appurtenances including playgrounds, sidewalks, drives, curbs, manholes, parking lots, etc.
7. All existing and proposed miscellaneous improvements and appurtenances including playgrounds, sidewalks, hardscape play areas, trails, pavilions, site furniture, lighting including trail and street lights, signage, drives, curbs, manholes, parking lots, berms, water features, etc.
8. Graphic representation of all groundcover types (sod, seed, bedding plants, mulch, rock, etc.).
9. All proposed retaining walls or slope retention methods.
10. Seed blend, amendment required, and application rate for all seeded areas.
11. Amount and type of soil amendment required for landscape areas not seeded.
12. Existing and proposed utility easements.
13. Sight triangles.

14. Recreation athletic facilities (such as softball, baseball, soccer, football, tennis, basketball, playground equipment, etc,) shall be reviewed on a case by case basis and be approved by the Town prior to beginning any construction on the site. At a minimum, all such facilities plans shall meet the requirements of section 800 of these Standards and Specifications.
15. Regional trail profiles and cross sections.
16. Listing of total linear footage of sidewalks and trail, square footage of all planting beds, square footage of sod, and square footage of seeded areas.
17. Natural features relevant to the site.
18. All appropriate details.

201.3 Town of Berthoud Standard Notes

The following standard notes shall be included on all construction plan sets as appropriate.

A. General Notes

1. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST TOWN OF BERTHOUD STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS, COLORADO DEPARTMENT OF TRANSPORTATION, MOUNTAIN VIEW FIRE PROTECTION DISTRICT REQUIREMENTS, <*INSERT APPROPRIATE UTILITY DISTRICTS*>, AND ALL APPLICABLE STATE AND LOCAL STANDARDS AND SPECIFICATIONS.
2. THE CONTRACTOR SHALL HAVE IN POSSESSION AT THE JOB SITE AT ALL TIMES ONE (1) SIGNED COPY OF APPROVED PLANS, STANDARDS AND SPECIFICATIONS, AND PERMITS. CONTRACTOR SHALL CONSTRUCT AND MAINTAIN EMERGENCY ACCESS ROUTES TO THE SITE AND STRUCTURE AT ALL TIMES PER THE APPLICABLE MOUNTAIN VIEW FIRE PROTECTION DISTRICT REQUIREMENTS. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FOR ANY VARIANCE TO THE ABOVE DOCUMENTS. THE CONTRACTOR SHALL NOTIFY THE TOWN ENGINEER OF ANY CONFLICTING STANDARDS OR SPECIFICATIONS. IN THE EVENT OF ANY CONFLICTING STANDARD OR SPECIFICATION, THE MORE STRINGENT OR HIGHER QUALITY STANDARD, DETAIL OR SPECIFICATION SHALL APPLY.
3. THE CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE CODES, LICENSES, STANDARD SPECIFICATIONS, PERMITS, BONDS, ETC., WHICH ARE NECESSARY TO PERFORM THE PROPOSED WORK, INCLUDING, BUT NOT LIMITED TO A LOCAL AND STATE GROUNDWATER DISCHARGE AND COLORADO DEPARTMENT OF HEALTH AND ENVIRONMENT (CDPHE) STORMWATER DISCHARGE PERMIT ASSOCIATED WITH CONSTRUCTION ACTIVITY.
4. ALL WORK SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY AUTHORIZED TOWN OF BERTHOUD PERSONNEL.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE TOWN ENGINEER, GEOTECHNICAL ENGINEER, AND ALL UTILITY OWNERS, AT LEAST 48 HOURS PRIOR TO START OF ANY CONSTRUCTION, PRIOR TO BACKFILLING, AND AS REQUIRED BY JURISDICTIONAL AUTHORITY AND/OR PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL CONTINUE WITH NOTIFICATIONS THROUGHOUT THE PROJECT AS REQUIRED BY THE STANDARDS AND SPECIFICATIONS.
6. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB SITE; INCLUDING, SAFETY OF PERSONS AND PROPERTY DURING THE PERFORMANCE OF WORK. THIS

REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE TOWN CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON, OR NEAR THE CONSTRUCTION SITE.

7. THE CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN FOR TOWN APPROVAL BY THE TOWN OF BERTHOUD PRIOR TO CONSTRUCTION AND PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FENCING, FLAGMEN OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY. THE CONTRACTOR AGREES TO COMPLY WITH THE PROVISIONS OF THE TRAFFIC CONTROL PLAN AND THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)," PART VI, FOR CONSTRUCTION SIGNAGE AND TRAFFIC CONTROL. ALL TEMPORARY AND PERMANENT TRAFFIC SIGNS SHALL COMPLY TO THE MUTCD WITH REGARD TO SIGN SHAPE, COLOR, SIZE, LETTERING, ETC. UNLESS OTHERWISE SPECIFIED. IF APPLICABLE, PART NUMBERS ON SIGNAGE DETAILS REFER TO MUTCD SIGN NUMBERS.

8. THE TYPE, SIZE, LOCATION, AND NUMBER OF ALL KNOWN UNDERGROUND UTILITIES ARE APPROXIMATE AS SHOWN ON THE DRAWINGS BASED ON INFORMATION BY OTHERS. NOT ALL UTILITIES ARE SHOWN. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE, SIZE, TYPE, AND LOCATION OF ALL UNDERGROUND UTILITIES WHETHER SHOWN OR NOT ALONG THE ROUTE OF THE WORK. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY CONTRACTOR PRIOR TO DATE OF CONSTRUCTION. IT IS THE CONTRACTOR’S RESPONSIBILITY TO FIELD VERIFY SIZE AND HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING FACILITIES PRIOR TO CONSTRUCTION AND NOTIFY THE TOWN OF ANY DISCREPANCIES. THE ENGINEER AND/OR OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS SHOWNON PLANS. THE CONTRACTOR SHALL BE FULLY AND SOLELY RESPONSIBLE FORANY AND ALL DAMAGES AND COSTS WHICH MIGHT OCCUR BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES. THE CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE UTILITY COMPANIES AND DETERMINE THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO PROCEEDING WITH GRADING AND CONSTRUCTION. ALL WORK PERFORMEDIN THE AREA OF UTILITIES SHALL BE PERFORMED AND INSPECTED ACCORDING TO THE REQUIREMENTS OF THE UTILITY OWNER. LIKEWISE, THE CONTRACTORSHALL BE RESPONSIBLE FOR LOCATING AND MAPPING ANY EXISTING UTILITY (INCLUDING DEPTH) WHICH MAY CONFLICT WITH THE PROPOSED CONSTRUCTION, AND FOR RELOCATING ENCOUNTERED UTILITIES AS DIRECTED BY THE ENGINEER. CONTRACTOR SHALL CONTACT AND RECEIVE APPROVAL FROM TOWN ENGINEER AND THE UTILITY OWNER BEFORE RELOCATING ANY ENCOUNTERED UTILITIES. CONTRACTOR RESPONSIBLE FOR SERVICE CONNECTIONS, AND RELOCATING AND RECONNECTING AFFECTED UTILITIES ASCOORDINATED WITH UTILITY OWNER AND/OR ENGINEER, INCLUDING NON- MUNICIPAL UTILITIES (TELEPHONE, GAS, CABLE, ETC., WHICH SHALL BE COORDINATED WITH THE UTILITY OWNER). THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE TOWN ENGINEER UPON DISCOVERY OF A UTILITY DISCREPANCY OR CONFLICT. AT LEAST 48 HOURS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE UTILITY NOTIFICATION CENTER OF COLORADO (1-800-922-1987, WWW.UNCC.ORG).

9. ALL TRENCHES SHALL BE ADEQUATELY SUPPORTED AND THE SAFETY OF WORKERS PROVIDED FOR AS REQUIRED BY THE MOST RECENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) "SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION." THESE REGULATIONS ARE DESCRIBED IN SUBPART P, PART 1926 OF THE CODE OF FEDERAL REGULATIONS. SHEETING AND SHORING SHALL BE UTILIZED WHERE NECESSARY TO PREVENT ANY EXCESSIVE WIDENING OR SLOUGHING OF THE TRENCH WHICH MAY BE DETRIMENTAL TO HUMAN SAFETY, TO THE PIPE BEING PLACED, TO TREES, OR TO ANY EXISTING STRUCTURE WHERE EXCAVATIONS ARE MADE UNDER SEVERE WATER CONDITIONS. THE CONTRACTOR MAY BE REQUIRED TO USE AN APPROVED PILING INSTEAD OF SHEETING AND SHORING.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF EXISTING STREETS NOR EROSION ON ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. GROUNDWATER TO BE PUMPED SHALL BE TESTED, PERMITTED, AND PUMPED PER THE STATE OF COLORADO AND LOCAL GROUNDWATER DISCHARGING PERMIT REQUIREMENTS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING NEARBY PUBLIC STREETS OF MUD OR DEBRIS DUE TO CONSTRUCTION ACTIVITY INITIATED BY SAID CONTRACTOR ON A DAILY BASIS OR AS OTHERWISE DIRECTED BY AUTHORIZED TOWN PERSONNEL.
12. ALL SURPLUS MATERIALS, TOOLS, AND TEMPORARY STRUCTURES, FURNISHED BY THE CONTRACTOR, SHALL BE REMOVED FROM THE PROJECT SITE BY THE CONTRACTOR. ALL DEBRIS AND RUBBISH CAUSED BY THE OPERATIONS OF THE CONTRACTOR SHALL BE REMOVED, AND THE AREA OCCUPIED DURING CONSTRUCTION ACTIVITIES SHALL BE RESTORED TO ITS ORIGINAL CONDITION OR BETTER, WITHIN 48 HOURS OF PROJECT COMPLETION.
13. PRIOR TO THE BEGINNING OF WORK, A PRECONSTRUCTION CONFERENCE SHALL BE HELD BETWEEN THE TOWN, THE RESPONSIBLE PARTY WHO IS SCHEDULED TO PERFORM THE WORK, THE DESIGNATED ON-SITE FIELD REPRESENTATIVE, THE CONSULTING ENGINEER OR LANDSCAPE PROFESSIONAL, AND ANY OTHER ENTITIES INVOLVED IN THE CONSTRUCTION.
14. THE CONTRACTOR IS REQUIRED TO PROVIDE AND MAINTAIN EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE TOWN OF BERTHOUD STANDARDS AND SPECIFICATION, THE STATE OF COLORADO, MILE HIGH FLOOD DISTRICT "URBAN STORM DRAINAGE CRITERIA MANUAL VOLUME 3", THE M-STANDARD PLANS OF THE COLORADO DEPARTMENT OF TRANSPORTATION, AND THE APPROVED EROSION CONTROL PLAN. THE TOWN OF BERTHOUD MAY REQUIRE THE CONTRACTOR TO PROVIDE ADDITIONAL EROSION CONTROL MEASURES AT THE CONTRACTOR'S EXPENSE DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE PLANS DO NOT FUNCTION AS INTENDED. THE CONTRACTOR IS RESPONSIBLE FOR PROHIBITING SILT AND DEBRIS LADEN RUNOFF FROM LEAVING THE SITE, AND FOR KEEPING ALL PUBLIC AREAS FREE OF MUD AND DEBRIS. THE CONTRACTOR IS RESPONSIBLE FOR RE-ESTABLISHING FINAL GRADES AND FOR REMOVING ACCUMULATED SEDIMENTATION FROM ALL AREAS INCLUDING SWALES AND DETENTION/WATER QUALITY AREAS. CONTRACTOR SHALL REMOVE TEMPORARY EROSION

CONTROL MEASURES AND REPAIR AREAS AS REQUIRED AFTER VEGETATION IS ESTABLISHED AND ACCEPTED BY THE TOWN OF BERTHOUD.

15. DEVELOPMENT PHASING OF ANY PROJECT MUST BE SHOWN ON THE CONSTRUCTION PLANS, APPROVED BY THE TOWN ENGINEER AND MADE A PART OF THE APPLICATION PROCEDURE. NO PHASING SHALL BE PERMITTED UNLESS THIS REQUIREMENT HAS BEEN ADHERED TO.
16. NO WORK SHALL BEGIN UNTIL THE INSTALLING RESPONSIBLE PARTY IS IN POSSESSION OF AN APPROVED SET OF PLANS AND THE TOWN OF BERTHOUD STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS, AND ALL NECESSARY PERMITS FOR THE IMPROVEMENTS HAS BEEN ISSUED BY THE TOWN. TOWN ENGINEERING'S APPROVAL SHALL BE FOR GENERAL CONFORMITY TO THE UTILITY SPECIFICATIONS AND SHALL NOT CONSTITUTE BLANKET APPROVAL OF ALL DIMENSIONS, QUANTITIES AND DETAILS OF THE MATERIAL OR EQUIPMENT SHOWN. NOR SHALL SUCH APPROVAL RELIEVE THE RESPONSIBLE PARTY, CONSULTING ENGINEER, OR LANDSCAPE ARCHITECT OF THEIR RESPONSIBILITY FOR ERRORS CONTAINED IN THE DRAWINGS.
17. THE RESPONSIBLE PARTY SHALL FURNISH REASONABLE AID AND ASSISTANCE REQUIRED BY THE TOWN ENGINEER FOR THE PROPER EXAMINATION OF THE MATERIALS AND WORK. WORK SHALL BE PERFORMED IN ACCORDANCE WITH ACCEPTED WORKMANSHIP PRACTICES AND THE TOWN OF BERTHOUD STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS. ANY WORK NOT ACCEPTED BY THE TOWN ENGINEER SHALL BE REDONE UNTIL COMPLIANCE WITH THESE STANDARDS IS ACHIEVED. INSTRUCTIONS GIVEN BY THE TOWN ENGINEER RELATING TO QUALITY OF MATERIALS AND WORKMANSHIP MUST BE OBEYED ATONCE BY THE RESPONSIBLE PARTY. THE TOWN SHALL NOT SUPERVISE SET OUT WORK, OR GIVE LINE AND GRADE STAKES.
18. THE MATERIALS USED IN PROJECTS SHALL BE NEW AND SUBJECT TO THE INSPECTION AND APPROVAL OF THE INSPECTOR AT ALL TIMES. THE INSPECTOR HAS THE RIGHT TO PERFORM ANY TESTING DEEMED NECESSARY TO ENSURE COMPLIANCE OF THE MATERIAL WITH THESE STANDARDS. NO MATERIAL SHALL BE USED BEFORE BEING INSPECTED AND APPROVED BY THE INSPECTOR. FAILURE OR NEGLECT ON THE PART OF THE INSPECTOR TO CONDEMN OR REJECT INFERIOR MATERIALS OR WORK SHALL NOT BE CONSTRUED TO IMPLY THEIR ACCEPTANCE SHOULD THEIR INFERIORITY BECOME EVIDENT AT ANY TIME PRIOR TO FINAL ACCEPTANCE OF THE WORK. INSPECTORS HAVE THE AUTHORITY TO REJECT DEFECTIVE OR INFERIOR MATERIALS AND/OR DEFECTIVE WORKMANSHIP AND TO SUSPEND WORK UNTIL SUCH TIME AS THE RESPONSIBLE PARTY SHALL CORRECT THE DISCREPANCIES IN QUESTION.
19. WHENEVER DEFECTIVE MATERIALS AND WORK ARE REJECTED, THE RESPONSIBLE PARTY SHALL PROMPTLY REMOVE SUCH DEFECTIVE MATERIALS AND CONSTRUCTION FROM THE JOB SITE AND REPLACE ALL DEFECTIVE PORTIONS TO THE SATISFACTION OF THE TOWN ENGINEER. IN THE EVENT THE RESPONSIBLE PARTY FAILS TO REMOVE REJECTED ITEMS FROM THE JOB SITE WITHIN A REASONABLE LENGTH OF TIME, THE TOWN ENGINEER MAY ARRANGE FOR SUCH REMOVAL AT THE EXPENSE OF THE RESPONSIBLE PARTY.
20. INSPECTION SHALL NOT RELIEVE THE RESPONSIBLE PARTY FROM ANY OBLIGATION TO PERFORM THE WORK STRICTLY IN ACCORDANCE WITH THE

PLANS AND SPECIFICATIONS OR ANY MODIFICATIONS THEREOF. WORK NOT SO CONSTRUCTED SHALL BE REMOVED AND CORRECTED BY THE RESPONSIBLE PARTY AT HIS SOLE EXPENSE, WHENEVER SO ORDERED BY THE TOWN ENGINEER, WITHOUT REFERENCE TO ANY PREVIOUS ERROR OR OVERSIGHT IN INSPECTION.

21. EXCEPT IN CASES OF EMERGENCY, MAINTENANCE, OR PROTECTION OF WORK ALREADY COMPLETED, NO WORK SHALL BE ALLOWED BETWEEN THE HOURS OF 7 P.M. AND 7 A.M.; NOR ON SATURDAY, SUNDAY, OR LEGAL HOLIDAYS UNLESS APPROVED BY THE TOWN ENGINEER IN EACH CASE. WHEN ANY INSPECTOR IS REQUIRED TO WORK OUTSIDE THE HOURS OF 7 A.M. TO 4 P.M. ON REGULAR TOWN BUSINESS DAYS, OVERTIME SHALL BE CHARGED TO THE RESPONSIBLE PARTY. HOWEVER, SUCH INSPECTORS SHALL REMAIN EMPLOYEES OF THE TOWN FOR ALL PURPOSES. REQUESTS FOR OVERTIME SHALL BE MADE TO THE TOWN ENGINEER AT LEAST 48 HOURS IN ADVANCE. PAYMENT FOR SUCH OVERTIME WORK SHALL BE MADE TO THE TOWN PRIOR TO FINAL ACCEPTANCE.
22. IN THE EVENT ONE OR MORE INSPECTORS REPRESENTING PRIVATE CONSULTING ENGINEERING FIRMS ARE ALSO INSPECTING A PROJECT ALONG WITH THE TOWN ENGINEER, THE INSTRUCTIONS GIVEN BY THE TOWN ENGINEER SHALL PREVAIL IN THE EVENT OF CONFLICTING INSTRUCTIONS.
23. PROTECT ALL TREES AND VEGETATION. PLACE CONSTRUCTION FENCING AT DRIP LINE OF TREES AND PLANTS NEAR THE WORK ZONE. DEEP WATER TREES WEEKLY. HAND EXCAVATION REQUIRED AT ROOT ZONES WHERE PROPOSED PAVING OR UTILITY WORK IS WITHIN DRIPLINE OF TREES. REPAIR OF ANY DAMAGE TO EXISTING IMPROVEMENTS OR LANDSCAPING IS THE RESPONSIBILITY OF THE CONTRACTOR.
24. THE WORK SHALL BE SURVEYED AND STAKED UNDER THE SUPERVISION OF A LICENSED LAND SURVEYOR IN ACCORDANCE WITH THE APPROVED PLANS.
25. RIM AND GRATE ELEVATIONS SHOWN ON PLANS ARE APPROXIMATE ONLY AND ARE NOT TO BE TAKEN AS FINAL ELEVATIONS. THE CONTRACTOR SHALL ADJUST RIMS AND OTHER IMPROVEMENTS TO MATCH FINAL PAVEMENT AND FINISHED GRADE ELEVATIONS.
26. THE CONTRACTOR SHALL FURNISH THE ENGINEER OF RECORD A COMPLETE SET OF CONSTRUCTION RECORD DRAWINGS ("AS-BUILTS"), FOR THE CONSTRUCTED IMPROVEMENTS. THE PLANS SHALL SHOW SUFFICIENT DIMENSION TIES TO PERMANENT SURFACE FEATURES FOR ALL BURIED FACILITIES TO ALLOW FOR FUTURE LOCATING. THE PLANS SHALL SHOW FINAL PAVEMENT, FLOW LINE ELEVATIONS, CONTOURS AT POND/DRAINAGEFEATURES (AS SURVEYED AND CERTIFIED BY A COLORADO P.L.S.), MANHOLE, PIPE, AND INLET LOCATIONS, INVERTS, GRATE ELEVATIONS, SIZES OF ALL UTILITIES, AND ANY VARIATIONS FROM THE APPROVED PLAN. FINAL AS-BUILT PLANS PREPARED BY THE ENGINEER OF RECORD SHALL BE PROVIDED TO THE TOWN OF BERTHOUD.
27. IF A FOUNDATION UNDERDRAIN SYSTEM IS INSTALLED IN THE PUBLIC RIGHT-OF-WAY, THE FOLLOWING STATEMENT SHALL BE INCLUDED IN THE DRAWINGS:
    a. “THE FOUNDATION UNDERDRAIN SYSTEM IS THE RESPONSIBILITY OF THE OWNER/DEVELOPER OR ITS ASSIGNS. THE TOWN IS NOT RESPONSIBLE FOR THE MAINTENANCE OR REPAIR OF SAID SYSTEM.”

B. Grading Notes

1. CONSTRUCTION SHALL ADHERE TO THE FOLLOWING SEQUENCE UNLESS OTHERWISE SPECIFIED BY THE TOWN ENGINEER: SANITARY SEWER INSTALLATION, WATER MAIN INSTALLATION, CURB AND GUTTER INSTALLATION, WATER SERVICE INSTALLATION.
2. COMPACTION OF ALL TRENCHES MUST BE ATTAINED AND COMPACTION TEST RESULTS SUBMITTED TO THE ENGINEER AND THE TOWN OF BERTHOUD PRIOR TO FINAL ACCEPTANCE.
3. ALL WORK, INCLUDING CORRECTION WORK, SHALL BE INSPECTED BY A TOWN REPRESENTATIVE WHO SHALL HAVE THE AUTHORITY TO HALT CONSTRUCTION WHEN STANDARD CONSTRUCTION PRACTICES ARE NOT BEING ADHERED TO.
4. DEVELOPER AND BUILDER SHALL REGULARLY PATROL THE PUBLIC LANDS ADJACENT TO THE DEVELOPMENT TO REMOVE CONSTRUCTION DEBRIS AND KEEP THE SITE CLEAN AND SAFE.
5. ALL SITE GRADING (EXCAVATION, EMBANKMENT, AND COMPACTION) SHALL CONFORM TO THE RECOMMENDATIONS OF THE LATEST SOILS INVESTIGATION FOR THIS PROPERTY AND SHALL FURTHER BE IN CONFORMANCE WITH THE TOWN OF BERTHOUD STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS", LATEST EDITION. A CDPS GENERAL PERMIT FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES SHALL BE OBTAINED PRIOR TO ANY GRADING BEING PERFORMED ON SITES ONE (1) ACRE OR LARGER IN SIZE. THESE PERMITS CAN BE OBTAINED FROM THE STATE WATER QUALITY CONTROL DIVISION.
6. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATION AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
7. TOPSOIL SHALL BE STOCKPILED TO THE EXTENT PRACTICABLE ON THE SITE FOR USE ON AREAS TO BE REVEGETATED. ANY AND ALL STOCKPILES SHALL BE LOCATED AND PROPER MEASURES TAKEN TO CONTROL EROSION AND SEDIMENT MOVEMENT.
8. AT ALL TIMES, THE PROPERTY SHALL BE MAINTAINED AND/OR WATERED TO PREVENT WIND-CAUSED EROSION. EARTHWORK OPERATIONS SHALL BE DISCONTINUED WHEN DUST SIGNIFICANTLY IMPACTS ADJACENT PROPERTY. IF EARTHWORK IS COMPLETE OR DISCONTINUED AND DUST FROM THE SITE CONTINUES TO CREATE PROBLEMS, THE OWNER/DEVELOPER SHALL IMMEDIATELY INSTITUTE MITIGATIVE MEASURES AND SHALL CORRECT DAMAGE TO ADJACENT PROPERTY.
9. PERMANENT SLOPES SHALL NOT EXCEED 4:1 (H:V) IN AREAS TO BE SEEDED OR SODDED. RETAINING WALLS SHALL BE REVIEWED AND APPROVED BY SEPARATE APPLICATION TO THE TOWN OF BERTHOUD.
10. THIS EROSION AND SEDIMENT CONTROL PLAN HAS BEEN SUBMITTED TO THE TOWN OF BERTHOUD AND IS IN GENERAL CONFORMANCE WITH THE TOWN'S EROSION CONTROL STANDARDS. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURE MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEM OR IF THE PROPOSED

EROSION CONTROL MEASURES DO NOT FUNCTION AS INTENDED. THE REQUIREMENTS OF THIS EROSION CONTROL PLAN AND THE OBLIGATION OF THE LANDOWNER SHALL RUN WITH THE LAND UNTIL SUCH TIME AS THE EROSION CONTROL PLAN IS PROPERLY COMPLETED, OFFICIALLY MODIFIED, OR VOIDED.

C. Water Notes:

1. ALL WATER MATERIALS, CONSTRUCTION, AND TESTING SHALL MEET THE REQUIREMENTS OF BERTHOUD STANDARDS AND SPECIFICATIONS AND THE BERTHOUD FIRE PROTECTION DISTRICT SPECIFICATIONS.
2. FIRE HYDRANT SPECIFICATIONS:
    a. ALL FIRE HYDRANTS WILL BE MUELLER.
    b. ALL HYDRANTS WILL HAVE A FIVE AND ONE-QUARTER (5-1/4) INCH OR LARGER VALVE OPENING, TWO (2) TWO AND ONE-HALF (2-1/2) INCH HOSE NOZZLES, ONE (1) PUMPER NOZZLE AND SIX (6) INCH OR LARGER MECHANICAL JOINT INLET.
    c. ALL NOZZLES SHALL HAVE NATIONAL STANDARD THREADS.
    d. THE HYDRANT SHALL BE OF TRAFFIC HAZARD TYPE WITH SAFETY FEATURES WHICH WILL PREVENT BARREL BREAKAGE.
    e. SPECIFICATIONS FOR THE OPERATING NUT AND STUBS AND CUPS SHALL BE ONE (1) INCH SQUARE OR PENTAGON AND OPEN RIGHT.
3. WATER SERVICE LINE SPECIFICATIONS:
    a. CORPORATION STOPS SHALL HAVE INLET THREADED CC TYPE, OUTLET COPPER COMPRESSION OR FLARE, NO SOLDERING WILL BE ALLOWED.
    b. SERVICE SADDLES SHALL BE “O” RING GASKET, DOUBLE BAND, OR HINGE PIN CC THREAD, ¾ INCH – 2 INCH COPPER.
    c. CURB STOP STYLE SHALL BE COMPRESSION OR FLARED COPPER BOTH ENDS, MINNEAPOLIS PATTERN VALVE-THREADS AROUND TO ALLOW MINNEAPOLIS STYLE CURB BOX.
    d. CURB BOX SHALL HAVE MINNEAPOLIS BASE EXTENSION TYPE CURB BOXES, CAST IRON LID AND BASE WITH BRASS PENTAGON HEAD PLUG USING A 1 ½ INCH UPPER SECTION.
4. ALL WATER VALVES SHALL OPEN LEFT.
5. THE MINIMUM COVER OVER THE WATER LINE IS 5 FEET AND THE MAXIMUM COVER IS 6 FEET UNLESS OTHERWISE NOTED IN THE PLANS AND APPROVED BY THE TOWN.
6. PRIOR TO INSTALLATION OF WATER MAINS, ROAD/DRIVE CONSTRUCTION MUST HAVE PROGRESSED TO AT LEAST THE “SUB-GRADE” STATE. SUB-GRADE IS DEFINED AS AN ELEVATION OF NO MORE THAN SEVEN (7) INCHES BELOW THE FINISHED STREET GRADE. ALL VALVE BOXES AND FIRE HYDRANTS WILL BE ADJUSTED TO THE FINAL FINISHED GRADE BY THE CONTRACTOR.
7. BEFORE ANY TAPS ARE MADE FROM MAINS, APPLICATIONS FOR THE TAPS MUST BE RECEIVED AND APPROVED BY THE TOWN.
8. TRACER WIRE SHALL BE USED FOR ALL NON-METALLIC WATER MAINS. TRACER WIRE SHALL BE BROUGHT UP TO TEST STATIONS AT ALL FIRE HYDRANTS.
9. PVC WATER MAINS SHALL BE AWWA C900, DR 18
10. ALL WATER SERVICES SHALL BE TYPE K COPPER.
11. CONTRACTOR TO CONTACT BUILDING DEPARTMENT PRIOR TO INSTALLATION OF METER SETTER.

D. Sanitary Notes

1. MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST EDITION OF THE TOWN OF BERTHOUD STANDARDS AND SPECIFICATIONS AND WORK SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY AUTHORIZED TOWN OF BERTHOUD PERSONNEL.
2. NEW SEWER MAINS SHALL BE POLYVINYL CHLORIDE (PVC) ASTM D3034 SDR-35 PIPE AND IN ACCORDANCE WITH THE ABOVE REFERENCED SPECIFICATIONS.
3. CONTRACTOR TO VERIFY LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES PRIOR TO COMMENCING ANY CONSTRUCTION.
4. THE CONTRACTOR SHALL NOTIFY THE TOWN A MINIMUM OF 48 HOURS AND A MAXIMUM OF 96 HOURS PRIOR TO STARTING CONSTRUCTION OR PRIOR TO RESUMING CONSTRUCTION AFTER A BREAK.
5. MAINTAIN A MINIMUM OF 10 FEET HORIZONTAL SEPARATION OUTSIDE DIAMETER TO OUTSIDE DIAMETER BETWEEN WATER MAINS AND ALL SEWER MAINS AND MANHOLES.
6. ALL SEWER MAINS CROSSING WATER MAINS WITH LESS THAN 18 INCHES OF SEPARATION SHALL BE ENCASED IN CONCRETE.
7. RIM ELEVATIONS SHOWN ARE APPROXIMATE AND SHOULD NOT BE TAKEN AS FINAL. ALL MANHOLES SHALL BE FINAL ADJUSTED AFTER PAVING SUCH THAT THE RIM IS ¼ TO ½ INCH BELOW FINISHED ASPHALT. MANHOLES IN UNPAVED AREAS SHALL BE SET SO THAT THE RIM IS 0.5' ABOVE FINISHED GRADE. BURIED MANHOLES ALLOWED IN CULTIVATED FIELDS AS APPROVED BY TOWN ENGINEER. AS-BUILTS SHALL ALLOW FINAL NORTHING/EASTING AND RIM ELEVATION OF ALL BURIED MANHOLES.
8. INVERT (AS-BUILT) DATA SHALL BE COLLECTED BY A LICENSED SURVEYOR ON EACH PIPE INVERT IN A MANHOLE. CENTER OF MANHOLE SURVEYING IS NOT ACCEPTABLE FOR SLOPE CALCULATIONS. RECORD DRAWINGS (AS-BUILTS) MUST DEMONSTRATE CONFORMANCE TO TOWN STANDARDS.
9. THE CONTRACTOR SHALL HAVE A SET OF APPROVED PLANS ON SITE AT ALL TIMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECORDING ACTUAL RECORD DRAWING DIMENSIONS AND DISTANCES AS WELL AS SERVICE LOCATIONS ON THESE PLANS AND SUBMITTING THEM TO THE ENGINEER FOR PREPARATION OF RECORD DRAWINGS. THESE DRAWINGS SHALL BE KEPT CURRENT AT ALL TIMES.
10. BEFORE ANY CONSTRUCTION COMMENCES, A PLUG SHALL BE INSTALLED TO PREVENT DRAINAGE THROUGH THE NEW SEWER LINE FROM ENTERING THE EXISTING SEWER LINE. THIS PLUG WILL BE INSTALLED IN THE MANHOLE, WHICH CONNECTS NEW WORK WITH THE EXISTING AND MAY NOT BE REMOVED UNTIL SUBSTANTIAL ACCEPTANCE.
11. UNDERDRAINS, IF INSTALLED, ARE THE RESPONSIBILITY OF THE DEVELOPER. THE TOWN ASSUMES NO LIABILITY FOR ANY PORTION OF OR ANY DAMAGE CAUSED BY UNDERDRAINS. ABSOLUTELY NO PART OF AN UNDERDRAIN SYSTEM, INCLUDING CLEAN OUTS, WILL BE ALLOWED INSIDE OF SANITARY SEWER MANHOLES. ALL UNDERDRAINS SHALL BE INSTALLED BELOW THE SANITARY SEWER AND OFFSET TO THE SIDE. PIPE MATERIAL SHALL BE DIFFERENT COLOR THAN SANITARY SEWER.

12. NO SERVICE LATERALS SMALLER THAN 8-INCH IN DIAMETER SHALL ENTER MANHOLES.
13. SERVICE CROSSINGS OF CURB SHALL BE MARKED WITH A CUT "S" IN CURB FACE. PAINT IS NOT ACCEPTABLE. SERVICE SHALL BE EXTENDED INTO THE LOT A MINIMUM OF 10 FEET.
14. CONTRACTOR SHALL MARK THE END OF ALL SEWER SERVICES AND MAIN STUBS WITH A CARBONITE COMPOSITE UTILITY MARKER WITH MINIMUM OF FOUR FEET ABOVE GRADE, PAINTED GREEN.
15. ALL 8-INCH PIPES SHALL HAVE SQUEEGEE (CDOT #8 BEDDING) UNLESS OTHERWISE SHOWN OR THE TOWN MAY APPROVE AN ALTERNATE BEDDING IN SPECIAL CASES.LARGER PIPES REQUIRE WASHED OR CRUSED ROCK AS SHOWN IN THE CONSTRUCTION SPECIFICATIONS
16. PRIOR TO APPROVAL, ALL SANITARY SEWER PIPES SHALL BE PRESSURE-TESTED PER ASTM C924. ALL MANHOLES SHALL BE VACUUM-TESTED PER UNI-B-98.
17. PRIOR TO REMOVAL OF PLUGS AT MANHOLES, PIPE SHALL BE JET-CLEANED AND VACUUMED TO REMOVE DEBRIS AND VIDEOED. NOTICE SHALL BE GIVEN TO THE TOWN INSPECTOR ONE (1) WEEK PRIOR TO CLEANING. INSPECTOR MUST BE PRESENT DURING THE OPERATION. ONCE APPROVAL HAS BEEN GIVEN BY INSPECTOR, PLUGS MAY ONLY BE REMOVED AFTER CONDITIONAL ACCEPTANCE BY THE TOWN.
18. THE FINAL RECORDED PLAT AND RECORDED ADDRESS PLAT SHALL BE PROVIDED TO THE TOWN FOR CONDITIONAL ACCEPTANCE.L
19. TWENTY (20) MONTHS AFTER CONSTRUCTION AND PRIOR TO THE EXPIRATION OF WARRANTY, THE DEVELOPER SHALL CAMERA/VIDEO THE SANITARY SEWER LINES AND PROVIDE A DVD TO THE TOWN FOR REVIEW.

201.4 Final Stormwater Report Requirements

A. The purpose of the Final Stormwater Report is to provide a detailed study and analysis of the proposed development. It shall include calculations for all runoff and for all drainage structures of facilities within the development. Also, any change to the Preliminary concept shall be presented.

B. The Final Stormwater Report shall be submitted with the civil construction drawings for the site. The Final Report (which updates the Preliminary Drainage Study) shall be reviewed with the submittal of the construction plans and approved by the Town Engineer prior to issuance of construction permit.

C. Reports shall be typed on 8-½ " x 11" paper and bound. The drawings, figures, charts, photos and illustrations, and/or tables shall be bound with the report or included in a folder/pocket attached at the back of the report.

D. The report shall include a cover letter presenting the final design for review and shall be prepared by or under the direction of an engineer licensed in Colorado. The report also shall contain a Responsible Party certification sheet as follows:

1. "*(Name of Responsible Party)* hereby certifies that the drainage facilities for *(Name of Development)* will be constructed according to the design presented in this report. I understand that the Town of Berthoud does not and shall not assume liability for the

drainage facilities designed and/or certified by my engineer. I understand that the Town of Berthoud reviews drainage plans but cannot, on behalf of *(Name of Development),* guarantee that final drainage design review will absolve *(Name of Responsible Party)* and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Plat and/or Development Permit does not imply approval of my engineer's drainage design."

Attest: _____

(Name of Responsible Party)

_____

Authorized Signature

2. "I hereby certify that this report (plan) for the final drainage design of *(Name of Development)* was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Berthoud Standards and Specifications for the Design and Construction of Public and Private Improvements for the Responsible Parties thereof. I understand that the Town of Berthoud does not and shall not assume liability for drainage facilities designed by others."

_____

Registered Professional Engineer

State of Colorado No. _____

(Affix Seal)

E. The Final Stormwater Report shall be prepared in accordance with the requirements outlined in Chapter 600.

202 PERMITS AND INSPECTIONS

202.1 Permits Required

All Contractors, public utility agencies, and property owners installing public or private improvements, or storing materials or equipment, within any public right-of-way or easement must obtain the required permit prior to the commencement of the work.

A. State and Federal Permits

1. Land development activity and the construction of public infrastructure often requires additional permits from state and federal agencies. Examples include an Emission Permit for fugitive dust (issued by the Colorado Department of Public Health and Environment), a Discharge Permit for storm water associated with construction activity (issued by the Colorado Department of Health), and a Section 404 Permit for impacts to wetlands or waterways (issued by the US Army Corps of Engineers). It is the responsibility of the developer to obtain all applicable State and Federal Permits.

202.2 Application

A. Applications for the various permits are available through the Town of Berthoud. The application form must be completed and submitted to the Town along with the required items stated on the permit application or as required by the Town.

202.3 Review and Approval of Submittals

A. The application will be reviewed by the Town of Berthoud. If additional information is required, the Applicant will be contacted. The Town of Berthoud will check to make certain that the Applicant has provided the required bond(s) and when applicable the license and insurance certificates. Once the permit application and all required submittals have been reviewed and found to be complete, the Permit may be issued by the Town of Berthoud.

202.4 Issuance of Permit

A. The Permit is issued to the Applicant after all fees have been collected.

B. The Town of Berthoud may authorize a private entity to issue permits for all work described in this chapter.

202.5 Plans

A. Any plans required for permit process shall clearly indicate the proposed work and its location. Refer to Chapter 200 for all plan requirements.

202.6 Permit Standard and Conditions

A. General Requirements

The Applicant shall be responsible for all of the following requirements which are relevant for the Project:

1. Approval of Permit: Permits are issued subject to the approval of the Town of Berthoud, State, or other governmental agencies having either joint supervision over the section of road, or authority to regulate land use by means of zoning and/or building regulations.
2. Other Agency Approval: Permit Applicants are responsible for obtaining separate permits or permission as may be required. Examples may be when work is proposed within the state highway, railroad or irrigation company rights-of-way or private property.
3. Easements: It shall be the Applicant's responsibility to determine the necessity of any Easements and to obtain those Easements and approvals that may be required.
4. Submittals and Fees: Applicant shall pay all required fees, provide insurance, surety (if required), and provide appropriate plans, if necessary.
5. Coordination of Utility Work: The Applicant shall be responsible for coordinating any utility work including relocation of the utilities (e.g., power poles, transformers, signals, etc.).
6. Affected Area: The Applicant is responsible for returning the areas affected by construction to equal or better condition. The Applicant is responsible for repairing any damage to private or public property or other adjacent right-of-way that occurs during construction.
7. Not Transferable: The permit may not be transferable or assignable except as designated in the Development Agreement. The Applicant may subcontract the work to be performed under a permit, provided that the Applicant remains responsible for the performance of the work identified in the permit, the insurance and Surety, and the Warranty period. If permit is transferred, a new construction coordination meeting may be required.
8. Supplemental Permit: No work outside the scope of the approved permit may occur without the approval of the Town Engineer. It is the Applicant's responsibility to notify the Town of Berthoud of the issues and apply for a supplemental permit for the additional work.

9. Public Display: All required permits and approved plans must be available on the job site at all times during construction and placement of traffic control devices.
10. Protection of Existing Improvements: Ensure protection as follows:
    a. Existing Installations: The Contractor shall at all times take proper precautions and be responsible for the protection of existing street and alley surfaces, driveway culverts, street intersection culverts or aprons, irrigation systems, mail boxes, driveway approaches, curb, gutter, and sidewalks, and all other identifiable installations that may be encountered during construction.
    b. Utilities: The Contractor shall at all times take proper precautions for the protection of existing utilities, the presence of which are known or can be determined by field locations of the utility companies. The Contractor shall contact the Colorado811 at 1-800-922-1987 for utility locates a minimum of 2 working days prior to his proposed start of work.
    c. Existing Improvements: Existing improvements to adjacent property such as landscaping, fencing, utility services, signs, driveway surfaces, etc., that are not authorized for removal, shall be protected from injury or damage resulting from the Contractor's operations.
    d. Survey Markers. The Contractor shall at all times take proper precautions for the protection of property pins/corners and survey control monuments encountered during construction. Any damaged or disturbed survey markers shall be replaced by a registered land surveyor at the Contractor's expense.
    e. Responsibility for Repair: The repair of any damaged improvements as described above shall be the responsibility of the permit holder.
    f. Minimizing Inconvenience. The Contractor shall abide by the requirements set forth by the permit to minimize inconvenience to traffic and any inconvenience to adjacent property owners.
11. Work to be Done in Expedient Manner: All work shall be done in an expedient manner. Repairs shall be made as rapidly as is consistent with high quality workmanship and materials. Use of fast setting concrete and similar techniques may be required and are encouraged whenever possible without sacrificing the quality of repair.
12. Inspection Requests: It shall be the responsibility of the person performing the work authorized by the permit to notify the Town Engineer or authorized representatives that such work is ready for inspection. The Town Engineer requires that every request for inspection be received at least 48 hours before such inspection is desired. Such requests may be in writing or by telephoning the Town Engineer.
13. Removal and Replacement of Unsatisfactory Work: Removal and replacement of unsatisfactory work shall be completed within fifteen days of written notification of the deficiency unless deemed an emergency requiring immediate action. If deemed an emergency for health/safety reasons, the contractor must complete the work immediately. In the event the replacement work has not been completed, the Town of Berthoud will take action against the Contractor's bond to cover all related costs.
14. Road Closures: Road closures will only be allowed with the written approval of the Town Engineer. Proper posting and public notification will be required 7 days in advance of any closure. Forms of notification may include door hangers, variable message signs and press releases.

202.7 Construction Water

A. Water from the Town of Berthoud used during construction can only be acquired using a Town approved meter at a Town approved hydrant. Failure to comply with this policy could result in fines and penalties from the Town. Use of water from the Town of Berthoud without a town approved meter or at a town approved hydrant can be deemed as water theft.

202.8 Stop Work Orders

A. Any person, corporation, quasi-governmental agency, special district, public utility, or private utility company that has performed work without first having obtained a permit or has performed work in the right-of-way that is considered a safety hazard or has non-conforming items that have not been addressed will be issued a notice to stop work. All specified work shall be discontinued until such time that the appropriate repair or permits are in place. The Town Engineer or Inspector is authorized to issue Stop Work Orders. The stop work order shall contain a written statement of the violations that caused the issuance. Immediately upon receipt of a stop work order, the Applicant shall consult with the Town Engineer to resolve the violations.

CHAPTER 300 STREET AND ROADWAY DESIGN

301 GENERAL PROVISIONS

301.1 Purpose

This Chapter contains minimum criteria to be met on newly designed and constructed public and private streets and parking lots in the Town. Roadway design shall meet or exceed these Standards and Specifications. Improvements shall be in conformance with the Development Code and the most recent version of the Larimer County Urban Area Street Standards (LCUASS). The most recent version of LCUASS standards shall be used for the street and roadway design. When differing standards are available, the Loveland referenced design standards in LCUASS shall be followed. Policies and technical criteria not specifically addressed in this document shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO), CDOT Standard Specifications for Road and Bridge Construction (CDOT S&S), Highway Capacity Manual, Manual on Uniform Traffic Control Devices (MUTCD), and the Colorado Department of Transportation's Standard Plans ("M-Standards").

These Standards and Specifications are supplementary to the most recent version of LCUASS. In the event there is a discrepancy between LCUASS and these Standards and Specifications, LCUASS should supersede the Standards and Specifications.

302 DESIGN CRITERIA

302.1 Street Classifications

A. All streets are classified as Arterial, Collector, Local streets, Lanes or Alleys. These classifications relate to the function of the streets. Lower order streets function primarily as access to individual lots, and higher order streets function primarily for the purpose of mobility (expeditious movement of people and goods).

B. Street cross sectional elements shall conform to the detail drawing as determined by the Town Engineer. Collector and arterial streets shall be constructed whenever the alignment of the proposed street is generally the same as the collector and arterial streets shown on the Comprehensive Plan, Transportation Plan, or whenever a traffic engineering analysis of the future traffic volumes indicates the need of a cross section greater than that of a local residential street. The development Transportation Impact Study shall determine the required street classification based on anticipated traffic volumes.

C. Additional ROW may be required to satisfy other criteria contained in these Standards and Specifications. Areas outside the ROW shall be contour graded, compacted, and sloped, as required for proper drainage, soil stability, and maintenance accessibility.

302.2 Traffic Impact and Access Study Report

A. LCUASS Standards shall be followed.

303 CONSTRUCTION SPECIFICATIONS

303.1 General

A. All Street Construction shall be completed in accordance with the Construction Specifications included in Appendix A.

304 STREET DETAILS

A. See LCUASS details. Only LCUASS details are acceptable. Exception per town approvals.

305 STREET FRONTAGE IMPROVEMENTS

305.1 When Required. Street frontage improvements are required for the following development projects:

A. *New Construction.* The installation of street frontage improvements is required prior to issuance of a certificate of occupancy for all new construction projects except two or fewer single-family houses (when constructed concurrently on adjacent existing lots) or one duplex, unless otherwise required by the Town Engineer.

B. *New Subdivisions and Short Plats.* The installation of street frontage improvements is required prior to final plat approval for subdivisions and short plats which create two or more additional/new lots, unless otherwise required by the Town Engineer.

C. *Additions, Alterations, or Tenant Improvements- Special Provisions Apply.* Street frontage improvements shall be constructed as part of all additions, alterations or tenant improvements if one of the following conditions is met:

1. The proposed addition, alteration or tenant improvement will generate an increase in traffic exceeding 12 additional/new vehicular trips per day as determined by the latest edition of the Institute of Transportation Engineers (ITE) manual.

2. The proposed addition, alteration or tenant improvement is considered a change of use which intensifies the use of the site or significantly alters the traffic circulation within the site.

3. The proposed addition, alteration or tenant improvement will create a traffic safety concern or exacerbate a known traffic safety concern in surrounding project vicinity.

4. The proposed addition, alteration or tenant improvement will redevelop the property (remove/ demolish existing buildings, parking areas and improvements on site and construct new buildings, parking areas and improvements within the property).

305.2 Scope of Improvements. Street frontage improvements shall be installed along the entire frontage of the property, to the centerline of the street, or if a multi-lane street, the affected lane, at the sole cost of the applicant as directed by the Town Engineer. The Town Engineer may permit modification of street improvement standards where the required street improvements are not in the opinion of the Town Engineer, roughly proportionate to the impact, type, scale and cost of the proposed development action.

A. Street frontage improvements may include the following: curb, gutter, sidewalk, storm drainage, street lighting, traffic signal equipment, utility installation. extension, or relocation, landscaping strip, street trees and landscaping, irrigation, street widening, pavement overlay or reconstruction, and channelization.

B. In addition to required frontage improvements, the applicant shall provide ramps from the new sidewalk or walkway to the existing shoulder, across streets and pavement and channelization tapering back to the existing pavement and channelization as required to address safety concerns.

C. **Frontage Improvement Pavement Requirements.**

1. Half-street pavement reconstruction shall be required when: the existing pavement condition rating is at or below 40, based on the pavement condition index score (calculated with DRCOG's PCI program; crown slope is greater than three percent; is light bituminous pavement; and/or was built with no base structure. Pavement coring and/or subsurface investigation by a geotechnical engineer shall be required to determine base condition.

2. Half-street asphalt overlay (two-inch minimum} shall be required when the existing pavement rating is at or below 60 based on the pavement condition index score (calculated with DRCOG's PCI program. Pre-leveling and/or grinding may be required to create a uniform two percent crown slope.

3. Minimum frontage improvement pavement requirements shall be a patch per Town standard plans and one lane grind/inlay (two-inch minimum).

4. See the Engineering Standards Manual for additional requirements.

305.3 Deferral of Improvements. When the Town has plans for an improvement project, or an area is deemed not essential to the Town sidewalk system, or for other similar reasons, the Town Engineer may determine that street frontage improvements cannot or should not be constructed at the time of building construction or subdivision and may allow improvements to be deferred. In these instances, the property owner shall, prior to issuance of the building permit or site development permit, at the direction of the Town Engineer:

1. Pay to the Town an amount equal to the property owner's cost of installing the required improvements prior to issuance of a building permit. The property owner shall provide documentation satisfactory to the Town Engineer that establishes the cost of the materials, labor, quantities; or

2. Record an agreement which provides for these improvements to be installed by the property owner by a date acceptable to the Town Engineer; or

3. Record an agreement to not protest a local improvement district to improve the street frontage.

305.4 Corner Lots. In the case of corner lots or other development sites fronting more than one right-of-way, should the impact of the development be such that street system improvements would not be required on all rights-of- way fronting the development site, street system improvements shall be constructed on the right-of-way or rights- of-way selected by the Town Engineer.

305.5 Traffic Control Devices. The type and location of traffic control devices used on Town streets must be approved by Town Staff. Traffic signals should be used where warranted, but alternate traffic control such as roundabouts will be considered first. When it can be shown that a particular zoning action, master plan, or development plan impacts the street system to a point that a traffic signal is warranted according to Manual on Uniform Traffic Control Devices (MUTCD) and approved by Town Staff, the developer shall be responsible for all or a portion of the signal installation.

305.6 Dedication of Right-of-Way. The Town Engineer may require the applicant to deed to the Town, additional right-of-way as necessary from the property under consideration to create a right-of-way width which complies with state statutes, Town ordinances, and/or any other statutes, ordinances, or regulations as a means of mitigating any impact the project may have on the Town street system.

306 PAVEMENT DESIGN REQUIREMENTS

306.1 Pavement Design Criteria. The design of streets shall be based on the design period of twenty (20) years. If a single pavement design is used for all streets within the development, that pavement design shall be based on the worst soil encountered from the standpoint of subgrade support. The design of pavements shall be based upon the Roadway Design Manual of the State of Colorado, Department of Transportation, as modified by these specifications. The Colorado Department of Transportation methodology is accepted for both rigid and flexible street pavement designs. The strength coefficients of the various layers of the pavement structure shall be determined from the Colorado Department of Transportation Roadway Design Manual

306.2 Concrete Pavement. The minimum concrete structural section shall be seven (7) inches of non-reinforced Portland Cement concrete pavement placed on six (6) inches of Class 4 or Class 5 base and compacted subgrade. Construction plans for concrete pavement shall include a layout for locations of construction joints. Concrete pavement shall not be allowed on local streets. If the minimum pavement section is to be used, the Soils Report and Pavement Design must demonstrate the adequacy of the structural section for the soil conditions encountered. The City reserves the right to require concrete or treated subgrade in locations where traffic, utilities, type of construction, or time of construction would make asphalt on aggregate impractical.

306.3 Asphalt Pavement. Flyash subgrade treatment shall be required with all new roads constructed in the Town of Berthoud. A pavement design shall be submitted that includes the flyash treatment of the subgrade recommended in these specifications by a Geotechnical Engineer licensed in the state of Colorado. Full-depth asphalt is not an accepted alternate if treated subgrade is used. When flyash is used, a bond breaker shall be used. The thickness and the type of bond breaker shall be recommended by the geotechnical engineer and approved

CHAPTER 400 SANITARY SEWER UTILITY

401 GENERAL PROVISIONS

401.1 General

A. These Standards and Specifications are promulgated by the Town Administrator in accordance with the authority contained in the Town of Berthoud Municipal Code. Improvements shall also be in conformance with Chapter 13, Article 1 of the Town of Berthoud Municipal Code.

401.2 Purpose

A. This Chapter pertains to all components of the sanitary sewer system. Designs are intended to provide safe, reliable sewer service to customers and serve the sewage treatment needs of customers in an efficient, cost effective and environmentally responsible manner. Determination of the best materials and construction methods are based upon lowest life cycle costs, not necessarily upon lowest initial costs.

B. All utility installation within the Town Right-of-Way shall require a Right-of-Way Use Permit prior to any installation activity. See Chapter 200 regarding permits and permitting processes in the Town and Chapter 300 regarding road cut standards.

C. All utility installation outside of the Town Right-of-Way (private property) shall require a Grading Permit prior to any installation activity. See Chapter 200 for Grading Permit regulations.

D. All utilities must be clearly labeled on the plans and include the type, size, depth, etc.

401.3 General Specifications

A. General Process/Submittal Requirements:

1. The purpose of these Standards and Specifications are to provide general criteria for the design of sanitary sewer mains and appurtenances within the Town of Berthoud sanitary sewerage service area. Any deviation from these standards must be approved by the Town and additional documentation may be required. The Town reserves the right for a submittal and review process as outlined in Chapter 200 for plan approval.

2. If construction has not commenced within one (1) year from Town approval, the plans must be resubmitted for review and comment.

3. The Town will establish and may amend procedures to be followed by the Responsible Party performing work on sanitary sewer lines. These procedures will include all requirements for documentation, submittals, fees, engineering design, construction, and acceptance.

401.4 Granting of Service

A. Sanitary sewer services shall be granted to an area, at the requestor's expense, after the following requirements have been determined. The Town must have the capability and capacity to serve the proposed area, the region being served must be located within the Town of Berthoud sanitary sewer service area, and the Responsible Party must show evidence of fee ownership of the property to be serviced. The request for service must be in compliance with stipulations contained in all utility agreements entered into by the Town and said applicant as well as in compliance with all applicable Town ordinances, codes and charter principles.

402 DESIGN CRITERIA

402.1 General Criteria

A. Sanitary sewer design and construction shall adhere to The Town of Berthoud's criteria and standards. Additional criteria may be required by the Town for the overall hydraulics of the wastewater collection system. The Town may also have additional requirements based on the potential impact of proposed sewer facilities through affected public right-of-way or adjacent public infrastructure.

B. In general, sewer easements, proximity of sewer to other utilities, proximity of sewer within Town of Berthoud Right-of-Way, and the location of sewer service lines shall comply with Service Provider's and Town of Berthoud standards. In the event of conflict or discrepancy between standards, the more stringent standards shall apply.

C. Sewer mains shall be designed and sized through manholes at the end of cul-de-sacs or out lots to serve future upstream development.

D. Sanitary sewer mains and appurtenances shall be constructed in conformance with these Standards and Specifications and shall be designed by or under the direct supervision of a registered P.E. licensed to practice in the State of Colorado.

E. Refer to the checklist in Chapter 100 for construction drawing requirements related to sanitary sewer.

402.2 Sewer Location and Alignment

A. Sewer Location in Easements

1. A Non-Exclusive sewer easement dedicated to the Town must be provided when the sewer is located outside of public right-of-way or outside of an easement within a subdivision that is dedicated to the public for utility purposes on the recorded plat of that subdivision. The easement width shall depend on location but shall be a minimum of twenty (20) feet. Sewer mains installed in easements shall ordinarily be located in the center of the easement unless stated otherwise in the easement documents and indicated in the Town approved plans.

2. A combined sewer and water easement shall have a minimum width of thirty (30) feet, plus ten (10) feet for each added utility in the easement.

B. Sewer Proximity to Other Utilities

1. Sewer lines that parallel water lines shall be located a minimum distance of ten (10) feet horizontally from the water line, as measured from outside diameter of pipe (OD) to OD. Where sewer lines cross water mains, the sewer pipe must be a minimum vertical distance of eighteen (18) inches below the water main as measured OD to OD. If this distance is not feasible, the crossing must be designed and constructed to protect the utilities. The design must be approved by the Town Engineer.

2. If the minimum vertical separation cannot be achieved at a utility crossing, minimum protection shall consist of the installation of an impervious structural material. Sewer pipe shall be encased in reinforced concrete. The encasement on sewer line shall be at least six (6) inches thick around the entire pipe and shall extend ten (10) feet in either direction from the central point of utility crossing. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the adjacent or perpendicular crossings.

3. Clearance from other utilities must be enough to facilitate future repairs to either utility line; minimum separation distances are eighteen (18) inches of vertical and ten (10) feet of horizontal.

402.3 Service Line Location and Alignment

A. Sanitary sewer service lines shall be designed on the shortest and straightest possible route.

B. Sanitary sewer service lines shall not enter manholes and must connect to the mains with a wye fitting at least five (5) feet from the outer diameter of sanitary sewer manholes.

1. A manhole connection must be approved by the Town Engineer but is not recommended. Service pipe shall transition from a 4-inch to an 8-inch pipe matching crowns and be 5 feet from the manhole. Connection of service shall be a standard connection at bottom of manhole either by less than or equal to the maximum slope or by an outside drop manhole connection.

C. Each structure and each subdivided lot shall be served by a separate line. Compound taps are not allowed.

D. Service lines shall be at least five (5) feet from the side property line, and no service line may be designed through or in front of any adjoining property. If possible, the service line should be located toward the low side of the lot.

E. If possible, service lines shall not extend beneath driveways or intersection streets.

F. The minimum separation of sewer service from water service lines is ten horizontal (10) feet within the public ROW. If minimum horizontal separation cannot be achieved, the sewer line shall be concrete encased or otherwise protected with an impervious structural material approved by the Service Provider.

G. Service Laterals to the Property Line: service laterals shall be extended at least ten (10) feet into the property or at least five (5) feet past the easement and shall be plugged or capped.

H. All sanitary services shall be marked with an “S” chiseled into the concrete curb or other paved surface it crosses under.

I. Clean outs

1. Building sewer cleanouts shall be installed at intervals not to exceed 100 feet and/or for each aggregate change in direction exceeding 135 degrees. Each cleanout must be inspected and approved by the Town’s inspector. Cleanouts must be the same size as the service size. Manholes must be installed in accordance with Chapter 400 – Sanitary Sewer Utility on any building sewer greater than 6 inches in diameter (i.e. no cleanouts allowed).

2. Two-way cleanouts are required within two (2) feet to five (5) feet outside of a building (or at other location as approved by the Wastewater Management Division inspector) on sewer service lines (see Figure 2.11.1).

J. Ejector Systems/force service lines

1. When sewer service cannot be obtained under traditional gravity conditions the owner may request Town approval the use of an ejector system and force service line. Force service lines less than 4 inches in diameter must connect to the public sanitary sewer through a standard tee or wye. The force service line must connect to the tee or wye in a manner to prevent leakage and to prevent sewage from entering the force service line when the main line sewer is flowing full. After the connection is inspected the connection must be concrete encased to prevent separation due to thrust. The connection must be specifically detailed and the Town must approve the detail. Force service lines need to be installed at a

minimum depth of 5 feet to prevent freezing. “The force service line must be protected against freezing when it is located less than five (5) feet below grade.”

K. Size

402.4 The minimum allowable diameter from the main line to a building is four inches. Sanitary services within a building's footprint shall adhere to the requirements set forth by the International Plumbing Code.Manholes

A. Below grade design and construction of manholes will adhere to Service Provider’s criteria. Manhole locations within the Town Right-of-Way and exposed portions of the manholes will adhere to additional criteria of this Chapter.

1. Manholes shall not be installed in curbs, gutters, concrete pans or in the wheel path in the road.

2. Lids

a. All sanitary sewer lids shall be forged with the following: "Town of Berthoud Sanitary Sewer". Sewer manhole lids must be Denver Pick slot style model #1156 manufactured by Deeter Foundry or A-1480 by D&L Foundry, unless a bolted lid is required..

b. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes.

402.5 Future Connections

A. Sanitary utilities shall be stubbed out to the right-of-way or limits of property at all locations that are planned for future tie-ins. Other reasonable stub-outs or main extensions may be requested by the Sanitary Service Provider or the Town based on knowledge of adjacent development.

B. The end of a service stub-out shall be marked in the field with a painted green, carbonite composite utility marker reaching no less than four (4) feet above finished grade and labeled with the size and material of the sanitary service line and be sealed with a glued fitting.

C. The end of a main extension shall be marked in the field with a painted green, carbonite composite utility marker reaching no less than four (4) feet above finished grade and labeled with the size and material of the sanitary main extension. Markers shall not be located in improved surfaces.

D. All sanitary services shall be marked with an “S” chiseled into the concrete curb or other paved surface it crosses under.

402.6 Design Flow

A. Sewer infrastructure design includes consideration of providing sewer service for the entire tributary area to the outfall point.

B. Per Capita Flow/Capacity

1. In general, sewer capacities shall be designed for the estimated maximum population in a specific drainage area or area to be served.

2. Where future sewer infrastructure is planned, economic and engineering analysis of alternatives should accompany any request for service.

3. In determining the required capacity of sanitary sewer, the following factors shall be considered:

a. Maximum hourly domestic sewage flow

b. Additional maximum sewage or wastewater flow from non-residential dischargers
c. Inflow and groundwater infiltration
    i. Include an additional 10% of peak sewage flow to account for inflow and infiltration (I/I)
d. Topography of area
e. Location of sewage treatment plant
f. Depth of excavation

4. Sewer infrastructure shall be designed on the basis of ninety-five gallons per day (95 gpd) per capita. Minimum residential population density is computed using 2.55 persons per dwelling unit.
5. For initial flow approximation in a residential development, refer to the Town of Berthoud Wastewater Master Plan, Town Comprehensive Plan, and zoning maps for respective land uses.

C. Peak Design Flow

1. Sanitary sewer must be designed to carry the peak discharge with the pipe being no more than eighty percent (80%) of maximum capacity (q/Q) for mains.
2. Sewers shall have capacity for peak hourly sewage flow and adequate velocity at minimum sewer flows.

D. Combined Sewer Interceptors

1. Combined sewers are not permitted. Storm water and underdrains must be separate and isolated from the sanitary sewer system so there is no combination of the flows. No storm water or ground water shall be introduced into the sanitary sewer collection system.

402.7 Sewer Design

A. The basis of design for all sewer projects within the Town of Berthoud sanitary sewer jurisdiction shall comply with Town details and design specifications and accompany the plan documents submitted for review. Additional computations or changes may be required after plan review. All sanitary sewer main construction within the Town's sanitary sewer system, and all service line construction connecting to the Town's sewer mains, shall be completed in accordance with these Standards and Specifications. These design specifications cover all sanitary sewer service line design, construction and repairs to existing facilities within the Town.

B. Minimum Size

1. All gravity sewer mains shall be eight (8) inches or greater in diameter. Sewer service lines from residences or other facilities to Town gravity sewer may be four (4) or six (6) inches in diameter.

C. Bury Depth

1. In general, sewers should be sufficiently deep to receive sewage from basements and to prevent freezing. Sewers shall not be installed at depths greater than twenty (20) feet. Where pipe has less than five (5) feet of cover, provisions shall be made to protect pipe from impact, loading and freezing.
2. Sewer bury depths less than five (5) feet or greater than twenty (20) feet will be at the discretion of the Town Engineer.

D. Slope

1. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than two feet per second (2 fps) and no greater than ten feet per second (10 fps). The following table provides the minimum and maximum slopes allowable for collection and outfall mains. Whenever possible, sewers that are designed to carry an average design flow of less than 0.10 cfs shall not be installed at a slope of less than 0.6%. Slopes within the following ranges are desirable:

Table 400- 1: Sanitary Sewer Slope Ranges per Pipe Size

Sewer Size	Minimum Slope (%)	Maximum Slope (%)
8 inch (20 cm)	0.40	7.5
10 inch (25 cm)	0.25	5.5
12 inch (30cm)	0.20	4.5
15 inch (38 cm)	0.15	3.5
18 inch (46 cm)	0.11	2.5
21 inch (53 cm)	0.09	2.0
24 inch (61 cm)	0.08	1.8
27 inch (69 cm)	0.07	1.5
30 inch (76 cm)	0.06	1.3
33 inch (84 cm)	0.05	1.2
36 inch (91 cm)	0.05	1.0
42 inch (107 cm)	0.04	0.8
48 inch (123 cm)	0.03	0.7

E. Alignment

1. All sewers shall be designed with straight pipe and uniform slope between manholes. The drop in a manhole shall be 0.2 feet for straight runs and for changes in direction.

F. Underdrains

1. Underdrain pipe may be installed when recommended by the soils/design engineer at locations shown on the accepted plans and shall only be installed at those locations where excessive groundwater is encountered.
2. Underdrain installations shall be at the discretion of the Town Engineer when in the same trench as the sewer.
3. The size and extend of underdrains shall be established by a Design Engineer, registered in the State of Colorado, based on anticipated underdrain service line flow and groundwater flow in the Wastewater Main trench if applicable. The minimum size of a main line groundwater underdrain system shall be 6 inches. The underdrain service line shall be 3 inches in diameter to minimize any chance of confusion and cross-connection with wastewater service lines.
4. The slope of the underdrain main shall be a minimum of 0.5%.
5. Underdrain mains shall be located horizontally and vertically parallel to the wastewater main, opposite to the water main.
6. Passive systems shall be laid with solid pipe using one ten (10) foot section of active pipe downstream of each manhole. A trench dam shall be installed at the transition from active to passive system, see Detail D4.08. Cleanouts shall be constructed outside a wastewater manhole as shown in Detail D4.08 within the concrete collar of the manhole.

7. At any point where there may be gravel to gravel contact between the underdrain trench and the sanitary sewer trench (e.g., on private property) a concrete cut off wall is required (e.g., at the property line) in order to ensure that there is no continued flow of water in the sanitary trench, so that all water is "forced" into a perforated section of underdrain pipe.
8. The design shall show that underdrains discharge to an appropriate location such as a storm sewer system or drainageway.
9. Should the Responsible Party's Contractor desire to install an underdrain system to specifically collect the discharge of peripheral drain systems from individual house foundations or from sump pumps installed as a part of a peripheral drain system for house foundations, such a system shall be constructed for the exclusive advantage of the Responsible Party. Any such system will not be tied into or connected with the sanitary sewer collection system in any manner All underdrain systems are considered private and shall be owner maintained. The Town will not maintain private underdrain systems.

G. Cleanouts and Basement Sump Pumps

1. All basement sump pumps intended to intercept groundwater shall be discharged to a private underdrain system if one exists. Otherwise, the pump must discharge to ground surface.
2. Cleanouts shall not be installed within a sanitary sewer manhole and will not be maintained by the Town. Underdrains and associated clean outs shall not be green in color.

H. Future Connections

1. Whenever future expansion of the system is anticipated, the stub out size and length will be at the discretion of the Town Engineer.

402.8 Manholes

A. Location: Manholes shall be installed at the following points:

1. At the end of each line.
2. At all changes in grade, pipe size, or alignment.
3. At all sewer main intersections.
4. At distances, not greater than four hundred (400) feet for sewers that are fifteen (15) inches or less in diameter, and five hundred (500) feet for sewers eighteen (18) inches to thirty (30) inches in diameter. Greater manhole spacing may be permitted in special cases based on a review and authorization by the Town Engineer.

B. All manhole exteriors shall be damp proofed.

C. Manholes shall be inspected prior to backfill.

D. Cleanouts may not be substituted for manholes.

E. Changes in pipe size shall occur at manholes to maintain energy gradient or allow for changes in energy gradient within the manhole.

F. Where varying pipe sizes enter and exit a manhole, the crown invert elevations shall match.

G. Manhole Diameter

1. Manhole barrels shall be sized per the following table:

Table 400- 2: Sewer Manhole Sizing:

Pipe Size	Barrel Size
30-inch and smaller	48-inch
33-inch to 36-inch	60-inch
42-inch and larger	As determined by Town

H. If three or more pipes at the upper limit of Pipe Size in Table 400-2 connect in a manhole, the barrel size shall be increased to a larger barrel size. Specially designed manholes/vaults are required for pipes greater than forty-two (42) inch diameter and when multiple inverts exist.Drop Manholes

1. A drop manholes shall be provided when the sewer line entering a manhole is at an elevation of eighteen (18) inches or more above the manhole invert, or where flow velocities exceed fifteen (15) feet per second in the upstream pipe segment of a manhole. Where the difference in elevation between the incoming sewer and the manhole invert is less than eighteen (18) inches, the invert is required to be filleted (shaped) to prevent solids deposition/buildup.
2. Drop manholes shall be constructed with an outside drop connection. See Detail D4.01. Inside drop connections are allowed at the discretion of the Town Engineer.

I. Flow Channel

1. The flow channel through manholes shall be made to conform in shape and slope to that of the sewer pipe.
2. Smooth, non-jagged surfaces are mandatory.
3. The flow channel shall be pre-formed or cast in place grout.

J. Water Tightness

1. Manholes on new sanitary lines shall be pre-cast concrete. Poured-in-place concrete may be used on an existing sewer line or as authorized by the Town Engineer. Inlet and outlet pipes shall be joined to the manhole by a gasketed, flexible watertight connection.
2. Watertight manhole covers (bolt down manhole covers) shall be used wherever the manhole lids may be flooded by street runoff, high water or any other water source. The assignment of these types of manhole covers is at the sole discretion of the Town and at the Responsible Party's expense.

K. Rim Elevations and Manhole Markers

1. If manholes are in cultivated fields, they should be left twenty (20) inches below grade unless directed otherwise by Town Engineer. Manholes in parks or detention basins must be above the flood plain. All other manholes in these types of areas should be no more than six (6) inches above grade. In these circumstances, bolt down ring and cover are to be used and properly marked carbonite composite utility marker (see Detail D0.10), located by a property line or other suitable site as close to the manhole as possible, with the off-set marked in feet to the centerline of the manhole cover.
2. In paved roads, the manhole ring and cover shall be designed to final grade. In unpaved roads, the manhole ring and cover shall be designed to be six (6) inches below final grade.

L. Steps

1. Manhole steps shall be manufactured of polypropylene reinforced as manufactured by M. A. Industries, spaced twelve (12) inch typical, sixteen (16) inch maximum on center, aligned away from invert.

M. Cones

1. All cones shall be eccentric. Each cone shall be rotated such that its opening is vertically aligned away from pipe openings thus maximizing the potential amount of manhole steps to the base of the manhole.
2. Only pre-cast manhole risers and cones shall be used and manufactured in accordance with ASTM Designation C-478.
3. Risers may not be used if it causes the first step to be 16-inches below the cover. Add a barrel section as need to maintain a maximum of 16-inches to the first step.

N. Inverted Siphons

1. The use of an inverted siphon will be evaluated on a case by case basis and will require approval from the Town Engineer.

402.9 Sewers in Relation to Waterways

A. Alignment

1. Sewers crossing waterways shall be designed to cross the waterway as perpendicular to the waterway flow as possible. Sewer systems shall be designed to minimize the number of waterway crossings.

B. Horizontal Location

1. Sewers located parallel or horizontal to waterways shall be located beyond the top banks of the natural floodway, and at a sufficient distance from any waterway to allow for the possible widening of the channel.
2. Sanitary sewer manholes may not be located within the limits of a detention pond.

C. Structures

1. Sewer outfalls, headwalls, manholes, gate boxes, and any other structures shall be located so that they do not interfere with the free discharge of flood flows of the waterway.

D. Depth of Cover

1. The top of all sewers entering or crossing waterways shall be at a sufficient depth below the natural bottom of the waterway's bedrock to protect the sewer line. In general, the following cover requirements shall be met:
    a. One (1) foot of cover is required when the sewer is located in bedrock.
    b. Three (3) feet of cover is required in any material other than rock. In major waterways, more than three (3) feet of cover may be required due to anticipated scour depths and pending review from the Town, Corps of Engineers and any other wetland authorities.
    c. In paved waterway channels, the top of the sewer line shall be placed three (3) feet below the bottom of the channel pavement and protected with a casing.
    d. Less cover will be approved only if the proposed sewer crossing will not interfere with any future improvements to the waterway. Reasons for requesting less cover shall be submitted for review by the Town.

E. Materials

1. Sewers crossing a waterway shall be constructed of C900 PVC or other approved material. The pipe shall be constructed to remain watertight and free from changes in alignment or grade.
2. Material used to backfill the trench shall be as stated in the construction drawings and shall not cause settling. Construction documents shall call out construction requirements of the trench and backfill.
3. Controlled Low Strength Material (CLSM), i.e., a lean, sand-cement slurry or "flowable fill," is the preferred method to prevent scour in utility trenches where groundwater is present.

F. Encasement of Pipe

1. All pipe installed through natural drainage ways must be concrete encased.
2. All Pipe installed through paved waterways shall be sleeved through a casing.
3. Pipe encasement will extend ten (10) feet beyond either top bank of the waterway, or two times the depth of the waterway past either bank of the water waterway, whichever is greater.

G. Suspended or Exposed Crossings

1. The Town will not approve or allow these types of crossings:
   a. Aerial - suspended in air,
   b. Suspended - attached to a bridge,
   c. Exposed crossings - not covered, pipe is visible.

402.10 Sewage Lift Stations

A. On a case by case basis, lift stations are at the discretion of the Town Engineer either within or outside its collection system. Lift stations are not recommended by the Town and must be designed as a regional lift station with the ability to accommodate future flows. Lift Station facilities shall be located and sized in accordance with the Town's Master Plan.

B. All lift stations with capacities at 2,000 gallons per day (gpd) or greater are subject to Colorado Department of Health and Environment (CDPHE) Regulation 22

C. Lift Station locations shall be compatible with approval from the North Front Range Water Quality Planning Association (NFRWQPA).

D. The Developer shall be solely responsible for all costs associated with the design and construction of the lift station and force mains. This includes the cost of any easements, land acquisition, documents associated with permitting approval through CDPHE and NFRWQPA, and any other cost associated with the project.

E. Where additional service area outside of the proposed development is anticipated, the Town will require the lift station and associated improvements to provide capacity greater than what is necessary for the initial development. A reimbursement agreement may be appropriate in this condition.

F. Public lift stations are defined as any lift station serving more than one user and accepted by the public utility. Operations and maintenance activities shall be the responsibility of the Town for all public pumping facilities only upon completion and acceptance of the proposed improvements. The Developer shall provide an operations and maintenance manuals and procedures for all equipment and processes associated with the pumping facility. The

Developer shall meet with the Town during the planning and design phases on equipment operations and maintenance requirements.

G. All new pumping facilities shall be monitored by the Town's Supervisory Control and Data Acquisition (SCADA) system.

H. Private lift stations are defined as any lift station serving only one user. Operations and maintenance responsibilities for private lift stations are the sole responsibility of the owner or private entity.

402.11 Silting and Erosion

A. Construction methods that minimize silting and erosion shall be employed.

B. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers to control silting and erosion such that the land is restored back to its original condition. Specifications shall require the cleanup, grading, seeding, and planting or restoration of all work areas to begin immediately upon the completion ofconstruction.

403 CONSTRUCTION SPECIFICATIONS

403.1 General

A. All Sanitary Sewer Construction shall be completed in accordance with the Construction Specifications included in Appendix A.

404 SANITARY DETAILS

A. The following is a list of standard details for sanitary sewer work that are part of the Town of Berthoud Standards and Specifications:

D4.01	Sanitary Drop Manhole
D4.02	Monitoring Sanitary Manhole
D4.03	Monitoring Sanitary Manhole Diagrams
D4.04	Sanitary Cleanout
D4.05	Typical Service Connection
D4.06	Tapping Saddle
D4.07	Pipe Encasement
D4.08	Concrete Collar Underdrain

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CHAPTER 500 WATER UTILITY

501 GENERAL PROVISIONS

501.1 General

A. These Standards and Specifications are promulgated by the Town Administrator in accordance with the authority contained in the Town of Berthoud Municipal Code. Improvements shall also be in conformance with Chapter 13, Article 1 of the Town of Berthoud Municipal Code.

501.2 Purpose

A. This section pertains to all components of the water distribution and transmission systems. Designs are intended to provide safe, reliable water supplies to customers and provide fire suppression flows where available.

B. All utility installation within the Town Right-of-Way shall require a Right-of-Way Use Permit prior to any installation activity. See Chapter 200 regarding permits and permitting processes in the Town and Chapter 300 regarding road cut standards.

C. All utility installation outside of the Town Right-of-Way (private property) shall require a Grading Permit prior to any installation activity. See Chapter 200 for Grading Permit regulations.

D. All utilities must be clearly labeled on the plans and include the type, size, depth, etc. Whenever possible, utilities shall be designed according to the typical utility layout plan (See detail drawing D4.02.)

501.3 General Specifications and District Jurisdictions

A. There are two Water Service Providers within the Town:

1. Town of Berthoud (Town)
2. Little Thompson Water District (LTWD)

B. Regardless of Water Service Provider, all developments within the Berthoud town boundary must follow the Berthoud Standards and Specifications for water distribution and transmission systems.

C. The Berthoud Fire Protection District (BFPD) has authority over fire protection and emergency services within the Town and the surrounding community. Responsible Party shall design and construct the water system to provide fire suppression flows as required by International Fire Code (IFC) and BFPD.

502 DESIGN CRITERIA

502.1 General

A. Water distribution design and construction shall adhere to the Town's criteria and standards. Additional criteria may be required by the Town's Engineer for the overall hydraulics of the impacted water utility system.

B. Design fire flow and line sizing must be reviewed and approved by the Berthoud Fire Protection District (BFPD).

502.2 Water Distribution System

A. General:

1. Water is delivered to the individual customer in sufficient volumes without excessive head loss. The design and layout criterion presented herein applies solely to distributionsystems.
2. The sizing and layout of a water system are elements of the total consideration of the design, operation, and maintenance of a water supply system that yields optimum quality service at the lowest total cost to the consumer.

B. Layout and Alignment:

1. Main layout shall be of such grade, alignment, curvature, and other characteristics as to permit installation and maintenance in accordance with these Standards and Specifications.
2. Mains shall be installed in dedicated public streets.
3. When the Town of Berthoud determines it is not feasible for an installation to be made in a dedicated street, the installation shall be made in a water easement or combined water and sewer easement.
4. Deflections in alignment shall be made with fittings. Water and sewer lines shall be installed with a minimum ten-foot horizontal separation and an eighteen-inch minimum vertical separation at utility crossings, as measured from outside pipe diameter to outsidepipe diameter.
5. No water mains shall be installed within fifteen (15) feet of any building, retaining wall or structure unless approved by the Town Engineer. No building, retaining wall or structure shall be constructed within a minimum of fifteen (15) feet from any water main, unless approved by the Town Engineer.
6. Depth of Cover:
    a. The minimum depth of cover for main lines shall be five (5.0) feet measured from the top of the pipe to the surface or planned finished grade, whichever provides the greatest depth of final cover.
    b. The minimum depth of cover for service lines shall be five (5.0) feet measured from the top of the pipe to the final surface or planned finished grade with any necessary grade adjustments being made as close to the main line as possible.
7. Whenever possible, water lines shall be located on the high side of any street, roadway, irrigation ditch or right of way.
8. Waterway, railroad, highway, fiber optic or any other type of crossing, which may require boring and casing must be reviewed with the Town before final plans are prepared.
9. Easement Width Requirements:
    a. An exclusive water easement shall have a minimum width of 20-feet. Pipes that have a bury depth of more than 5.0 feet may require an easement wider than 20-feet and will be at the discretion of the Town Engineer.
    b. A combined water and sewer easement shall have a minimum width of 30-feet
    c. Private Roadways with Island Median:
        i. Islands at the entrances to developments shall have easements that extend across the entire roadway with the island located in the middle.

ii. The water line shall be installed on the side of the island that is at least 20-feet wide from back of curb to back of curb. Other utilities shall be confined to the opposite side of the island.

d. Private Roadways:

i. The easement shall have a minimum width of 20-feet. The Town of Berthoud shall have exclusive use of 20-feet thereof, except for right angle utility crossings.

e. Undeveloped Areas:

i. A water easement shall have a minimum width of 20-feet.

C. Sizing of Distribution Mains:

1. All water main lines shall be sized from a hydraulic analysis based on present and anticipated future flow demands and pressure requirements.
2. New mains shall be a minimum of 8-inch and “looped”.
3. Final main line size determination and layout shall be at the discretion of the Town Engineer and shall not be open to arbitration or negotiation.
4. Mains shall be sized to provide for domestic, irrigation, and fire protection flows to the area requesting service but not so large as to cause water quality issues.
5. The maximum acceptable head loss is 2-feet per 1,000-feet of main for the maximum hour flow using a C-value of 130. This does not apply under fire flow conditions.
6. Mains shall be sized for fire protection utilizing maximum day flows and needed fire flow resulting in a minimum residual pressure of no less than 20 psi in the localized area of interest.
7. Site fire flows for multi-family and mixed-use developments are evaluated with one side of the looped system out of service. This evaluation is used to simulate a distribution system outage that would result in a worst-case scenario for the development.

D. Operating Pressure:

1. The Pressures within the distribution system shall be:
   a. A minimum of 45 psi
   b. A maximum of 100 psi
2. The maximum pressure fluctuation at any location in the distribution system between maximum hour demand and minimum hour demand shall not exceed 30 psi.

E. Pressure Regulating Valves (PRV):

1. PRV installations are used to control pressures within distribution systems.
2. When main extension plans are submitted for review, the need for a PRV installation will be determined based on existing pressure zones and the existing distribution system layout. PRV settings are to be included on plans with the elevation and the upstream and downstream hydraulic grade line and pressure.
3. PRVs shall be sized so that the velocity through the valve at maximum demand does not exceed 25 fps or shall not exceed the manufacturer’s recommended velocity, whichever is less. If a wide range of flow rates is anticipated, more than one valve may be required.
4. When pressure differentials greater than 45 psi are expected or when the downstream pressure is low relative to the differential or cavitation is likely, special valve materials, or a special valve design may be required.

5. PRVs shall be properly supported and have adequate clearance above and below the valve to facilitate servicing. A manual bypass is required for single valve installations. Telemetering of data may be required. Each PRV shall have a gate valve on both sides for isolation purposes, pressure gauges on both sides, and a valve position indicator.
6. A regulated bypass may be required for PRV installations.
7. The Town of Berthoud may require the installation of SCADA equipment for PRV installations of the type specified by the Town.

F. Valves:

1. Isolation valves are required every 600-feet in the distribution system.
2. Where blocks exceed 600-feet in length, or if two or more hydrants are connected to the same main, additional isolation valves are required.
3. Valves are required at the following locations:
   a. Between fire hydrants
   b. Street intersections that carry heavy traffic of that contain major water distribution mains in both directions, as determined by the Town of Berthoud, require four valves, one on each extended property line.
   c. Between a fire hydrant and main line
   d. River and ditch crossings
   e. Between a blow-off and main line
   f. Vaults – inside and outside on the upstream and downstream side
   g. All tees with a minimum of two (2) valves
   h. All crosses with a minimum three (3) valves
4. Isolation valves shall be resilient seat gate valves. Valves shall be the same size as the main and shall open clockwise

G. Air, Blow-off and Vacuum Valves

1. The need for blow-off or drain valves at low points and combination air valves at high points in the distribution system will be at the discretion of the Town Engineer. In no case will a dead-end main line be accepted without a blow-off or a hydrant for flushing the distal end.
2. Air release and vacuum valve assemblies shall be installed at high points in the conduit or main, where there is an abrupt change of slope, at isolation valves where the conduit slopes away from the valve, or as determined by the Town.
3. All above grade blow-off valves shall have an appropriate drainage path to an appropriate drainage feature.

502.3 Water Storage

A. Water storage tanks are not recommended by the Town, unless they are identified in a The Town Master Plan and must be designed as a regional tank with the ability to accommodate future demands. The need for water storage shall be evaluated on a case-by-case basis by the Town.

B. The Developer shall be solely responsible for all costs associated with the design and construction of the water storage tanks. This includes the cost of any easements, land acquisition, documents associated with permitting approval through CDPHE, and any other cost associated with the project.

C. Where additional service area outside of the proposed development is anticipated, the Town will require the water storage tank and associated improvements to provide additional capacity than what is necessary for the initial development. A reimbursement agreement may be appropriate in this condition.

D. Water storage shall be located and sized in accordance with the Town's Master Plan. Water storage tank design shall be approved by the Town Engineer.

E. Water storage shall have built in provisions for overflow and draining as well as access and provisions for inspecting and cleaning including a suitable source of water.

F. The Town of Berthoud may require the installation of SCADA equipment for storage facilities of the type specified by the Town.

G. Interconnections with Other Water Systems:

1. Interconnections between the Town's treated water system and another approved system will be at the discretion of the Town Engineer.

502.4 Supervisory Control and Data Acquisition (SCADA)

A. General:

1. A SCADA system will provide for remote stations being automated and signaling devices from remote station reporting the status of the remote station to a Central Processing Unit (CPU). Installation of all SCADA equipment shall conform to application state and local electrical codes and the National Electric Code.

B. Scope:

1. The Responsible Party will only be concerned with the Remote Terminal Units (RTUs) at the remote stations. The Responsible Party will be responsible for providing and totally integrating the RTUs with the complete SCADA system including required programming.

Table 500- 1: SCADA System Required Programming

	Pumping Station	Storage Tank	PRVs	Metering Station
Valve Position	-	-	X	-
Influent Position	X	-	X	-
Effluent Position	X	-	X	-
Water Level	-	X	X	-
Water on Floor	X	-	X	X
Pump Fail	X	-	-	-
Power Out	X	-	X	-
High Water	-	X	-	-
Low Water	-	X	-	-
Intruder Entry	X	X	-	-
Flow Rate	X	X	X	X
Low Temperature	X	-	X	X

C. Monitoring

1. Remote stations will require automation and/or monitoring control. Automation requirements will be as required by the Town Engineer, the equipment suppliers, and SCADA designer. Suggested monitoring requirements are shown in the table above.

2. The remote stations will require an interfacing panel with terminal block wired into the individual sending devices. The remote panel will, in turn, be required to be wired to the communication system to the CPU.

502.5 Transmission Mains

A. General:

This section addresses transmission mains, 16-inch, 20-inch, or larger. Standards that apply to distribution mains shall also apply to transmission mains along with the following requirements or exceptions herein. In case of a conflict with any other Chapter in these Standards, this section shall govern for transmission mains.

1. Design Criteria:

Water transmission mains shall be sized and designed in accordance with Chapter 500 and the following additional requirements:

a. All transmission mains shall be ductile iron pipe.

b. Transmission mains shall be supplied by dual feeds, unless otherwise directed by the Town.

c. Isolation valves shall be optimally placed such that service outages during repairs or construction are minimized. This generally requires the ability to isolate and alternately supply mains extending from the transmission main; therefore, the spacing between valves shall not exceed 1,200-feet.

Isolation valves used on transmission mains shall be 16-inch or 20-inch flanged end butterfly valves. The size and type of valve to be used shall be clearly indicated on the submitted plans.

d. All joints require restraint due to line thrust shall be restrained by using a means of mechanical restraint. Restraint requirements shall be in accordance with line size. Other restraint systems will need to be approved in writing by the Town.

e. The maximum design head loss for 16-inch mains is 2-feet per 1,000-feet of main. The maximum design head loss for 20-inch mains is 1 1/2-feet per 1,000-feet of main. Head loss is based on a Hazen-Williams C-value of 130 at the maximum hourly demand. Head loss criterion does not apply under fire flow conditions.

f. Blow-off assemblies shall be installed at low points in transmission mains and wherever a transmission main is dead-ended; i.e., unless a fire hydrant is provided at the dead-end location. (A fire hydrant may serve as a blow-off.)

g. Cathodic protection requirements for transmission mains will be at the discretion of the Town Engineer on an individual basis. Mains installed in corrosive soils shall be protected using methods determined by the Town. This may consist of the installation of anodes, the bonding of pipe, polyethylene encasement, or other requirements.

h. Special Conditions: Each transmission main will be examined individually to determine any special conditions and/or requirements necessary (e.g., air valves and PRVs).

2. Plans:

Detailed plans for transmission main extensions shall be prepared for approval in accordance with Section 200 and shall contain a top of pipe profile showing the following:

a. Proposed and existing ground lines.

b. The elevation of grade breaks, slope of pipe, locations of bends and fittings, and minimum clearances to interference.

c. The elevation of crossing interference verified by pothole.

3. Installation

    a. The Town may allow the Owner/Developer to use prequalified Contractor to install a transmission main. The Owner/Developer shall pay the costs for extending mains whether installed by the prequalified Contractor or by the Town.

502.6 Water Main Pipe Selection, Fittings, and Protection

A. Pipe Classes and Selection

1. Pipe Classes: The following minimum AWWA Standard pressure classes for acceptable types of pipe are required:

    a. Ductile Iron Pipe

        i. Special Thickness Class 51

    b. PVC

        i. C 900 DR 18 (6-inch and larger)

2. Pipe Selection: The selection of the type of pipe shall be left to the discretion of the registered engineer in charge of the design. However, the Town reserves the right to deny the use of certain types of materials in specific circumstances.

    a. The installation of mains through hazardous areas, at depths greater than 10-feet, and in the roadways of state and federal highways may require the selection of pressure classes in excess of the minimums stated above.

    b. All joints must be restrained

    c. All mechanical joint fittings including: hydrants, plugs, caps, tees, and 90-degree bends shall be restrained with Mega lugs (or other approved mechanical joint restraint gland) and concrete thrust blocks supported by undisturbed ground. Thrust blocks should not be used on bends 45 degrees or less.

    d. Nonmetallic pipe is not allowed in areas with soil contamination. The determination of soil contamination that consists of hazardous substances or materials or toxic substances will be at the discretion of the Town Engineer.

B. Pipe Fittings:

1. Joints and fittings shall be in accordance with applicable AWWA Standards and bear the pressure rating of the straight pipe involved at a minimum.

2. Acceptable types for straight lengths of pipe are push-on, mechanical joint, and bell spigot restraint systems. Mechanical joints for straight lengths of pipe are allowed in specific situations at the discretion of the Town Engineer.

3. Fittings shall be furnished with mechanical joint ends. The use of wyes is prohibited.

4. Bolted sleeve-type couplings, in accordance with AWWA C219, shall be of a gasketed, sleeve-type with a diameter that properly fits the pipe. Table 500-1 contains the minimum center sleeve dimensions for bolted sleeve-type couplings:

Table 500-2: Minimum Center Sleeve Dimensions

Pipe Diameter (Inch)	Center Sleeve Thickness (Inch)	Center Sleeve Width (Inch)
6	0.250	5
8		
12		
16	0.375	7
20		

5. DI sleeves shall have mechanical joints of the proper size and tolerance to ensure a watertight fit.
6. Split sleeve couplings in accordance with AWWA C227 are acceptable.
7. Long bell closure pieces shall be equal in strength, at a minimum, to the straight pipe being joined and shall contain push-on joints of the proper tolerance to ensure watertight connections.
8. Where pipes of different types are connected or where pipe is connected to fittings or valves of different materials, care shall be taken to ensure the proper ring, insulating gasket, or adapter is selected.
9. Flanged adapters, plugs, end caps, bulkheads, cut-in sleeves, anchor couplings, repair fittings, and other appurtenances shall be used where appropriate throughout the system at the discretion of the Town Engineer.

C. Mechanical Joint Restraint Devices

1. A mechanical joint restraint gland is the normal mechanical joint restraint system used in the Town's water line installations and all joints shall have a mechanical joint restraint gland.
2. Mechanical joint restraint glands, other than Megalugs (EBAA Iron, Inc.), may be approved by the Town.
3. Proprietary joint restraint systems for pipe and fittings require the approval of the Town prior to installation.
4. Harnessing of joints by harness rods must be approved by the Town prior to installation.
5. The harnessing of joints may be accomplished using one of the mechanical joint restraint systems in accordance with Town Standards or using one of the several proprietary joint restraint systems supplied by Pipe Manufacturers.
6. Where joint restraint is required on PVC pipe, the designer may use a joint restraint system of the type supplied by Pipe Manufacturers and approved by the Town or switch to a metallic pipe. The use of rods and clamps on PVC pipe are not allowed.

A. Corrosion Protection Systems

1. CI and DI pipes and fittings shall be protected against corrosion:

   a. Polyethylene wrap shall be used on buried metallic pipe fittings, rods, and appurtenances.

   b. Electrical isolation is required at dissimilar metal connections and at corporation stops.

   c. Buried harness rods shall be covered by 4-inch flat width polyethylene tubing. The entire joint shall be covered by a wrap of 48-inch wide polyethylene sheet material over each set of lugs. Irregular shaped valves and fittings shall be covered with flat 48-inch wide polyethylene sheet material. V-Bio enhanced polyethylene wrap may be required for areas where the soil resistivity is 1,000 ohm-centimeters or less.

   d. When the installation of metallic pipe is contemplated, a soil resistivity survey of the construction area shall be performed. The survey data and calculations, coupled with the service history of other existing pipes in the area, shall be submitted by the registered engineer in charge of the design for the Town to review.

   e. When water mains are to be constructed in soils that have a resistivity of less than 1,000 ohm-centimeters or where stray current corrosion is expected to be present, an approved nonmetallic pipe system shall be selected. When water mains are to be constructed in soils that have a resistivity of more than 1,000 ohm-centimeters, metallic or nonmetallic pipe material may be selected.

   f. In areas where the soil resistivity is 1,000 ohm-centimeters or less and metallic pipe needs to be used, joints shall be bonded with HMWPE insulated stranded copper wire. Exothermic welds shall be covered by an approved weld cap.

B. Thrust Blocks

1. Concrete thrust blocks shall be sized for working pressure plus water hammer surge pressures, and soil bearing capacity. Thrust blocks shall be constructed of Class B concrete or of a premeasured, sacked industrial mix.

C. Concrete Encasement or Pads

1. Under unusual circumstances, it may be necessary to lay pipe at shallow depths. Concrete encasement or pads shall be used over the pipe to protect it from traffic loading when this occurs. The encasement or pads shall be designed to support loads from traffic without transmitting the load to the pipe. Approved insulation shall be required between the pipe and the concrete encasement or pad to protect the pipe from frost. Designs are subject to the Town’s approval.

D. Casing Pipe

1. Installation of mains through Town of Berthoud ROW, or the ROW or easements of others, (e.g., highways, waterways, and railroads) may require casing pipes to facilitate the installation of the main. The casing pipe may be required by the permitting agency or by the Town of Berthoud. The type of casing material and its properties shall be specified by the agency granting permission to cross.

501.2 Pumping Facilities

A. General: Pumping facilities are allowed on mains or services supplying water from the Town's system only where specifically authorized by the Town. The Town will prohibit the installation of pumping facilities where such installations would be injurious to the operation, or future operation, of the Town’s system. This requirement is not applicable to individual building fire sprinkler system pumps, domestic system boosters required in multi-story buildings, or irrigation system pressure boosting. Such applications require backflow prevention (BFP) to

eliminate the possibility of pumping into the Town's distribution system. Materials, equipment, and construction shall be in accordance with applicable codes and standards and approved by the Town.

B. Pumping facilities are not recommended by the Town, unless identified in the Berthoud Master Plan, and must be designed as a regional pumping facility with the ability to accommodate future demands. The need for pumping facilities shall be evaluated on a case-by-case basis by the Town.

C. The Developer shall be solely responsible for all costs associated with the design and construction of the pumping facility. This includes the cost of any easements, land acquisition, and any other cost associated with the project.

D. Where additional service area outside of the proposed development is anticipated, the Town will require the pumping facility and associated improvements to provide additional capacity than what is necessary for the initial development. A reimbursement agreement may be appropriate in this condition.

E. Public pumping facilities are defined as any pumping facility serving more than one user and accepted by the public utility. Operations and maintenance activities shall be the responsibility of the Town for all public pumping facilities only upon completion and acceptance of the proposed improvements. The Developer shall provide an operations and maintenance manuals and procedures for all equipment and processes associated with the pumping facility. The Developer shall coordinate with the Town during the planning and design phases on equipment operations and maintenance requirements.

F. Private booster pumping facilities are defined as any pumping facility serving only one user. Operations and maintenance responsibilities for private pumping facilities are the sole responsibility of the owner or private entity.

   1. Design shall follow plumbing code.

G. Pumping facilities shall be located and sized in accordance with the Town's Master Plan.

H. All new pumping facilities shall be monitored by the Town's SCADA system.

I. General Design Criteria: Pump stations receiving water from the Town of Berthoud shall:

   1. Be secured against unauthorized entry.

   2. Be located and kept in a manner that allows for easy and safe access for maintenance and inspection.

   3. Provide mechanical forced ventilation in the pump station at a rate of no less than 6 air changes/hour. The intake and exhaust vents shall be designed to prevent the entry of small animals and insects. The intake vent ductwork shall include a filter rack. Vents shall have motorized dampers to prevent air infiltration into the vault when the ventilation system is not in operation. Fans, ductwork, and damper materials shall be constructed of aluminum and/or PVC. Vent stacks may be steel gooseneck type or aluminum tiered caps depending on architectural requirements.

   4. Provide heating, cooling, and humidity controls to ensure the safe, dry, and efficient operation of piping, pumping equipment, instrumentation, and alarms.

   5. Have pumping capacity sized to provide adequate flow coverage for minimum demands up to the maximum requirements as determined by fire demand, maximum day demand, maximum hour demand, or replenishment, whichever is greater.

   6. Provide a means for measuring flow on pump discharge headers.

7. Provide corrosion protection for underground steel and iron.
8. Provide code compliant plumbing systems that include floor drains, sump pump systems, and wash-down service water systems. Pump and valve packaging leakage shall be piped to the floor drain or sump pump system.
9. Provide local and remote electronic telemetry equipment of the type specified by the Town for monitoring the discharge pressure and confirming the pump motor status.
10. Provide a frost proof gravity line or sump pump for pump station drainage to the local sanitary sewer. Provide a check valve, p-trap, and cleanout on the sump discharge line.
11. Provide a means to prevent water from backing up into the pump station from other sources (e.g., installing a check valve on the drain line).
12. Standardize equipment to permit interchangeability with other equipment.
13. Ensure special care is exercised in the selection of pumping units and associated components to prevent pressure surges. Ensure the suitability, flexibility, and adaptability of the units to the hydraulic conditions of the system from which water is taken and the system into which it is pumped.
14. Ensure the horsepower rating of each pump motor will continuously carry the maximum load that may possibly develop (non-overloading at any point on the pump curve) without exceeding the motor nameplate rating and without using the service factor.
15. Provide that pumps are located to receive positive suction head and meet the Manufacturer's required net positive suction head requirements.
16. Provide steel pump and motor bases that are level, coplanar, free from internal stress, and have internal voids filled with epoxy grout above a steel reinforced concrete base.
17. Provide DI or steel piping designed according to AWWA Standards with adequate couplings for equipment, stainless steel piping supports, and drains.
18. Ensure the mechanical design, equipment selection, and installation practices are approved by the Town of Berthoud. Drawings and information shall be provided to describe the system curve and pump curve interactions, the pump operating conditions and associated efficiencies, the pumping equipment sizing and features, the valve/actuator sizing and operating requirements, and the HVAC design loads, ductwork sizing, and equipment selections. Provide the certified Manufacturer’s pump performance curves.
19. Ensure that electrical design, equipment selection, and installation practices are approved by the Town. Drawings shall show the power system, switchgear, protective devices, feeder panels, and wiring and motor controllers along with sizing, fault current, and protective device coordination calculations. The latest edition of the NEC, OSHA's Design Safety Standards for Electrical Systems, and applicable ANSI/IEEE Standards shall set the minimum standards to which the design, equipment, and installation shall conform. The Town of Berthoud may set higher standards for safety or reliability purposes.
20. Provide slow-closing regulating and/or check valves on pumps to minimize water hammer.
21. Provide ample clearance between equipment for operation and maintenance.
22. Provide electrical outlets and lighting on walls in the pump room.

J. Conditional Design Criteria: Depending on the function and the location of the pump station, the following criteria may be required by the Town:

1. Exterior and interior lighting.

2. Access and parking for vehicles on the pump station site.
3. Fencing for securing the area around the pump station and transformers.
4. Space for the future addition of pumps and piping.
5. A means to lift heavy equipment (e.g., a bridge crane or access for a boom crane).
6. Variable speed or throttling control with the appropriate discharge valves and controls.
7. An emergency power supply for telemetry, lights, a drain sump pump, and other necessary items.
8. Surge control.
9. The installation of guard valves on each side of the pumping unit.
10. Systems capable of supplying adequate fire protection during power outages.
11. Resistance temperature detectors in stator windings of pump motors for remote alarming in the event of overheating.
12. A spare pump for backup capability.
13. Pump and motor bearing high-temperature sensors for remote alarming and lock out relays to shut down the pump and the motor in the event of bearing overheating.
14. There shall be a temperature shutdown switch on the pump to protect the pump from overheating.
15. Reduced voltage motor starters, depending on the motor size and the electric power system.
16. Dual transformers cross-connected with a tie breaker and separately switched for isolation.
17. A remote control for pumps, gas engines, and filling valves (start – stop – position discharge valve).
18. Local and remote instrumentation for monitoring:
    a. Discharge valve positions.
    b. Discharge header pressure and flow.
    c. The reservoir level, if applicable.
    d. Upstream pressure, if applicable.
    e. Suction header pressure, if applicable.
    f. The pump status (on-off).
    g. Gas engine standby generator status (on-off).
    h. Total kilowatt demand (station).
19. Provide remote and local sensors and alarms to detect:
    a. Water on the floor.
    b. Bearing high-temperature for each pumping unit.
    c. Motor windings high-temperature for each pumping unit.
    d. Pump building door intrusion.
    e. High and low room temperature.
    f. Electrical ground fault.
    g. Low accumulator pressure, if applicable.

h. Power failure.

i. High and low reservoir levels, if applicable.

j. Fire and/or smoke.

501.3 Service Lines and Appurtenances

A. General:

1. Water is conveyed from mains to consumers by service lines and their associated appurtenances. Except for fire service lines, water delivered to customers shall be metered.
2. Service lines shall include all pipe and fittings up to and including the connection point provided by the Town.
3. The service line from the main to the meter pit assembly shall be owned and maintained by the Town.
4. The Tapholder shall install, own, and maintain the water line from the connection point outside of the meter pit to the point-of-use.

B. Layout of Water Service Lines

1. The service line shall be arranged to provide convenient access to the curb stop and the meter pit or vault for meter reading, operation, and maintenance.
2. The service line, to a point 5-feet past the meter pit or vault, shall be a minimum of 5-feet from any side property line.
3. The service line shall be installed in a continuous straight line, perpendicular to the property line or curb, from the tap to a point 5-feet past the back wall of the meter pit or vault. Servicefor lots at the end of cul-de-sacs or at a corner will need be approved by the Town.
4. Service lines shall be installed 5-feet to 6-feet below the ground line.
5. Deviations to the service line standards contained in this Section will need to be approved through the Town.
6. Backfill material around service lines, stop boxes, and meter settings shall be at 90% compaction.
7. That portion of the service line between the main and the meter pit shall not exceed a horizontal length of 85 feet. Longer service lines may be installed with the approval of the Town and may require over sizing to minimize losses.
8. Service lines may not share a trench containing conduits which carry any substance other than potable water if there is space for multiple trenches outside of the ROW. If the lot outside of the ROW is too narrow to provide separate trenching, a service line should be separated horizontally from foreign conduits by a minimum of 5 feet and shall follow plumbing code.
9. If same trench is required due to lot width, the water service pipe and building sewer shall not be horizontally separated by less than 5 feet.

C. Sizing of Service Lines

1. Taps and service lines shall be of a size that is adequate to supply the requirements of the property being served while not being so large as to cause inaccuracies in metering low flows. The minimum size allowable for a service line shall be 3/4-inch.
2. The tap, corporation stop, meter, and the portion of the service line between the corporation stop and 5-feet past the meter shall be the same size. The service line may only be

increased one standard size to the next approved larger diameter beginning 5-feet downstream of the meter, including BFP.

3. Taps and services shall be sized to produce a water velocity that is no greater than 10 fps at peak demand as estimated by an accredited Fixture Unit/Count methodology.
4. The total pressure drop in the service line from the main to the building shall not exceed 25 psi without BFP or 35 psi with BFP and a minimum residual pressure of 20 psi at the building beyond any BFP under peak domestic demand flow.
5. The manifold tap, manifold service line, manifold corporation stop, and manifold trunk line shall be the same size.

D. Pipe Material and Joints

1. Pipe material is dependent on the size of the service line and shall extend from the tap to the first mechanical fitting inside the structure:
    a. Seamless copper tube, designated as “Type K” soft, shall be used for 3/4-inch through 2-inch service lines.
        i. Polyethylene SDR 9, 200 pounds per square inch (psi) minimum pipe may be used for service lines three quarter (3/4) inch to two (2) inches only under certain conditions approved by the Town Engineer.
    b. Ductile iron pipe shall be used for 3-inch and larger service lines.
        i. PVC pipe may be used for domestic service lines two (2) inches and larger only under certain conditions approved by the Town Engineer.
    c. Service lines shall be the same type of material from beginning to end.
    d. Copper joints installed underground shall be flared or brazed. Flaring and brazing shall be performed in accordance with the best plumbing practices.

E. Pumps

1. Pumps are only allowed on fire suppression systems for the purpose of increasing pressure as required for either insufficient initial pressure supplied from the distribution system to meet application needs or in the case where internal change in elevation requires an additional boost to meet pressure requirements on higher floors. All pumps must be approved by the Town.
2. Pumps may not be used for the purposes of sizing calculations.

F. Tanks

1. Tanks are not allowed for either domestic or fire suppression supply.

G. Connections for Service Lines

1. Taps for 2-inch and smaller domestic, irrigation, or fire service lines will be made by a prequalified Contractor. The connection shall be made using a corporation stop of the same size as the service line through a bronze tapping saddle, both of which shall be supplied by the licensee. Taps shall be made only after satisfying the following conditions:
    a. The main has been released by the Town following the completion of the conditions and tests.
    b. The license application has been completed, signed by an authorized individual, and submitted to the Town.
    c. Appropriate fees and charges have been paid to the Town.
    d. The street opening permit has been obtained from the authority having jurisdiction.

e. Underground utilities near the tap are marked.

f. Tapping materials are on-site.

g. Front property corners are clearly staked, and the service address visibly posted.

h. Water main valves are marked or staked.

i. Safety equipment and procedures are in place including trench shoring.

j. The tapping location on the main is excavated and the water main surface is exposed and clean.

2. Taps to the main for 3-inch and larger service lines shall be made by a tapping sleeve.

3. Domestic service lines connected to metallic water mains shall be electrically insulated by means approved by the Town for insulating fittings or gaskets.

4. Care shall be taken to properly install corporation stops and provide enough slack in the service lines to protect against pullout.

5. When tapping mains, dig out bedding material and apply two to three wraps of adhesive tape completely around the polyethylene-encased pipe to cover the area where the tapping saddle and machine is to be mounted.

6. Multiple taps on the same side of the main shall be a minimum of 5-feet apart, measured longitudinally along the centerline of the main. Multiple taps on opposite sides of the main shall be staggered by a minimum of 2 1/2-feet, measured longitudinally along the centerline of the main. Taps shall not be made within 5-feet of any main line pipe fitting.

7. Corporation stops shall be used to connect the service line to the main without taking the main out of service.

H. Taps, Saddles, and Sleeves

1. Tapping saddles or sleeves shall be required for all taps on main lines.

2. No direct tapping of any main line materials shall be allowed without approval from Town.

3. Taps and service lines shall be of a size, which is adequate to supply all the requirements of the property being served as determined by the Tapholder. The recommended minimum sizes for service lines are shown in the table below:

Table 500- 3: Recommended Service Line Sizes

Minimum Service Line Size			
Tap Size (Inches)	Water Line Length		
	< 85 feet	85-100 feet	> 100 feet
5/8"	3/4"	1"	Minimum 2"
3/4"	3/4"	1"	
1"	1"	1 1/2"	
1 1/2"	1 1/2"	2"	
1 1/2"	2"	2"	

4. Tapping saddles with a tap size of 2-inch and smaller for DI and Asbestos-Cement (AC) pipe shall consist of a bronze body with two bronze straps. Saddles for PVC pipe shall be single strap bronze saddle. They shall be made by a corporation stop that is the same size as the service line.
5. Taps 3-inch and larger, shall be made with an existing tee or a tapping sleeve and a tapping valve. Whichever method is used, care shall be exercised to select sleeves and gaskets that are properly sized to fit the type and class of pipe to be tapped. Where tapping sleeves, 3-inch and larger are used a thrust block shall be placed behind the tapping sleeve to prevent possible damage to the main from pressure shocks that develop as valves are firstopened.
6. Tapping of PVC pipes shall only occur on dry pipes. Wet taps are not allowed on PVC pipe containing water under pressure. Taps on AC, CI, or DI pipe may be tapped under pressure or wet.

I. Curb Stops, Valves, and Valve Boxes

1. Valve boxes, vault access lids, or other surface features of the water system that will be placed in paved areas shall not be placed in curb and gutter, concrete cross pans or edges of pavement. Surface features of the water system shall be placed a minimum of two (2) feet from outside edges of concrete curb and gutter pans, street cross pans, and edges of pavement.
2. A curb stop or gate valve of the same size as the service line shall be installed on the service line at a location in accordance with Section 502.7.
3. Deviations to the curb stop installations, 1-inch and smaller, requested in writing by the Engineer of Record may be authorized by the Meter Inspection Technician.
4. Buried valves and curb stops shall be equipped with a CI valve box and large oval base. A roadway box shall be used when a 3/4-inch or 1-inch curb stop is placed in paved areas.
5. Valve Boxes:
    a. Buried gate valves shall be provided with a 6-inch CI valve box and large oval base. The valve box shall be of a design that shall not transmit shock or stress to the valve and shall have enough extension capability to be raised to the ground line.
    b. The top section of the valve box shall be acceptable for use with a butterfly valve.
6. Check Valves:
    a. Check valves are required for meter installations, 1 1/2-inch and larger, where there is no BFP assembly downstream and at Distributor master meter locations.
    b. Check valves are not a substitute for BFP assemblies; however, they may be omitted from the meter installation in cases where a BFP assembly is within 150-feet of the meter.
7. Valve Reference Marker Posts:
    a. When valves are installed where adequate physical reference points are not available, as determined by the Town, a valve reference marker post may be required.

J. Abandonment or Removal of Service Lines and Tap Cuts

1. It may become necessary to remove or abandon a service line or a stub-in due to redevelopment and changes in water requirements for the premises, or to relocate a service line due to changes in the configuration of the premises. An abandoned or relocated service line shall have the tap cut at the main or fire service line to ensure that it

cannot be used to remove water from the system. Service line tap cuts shall be witnessed by the Town's Inspector.

K. Construction

1. The Contractor shall be a licensed plumber by the authority having jurisdiction to perform work in the public ROW. The Contractor shall have a current plumbing license to install service lines in the Town of Berthoud.

501.4 Cross Connection Control and Backflow Prevention (BFP):

A. General:

1. The following Standards are to be used in conjunction with Section 6.28 of Berthoud Municipal Code.

B. The Town of Berthoud is responsible for protecting its public water system from contamination due to backflow occurrences through residential, multi-family, irrigation, and/or commercial property water service connections in accordance with CDPHE Regulation 11. The Town needs the assistance and the cooperation of the public and licensees to ensure this responsibility is met. The Town of Berthoud may request access to a property or facility to conduct an on-site cross-connection control audit.

The Town of Berthoud requires the installation of a containment assembly on commercial property service lines. In high hazard applications, a RP BFP assembly shall be installed. In low hazard applications, a DC BFP assembly may be installed at the discretion of the Town.

Failure to comply with installation and annual testing requirements may result in suspension of service.

C. An approved BFP assembly shall be manufactured in accordance with AWWA C510 and C511 and meet USC FCCCHR specifications. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372. The BFP shall be selected and installed in accordance with the Construction Specifications.

D. Testing Requirements for BFP Assemblies Installed on Potable and Recycled Water Services: The licensee is required to have a certified ABPA or ASSE tester inspect and test an existing or newly installed containment BFP assembly on dedicated and recycled water service lines, if applicable, upon installation and annually thereafter. Tests shall be conducted at the expense of the licensee. BFP assemblies shall be repaired or replaced at the licensee's expense when found to be defective. Records of tests, repairs, and replacements shall be kept by the licensee and a copy of the annual test provided to the Town.

Installed BFP assemblies that fail to meet these requirements, but were approved assemblies at the time of installation, shall be excluded from the requirements if they have been properly maintained and pass annual testing. If the BFP assembly is replaced, the replacement shall be USC FCCCHR approved.

1. The tester is required to:

a. Complete BFP assembly testing and submit test reports within 2 days of The Town's setting of the meter and turning on of the water service.

b. Submit a copy of the official ABPA or ASSE certification to The Town each time the certification is renewed.

c. Submit a copy of the test kit calibration certification annually.

d. Have a dedicated recycled water test gauge.

e. Complete the BFP assembly test report and submit a copy of the containment BFP assembly report to The Town within 5 days. Incomplete or illegible test reports will not be accepted.

f. Indicate containment or containment by isolation on the test report.

g. The submission of isolation test results to the Town is not required by CDPHE.

h. Indicate the type of usage (i.e., domestic, irrigation, fire, or recycled) on the test report.

i. Confirm the premises ID, service address, meter number, BFP assembly serial number, and record the values on the test report.

j. Contact the Town for discrepancies regarding the meter or BFP assembly.

k. Sign, date, and include the time of the test on the report.

2. Failed Assemblies:

a. If the BFP assembly fails and cannot be repaired on the day of its failure, the Town shall be notified by the certified ABPA or ASSE tester within 24 hours. A copy of the failed test report shall be submitted to the Cross-Connection Control Section within 3 days.

b. The Property Owner is responsible for coordinating the necessary repairs to the BFP assembly and retesting the unit within 15 days. The Property Owner shall submit a passing test report to the Town. Failure to comply may result in the suspension of water service.

c. If the premises has a high hazard BFP assembly and is deemed a threat to public health (via the private plumbing system), it is at the discretion of the Town to suspend the dedicated water service line immediately. The Property Owner shall repair or replace the BFP assembly before water service will be restored.

E. Exemptions: Single-family residential customers are exempt from the Town's cross-connection control requirements unless the premises is served by a fire suppression system or a dual water supply. Multi-family residential customers are exempt from the Town's cross-connection control requirements unless the premises has a fire protection system or the premises has a common boiler.

F. Stop and Waste Valves:

1. Service lines shall have a stop and waste valve on the service line inside the residence (near where the line enters the residence).

The stop and waste valve shall have a drain plug located on the valve body so that when the valve is shut off the drain plug can be removed and the water above the valve drained out.

501.5 Water Meters

A. General:

1. Water meters used in the Town of Berthoud's system shall be preapproved by the Town Engineer in accordance with the approved Manufacturer and model. The Town will determine the type of meter to be installed at the time of the application based upon size, service requirements, location, and other conditions that may exist. The Town may change the type of meter at any time based on the water usage patterns of the licensee.

i. Displacement meters, 5/8-inch through 2-inch: residential, industrial, commercial, and irrigation applications requiring a 2-inch or smaller service.

ii. Compound meters larger than 3-inch: large irregular flows

iii. Turbine meters, 2 inches and larger: large, relatively constant flows

iv. Fire service type meters, used on any service including fire sprinklers, fire hydrants, or other fire protection

2. Only town approved meters are allowed. In most cases, the Town will require all meters to be purchased the Town's supplier.

3. All service meters shall be owned and maintained by the Town.

4. All Town master meters shall be owned and maintained by the Town and shall be connected to the Town's SCADA system.

B. Meter installations

1. Meter installations, 2-inch and smaller, will be inspected by The Town after final grade is established at a minimum of 5-feet radially around the meter setting. 3-inch and larger, will be inspected by the Town prior to backfilling and upon completion of the installation.

2. Meters shall be the same size as the corporation stop or service tee and that portion of the service pipe between the meter and the corporation stop.

C. Meter Setting

1. General:

a. The meter shall be installed in an approved coppersetter or yoke. The bypass line shall have a ball valve that may be locked in the closed position. Coppersetters for 1-inch and smaller meters shall include a lockable angle valve on the meter inlet. Coppersetters for 1 1/2-inch and 2-inch meters shall include lockable angle valves or ball valves on the meter inlet and outlet and a lockable ball valve on the bypass.

b. Meter supports shall be a solid concrete block. Fabricated metal supports or jack stands shall be used to support 3-inch and larger.

c. To ensure safety, meter settings shall provide for electrical continuity in the event the meter is removed from the setting. There shall be an electrical continuity wire or strap connecting the pipe on either side of the meter setting. The wire shall be made of copper with fittings suitable for bonding jumper and water pipe material.

2. Meter Setting

a. All meters shall be outside. Refer to detail.

b. Outside meters shall be installed with the inlet and outlet spuds in a horizontal position and housed in a concrete or approved composite meter pit or vault. The meter shall sit horizontally with the meter register pointing up. Larger meters shall be installed in vaults.

c. For all meter settings, install a curb stop 1 to 1.5 feet before the meter pit or vault. The meter setting shall include an angle valve or ball valve on the inlet side of the meter. For all settings, install a curb stop 2-feet before the meter vault. The meter setting shall include angle valves or ball valves on the inlet and the outlet sides of the meter. The bypass line shall have a ball valve that may be locked in the closed position.

D. Meter Bypass Lines

1. A bypass line is required for 1 1/2-inch and larger meters except those used for irrigation-only service.

2. Bypass lines shall contain an independent isolation valve and shall not contain tees, plugs, or other outlets through which water could be withdrawn. Bypass lines permit the customer

to have water while the meter is being repaired or replaced and may only be activated by the Town.

3. Bypass lines for 1 1/2-inch and 2-inch meters shall be integral to the meter yoke with an appropriately sized ball valve. Bypass lines for 3-inch and larger meters shall be connected to the main line at tees before and after the meter and shall include a gate valve with wheel operator.
4. Bypass lines shall be locked in the closed position when not in use.

501.6 Manholes, Vaults, and Pits

A. General:

1. Structures shall be designed to support applicable loads. Design calculations, drawings, and contract specifications shall be submitted to the Town of Berthoud for review. Concrete used in structures shall be Class A.
2. Steel reinforcement shall be deformed bars or welded steel fabric.

B. Manholes

1. Manhole base beams shall be constructed of precast, reinforced concrete.
2. All manholes shall be designed so that all joints and corners are waterproof either by construction methods or after construction by the use of sealants.
3. The manhole roof shall be designed to support the street fill and traffic loading in accordance with AASHTO Standards.
4. Manholes shall not be installed in curbs, gutters, concrete pans or in the wheel path in the road.
5. Lids :
    i. All manhole lids shall be forged with the following: "Water". Manhole lids must be approved by Town Engineer.
    ii. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes
    iii. Surface patterns in the lids shall be drivable and smooth. Checker patterns or other textured patterns are not allowed.
    iv. The 24-inch CI manhole cover shall weigh approximately 165 lbs. The 24-inch CI ring shall weigh approximately 240 lbs.

C. Meter Pits and Vaults

1. Water meter vaults shall be located between the curb and detached walk wherever size permits. Refer to detail.
2. 3/4-inch and 1-inch Meters:
    a. Meter settings for 3/4-inch and 1-inch meters shall be installed in meter pits with a 24-inch nominal diameter and a total depth of 52-inches minimum from grade. The pit shall consist of a 24-inch nominal diameter by 48-inch high cylinder of concrete or composite with a dome or bell housing holding an internal frost lid and a locking top lid.
    b. Rings shall be constructed of concrete and comply with the requirements of ASTM C 478.

c. A CI dome or bell housing shall be mounted on the top of the pit. The dome or bell housing shall have a support for an interior frost lid and a rim for locking the meter pit cover. Composite and plastic domes are not permitted.

d. The cap-type meter pit top lid shall be constructed of CI or an approved composite material. Lids shall be of the cap-type with a locking screw and bolt that provides a tight locking of the cover to the dome or bell housing of the meter pit. Lids shall withstand AASHTO HS 20 highway loading plus 25% impact not to exceed 20,000 lbs. Composite lids shall be available in various colors, as required by the Town. When set in place of the dome, the top of the meter pit lid shall be set at ground line. The inner frost lid shall be high-density polyethylene.

3. 1 1/2-inch and Larger Meters:

a. Meter vaults shall be precast concrete from approved manufacturers. The roof and the walls of precast vaults shall be made waterproof after construction using sealants, membranes, or other approved methods. Access manholes shall be adjusted to be flush with the finished landscape grade or surrounding pavement.

b. Circular vaults for 1 1/2-inch and 2-inch meters shall be 48-inch diameter and of sufficient depth to extend below the 4 1/2-feet to 6-feet depth below ground line of the service line. The wall thickness shall be at least 6-inches. The vault shall have a flat top with concrete grade rings supporting the manhole ring and 24-inch diameter manhole cover at ground line. When subject to traffic loads, vaults shall sit onreinforced concrete manhole.

c. Rectangular vaults for 3-inch and larger meters shall be approved by the Meter Technician. Vaults shall be precast concrete from an approved Manufacturer. Vaults shall be designed to support the street fill and HS 20 traffic loading in accordance with AASHTO Standards.

d. Meter vault lids shall be ASTM A 48 Class 35B CI manhole covers with a 24-inch lid set into a 36-inch outer diameter ring. The manhole lid shall be solid with one 2-inch hole for turbine or displacement meters and two 2-inch holes for compound meters to accommodate AMR/AMI devices specified by the Town.

e. Meter vaults shall include copolymer polypropylene plastic steps cast into the side of the vault evenly spaced at 12-inch centers, maximum.

f. AMR/AMI devices shall be mounted through the CI manhole lid or outer ring, inside the vault with a composite cover, in a remote location on the side of a building, or on a pole, as directed by the Meter Technician.

D. Sump Pits for Vaults and Manholes

1. Concrete vaults and manholes with concrete bases shall have sump pits.

2. The minimum pit opening shall be 12” x 12” square and open to gravel.

3. A gravity drain line or sump pump shall be used in conjunction with a sump where telemetry equipment is to be installed. A sump pump is not permitted in a meter vault.

4. Sumps are required for vaults and manholes where there is seepage into existing vaults, in PRV installations at the discretion of the Town Engineer.

E. Vent Pipes

1. Vent pipes shall be required on all vaults and manholes.

2. Vent pipes shall be field located at the nearest intersection of the street property line and the side lot line.

3. Installations that contain electrical equipment shall have a locally controlled, power-operated blower attached to the vent system. Electric powered blowers are not permitted in meter vaults.

4. The above ground vent pipe shall be steel pipe,4-inch nominal diameter, in accordance with ASTM A 53. The vent screen shall be No. 12 or No. 16 stainless steel mesh. The below ground vent pipe shall be 6-inch, black steel pipe – Schedule 40 with threaded joints. A 6-inch threaded black steel coupling shall be used to connect the pipes at ground level.

501.7 Future Connections

A. Water utilities shall be stubbed out to the right-of-way or limits of property at all locations that are planned for future tie-ins. Other reasonable stub-outs or main extensions may be requested by the Water Service Provider or the Town based on knowledge of adjacent development.

B. Service stub-outs and main extensions shall be valved such that only one valve will need to be closed when the water line is extended. Depending on location, Town may ask for a temporary blow-off at the end of a stubbed line.

C. The end of a service stub-out shall be marked in the field with a carbonite composite utility marker painted blue and labeled with the size and material of the water main extension.

D. The end of a main extension shall be marked in the field with properly marked carbonite composite utility marker.

E. All water services (domestic and fire) shall be marked with a “W” chiseled into the concrete curb or other paved surface it crosses under.

F. When a stub-out connection is installed to permit street paving or in advance of future development, it shall be located to provide a future connection that is in accordance with applicable standards at the time of activation. There is no assurance that any stub-out will meet the requirements for conversion to a service line at the time of activation. A licensee that installs a stub-out does so with the understanding that it shall be the responsibility of the licensee to modify, reconstruct, relocate, replace, or remove the stub-in, as necessary.

501.8 Fire Hydrants and Fire Service Lines

A. General:

1. The Responsible Party shall provide system improvements, including fire hydrants, for fire suppression as needed for the proposed development and its impact, if any, on adjacent properties.

2. The required number of fire hydrants and their locations shall be coordinated with the BFPD, Water Service Provider and the Town. As minimum general requirements, the number of fire hydrants, their location and spacing shall follow the latest edition of International Fire Code (IFC).

3. Private fire service main for use on an internal fire suppression system shall extend from the valve on the main to the base of the riser flange in the building.

4. The use of any private fire service main to supply more than one lot is not allowed.

5. There shall be two separate service lines to any building: fire and domestic. Domestic services taps shall be made off the Public Water System main and shall not be connected to any portion of a fire hydrant lead or fire service line.

6. No horizontal or vertical bends or reducers shall be used in fire hydrant or fire sprinkler branch lines unless specifically approved by the Town.

7. All fire hydrants shall be owned and maintained by the Town.
8. An approved USC FCCCHR BFP assembly shall be installed on water service connections that supply a fire protection system. On a fire service line that is required to have a detector check valve assembly, an approved DCDA or a RP BFP assembly is acceptable in lieu of a detector check valve assembly.

B. Hydrant Placement:

1. Hydrants shall be located at least one (1) foot inside the right-of-way or water utility easement and five (5) feet from the side lot line and shall conform to Standard Detail D5.01.
2. Hydrants shall be located a minimum of six (6) feet from edges of driveways to the center of the hydrant.
3. Installation of fences, signposts, landscaping or other obstructions shall in no way hinder the access or operation of the fire hydrant.
4. New fire hydrants must be fed by a minimum eight (8) inch main line from two (2) directions.
5. Fire hydrants are generally installed on the Northeast corner of street intersections. If hydrants are to be installed at locations other than street intersections, they shall be located on property lot side lines that are extended to the street.
6. The fire hydrant branch line shall be set at a 90-degree angle to the street main. The hydrant shall be set at the end of the branch line facing the branch line.
7. Dead end mains
    a. All main lines shall be “looped” when possible to minimize dead-ends.
    b. Main line extensions, which are to be used, for fire protection and are dead-ended shall not be longer than 500 feet. Extensions longer than 500 feet may require over sizing and approval by the Town.
    c. Where dead-ends occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes.
        i. No flushing device shall be directly connected to any sewer.
        ii. Flushing devices shall be installed at the distal end of all dead-end lines.
    d. A dead-end main may only have one fire hydrant connected to it in cases where looping is not an alternative, except as specifically approved in writing by the Town or the Distributor.
    e. Multiple fire protection appurtenances, including any combination of fire hydrants and fire service lines for any single project site, are not allowed on a dead-end main. Additional consideration will be given in the case of single-family residential homes on a cul-de-sac where fire service lines are required.
8. Redundant hydrant installations and the unnecessarily high density of fire hydrants shall be avoided where existing hydrant function would be duplicated.
9. Fire hydrants shall be installed within dedicated streets or in easements. When the Town of Berthoud determines it is not feasible for a hydrant to be installed in this manner, it shall be installed in an easement adjacent to the street. Fire hydrant easements shall have a minimum width of 20-feet. The easement shall extend a minimum of 5-feet beyond the center of the hydrant.

C. Public and private fire hydrants shall meet the Town’s Standards and Specifications:

1. Comply with American Water Works Association (AWWA) Specification C-502

2. All fire hydrants shall be Mueller or approved equal.
3. Open Direction: RIGHT (clockwise)
4. Operating Nut: 1-inch Pentagon (5-sided) or square
5. Painted yellow for Town of Berthoud
6. Bonnet and caps painted per Town of Berthoud standards for measured fire flow rates with 20 pounds per square inch (psi) residual pressure.
7. Five and one-quarter (5-1/4) inch or larger valve opening, two (2) two and one-half (2-1/2) inch hose nozzles, one (1) pumper nozzle and six (6) inch or larger mechanical joint inlet.
8. All nozzles shall have National Standard threads

D. Fire Service Lines:

1. The size and material of fire service lines shall be determined by the BFPD and the persons responsible for the structure. The Town of Berthoud will not size fire service lines.
2. Fire lines shall have an isolation valve at the main line.
3. Fire lines shall have an approved backflow prevention device.
4. Under no circumstances shall any size or manner of a tap be made on a fire hydrant or fire sprinkler branch line.
5. Under no circumstances shall any size or manner of a tap be made on a domestic service line for a fire service.
6. Fire service lines shall be considered privately owned and maintained from the connection of the service line into the isolation valve, continuing on to a building structure.
7. Fire service lines shall be located a minimum of five (5) feet from any domestic service line.
8. Fire service lines shall not be tapped off any portion of a fire hydrant lead.

501.9 Submittal Requirements

A. The Responsible Party is required to complete all review requirements of the appropriate service provider including Commitment Letters or will serve letter.

B. The Responsible Party is required to submit engineering plans of proposed water system improvements to the Town. All water mains shall be profiled. In addition to engineering plans, legal descriptions, agreements and exhibits for all proposed water line easements shall be submitted to the Town.

C. BFPD signature block and original signatures shall be required for development that includes or effects proposed or existing hydrants and/or fire service lines.

502 CONSTRUCTION SPECIFICATIONS

502.1 General

A. Water transmission lines, mains, services and appurtenances shall be installed per The Town of Berthoud's standards, specifications and drawings. In general, materials, installations and testing shall be in accordance with established American Water Works Association (AWWA) standards.

502.2 Coordination of Work

Coordinate with Town, Service Provider and BFPD representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

503 WATER DETAILS

A. The following is a list of standard details for water utility work that are part of the Town of Berthoud Standards and Specifications:

D5.01	Fireline Connection with Main Extension
D5.02	Fire Hydrant Profile
D5.03	Fireline Tracer Wire
D5.04	PRV Rectangular Vault Plan View
D5.05	PRV Rectangular Vault Cross Section
D5.06	PRV Manhole Plan View
D5.07	PRV Manhole Cross Section
D5.08	2-inch Air and Vacuum Valve Installation
D5.09	Blow-Off Installation – 12-inch and Smaller
D5.10	Blow-Off Detail
D5.11	Crossing Over or Under Conflicting Utility
D5.12	Meter Vault Assembly
D5.13	Service Line, Stop Box, Outside Meter Installation
D5.14	Outside Setting for 3/4-inch and 1-inch Meter
D5.15	Outside Setting for 1 ½-inch and 2-inch Meter
D5.16	Direct Butterfly Valve Installation
D5.17	Gate Valve
D5.18	Floor Pipe Support
D5.19	Residential Vent Assembly
D5.20	Wall Penetration with Core Hole
D5.21	Pressure Gauge
D5.22	Mechanical Joint Restraint
D5.23	Concrete Thrust Blocks – 1of 2
D5.24	Concrete Thrust Blocks – 2 of 2
D5.25	Tapping Tee and Valve
D5.26	Insulated Joint, Rod, and Coupling
D5.27	Polyethylene Wrap

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CHAPTER 600 STORM UTILITY, DRAINAGE FACILITIES, AND WATER QUALITY

601 GENERAL PROVISIONS

601.1 General

A. These Standards and Specifications are promulgated by the Town Manager in accordance with the authority contained in the Town of Berthoud Municipal Code. Improvements shall also be in conformance with Chapter 30, Article 2-123 of the Town of Berthoud Municipal Code.

B. All proposed construction submitted for approval by the Town shall include adequate storm drainage system analyses and appropriate drainage system design. Such analyses and design shall conform to the criteria set forth within these Standards and Specifications. Individuals using these Standards and Specifications are assumed to possess a working knowledge of hydrology and hydraulics and to have experience in storm drainage design and analysis.

C. Publications referenced in this Chapter can provide additional guidance as needed. Where the criteria in these Standards and Specifications vary from those found in other Larimer County, or MHFD Manual publications, the criteria in these Standards and Specifications shall govern.

D. Drainage easements or tracts, including access easements, shall be provided for all stormwater management facilities required as part of these Standards and Specifications. On- site drainage facilities that are private, affect only the individual property owner, or are not required by these Standards and Specifications need not be placed within public easements.Private detention ponds and outlet works are required by these Standards and Specificationsfor proper functioning of the public drainage system, and therefore are required to be placedwithin drainage easements or tracts.

601.2 Purpose

A. This Chapter pertains to the Town drainage policy and State of Colorado law described below as it pertains to drainage systems, stormwater quality control, flood control and site grading. Designs are intended to provide safe, reliable stormwater management in an efficient, cost effective and environmentally responsible manner. Determination of the best materials and construction methods are based upon lowest life cycle costs, not necessarily upon lowest initial costs.

B. All utility installation within the Town Right-of-Way shall require a Right-of-Way Use Permit prior to any installation activity. See Chapter 200 regarding permits and permitting processes in the Town and Chapter 300 regarding road cut standards.

C. All utility installation outside of the Town Right-of-Way (private property) shall require a Grading Permit prior to any installation activity. See Chapter 200 for Grading Permit regulations.

D. All utilities must be clearly labeled on the plans and include the type, size, depth, etc. For more complete information on plan submittal requirements, refer to Chapter 200 of these Standards and Specifications.

601.3 Submittal Criteria

A. Responsible Parties of new roadways and new developments and subdivisions within the Town must submit stormwater reports and designs, construction drawings, hydrologic and hydraulic calculations, and as-built information in accordance with Chapter 200 of these

Standards and Specifications. Checklists of submittal requirements for drainage designs are included in Chapter 200.

B. Stormwater reports are not needed for individual single-family-home construction sites. However, a stormwater report is needed for entire subdivisions of single-family homes.

C. Roadway Drainage Criteria

1. Borrow ditches need to be sized to reduce the potential for roadway overtopping. Overtopping of the roadway cannot result in more than 6 inches of water on the road during the 10-year event.

2. Culverts need to be sized to reduce the potential for backwater effects on adjacent houses or businesses. Culverts passing under Town roads must be designed for the 10-year storm and have a minimum diameter of 15 inches. Additionally, the culvert(s) must be sized so that road overtopping does not result in more than 6 inches of water on the flowline of thegutter in the 10-year event and 12 inches of water in the flowline of the gutter in the 100- year event. In addition to said criteria, a minimum of one, 12-foot wide drivable lane mustbe provided at all major arterials in the 100-year storm event.

3. If the roadway is being constructed in a floodplain, all applicable floodplain regulations and codes apply, including the need to submit an LOMR to FEMA for review and acceptance if applicable.

D. Preliminary Drainage Report

1. **Report**: The report shall provide an overview and impacts analysis of the proposed project or development, existing and developed runoff conditions, stormwater runoff flow rates and volumes, water quality and erosion control measures, stormwater attenuations or detention ponding measures, proposed stormwater utility improvements, basic design requirements, referenced study resources, methods, and findings. The preliminary drainage report shall be prepared by the Engineer of Record and include at a minimum the following sections. Approval of a preliminary drainage report and figures shall not be construed as approval of specific design details or the final drainage report and figures.

   a. Background: Provide written statement and discussion describing the proposed project or development including at a minimum the following information:

      i. Site location, including legal description (county, township, range, and section) and discussion of the area characteristics identifying land development patterns and features, transportation networks, major drainageways, facilities, and easements within and adjacent to the site and stormwater and systems including creeks, channels, irrigation ditches, and storm sewers.

      ii. Site description, including total land area, total offsite land area to be disturbed and/or effected, general topography, existing ground cover, wetlands, groundwater conditions.

      iii. Name surrounding developments.

   b. Development Proposal: Provide a general description of the proposed project or development, including land use, density, site development plans and coverage, and stormwater planning concepts.

   c. Existing Stormwater Basins and Drainage Patterns: Include a description of theexisting stormwater basins and drainage pattern that are impacted by the site development, including:

      i. The tributary stormwater basin containing the project site and tributary major drainageway.

ii. The stormwater major basin(s) that are onsite, upstream and downstream of the site,

iii. Offsite drainage patterns and their effect on site development,

iv. Onsite drainage patterns, existing runoff systems, and inflow and outflow points,

v. Previous drainage studies for the site, drainage basin, or local area that may influence drainage design, and

vi. Existing drainage problems, floodplain impacts, and groundwater conditions contributing to site runoff.

d. Conformance with Stormwater Master Plan(s): Describe how the proposed stormwater system improvements conform with adopted Stormwater Collections, Major Drainageways, and Stormwater Master Plans.

e. Design Criteria: Discussion of the proposed calculation methods and criteria used.

i. Hydrology Criteria: Design Rainfall, runoff calculation method, detention discharge and storage calculation method, design storm recurrence interval, justification of other criteria or calculation methods used that or not presented or referenced in these Standards.

ii. Hydraulic Criteria: State calculation methodology and programs that will be used for the hydraulic design and analysis and be completed with final design and included in the Final Drainage Report.

iii. Variance from Criteria: Identify provisions by section number for which a variance is requested. Provide justification.

f. Wetlands Impacts: Identify any delineated wetland or wetland buffer areas identified by the US Fish & Wildlife Services. If there is an area on the project site further investigation by a certified wetland delineator to determine the extents of the wetland on site. Include any discussion of any necessary analyses, avoidance and mitigation measures, and improvements needed to address wetlands permitting requirements.

g. Developed Stormwater Conditions: Describe and define proposed stormwater runoff conditions following development, estimated by using the proposed land use and developed patterns for the project site based on the minor and major storm events included a discussion and summary table of the following:

i. Acceptance and conveyance of offsite runoff through the proposed site development

ii. Proposed major basin(s) and sub-basin(s) onsite, upstream and downstream of the site,

iii. Proposed drainage rates, flow patterns, drainage facilities, detention ponds, water quality measures, and outflow points,

iv. Downstream properties and systems, such as streets, utilities, existing structures, and developments, impacted by the proposed development from the site to the receiving major drainageway, and

v. Proposed stormwater systems and facility design, including discussion of the following:

(a) General concepts and alternative for site drainage improvements, such as the provision, layout, alignment of storm sewer, open swales and channels, inlets, detention ponds and outlets.

(b) Solutions and alternatives for conveying onsite and contributing offsite runoff, mitigating drainage impacts, enhancing water quality, erosion and sediment control, and maintenance.

h. Water Quality: Describe mitigation measures and improvements that will be utilized to address Town Standards and how these improvements will be accommodated within the site development plan.

i. Stormwater Detention: Include a technical analysis of stormwater detention proposed for the development in conformance with these Standards. Identify the approximate size and location of any required detention facilities include the location of the emergency spillway and downstream pathway.

i. Include review and analysis of the downstream pathway to ensure there are no negative effects to the downstream properties for the proposed discharge rates (facility outlet flow rate(s) and emergency spillway flow rate)

j. Conclusions and Recommendations: Include conclusions and recommendations for proposed drainage facilities to be provided in conjunction with site development, and conformance with these Standards.

2. References

a. Provide references used in the design and preparation of the preliminary drainage report.

3. Technical Appendices

a. Provide all technical support material in an appendix, including without limitation, engineering equations, assumptions, calculations used in preparing the report, and hydrologic and hydraulic sources, references, and methods. The hydrologic analysis shall include areas, storm frequencies, runoff coefficients, times of concentration, and all runoff computation. Any relevant pages from previous drainage reports referenced in the report shall be included in the appendices.

b. Hydrologic models (CUHP, EPA SWMM, etc) if required per these Standards and Specifications need to be supplied.

4. Drawings and Figures

a. Vicinity Map: Provide a general location map identifying major drainageways and surrounding development and public infrastructure system. The map shall include and identify the site area, the area contributing off-site flow, location of the final discharge system (stream, lake, reservoir, etc.) and the pathway for flow from the site to the final discharge system. Typically, the map should be on 8 1/2 by 11 inches at a scale ranging from 1-inch equals 400 feet to 1-inch equals 2,000 feet.

b. Floodplain Map: Identify the 100-year floodplain, conveyances and high hazard zones for the site impacted by floodplains. Identify the site on the map.

c. Wetland Map: Identify Wetlands. Identify the site on the map.

d. Existing Drainage Plan:

i. General Property Boundaries

ii. Topography

iii. Stormwater Basins and Design Points

iv. Stormwater Drainage Facilities

v. Streets

vi. Irrigation Ditches

vii. Floodplains and Wetlands
viii. Site Runoff
ix. Existing Building Floor Elevations
x. Stormwater Routing

e. Developed Drainage Plan:
i. General Property Boundaries
ii. Topography
iii. Stormwater Basins and Design Points
iv. Stormwater Drainage Facilities
v. Streets
vi. Site Runoff
vii. Irrigation Ditches
viii. Floodplains and Wetlands
ix. Proposed Building Floor Elevations
x. Stormwater Routing Systems

f. Construction Plan Sheets:
i. Stormwater Management Plan
ii. Erosion Control Plan
iii. Storm Plan and Profile Plan
iv. Storm Details

E. Final Drainage Report

1. **Technical Report:** The technical report shall provide an overview and impacts analysis of the proposed project or development, historic and developed runoff conditions, stormwater runoff flow rates and columns, water quality and erosion control measures, stormwater attenuation or detention ponding measures, proposed stormwater utility improvements, basic design requirements, and referenced study data sources, methods and findings, and include the following information:

a. Engineer's Statement
i. See Section 200 for required Engineer's Statement.

b. Provide written statement and discussion describing the proposed project or development including at a minimum the following information:
i. Site location, including legal description (county, township, range, and section) and discussion of the area characteristics identifying land development patterns and features, transportation networks and stormwater systems (creeks, channels, irrigation ditches, and storm sewers) in the surrounding area.
ii. Site description, including total land area, total offsite land area to be disturbed or effected, general topography, and existing round cover, wetlands, groundwater conditions, and stormwater and irrigation ditch systems.

c. Development Proposal: Provide a general description of the proposed project or development, including land use, density, site development plans and coverage, and stormwater planning concepts.

d. Existing Stormwater Basins and Drainage Patterns: Include a description of the stormwater basins and drainage pattern that are impacted by the site development, including:
    i. The tributary stormwater basin containing the project site and tributary major drainageway,
    ii. Proposed major basin(s) and sub-basin(s) onsite upstream and downstream of the site,
    iii. Offsite drainage patterns and their effect on site development,
    iv. Onsite drainage patterns, existing runoff systems, and inflow and outflow points,
    v. Previous drainage studies for the site, drainage basin, or local area that may influence drainage design, and
    vi. Existing drainage problems, floodplain impacts, and groundwater conditions contributing to site runoff.
e. Conformance with Stormwater Master Plans: Describe how the proposed stormwater system improvements conform with adopted Stormwater Collections, Major Drainageways, and Stormwater Master Plans.
f. Design Criteria: Discussion of the proposed calculation methods and criteria used.
    i. Hydrology Criteria: Design Rainfall, runoff calculation method, detention discharge and storage calculation method, design storm recurrence interval, justification of other criteria or calculation methods used that are not presented or referenced in these Standards.
    ii. Hydraulic Criteria: Inlet, pipe, swale and other conveyance system sizing calculation methods, detention pond sizing calculation methods, and justification of other criteria or calculation methods used that are not presented or referenced in these Standards.
    iii. Variance from Criteria: Identify provisions by section number for which a variance is requested. Provide justification.
g. Wetlands Impacts: Identify any delineated wetland or wetland buffer areas identified by the US Fish & Wildlife Services. If there is an area on the project site further investigation by a certified wetland delineator to determine the extents of the wetland on site. Include any discussion of any necessary analyses, avoidance and mitigation measures, and improvements needed to address wetlands permitting requirements.
h. Developed Stormwater Conditions: Describe and define proposed stormwater runoff conditions following development, estimated by using the proposed land use and developed patterns for the project site based on the minor and major storm events included a discussion and summary table of the following:
    i. Acceptance and conveyance of offsite runoff through the proposed site development,
    ii. Proposed major basin(s) and sub-basin(s) onsite, upstream and downstream of the site,
    iii. Proposed drainage rates, flow patterns, drainage facilities, detention ponds, water quality measures, and outflow points,
    iv. Downstream properties and systems, such as streets, utilities, existing structures, and developments, impacted by the proposed development from the site to the receiving major drainageway, and

v. Proposed stormwater systems and facility design, including discussion of the following:

(a) General concepts and alternatives for site drainage improvements, such as the provision, layout, alignment and size of storm sewer, open swales and channels, inlets, detention ponds and outlets.

(b) Solutions and alternatives for conveying onsite and contributing offsite runoff, mitigating drainage impacts, enhancing water quality, erosion and sediment control, and maintenance.

i. Water Quality: Describe mitigation measures and improvements that will be utilized to address Town Standards and how and these improvements will be accommodated within the site development plan. Include a stormwater quality analysis stating the required and provided water quality capture volume treated onsite.

j. Stormwater Detention: Include a technical analysis of stormwater detention proposed for the development in conformance with these Standards. Identify the size and location of any required detention facilities include the location of the emergency spillway and downstream pathway.

i. Include review and analysis of the downstream pathway to ensure there are no negative effects to the downstream properties for the proposed discharge rates (facility outlet flow rate(s) and emergency spillway flow rate)

k. Stormwater Management Plan and Erosion Control Plan: Include analysis and describe necessary mitigation measures and improvements that will be incorporated into the erosion control plan as part of the site development. Provide a discussion of how proposed erosion and sedimentation control measures will ensure that downstream properties and drainageways will not be adversely impacted by site development and construction activities.

l. Conclusions and Recommendations: Include conclusions and recommendations for proposed drainage facilities to be provided in conjunction with site development, and conformance with these Standards.

2. References

a. Provide references used in the design and preparation of the final drainage report.

3. Technical Appendices

a. Provide all technical support material in an appendix, including without limitation, engineering equations, assumptions, calculations used in preparing the report, and hydrologic and hydraulic sources, references, and methods. The hydrologic analysis shall include areas, storm frequencies, runoff coefficients, times of concentration, and all runoff computation. Any relevant pages from previous drainage reports referenced in the report shall be included in the appendices.

b. Hydrologic and Hydraulic models (CUHP, EPA SWMM, etc) if created need to be supplied.

c. Final Stormwater Design Features: Construction plans for any site development shall include final stormwater design features in the report and attached drawings. The final design information in the report shall provide the technical basis and support for the proposed construction design and all detailed engineering calculations for stormwater systems. The stormwater system(s) shall be labeled as such that the storm system features can be identified between the report, calculations, and drawings/figures. Design features include without limitation:

i. Inlet sizing and design,

ii. Storm sewer sizing, design, type, EGL and HGLs,
iii. Open channel (swale and drainageway) design and sizing,
iv. Stormwater routing for stormwater conveyance (storm sewer and swales) and detention pond facilities,
v. Curb and gutter conveyance capacities,
vi. Detention pond outfall structures (orifices, inlets, and weirs).
vii. Water quality measures, and
viii. Any unique stormwater improvements design details.

4. Drawings and Figures
   a. Vicinity Map: Provide a general location map identifying major drainageways, surrounding development, and public infrastructure system. The map shall include the site area, the area contributing off-site flow, location of the final discharge system (stream, lake, reservoir, etc.) and the pathway for flow from the site to the final discharge system. Typically, the map should be on an 8 1/2 by 11-inch at a scale ranging from 1-inch equals 400 feet to 1-inch equals 2,000 feet.
   b. Floodplain Map: Identify the 100-year floodplain, conveyances and high hazard zones for the site impacted by floodplains. Identify the site on the map.
   c. Wetland Map: Identify Wetlands. Identify the site on the map.
   d. Existing Drainage Figure:
      i. General Property Boundaries
      ii. Topography
      iii. Stormwater Basins and Design Points
      iv. Stormwater Drainage Facilities
      v. Streets
      vi. Site Runoff
      vii. Irrigation Ditches
      viii. Floodplains and Wetlands
      ix. Building Floor Elevations
      x. Stormwater Routing
   e. Developed Drainage Figure:
      i. General Property Boundaries
      ii. Topography
      iii. Stormwater Basins and Design Points
      iv. Storm System Features
      v. Stormwater Drainage Facilities
      vi. Riprap and Embankment Protection
      vii. Streets
      viii. Site Runoff
      ix. Irrigation Ditches
      x. Floodplains and Wetlands
      xi. Building Floor Elevations

xii. Stormwater Routing System

f. Construction Plan Sheets:

i. Stormwater Management Plan

ii. Erosion Control Plan

iii. Storm Plan and Profile Plan with Storm HGL's

iv. Storm Details

601.4 Drainage Policy

A. Adequate drainage is necessary to preserve and promote the general health, safety, welfare, and economic wellbeing of the community. Drainage is a regional issue involving multiple governmental jurisdictions and affecting all property parcels. Therefore, drainage systems and programs shall address both public and private needs.

B. Drainage plans should adhere to generally accepted engineering principles and practices and should conform to applicable laws and regulations. Designers should reference the drainage policy chapter of the *MHFD Urban Storm Drainage Criteria Manual (Volume 1), and Larimer County Stormwater Design Standards.*

C. The Principals of the Town of Berthoud storm drainage policy are summarized below:

1. Storm drainage design shall observe Colorado water rights law.
2. Drainage is a regional phenomenon that does not respect the boundaries between government jurisdictions or between properties.
3. The storm drainage system is a subsystem of the total natural water resource system.
4. Planning and design of stormwater drainage systems should not be based on the premise that problems can be transferred from one location to another.
5. Storm drainage strategy should be a flexible, multi-objective, and multi-means effort.
6. In the Town of Berthoud, storm drainage design for new development shall accommodate agricultural facilities and practices.
7. Design of the constructed stormwater drainage system should consider the features and functions of the existing natural drainage system both upstream and downstream.
8. To the maximum extent practicable, storm drainage design for new developments should strive to reduce stormwater runoff rates and prevent pollutant load increases. The release rates outlined in the *Town of Berthoud Storm Drainage Master Plan* shall be adhered to unless otherwise required by the Town Engineer. If not specified in the *Town of Berthoud Stormwater Masterplan* the storm drainage design shall be based on detention of the 100-year developed site runoff released at or less than existing predeveloped historic 100-year release rates as determined by the latest methods endorsed by MHFD.
9. Storm drainage design for new development shall give full consideration to downstream impacts and safe conveyance of upstream off-site flows entering the system. Prevention of harm is paramount.
10. The stormwater management systems should receive regular maintenance.
11. Storm drainage design for new development should give full consideration to erosion prevention.

12. Adequate floodplain capacity needs to be preserved consistent with FEMA and Colorado Water Conservation Board (CWCB) regulations.
13. Land development should reserve sufficient floodplain width to accommodate lateral stream channel movement.
14. Retention of stormwater is discouraged and shall not be pursued without prior approval by the Town Engineer. Retention ponds are not acceptable unless there is no feasible method for draining the pond by gravity. If a retention pond is found to be the only alternative, the minimum volume of the facility must be adequate to retain the storm runoff from twice the 100-year 24-hour developed storm event. Percolation/evaporation alone may be an accepted method for draining the pond, but percolation will not be acceptable in situations where an increase in groundwater flow as a result of pond percolation could cause an adverse impact upon structures with basements down gradient of the pond site.
    a. The Pond must drain within 72 hours for storm event equal to or less than the 5-year event and 120 hours for all events greater than the 5-year event, to be consistent with Colorado Water Law.
    b. Water augmentation will be required if a retention pond is constructed on site and the site does not have soils that will allow for percolation to occur within the required time period.
15. Drainage Law
    a. Refer to the drainage law chapter of the MHFD Manual (Volume 1) for more information on drainage law as it relates to stormwater runoff and floodplain management.
    b. Refer to *Larimer County Stormwater Design Criteria* for additional principles of Colorado drainage law applicable within the Town of Berthoud.

602 DESIGN CRITERIA

602.1 General Drainage Criteria and MHFD Design Aids

A. As stated in the previous section, designers are advised to reference the Mile High Flood District's (MHFD) Urban Storm Drainage Criteria Manual (USDCM), and Larimer County Stormwater Design Standards as much of the criteria herein is adopted from said sources.

B. The Owner/Applicant is encouraged to use the spreadsheets and programs provided by the MHFD to assist in designing street drainage, inlets, and storm sewers. Other software programs may be used by the design engineer. The designs shall be verified using the MHFD spreadsheets and provided in the submitted Preliminary and Final Drainage Reports. The most current version of the MHFD spreadsheets can be downloaded from the MHFD website.

C. The Town will allow the use of other modeling methodologies on a case-by-case basis when complete documentation of all assumptions is provided. Approval must be provided by the Town Engineer prior to submittal of the Preliminary Drainage Report to the Town. The Town reserves the right to review alternative methods and compare with other commonly used approaches, including those discussed in the MHFD USDCM Manual.

602.2 Rainfall

A. This section presents the methods used to develop rainfall information for hydrological analyses. For more information regarding the development of rainfall information, refer to the rainfall chapter of the MHFD USDCM Manual (Volume 1).

B. Design Storms

1. Drainage designs for areas in and around the Town of Berthoud should use the depth-duration frequency information provided in the Precipitation-Frequency Atlas of the Western United States (Volume 2 - Colorado), published by NOAA. The NOAA Atlas can be accessed on the NOAA website.

   Table 600-1, shall be used but may be superseded if more recent NOAA data is published for the Town. The table below is based on NOAA Atlas 14, Volume 8, Version 2 for Berthoud, Colorado.

   Table 600- 1: Point Precipitation Frequency Estimates in Inches

Estimated Rainfall Depth in Inches									
	Average Return Interval (ARI) (Years)								
Duration	1	2	5	10	25	50	100	200	500
5-minutes	0.233	0.277	0.37	0.469	0.635	0.787	0.961	1.16	1.45
10-minutes	0.341	0.405	0.542	0.686	0.93	1.15	1.41	1.7	2.13
15-minutes	0.416	0.494	0.661	0.837	1.13	1.41	1.72	2.07	2.6
30-minutes	0.553	0.658	0.881	1.12	1.51	1.87	2.28	2.74	3.44
60-minutes	0.684	0.811	1.08	1.38	1.87	2.32	2.84	3.44	4.32
2-hours	0.816	0.963	1.29	1.63	2.23	2.78	3.41	4.13	5.21
3-hours	0.899	1.06	1.41	1.79	2.44	3.04	3.73	4.52	5.71
6-hours	1.07	1.26	1.66	2.09	2.81	3.48	4.24	5.11	6.4
24-hours	1.56	1.84	2.37	2.88	3.68	4.37	5.14	5.98	7.2

C. The Rational Method

1. The Rational Method is one method for determining runoff from a proposed development or road construction project. Note that it should not be used for basins greater than 160 acres. The MHFD spreadsheets can also be used for basins that are no greater than 160 acres. Refer to the rainfall chapter of the MHFD USDCM for more information regarding the rainfall parameters required to use the Rational Method.

D. Larger Basin Rainfall Methods (Basins sizes 160 acres and greater)

1. As noted above, the Rational Method should not be used to determine runoff for basins larger than 160 acres. Where areas are larger than 160 acres that have drainage characteristics similar to an urban area, the Colorado Urban Hydrograph Procedure (CUHP) is an acceptable model for determining runoff amounts. The CUHP model can be used for basins from 0 to 3,000 acres. The parameter adjustments provided in the runoff chapter of the MHFD USDCM Manual (Volume 1) should be used when dealing with basins that are larger than 160 acres.

2. The CUHP model is not applicable in non-urban areas, including those areas in Larimer County that are outside of the Denver metropolitan area. The U.S. Army Corps of Engineers (USACE) HEC-HMS model is more applicable for mixed suburban-agricultural areas. The HEC-HMS model can be used on watersheds and drainage basins larger than 160 acres provided the modeling follows the parameters in the HEC- HMS User's Manual, the HEC-HMS Technical Reference Manual, the HEC-HMS Application's Guide.

3. The HEC-HMS model is also recommended for determining the peak flow of large off-site stream flows moving through a proposed development site.
4. The stormwater report should fully describe the rationale for the chosen rainfall method of determining runoff, including the choices for all the various model parameters. The report must contain copies of all applicable tables and reference materials in an appendix, as well as electronic copies of any spreadsheets prepared, and must fully document the assumptions for reviewing purposes.

602.3 Runoff

This section presents the methods used to develop runoff information for hydrological analyses. For more information regarding the development of runoff information, refer to the runoff chapter of the MHFD USDCM Manual (Volume 1).

A. Rational Method

1. The Rational Method can be used for basins that are smaller than 160 acres. The Rational Method is based on the formula:

   Q = CIA

   Where

   Q = the maximum rate of runoff (cfs),

   C = a runoff coefficient that is the ratio between the runoff volume from an area and the average rate of rainfall depth over a given duration for that area,

   I = the average intensity of rainfall in inches per hour for a duration equal to the time of concentration, and

   A = area (acres).

2. Runoff Coefficients:
   a. Table 600-2 lists recommended percentages of imperviousness for various types of land usages. However, if the Engineer of Record can provide data for more specific percentage of imperviousness of proposed development, the data may be considered by the Town. Examples of a project specific imperviousness would be a green roof system or a porous paver system with manufacturers' data for a recommended imperviousness.
   b. Volume-based runoff coefficients have been derived by MHFD using the calculated percentage imperviousness and the hydrologic soil groups A, B, and C/D. The equations published in the MHFD Volume 1, Chapter 6 shall be utilized to compute runoff coefficients for use in rational method calculations.
3. Time of Concentration (tc) is used to determine the average intensity of rainfall.
   a. Time of Concentration is equivalent to the amount of time needed for runoff to travel from the most remote point of the basin to the design point. The time of concentration consists of two components, the initial or overland flow time "ti" (usually as sheet flow) and the time of travel "tt" in a concentrated form (i.e., in a storm sewer, gutter, swale, channel, etc.). The time of concentration is summarized by the following equation:

      tc = ti + tt

      Where,

      tc = time of concentration (minutes)

ti = overland flow time (minutes)

tt = travel time in the ditch, channel, gutter, storm sewer, etc. (minutes)

b. The specific parameters and equations for calculating the overland travel time (ti) and the channelized travel time (tt) are provided in the MHFD USDCM Manual.

c. The minimum time of concentration is as follows:

i. tc (min) = 5 minutes for urbanized watersheds

ii. tc (min) = 10 minutes for non-urban watersheds

4. The average rainfall intensity (I), in inches per hour, for a storm duration equal to the time of concentration for the Town of Berthoud can be found in Figure 600-1 or in Table 600-1. Once the time of concentration has been calculated, the rainfall intensity can be read from the intensity-duration curve and then used in the Rational Method equation.

5. The general procedure for using the Rational Method for basins is as follows:

a. Delineate the catchment basin and measure its area.

b. Define the flow path from the uppermost portion of the basin to the design point. This flow path should be divided into reaches of similar flow types (overland flow, shallow swale flow, gutter flow, etc). The length and slope of each reach should be measured. Flow path parameters shall be used to determine the time of concentration, tc, for each individual basin.

c. Find the rainfall intensity, I, for the design storm using the calculated tc and the Rainfall-Intensity-Duration Frequency Curve (Figure 600-1) included at the end of Chapter 600.

d. Determine the runoff coefficient, C, using the imperviousness values shown in Table 600-2, NRCS hydrologic soil classification (A, B, C or D) and MHFD equations for runoff coefficients based on NRCS soil types and storm return period.

e. Calculate the peak flow rate from the basin using the Rational Formula, Q = CIA

B. Runoff Calculation Methods for Basins 160 Acres and Greater in Size

1. The CUHP model is based on the unit hydrograph principle. It was developed by the MHFD for use in the urban areas around Denver and Boulder. The most current version of the CUHP model can be downloaded from the MHFD website under downloads. The CUHP model is generally used for basins that are larger than 160 acres. The CUHP model is notapplicable in non-urban areas that are outside of the Denver metropolitan area.

2. The USACE HEC-HMS model or other hydrologic models are more applicable for mixed suburban-agricultural areas.

3. The EPA's SWMM 5 model or newest version can be used to route multiple sub-basins and design detention facilities as part of the routed system for all sizes of development. The model shall not be used as a standalone design method for detention pond sizing. More information on the routing methodologies can be found in the runoff chapter of the MHFD USDCM Manual (Volume 1).

C. HEC-HMS Method

1. The USACE HEC-HMS model can be used in areas of Larimer County where the Rational Method and CUHP Method are not applicable. The HEC-HMS model is more applicable for the mixed suburban-agricultural areas typical of much of Larimer County. The HEC-HMS model can be used on watersheds and drainage basins larger than 160 acres. Designers must follow the parameters provided in the HEC-HMS User's Manual, the HEC-HMS Technical Reference Manual, and the HEC-HMS Application's Guide.

D. Differences between the Town of Berthoud and the MHFD

1. The Town of Berthoud will allow the use of other modeling methodologies on a case-by-case basis when complete documentation of all assumptions is provided. The Town of Berthoud reserves the right to review alternative methods and compare with other commonly used approaches, including those discussed in the MHFD USDCM Manual.

Table 600- 2: Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage of Imperviousness
Business:	
Commercial Areas	95
Neighborhood Area	85
Residential Lots: (lot area only)	
Single-Family, 0.25 acres or less	45
Single-Family, 0.25 - 0.75 acres	30
Single Family, 0.75 acres or larger	20
Multi-Family (attached)	60
Multi-Family (detached)	75
Apartments	80
Industrial:	
Light Areas	80
Heavy Areas	90
Parks and Cemeteries	10
Playgrounds	25
Schools	55
Railroad Yard Areas	50
Undeveloped Areas	
Historic Flow Analysis	2
Greenbelts, Agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and Walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

602.4 Roadway and Street Drainage

A. General Criteria

1. When runoff in the street exceeds allowable limits, a storm sewer system or open channel is required to convey the excess flows.

2. Design Criteria Based on Frequency and Magnitude: The design criteria for the collection and conveyance of storm water runoff on public streets are based on an allowable frequency and magnitude of traffic interference. The primary design objective shall be to keep the depth and spread (encroachment) of stormwater on the street below an acceptable value for a given storm event.

3. Street Function in Minor Storm Event: The primary function of streets in a minor storm event is to convey the nuisance flows quickly and efficiently to the next intended drainage conveyance system with minimal disruption to street traffic.
4. Street Function in Major (100-year) Storm Event: For the major storm event, the function of streets is to provide an emergency passageway for flood flows while maintaining public safety and minimizing flood damage. In the major event, the street may become an open channel and must be analyzed to determine when flooding depths exceed acceptable levels.
5. If the roadway is being constructed in a floodplain, all applicable floodplain regulations and codes apply, including the need to submit a LOMR to FEMA for review and acceptance if applicable.
6. For more information regarding the geometry of street and roadway design, refer to Chapter 300 of these Standards and Specifications and LCAUSS standards.

B. Identification of Downstream Constraints

1. Downstream constraints may affect the capacity and release rate of upstream drainage facilities. Any downstream constraints shall be considered in the drainage design and identified in the submitted drainage report.

C. Allowable Street Flow

1. Drainage Classifications: The streets in the Town are assigned a drainage classification of Type A, B, or C based on the average daily traffic (ADT) for which the street is designed or for the roadway classification. In general, the higher the ADT or mobility that the roadway provides, the more restrictive the allowable drainage encroachment into the driving lanes. The following Table 600-3 summarizes the drainage classification for each type of roadway:

Table 600- 3: Drainage Classification for Town of Berthoud Roadways

Street Classification	Drainage Classification
Local	A
Collector	B
Arterial (Major or Minor)	C

Table 600- 4: Minor Storm Allowable Street Flow

Drainage Classification	Allowable Flow Depth in Gutter Flowline	Maximum Street Encroachment
Type A	No curb overtopping.	Flow may spread to crown of street.
Type B	No curb overtopping.	Flow spread must leave at least one 10-foot lane free of water. (5-feet either side of the street crown)
Type C	No curb overtopping.	Flow spread must leave at least two 10-foot lanes free of water. (10-feet each side of the street crown or median)

Table 600- 5: Major (100-year) Storm Allowable Street Flow

Drainage Classification	Allowable Flow Depth in Gutter Flowline	Maximum Street Encroachment
Type A, B and C	The depth of water at the gutter flowline shall not exceed 12 inches 10-year within curb and gutter 6” depth	Flow must be contained within the public right-of-way or dedicated drainage easements, and all structures shall be a minimum of 1 foot above the adjacent 100-year water surface elevation.

A. Curb and Gutter

1. See LCUASS standards for design criteria.

B. Storm Sewer Systems

1. Introduction

   a. Storm sewers shall be designed to convey the minor storm event without surcharging the pipe.

   b. All storm sewer infrastructure in public right-of-way shall be designed for the ultimate cross section or full build-out of the roadway.

   c. The minimum allowable pipe size for all public storm sewer piping in public right-of-way shall be 18 inches in diameter or equivalent open area.

   d. Privately owned, public storm sewer in open spaces, and maintained detention pond outlet pipes which do not discharge to public right-of-way may be no smaller than 12 inches.

2. Vertical Alignment

   a. The storm sewer grade shall be such that a minimum cover is maintained to withstand AASHTO HS- 20 loading on the pipe. The minimum cover depends upon the pipe size, type and class, and soil bedding condition, but shall be not less than 18 inches for Reinforced Concrete Pipe (RCP).

   b. Refer to Chapters 400 and 500 for clearance requirements from other utilities.

   c. Uniform slopes shall be maintained between structures, i.e. manholes and inlets.

3. Horizontal Alignment

   a. The minimum horizontal separation between storm sewers and water mains shall be ten (10) feet, as measured from outside diameter of pipe to outside diameter of pipe.

   b. Refer to Chapters 400 and 500 for more complete clearance requirements.

4. Hydraulic Grade Line (HGL) and Energy Grade Line (EGL) Calculations

   a. The HGL and EGL shall be calculated for each storm sewer system and shall be included in the final stormwater drainage report.

   b. Each storm sewer system shall be profiled on the final construction drawings and shall include the routed design flow (Q) and the associated hydraulic grade line (HGL).

   c. The hydraulic grade line (HGL) for the routed design flow (Q) shall be at or below the final finished elevation of the manhole rims.

5. Inlets
    a. Inlet grates shall have a symbol of a fish with the words ”DUMP NO WASTE, DRAINS TO WATERWAYS”
    b. The design guidelines provided in the streets/inlets/storm sewers chapter of the MHFD USDCM Manual (Volume 1) should be used when designing stormwater inlets. The UD-Inlet Spreadsheet shall be used for the design of streets/inlets/storm sewer unless otherwise approved by the Town Engineer.
    c. An emergency overflow path that does not encroach on residential lots shall be provided for all inlets in sump conditions. All emergency overflow paths shall be designed for a major storm with the assumption that the storm sewer system is plugged. The limits of ponding for the major storm event shall be shown on the storm drainage plans. All emergency overflows shall be armored to protect from scouring.
    d. Design measures should be taken to minimize inlet placement in areas which will be in shadow during winter months by structures, landscaping or fencing along the south side of east-west streets. This effort may require additional inlets along north-south roadways to minimize flows to the south side of an east-west roadway.
    e. The standard CDOT inlets and inlets included in Appendix B are permitted for use in the Town based on street conditions as follows:
        i. Grated, Type C inlets are permitted in all streets with a roadside ditch or swale,
        ii. Grated, Type 13 inlets are permitted in alleys or private drives with valley gutters,
        iii. Combination, Type 13 inlets are permitted in all street types with 6-inch vertical curbs,
        iv. Type R inlets are not permitted unless otherwise approved by the Town Engineer.
    f. Consistent with MHFD recommendations, inlets shall be designed with a 50% clogging factor.
    g. Curb chase drains or sidewalk chases shall not be used in place of an inlet to remove runoff from street sections.
    h. Maximum inlet length shall not exceed 15 feet.
6. Manholes
    a. Manholes are required where there is a change in size, direction, or grade of a storm sewer pipe. A manhole shall also be constructed where there is a junction of two or more storm drainage pipes.
    b. Manholes are required along straight segments of storm sewer pipe in order to provide maintenance access. Maximum spacing between manholes or inlets will be as follows:
        i. 400 feet maximum distance between structures for pipe diameters ranging from 18 inches to 36 inches.
        ii. 500 feet maximum distance between structures for pipe diameters greater than 36 inches.

c. Manhole sizing shall be per Table 600-6:

Table 600- 6: Required Manhole Sizes

Storm Sewer Diameter	Minimum Manhole Diameter
30-inch and smaller	48-inch
33-inch to 36-inch	60-inch
42-inch and larger	As determined by Town

Note: Larger manhole diameters or a junction structure may be required where storm sewer alignments change direction or more than two storm sewer pipes enter the manhole.

d. The elevation of pipe crowns shall be matched when the downstream pipe is larger than upstream pipe.

e. The manhole inverts shall be sloped between the upstream and downstream pipes. The slope shall be the average of the upstream and downstream pipe slopes or based on a fall of 0.2 feet through the manhole.

f. Manhole covers are not allowed in concrete areas such as sidewalks, crosspans, gutters and curbs.

g. A locking ring and cover shall be installed on manholes located below the HGL of the major (100-year) storm event.

h. Manhole cover shall have a symbol of a fish with the words ”DUMP NO WASTE, DRAINS TO WATERWAYS”

7. Pipes

a. The design guidelines provided in the streets/inlets/storm sewers chapter of the MHFD USDCM Manual (Volume 1) should be used when designing stormwater pipes.

b. Allowable Storm Sewer Velocity and Slope

i. Maximum flow velocity shall be limited to 18 feet per second (fps).

ii. Minimum flow velocity shall be 4 fps with the pipe flowing 25% full.

iii. Minimum allowable longitudinal slope shall be 0.50% for pipe sizes of 30 inches and greater and 1.00% for pipes smaller than 30 inches.

c. The minimum allowable size for a sewer within a public right-of-way shall be 18 inches. The minimum allowable size for a sewer within a public drainage easement shall be12 inches in diameter or equivalent open area.

d. The Manning’s roughness coefficient “n” for all storm sewer capacity calculations shall be 0.013 regardless of pipe material (e.g., concrete, PVC, or HDPE) — with the exception of corrugated metal pipes, which shall have a coefficient of 0.025.

C. Roadside Ditches

1. Roadside ditches are not recommended by the Town and will require a variance.

602.5 Major Drainage

This section presents guidelines for the design of major drainage systems. For more information regarding the design of major drainage systems, refer to the major drainage chapter of the MHFD USDCM Manual (Volume 1).

A. Design Flows and Design Criteria

1. The major drainage system must be able to convey the fully developed flow from a watershed for the 100-year storm event without significant damage to the system.
2. The Table 600-7 below summarizes the general design guidelines and for major drainage channels. More information and design examples are provided in the major drainage chapter of the MHFD USDCM Manual (Volume1).

Table 600- 7: Summary of Channel Lining and Design Criteria

	Criteria for Various Types of Channel Lining			
	Grass: Erosive Soils	**Grass: Erosion Resistant Soils**	**Riprap**	**Concrete**
Maximum 100-yr velocity	5.0 ft/sec	5.0 ft/sec	16.0 ft/sec	18.0 ft/sec
Minimum Manning's n – stability check	0.020	0.020	0.03	0.011
Maximum Manning's n- capacity check	0.035	0.035	0.04	0.013
Maximum Froude number	0.5	0.8	0.8	N/A
Maximum depth outside low- flow zone	5.0 ft	5.0 ft	N/A	N/A
Maximum channel longitudinal slope	0.6%	0.6%	1.0%	N/A
Maximum side slope[6]	4H:1V	4H:1V	2.5H:1V	1.5H:1V[1]
Minimum centerline radius for a bend	2 x top width	2 x top width	2 x top width	2 x top width
Minimum freeboard[2]	1.0 ft [3,5]	1.0 ft [3,5]	2.0 ft [3]	2.0 ft [4]

This table was obtained from Weld County Engineering and Construction Criteria, Table 5-9.

1 Side slopes may be steeper if designed as a structurally reinforced wall to withstand soil and groundwater forces.
2 Add superelevation to the normal water surface to set freeboard at bends.
3 Suggested freeboard is 2.0 feet to the lowest adjacent habitable structure's lowest floor.
4 For super critical channels, use the freeboard recommended in the major drainage chapter of the MHFD USDCM Manual (Volume 1), Section 4.3.1.5.
5 Grass-lined open channels conveying less than 50 cfs may reduce the minimum 1.0 foot freeboard requirement to the freeboard required to convey 1.33 times the 100-year design flow. The reduced freeboard may only occur if a 1.0-ft minimum freeboard is not physically possible and a variance request is submitted.
6 Maximum side slopes may be as steep as 3H:1V; however, the design engineer should address how the channels will be maintained since it may not be safe to mow on slopes that are greater than 4H:1V.

B. HEC-RAS

1. It is acceptable to use HEC-RAS to determine the hydraulics of the major drainage system. HEC-RAS is useful in sizing the major drainage system to carry the design storm. Standard modeling practices accepted by FEMA should be used when performing HEC-RAS modeling.

C. It is not acceptable to rely on HEC-RAS output to estimate maximum velocities for erosive or hazard considerations or local scour in a channel. A more detailed hydraulic analysis of the specific cross section, accounting for variable velocities across the channel, is required.

D. FEMA Floodplain Considerations

1. Construction of major drainage systems within FEMA floodplains must not increase the 100-year water surface elevation.
2. Per FEMA regulations, a Flood Hazard Development Permit will be required for the construction of channels and other major drainage system components within the FEMA mapped 100- year floodplain. It may be necessary to submit to FEMA a Conditional Letter of Map Revision (CLOMR) followed by an LOMR as part of the development process.
3. All design and engineering of the major drainage system components must follow accepted FEMA methodology.
4. For more reference information and criteria, refer to the FEMA Floodplain Requirements section at the end of this chapter.

E. Erosion Protection Design Criteria

1. Protecting major drainage channels from erosion is critical for maintaining channel stability. Channels need to be designed so that they remain stable until they are fully constructed or vegetated. It may be necessary to install riprap, straw bales, erosion control logs, or erosion control blankets in the channels to ensure that they remain stable. The best management practices (BMPs) outlined in the MHFD USDCM Manual (Volume 3) should be used to ensure stability.
2. The grading and erosion control plan that is submitted with the stormwater reports and construction drawings shall include the placement of BMPs, typical installation details, and typical installation/maintenance notes for each type of BMP to be used on the site.

602.6 Minor Drainage

This section provides guidelines for the design of minor drainage systems.

A. Design Flows and Design Criteria

New minor drainage channels and/or storm sewer systems shall be designed at a minimum to convey the storm frequencies listed in Table 600-8, below.

Table 600- 8: Minimum Design Storm Frequency by Land Use

Land Use	Design Storm Frequency
Residential	2-year
Open Space	2-year
Commercial	10-year
Public Buildings	10-year
Industrial	10-year

B. Erosion Protection Design Criteria

1. Protecting minor drainage channels from erosion is critical for maintaining channel stability. Channels need to be designed so that they remain stable until they are fully constructed or vegetated. It may be necessary to install riprap, straw bales, erosion control logs, or erosion control blankets in the channels to ensure that they remain stable. The BMPs outlined in the MHFD USDCM (Volume 3) should be used to ensure stability.

2. The grading and erosion control plan that is submitted with the stormwater report/s and construction drawings shall include the placement of BMPs, typical installation details, and typical installation/maintenance notes for each type of BMP to be used on the site.

602.7 Hydraulic Structures

This section presents the guidelines for the design of hydraulic structures such as bridges, rundowns, emergency spillways, etc. For more information regarding design, refer to the hydraulic structures chapter of the MHFD USDCM (Volume 2).

A. Design Flows and Design Criteria

1. Hydraulic structures shall be designed for the 100-year storm event and other minor design discharges as applicable.

2. The design criteria for check and drop structures, conduit outlet structures, bridges, transitions and constrictions, bends and confluences, and rundowns should follow the design criteria and recommendations outlined in the hydraulic structures chapter of the MHFD USDCM (Volume 2).

3. Bridges shall be designed so that the low chord elevation of the bridge is a minimum of one (1) foot above the 100-year water course energy grade line (EGL).

4. The Town will allow the use of other modeling methodologies on a case-by-case basis when complete documentation of all assumptions is provided. The Town reserves the right to review alternative methods and compare with other commonly used approaches, including those discussed in the MHFD USDCM.

5. Seepage and Breech Analysis

a. Seepage analysis should be considered and shall be performed on all hydraulic structures (i.e. irrigation ditches, ponds, etc.) for both existing and proposed conditions which may impact the development. Linings, cut-off walls and/or underdrains may be required if seepage potential exists.

b. Breech analysis should be considered and shall be performed for all hydraulic structures

B. Culvert or Storm Sewer Outlet Structures

1. Riprap or other approved method to slow exit velocities and provide erosion protection shall be provided at all outfalls from culverts and storm sewer outfalls. The outfall protection shall be designed to minimize or eliminate standing water.

C. HEC-RAS

1. HEC-RAS is useful in sizing hydraulic structures and it is acceptable to use it to determine hydraulic characteristics of the hydraulic structure. Standard modeling practices accepted by FEMA should be used when performing HEC-RAS modeling.

2. It is not acceptable to rely on HEC-RAS output for estimating maximum velocities for erosive or hazard considerations or local scour in a channel. A more detailed hydraulic analysis of the specific cross section, accounting for variable velocities across the channel, is necessary.

D. FEMA Floodplain Considerations

1. Construction of hydraulic structures within FEMA floodplains must not increase the 100-year water surface elevation. Per FEMA regulations, a Flood Hazard Development Permit will be required for the construction of channels and other major drainage system components within the FEMA mapped 100- year floodplain. It may be necessary to submit to FEMA a Conditional Letter of Map Revision (CLOMR) followed by an LOMR as part of

the development process. All design engineering of the hydraulic structures must follow accepted FEMA methodology.

2. For more reference information and criteria, refer to the FEMA Floodplain Requirements section at the end of this chapter.

E. Erosion Protection Design Criteria

Protecting hydraulic structures and adjacent channel from erosion is critical for maintaining channel stability. Hydraulic structures need to be designed so that the adjacent channel remains stable until it is fully constructed or vegetated. It may be necessary to install riprap, straw bales, erosion control logs, or erosion control blankets in the channels and around the hydraulic structures to ensure that they remain stable. The BMPs outlined in the MHFD USDCM (Volume 3) should be used to ensure stability.

602.8 Culverts

A. Sizing

1. The minimum culvert capacity is the capacity required to convey the 10-year storm. However, the minimum culvert diameter allowed in public right-of-way is 15 inches.
2. The Manning's roughness coefficient "n" for all culvert capacity calculations shall be 0.025 for corrugated type pipes and 0.013 for smooth wall pipe types.
3. The minimum slope and velocity requirements for culverts are the same as for storm sewer pipes under the Roadway and Street Drainage section of this chapter and these Standards and Specifications. Minimum slope shall be per storm sewer piping requirements or a minimum slope of 2%, whichever is greater.
4. The Town may require additional culvert capacity in order to prevent flooding of adjacent properties.
5. Any flooding of adjacent roadways will be limited to criteria in Tables 600-4 and 600-5 to gutter flowline or edge of pavement.
6. The maximum culvert headwater-to-diameter ratio is 1.0 for the 10-year design storm and 1.5 for the 100-year design storm.
7. Culverts should be installed to the minimum slope required to prevent sediment deposition within the pipe. The slope should be checked for each design, and if the proper minimum velocity is not obtained, other design options should be evaluated.
8. The designer is encouraged to use the spreadsheets and programs provided by the MHFD to assist in culvert design. Other software programs may be used, but the designs shall be verified using the MHFD programs and spreadsheets. The most current version of the MHFD spreadsheets can be downloaded from the MHFD website.
9. The Town will allow the use of other modeling methodologies on a case-by-case basis when complete documentation of all assumptions is provided. The Town reserves the right to review alternative methods and compare with other commonly used approaches, including those discussed in the MHFD USDCM.
10. Culverts need to be sized to reduce the potential for backwater effects on adjacent houses, buildings or businesses. Culverts passing under Town of Berthoud roads shall be designed for the 10-year storm and have a minimum diameter of 18 inches.

B. Materials

1. The Town allows the installation and use of commonly available culvert types such as reinforced concrete pipe (RCP). The Town will allow the use of other culvert types on a

case-by-case basis when complete documentation of all culvert specifications is provided and approval by the Town Engineer.

2. Culverts that are to be installed in a public right-of-way that is routinely burned must be made of either concrete or metal. Plastic pipes will not be allowed in public right-of-way that is subject to weed burning.

C. Cover

1. All culverts shall be installed with a minimum of eighteen (18) inches of cover. If minimum cover is not possible, the culvert material and bedding shall be rated for a minimum of HS-20 loading or the largest expected traffic loads crossing it (i.e. oil rigs, semis, etc).

D. End Sections and Trash Racks

1. Culverts installed in public right-of-way shall be equipped with a flared end section or headwall on the culvert entrance and outlet. Erosion protection such as riprap may be required. If riprap is required, it shall be installed on top of a geotextile and properly designed filter bed. Riprap designs should use the design methodologies outlined in the hydraulic structures chapter of the MHFD USDCM (Volume 2).

2. The Town does not recommend trash racks on culverts. However, the requested use of trash racks will be considered on a case by case basis.

3. The Town does not recommend the use of collapsible gratings.

E. Maintenance Responsibility

1. Culverts in the Town-maintained road rights-of-way are generally maintained by the Town on an as-needed basis to ensure that the roadside barrow ditches function properly.

2. Culverts located outside of public-maintained road rights-of-way are not maintained by the Town. Culverts on private land shall be maintained by their Owners. Culverts that are part of a subdivision drainage plan shall be maintained by the respective homeowner's association. Culverts that are outside of public right-of-way or public drainage easements shall be maintained and cleaned out annually or on an as-needed basis to ensure proper drainage of the subdivision.

F. Erosion Protection Design Criteria

1. Erosion protection for culverts is to be designed to ensure that the adjacent drainage channel remains stable until such time as it is vegetated or fully constructed. It may be necessary to install straw bales, riprap, erosion control logs, erosion control blankets, etc. in the channels impacted by the culverts to ensure that erosion does not occur at or near the culvert. The BMPs outlined in the MHFD USDCM (Volume 3) should be used.

602.9 Stormwater Lift Stations

A. Storm lift stations are allowed at the discretion of the Town

1. A lift station cannot be used in lieu of storage capacity for a detention facility.

2. Any lift station will be owned and maintained by the HOA or Metropolitan District and not the Town.

602.10 Detention Basins and Detention Storage

A. General Information and Criteria

1. This section summarized evaluation methods and design criteria for flood control detention facilities, referencing the Storage chapter of the MHFD USDCM for much of the

background information. Criteria presented in the MHFD USDCM shall govern except as modified or added herein.

2. Detention facilities are used both for attenuating peak flows during large flood events and for providing extended detention and sedimentation during small, frequent events to enhance stormwater quality. Extended detention facilities used for water quality management may be incorporated into flood control detention basins or kept separate when combined with other Best Management Practices (BMPs) for stormwater quality.
3. Detention storage shall be provided for new development, redevelopment or expansion as follows:
    a. <½ acre: None required – Source Control, Runoff Reduction and Conveyance based BMPs are encouraged
    b. ½ acre: 1-acre – Source Control, Runoff Reduction and Conveyance based BMPs required
    c. >1 acre: Storage based BMPs providing WQCV or EURV in accordance with Standard Specifications
4. Parking lot and underground detention are not allowed in residential subdivisions. Underground detention will only be allowed on a case by case basis.
5. Rooftop detention is not allowed.
6. Detention basins shall be located outside of FEMA mapped 100-year floodplain.
7. For more information regarding design, refer to the storage chapter of the MHFD USDCM (Volume 2).
8. Storage volume and release rate criteria are based on three design events, as follows:
    a. Water quality capture volume (WQCV). This is defined in Volume 3 of the MHFD USDCM.
    b. Excess Urban Runoff Volume (EURV). This is the difference between the developed and pre-developed runoff volume, a relatively constant value for a given developed imperviousness over a wide range of storm events. Use the MHFD UD-Detention spreadsheet for calculating design volume. WQCV is included in the EURV volume.
    c. The major storm event or 100-year storm event.
9. The designer is encouraged to use the spreadsheets and programs provided by the MHFD to assist in culvert design. Other software programs may be used, but the designs shall be verified using the MHFD programs and spreadsheets. The most current version of the MHFD spreadsheets can be downloaded from the MHFD website.

B. Detention Basin Design Criteria

1. Sizing Methodology. Three different procedures for sizing full-spectrum detention volumes are described in the Storage chapter of the MHFD USDCM. A set of simplified equations or a design spreadsheet may be used for drainage areas up to 130 acres and a hydrograph approach is outlined for watershed areas up to one square mile. The maximum drain time for the Excess Urban Runoff Volume shall be 72 hours, as specified in the MHFD USDCM.
    a. The designer is encouraged to use the spreadsheets and programs provided by the MHFD to assist in detention basin and storage design. Other software programs may be used, but the designs shall be verified using the MHFD programs and spreadsheets. The most current version of the MHFD spreadsheets can be downloaded from the MHFD website.

2. The Water Quality Capture Volume (WQCV) and the incremental portions of the Excess Urban Runoff Volume (EURV), and the 100-year volume of a full-spectrum detention basin are normally combined into one facility with one outlet structure. However, the required volumes may be designed into separate facilities draining from a combined WQCV and EURV detention basin to the 100-year storm event detention.
3. Onsite Detention and Addressing Offsite Flows: Two approaches are generally acceptable for addressing offsite flows that must be conveyed through a site, and the potential impacts to the onsite detention.
    a. Design for Offsite Flows: An alternative method is to design the detention basin for the entire upstream watershed area, including the future development flows from offsite areas without giving any credit to offsite detention facilities. This method may be practical if the offsite tributary area is relatively small.

C. Multiple Small Detention Basins

1. Extended detention basins providing Water Quality Capture Volume, Excess Urban Runoff Volume, and 100-year detention typically function best if configured in one or a few large basins as opposed to multiple small basins with very small orifices. Therefore, the minimum number of detention installations is generally preferable. The same is not necessarily true for porous landscape and porous pavement detention, which may be configured in multiple small installations.

D. Detention Basins in Series

1. Locating two or more detention basins in series on an individual development site is generally discouraged, especially for the WQCV and the EURV portion of a full-spectrum detention facility.
2. If site runoff is detained by two or more detention facilities in sequence before leaving the site, hydrograph approaches, as described in the Storage Chapter in Volume 2 of the MHFD USDCM, shall be used to determine the effect of sequential detention and to determine the detention capacity that is needed to reduce runoff peaks to the specified predevelopment flow rates at the end of the system.

E. Interconnected Detention Basins

1. When sequential ponds are located in close proximity, separated by a short culvert or pipe at a roadway crossing, or when sequential ponds have similar invert elevations, the ponds may have to be modeled as “interconnected ponds”.
2. This situation could also occur if other downstream conditions cause variable backwater effects that influence the discharge of the detention pond outlet pipe. In these scenarios, the water surface elevation in the downstream pond can reduce the discharge rate from the upper pond and in some cases reverse flow can occur from the downstream pond into the upstream pond.
3. It is the responsibility of the Engineer of Record to ensure that the appropriate analyses are performed and submitted when ponds are “interconnected”.

F. Outlets into Streets

1. Detention ponds that have an outlet pipe terminating in the gutter of a street, such as through a chase section, present potential ponding and icing problems in the gutter, and create hazards to the traveling public during periods in which the pond is emptying rapidly. Therefore, detention ponds shall be designed to outlet into a storm sewer, drainageway, or other designated drainage system that is reasonably available, as determined by the

Town. It must be shown that the storm sewer, drainageway, or other designated drainage system to which the pond outlets, has the capacity to convey the detention pond flows.

2. The Town may allow an outlet to discharge into the gutter in cases where the minor storm (5-year) peak flow for the tributary area is less than 3.5-cubic feet per second and a storm sewer or other drainage system is not reasonably available. It must be demonstrated that the street has adequate capacity to convey the excess runoff within the allowable limits. A transition from the outlet pipe to a curb chase will normally be required, and the chase section shall be designed to reduce the velocity and spread of flow as much as possible. The location of the outlet shall be designed to minimize potential problems or conflicts with other improvements and shall be angled toward the downstream slope of the gutter to direct flows downstream instead of perpendicularly into the street.

G. Excavated and Embankment Slopes

1. All excavated or embankment slopes from the pond bottom to the 100-year water surface elevation shall be no steeper than 4 (horizontal) to 1(vertical). Excavated slopes above the 100-year water surface elevation and the slope on the downstream side of embankments shall be 3 to 1 or flatter. Embankments shall be provided with a top width of at least 10 feet. An emergency overflow spillway shall be provided as described later inthis chapter.

2. Any detention pond embankment located adjacent to a sidewalk or trail shall have side slopes of 4 to 1 or flatter.

3. It is the responsibility of the Engineer of Record to ensure that the design of any earthen embankment is based on specific recommendations of a geotechnical engineer and that the design requirements are clearly identified within the construction plans. In addition, the construction of large embankments or dams may fall under the jurisdiction of the Office of the State Engineer and will be subject to State review and approval.

4. All earthen slopes shall be covered with topsoil and revegetated for erosion protection. Adequate provisions for the establishment and maintenance of the vegetation, such as temporary or permanent irrigation should be provided.

H. Freeboard Requirements.

1. The minimum required freeboard for detention facilities is one (1) foot above the computed water surface elevation when the emergency spillway is conveying the maximum design flow. The crest of the emergency spillway may be set at or above the 100-year storm water surface elevation.

I. Low Flow Channels

1. All grassed-bottom detention basins shall include a low flow channel sized to convey a minimum of 1% of the 100-year peak inflow and be a minimum of 6-inches in depth and a minimum of 18-inches wide. The low flow channel shall be constructed of 12-inches of mitigated soil topped with 6-inch of cobbles.

2. If accepted by the Town, an unlined low flow channel may be used. The unlined low flow channel shall be at least 1.5-feet deep below adjacent grassed benches and shall be vegetated with herbaceous wetland vegetation or riparian grasses, appropriate for the anticipated moisture conditions. The minimum longitudinal slope shall be 0.5-percent and the minimum width of the grassed bench adjacent to the low flow channel shall be 12-feet on one or both sides where equipment can access. The maximum side slope below the bench shall be 4 to 1 and the maximum bottom width of the channel shall be 12-feet if

equipment can access one side of the channel and 24-feet if equipment can access both sides.

3. The minimum longitudinal slope shall be 0.5-percent to ensure that non-erosive velocities are maintained adjacent to the low-flow channel when the design capacity is exceeded

J. Bottom Slope

1. For grassed detention facilities, the pond bottom shall be at least 2% to drain toward the low flow channel or outlet, measured perpendicular to the low flow channel.

K. Forebays and Micropools

1. Forebays and micropools are not required to be installed with a detention facility. If included they shall be designed following MHFD criteria manual and design standards

L. Inlet Facilities

1. Unless otherwise accepted by the Town, runoff shall enter a detention facility via a stabilized drainageway, a 100-year drop structure, or a storm sewer with energy dissipater. Riprap rundowns or equivalent erosion control options into the detention pond are required.

M. Outlet Configuration and Safety/Debris Grates

1. Detention basin outlets shall be functional for controlling the design release rates, provided with oversized safety/debris grates to reduce the potential for debris plugging, easy to maintain, and designed with favorable aesthetics.
2. The minimum net open area of the trash rack protecting the EURV orifices and the flood control orifice shall comply with Typical Structural Best Management Practice Details in Volume 3 of the MHFD USDCM. The safety grate criteria discussed in the Culverts section of the Volume 1 of the MHFD USDCM, shall also apply.
3. Water Quality/EURV Outlet Control Orifices
    a. If the outlet control orifices are 2.5 inches or greater in diameter or 2-inches square, standard fabricated bar grating (with nominal openings of 1 inch by 4 inches) may be used as a debris grate instead of well-screen. The larger grate may reduce the potential for clogging with debris.
    b. If approved by the Town, the vertical spacing between outlet control orifices may be increased to 8-inches or 12-inches and the orifice areas increased by a factor of two (for 8-inch spacing) or three (for 12-inch spacing) to enable larger orifices and larger trash rack openings.
4. Water Quality/EURV Outlet Bar Grating
    a. Bar grating may be used on parallel sloping wingwalls, either as the primary debris grate (if orifices are at least 2.5 inches in diameter) or as a course screen and safety grate in lieu of handrail. Sloping bar grating shall have a lockable hinged section at least 2-feet square to allow access to the orifice plate or wellscreen.
    b. The bearing bars for steel bar grating shall be designed to withstand hydrostatic loading up to the spillway crest (assuming the grate is clogged and bears the full hydrostatic head), but generally not designed for larger loads (like vehicular loads) so that the hinged panels are not excessively heavy.
    c. Panels of bar grating shall be no more than 3-feet wide and all parts of the grating and support frames shall be hot-dipped galvanized.
    d. Bar grating shall be fastened down to the water quality outlet structure.

5. The flood-flow orifice shall be sized to provide the allowable 100-year release rate when the 100-year detention volume is completely full.

N. Emergency Spillway and Embankment Protection

1. Detention basin embankments shall be protected from catastrophic failure due to overtopping. Erosion protection for the embankment may be provided in the form of a buried riprap layer on the entire downstream face of the embankment or a separate emergency spillway constructed of buried riprap or concrete. In either case, the emergency protection shall be constructed to convey the 100-year developed flow from the upstream watershed without accounting for any flow reduction within the detention basin.

2. The invert of the emergency spillway shall be set at or above the 100-year water surface elevation. A concrete wall or vertical curb shall be constructed at the emergency spillway crest extending at least to the bottom of the riprap and bedding layers located immediately downstream. The crest wall shall be extended at the sides up to one foot above the emergency spillway design water surface.

3. Riprap embankment protection shall be sized based on methodologies developed specifically for overtopping embankments. Two such methods have been documented by Colorado State University (USNRC, 1988) and by the US Department of Agriculture (ASAE, 1998) and designers are referred to these publications for a complete description of sizing methodology and application information. The thickness and bedding requirements shall be based on the criteria identified in the MHFD USDCM.

4. The emergency spillway is also needed to control the release point and direction of the overflow. The emergency spillway and the path of the emergency overflow downstream of the spillway and embankment shall be clearly depicted on the drainage plan. Structures shall not be permitted in the path of the emergency spillway or overflow. The emergency overflow water surface shall be shown on the detention facility construction drawings.

O. Retaining Walls

1. The use of retaining walls within detention basins is generally discouraged. If retaining walls are required, footings shall be located above the EURV water surface elevation. Wall heights shall not exceed 30 inches, and walls shall not be used on more than 50-percent of the pond circumference.

2. If retaining walls are terraced, a separation of at least 5-feet shall be provided between walls. Additional width may be required to address the wall design, anchoring system and maintenance requirements. The engineering analysis shall include a discussion and the necessary calculations to determine the appropriate “bench” width. The maximum ground slope between adjacent walls shall be 4-percent.

3. All detention pond retaining walls shall require a Building Permit (unless waived by the Building Department) and shall be provided with handrails or guardrails designed to meet safety criteria as well as International Building Code (IBC) requirements.

4. Retaining walls are not to be used where live loading or additional surcharge from maintenance equipment of vehicle traffic could occur unless the wall is designed to accommodate the live loading condition.

5. Foundation walls of buildings shall not be used as detention basin retaining walls. The distance between the top of any retaining wall in a detention area and any adjacent sidewalk, roadway curb or structured feature is to be a minimum of three times the height of the wall. The horizontal distance to any maintenance access drive not used as a sidewalk or roadway shall be at least four feet.

6. Any future outfalls to the pond shall be designed and constructed with the detention basin. This reduces the likelihood of disturbing the retaining walls when constructing the “future” outfall.
7. Perimeter fencing to limit access, safety railing, or guardrail may be required depending upon the location of the wall relative to roadways, parking areas and pedestrian use areas.
8. A Professional Engineer licensed in the State of Colorado shall perform a structural analysis and design the retaining wall for the various loading conditions the wall may encounter, including the hydrostatic pressure differential between the front and the back of the wall and live loading conditions, if applicable. A drain system should be considered behind the wall to ensure that hydrostatic pressures are equalized as the water level changes in the pond.
9. The wall design and calculations shall be stamped by the Engineer of Record and submitted to the Town’s Building Division for review. The designdetails and requirements for the retaining wall(s) shall be included in the construction drawings.
10. Retaining walls shall not be used within the limits of any impermeable lining of water quality basins or detention basins.

P. Landscaping Guidelines

1. Refer to Town of Berthoud Development Code for allowable landscaping within and around the Detention Pond.

Q. Easement Requirements

1. Drainage easements shall be granted to the Town for inspection and maintenance purposes, and shall be shown on the Drainage Plan, Final Plat and Final Development Plan.
2. Drainage easements shall be kept clear of obstructions to the flow and shall allow maintenance access.
3. The minimum requirements for detention basin easements are as required to contain storage and WQCV including freeboard, associated facilities, and adequate maintenance access around the perimeter based on any access road width. Access to the basin shall be provided in an easement.

R. Maintenance

1. The property owner, or other party as otherwise designated by legal agreement, is responsible for the maintenance of detention facilities.
2. Routine maintenance of detention basins shall include sediment and debris removal. Non-routine maintenance may include the repair and/or replacement of outlet structures, trickle channel, outlet pipes, channel slopes, and other related facilities. When appropriate maintenance is not provided, the Town shall provide the necessary maintenance and assess the associated cost to the property owner.

S. Design Standards for Parking Lot Detention

1. Easement Requirements
    a. Easements shall include the area of the parking lot that is inundated by the 100-year water surface elevation, and the outlet structure and conveyance facilities.

2. Maintenance Requirements

   a. Maintenance of parking lot detention basins and facilities shall be provided in accordance with the Maintenance paragraphs above. The property owner shall be required to ensure that the release structures are maintained.

3. Depth Limitation

   a. The maximum allowable design depth above pavement surfaces for the EURV is 3-inches and for the 100-year flood is 9-inches. However, to account for future overlays or parking lot resurfacing, the design volumes shall be attained even with an assumed 2-inch overlay (translating to an allowable depth of 1-inch for the EURV and 7-inches for the 100-year event).

   b. The WQCV shall be located entirely out of (below) the pavement area, possibly in one or more landscaped parking islands or adjacent landscaping. An emergency spillway sized for the 100-year inflow peak shall be provided with a crest set at the 100-year water surface elevation and a maximum flow depth over the emergency spillway of 6-inches. A minimum of 1 -foot of freeboard is required above the 100-year emergency water surface to the first-floor elevation of any adjacent structures (equivalent to 18-inches over the 100-year water surface).

4. Outlet Configuration

   The outlet configuration shall be designed in accordance with criteria shown in Volume 3 of the MHFD USDCM. Outlets for the EURV and 100-year events shall limit peak flows to the maximum design release rates.

T. Erosion Protection Design Criteria

Erosion protection for storage facilities needs to be designed to ensure that the sediment does not leave the site or impact downstream properties. It may be necessary to install straw bales, riprap, erosion control logs, erosion control blankets, etc. on the storage facility side slopes to ensure that erosion does not occur until the reseeded vegetation is established. The BMPs outlined in the MHFD USDCM (Volume 3) should be used.

U. State Water Rights Reporting

1. Compliance with Colorado Revised Statute (CRS) §37-92-602 (8) Water Rights reporting for Stormwater Detention and Infiltration Facilities is the responsibility of the Design Engineer. The compliance portal can be found at:

   https://maperture.digitaldataservices.com/gvh/?viewer=cswdif.

602.11 Revegetation

A. Site Preparation (see also Chapter 800 and Berthoud Municipal Code Chapter 30 Article 2-112 – Landscape Design and Article 2-113 – Tree Species)

1. In addition to the site preparation guidelines outlined in the revegetation chapter of the MHFD USDCM (Volume 2), an inventory of existing vegetation should be taken before any revegetation work is started. If noxious weeds exist on-site, the appropriate steps need to be taken before, during, and after work is completed to control their spread.

2. If soil amendments are needed, recommendations outlined in the revegetation chapter of the MHFD USDCM (Volume 2) should be followed.

B. Seeding and Planting

1. In addition to the site preparation guidelines outlined in the revegetation chapter of the MHFD USDCM (Volume 2), seed mixtures should be coated with Mycorrhiza at the rate of

2 pounds per acre at the time of seeding. If mulching with straw, the straw must be free of seeds and weeds.

602.12 Stormwater Quality

A. General

1. Post construction water quality best management practices (Permanent BMPs) are required with all new development or redevelopment within the Town. The Town also recommends stormwater quality and peak flow reduction practices associated with minimizing directly connected impervious area (MDCIA).
2. Best management practices that provide water quality capture volume (WQCV) will be required for the excess runoff that remains after the volume reduction practices are accounted for.
3. Common WQCV BMPs are porous pavement detention, porous landscape detention, extended detention basins, sand filter extended detention basins, and constructed wetland basins.
4. Issues associated with the long-term maintenance of permanent BMPs must be considered when selecting appropriate BMPs for a site. Implementation of water quality BMPs must be addressed hand in hand with the stormwater conveyance and detention storage facilities. Consult MHFD Volume 3 and the criteria in this manual for detailed design requirements, considerations, limitations, and information regarding proper implementation.

B. Sediment and Erosion Control Plans

1. Construction sites must have a sediment and erosion control plan showing the location and type of all BMPs deployed at the project. A copy of the plan must be kept on-site, along with a copy of the Storm Water Management Plan (SWMP). Changes to the sediment and erosion control plan and BMPs are allowed as construction and site stabilization progress; notes on the drawing set should show revisions and the dates of each revision.

602.13 Best Management Practices

A. The Town of Berthoud uses the BMPs that are outlined in the best management practices chapter of the MHFD USDCM (Volume 3). The AutoCAD files for the BMPs can be downloaded from the MHFD website.

B. The Engineer of Record is encouraged to use the spreadsheets and programs provided by the MHFD to assist in designing the BMPs. Other software programs may be used, but the designs shall be verified using the MHFD programs and spreadsheets. The most current version of the MHFD spreadsheets can be downloaded from the MHFD website.

C. BMP technology is constantly changing. The Town will evaluate the use of newly developed BMPs on a case-by-case basis when complete documentation of all assumptions is provided. The Town reserves the right to review alternative methods and compare with other commonly used approaches, including those discussed in the MHFD USDCM.

602.14 FEMA Floodplain Requirements

A. General Information

1. For more information regarding floodplain regulations, refer to the 2011 Colorado Water Conservation Board (CWCB) Rules and Regulations for Regulatory Floodplains in Colorado; and 44CFR 59, 60, and 65 of the FEMA NFIP regulations.
2. For more information regarding floodplain modeling and mapping requirements, refer to FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners.

B. FEMA Floodplains

C. Refer to the Flood Insurance Rate Maps (FIRMs) and Flood Boundary and Floodway Maps that are published by FEMA to determine if a proposed project is located within a mapped floodplain. The floodplain maps can be obtained from FEMA. The Town Engineer or Town Floodplain Manager should be contacted to determine if there have been any letters of map change that have been approved by FEMA for the proposed project area.

D. Floodplain Requirements

1. All development as defined by FEMA requires a Flood Hazard Development Permit from The Town. A copy of the application can be requested from the Town Engineer or Town Floodplain Manager.

2. The regulations and definitions for floodplain development can be found in Part 44CFR 59, 60, and 65 of the Code of Federal Regulations; and the 2011 CWCB Rules and Regulations for Regulatory Floodplains in Colorado.

3. Hydraulic modeling is required for the majority of Flood Hazard Development Permit applications. The modeling must conform to the standards outlined in FEMA's guidelines and specifications and must show compliance with the various floodplain regulations. In areas where there is a FEMA-approved model, the hydraulic model must contain the current effective model, a duplicate effective model, a corrected effective model, and the proposed conditions model. In areas where there is not a FEMA-approved model, the hydraulic model must contain the existing condition model and proposed condition model. A 0.5-foot floodway model is required for all sites where a FEMA-approved floodway has not been established. All hydraulic modeling must be certified by a registered professional engineer licensed in the State of Colorado.

4. All hydraulic models that are related to a LOMR or Physical Map Revision (PMR) must tie to a logical hydraulic control at the downstream and upstream ends of the model. It is not sufficient to start and stop the hydraulic modeling at the project boundaries.

5. A narrative outlining the modeling parameters used must be included with the Flood Hazard Development Permit application. The narrative must include a comparison of the current effective, duplicate effective, corrected effective, and proposed condition water surface elevations and floodplain top widths. The narrative must address how the warnings, errors, and notes statements generated by the hydraulic model were handled. The narrative must be stamped, signed, and dated by a registered professional engineer licensed in the State of Colorado.

6. A work map or Flood Hazard Development Permit map must be submitted with the hydraulic modeling. In addition to the information outlined in the Flood Hazard Development Permit application, the map must include the FEMA floodplain boundaries, the floodplain boundaries generated by the hydraulic modeling, cross section lines, and any proposed structures. The map must be provided at a common map scale on an 11" x 17" or 24" x 36" sheet. The floodplain top width shown on the map will be compared to the hydraulic model floodplain top width. If the difference between the two is greater than 5% of the FIRM scale, comments to review and revise the submittal will be made. The map must be stamped, signed, and dated by a registered professional engineer licensed in the State of Colorado.

7. If structures are proposed in the Flood Hazard Development Permit, elevation certificates for the proposed, under construction, and as-built conditions will be required. Theproposed condition elevation certificate can be stamped, signed, and dated by a registered professional engineer licensed in the State of Colorado. The under-construction and as-

built condition elevation certificates must be stamped, signed, and dated by a registered professional land surveyor licensed in the State of Colorado. Photos of the structure must be included with the under-construction and as-built elevation certificates.

8. Residential structure finished floor elevations must be a minimum of 1 foot above the base flood elevation. Commercial structure finished floor elevations must be a minimum of 1 foot above the base flood elevation or dry floodproofed. Critical facilities as defined by the CWCB must be elevated or dry floodproofed a minimum of 2 feet above the base flood elevation.
9. Structures that can float—such as fuel tanks, tank batteries, storage sheds, and the like—must be anchored. The anchoring design must be certified by a registered professional engineer licensed in the State of Colorado. Photos of the anchored structure will be required.
10. Non-habitable structures such as barns and large storage sheds can be flood vented using the FEMA requirements. If engineered flood vents are used, a registered professional engineer licensed in the State of Colorado must certify them. Photos of the flood vents will be required.

603 CONSTRUCTION SPECIFICATIONS

603.1 General

A. All Storm Sewer Construction shall be completed in accordance with the Construction Specifications included in Appendix A.

604 STORM DETAILS

A. The following is a list of standard details for storm sewer work that are part of the Town of Berthoud Standards and Specifications:

D6.01 Storm Cleanout
D6.02 Storm Sewer Bedding Detail
D6.03 CMP Type 1 Flared End Section
D6.04 Rip Rap Apron Sizing and Placement at Flared End Section
D6.05 Type C Inlet
D6.06A Combination Inlet (1 Of 2)
D6.06B Combination Inlet (2 Of 2)
D6.07B Direct Connection RCP To PVC Connection
D6.08A Valley Inlet (CDOT Type 13) (1 Of 2)
D6.8B Valley Inlet (CDOT Type 13) (2 Of 2)
D6.9A Type R Curb Inlet (1 Of 3)
D6.9B Type R Curb Inlet (2 Of 3)
D6.9C Type R Curb Inlet (3 Of 3)D6.10
Small Pipe Headwall
D6.11 Headwall with Circular PipeD6.12
Low Flow Channel
D6.13 Emergency Overflow

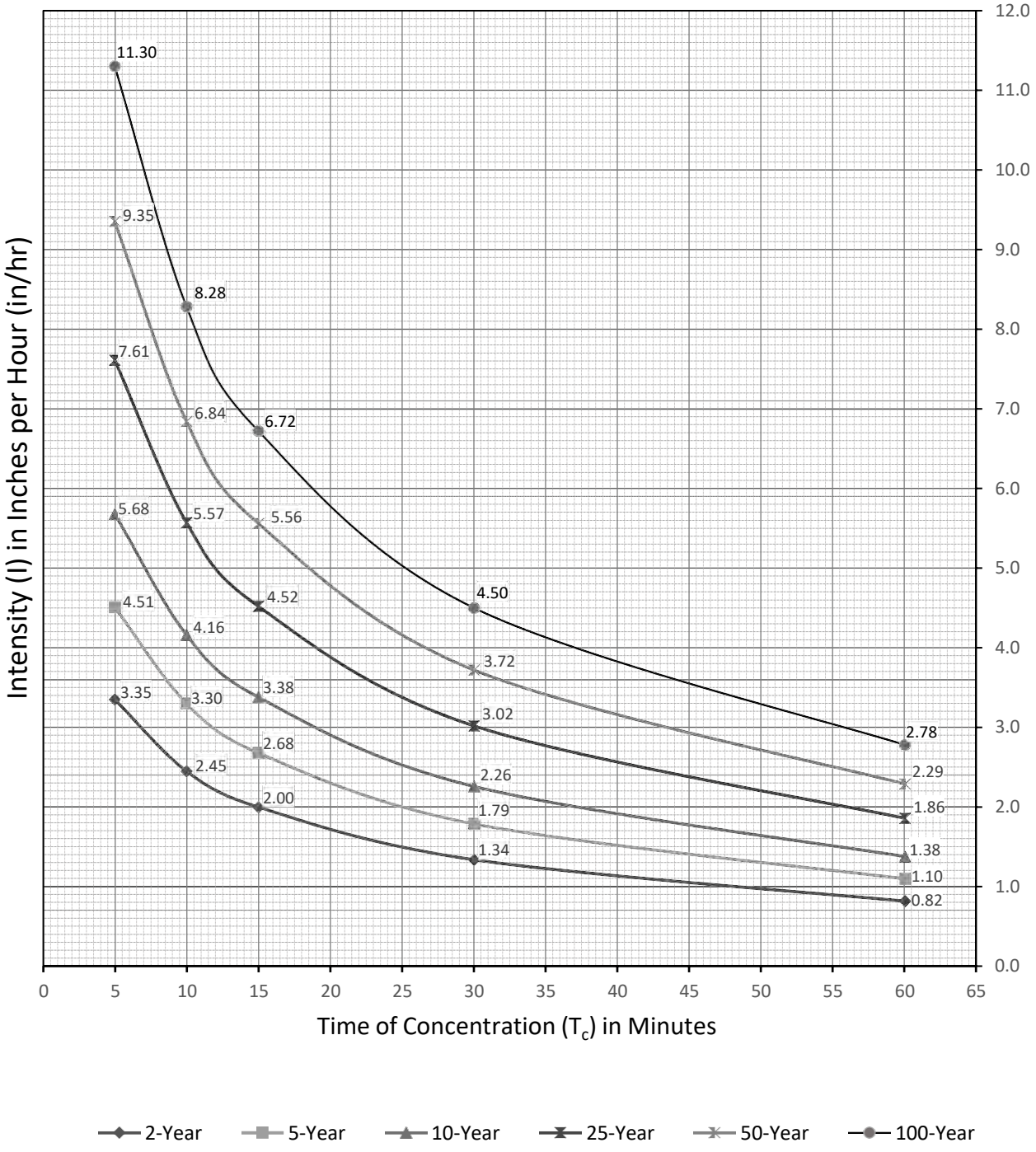

Figure 600- 1: Town of Berthoud – Intensity-Duration-Frequency Curves

CHAPTER 700 DRY AND NON-TOWN UTILITIES

701 GENERAL PROVISIONS

701.1 General

A. This chapter sets forth the criteria and location requirements for all dry utilities, such as: power (electric and natural gas), phone, CATV, traffic signals and mailboxes, within the right-of-way and/or public utility easements. The appropriate non-Town utility and the Town of Berthoud shall determine all final alignments of utilities.

701.2 Design Standards

A. Minimum Depth

1. All utilities shall be located at least 2 feet below the scarified subgrade elevation, unless specifically approved to be less by the Town Engineer. Greater depth of cover may be specified by the Town Engineer.

B. Access Covers

1. Clearance: All manhole lids, utility access covers, and range box access covers shall be flush with the roadway finished surface or depressed no more than 1/2 inch below the finished surface. If located in concrete, all access covers shall be set flush with surrounding concrete.
2. Wheel Path: Manholes or valves shall not be designed or constructed in the Wheel Path of the travel lane or at any location within a bike lane.
3. Location: Manhole, water valve or other utility access covers and lids shall not be located in the flowline of curbs or crosspans. Manholes and water valve covers shall be located more than 4 feet away from the curb or crosspan.

C. Trees and Large Shrubs Prohibited Over or Near Utilities

1. Buried Utilities: Trees, berms or large shrubs shall not be placed over buried utilities. Additional horizontal clearances from the trunk of any tree or shrub to any buried utility may be required by the Town Engineer.
2. Overhead Utilities: Trees should not be planted under overhead power lines when mature growth of the tree would come within 10 feet of the power lines.

D. Use of PVC Sleeves by Franchised and Private Utilities

1. It is the intent of these standards to reduce the amount of open cuts in the roadway. Therefore, franchised and private utility companies shall install all utilities within a non-corrosive sleeve equivalent to Schedule 40 PVC or other sleeves encased in concrete, slurry or flow-fill material, across all public streets to accommodate future repairs without street cuts.
2. Exceptions: Steel gas line street crossings will not require sleeves.
3. Depth: Sleeves shall be installed at a minimum depth of 36 inches from the top of the pipe to the top of pavement or 24 inches from the top of pipe to the top of subgrade, whichever is greater.
4. Locations: Sleeves shall be located within 15 feet of the parallel gutter flowline of the existing street and shall be coordinated with other utilities. All sleeve locations shall be marked appropriately in the field either by marking the concrete curb or providing

permanent stakes. Sleeves shall be separated for existing buried utilities in accordance with the utility owner requirements. Ten feet of separation is typically preferred.

5. Extra Sleeves: Extra PVC sleeves may be required on Collector or Arterial intersections for future traffic signalization or future utilities.

E. Poles

1. Location: Poles, signs, and any other above ground streetscape (except regulatory signs) should be located within 5 feet of the right-of-way line or 10 feet from the travel lane (flowline), whichever is most restrictive.
2. Clearance: Light poles shall be placed no closer to the roadway than 2 feet behind a vertical curb line and no closer than 2 feet to any sidewalk.
3. Pole Requirements: The Town Engineer may require breakaway poles on public right-of-way where speed limit is 40 m.p.h. or higher. Refer to **CDOT Roadway Design Manual, Section 1002.6, Specifications**.
4. Engineer Approval: All poles within the public right-of-way must be accepted by the Town Engineer prior to the permit application for installation.

SUBDIVISION IMPROVEMENT STANDARDS

801 GENERAL PROVISIONS

801.1 General/Applicability

A. Applicability

Unless otherwise exempted by this chapter, all development, subdivisions or re-subdivisions of land within the Town and shall be reviewed and approved according to the standards stated in the development code and the Engineering and Infrastructure Standards. In addition, this Chapter shall apply to all land in the process of annexation to the Town. No land shall be conveyed or developed, or lots consolidated or reconfigured until a plat has been approved, except as specifically exempted, under the provisions of the development code and the Engineering and Infrastructure Standards. All subdivisions with public infrastructure or bonded improvements, shall follow the improvement standards set out in this Chapter..

801.2. Improvement Guarantees/Surety

A. Standards governing improvement guarantees, including performance and maintenance guarantees for public and private on-site improvements.

B. Financial Collateral. Prior to the start of construction on an individual construction phase, Developer shall provide security or collateral by construction phase for Development Improvements (water facilities, sewer, storm-water facilities, roads, landscaping, etc.) as described in Addendum “B-2” equal to the following:

1. Payment and performance bond(s) in the amount of 115% of the Estimated Costs, or

2. Cash, certified funds, irrevocable letters of credit or other form of security as approved by the Town in the amount of 25% of the Estimated Costs. Collateral which is neither cash, certified funds, nor irrevocable letters of credit shall be reviewed and evaluated by the Town, and the Town will determine whether to accept said collateral based on whether it is equally secure, in its sole and absolute discretion, and whether said collateral is capable of being immediately liquidated.

After Construction Acceptance, the financial collateral will be released except for a continuing ten percent (10%) of total costs, which shall be maintained through the warranty period. Upon expiration of the warranty period, all remaining Financial Collateral for the Development Improvements shall be released.

The financial collateral described in this section (the “Financial Collateral”) shall be provided for all Development Improvements within each construction phase as follows:

i. Erosion Control – Financial Collateral for erosion control shall be in place and approved by the Town Engineer prior to scheduling a Pre-Construction Meeting.
ii. Public Water, Sewer and Storm Water Utilities – Financial Collateral for the public water facilities, sewer and storm-water facilities shall be in place and approved by the Town Engineer ten business days prior to the commencement of public water, sewer and storm water utility construction.
iii. Curb, Gutter, Sidewalk and Paving - Financial Collateral for the curb, gutter, sidewalk and paving shall be in place and approved by the Town Engineer ten business days prior to the commencement of curb, gutter, sidewalk, and paving construction.
iv.. Landscaping - Financial Collateral for public Landscaping (medians, parks, open space, trails, street trees, etc.) shall be in place and approved by the Town Engineer ten business days prior to the commencement of landscaping installation.

3. The purpose of the Financial Collateral is to guarantee that the Development Improvements are completed and that any defective conditions found within the Development Improvements are corrected in full and timely compliance with any Development Agreement with the Town on the property. With respect to the off-site improvements, in the event that any portion of the work or Development Improvements has not been made, installed, completed, or performed by Developer in full and timely compliance with this Section or any Development Agreement, the Town may, in its sole discretion, being under no obligation to do so, close the

work or improvement at the current stage of completion, or have such remaining work and improvements completed by such means and in such manner, by contract, with or without public letting, or otherwise, as it may deem advisable. Developer agrees that the Town shall be entitled to use the collateral for these purposes. In the event that the collateral is insufficient to complete or close the work and improvements, the Town shall be entitled to payment of such excesses by Developer in any way permitted by law, including placing a lien or certification of assessment through property taxes in the amount of the value of that work or improvement.

4. Remedies on Default. Upon default of the provisions of this Section or any recorded Development Agreement the parties agree that this may be specifically enforced. Nothing herein shall be construed as requiring the Town to complete all or a portion of the improvements specified or to finance the closure or completion of the infrastructure. In addition, the Town may in its discretion, without limiting any other remedies it may have:

i. Demand payment of, negotiate or liquidate any collateral provided by Developer; or

ii. Issue a written notice to Developer to appear and show cause as to why the final plat should not be vacated, which vacation the Developer specially consents to in consideration of the Town's approval of the final plat and this Agreement. Giving the notice shall be deemed complete upon mailing the same certified mail to the address stated herein. Said notice shall designate the date, time and place that the Town of Berthoud Board of Trustees will conduct a hearing to consider vacating the plat and construction approvals granted by this Agreement. Said hearing shall be not less than one month nor more than two months from the date of the notice; or

iii. Proceed in the manner described in the Town of Berthoud's Development Code as amended or State Statutes for a violation of a local subdivision egulation, including withholding building permits and certificates of occupancy;

iv.. Proceed in any other manner authorized by law for breach of contract.

801.3 Erosion Control, Preconstruction and Inspection of Improvements

Developer agrees that prior to commencement of construction of any Development Improvements including alterations to existing grading contours, removal of vegetation and/or excavating, the Town-approved erosion control plan will be implemented.

A. Erosion Control Required. Town-approved erosion control plan measures shall be installed and maintained throughout the construction of Development Improvements and shall not be removed or abandoned by Developer until authorized by the Town. Developer shall provide the Town with a copy of the approved storm water discharge permit issued from the State of Colorado prior to beginning construction.

B. Inspections. Regular inspections of erosion control measures will be conducted pursuant to the regulations adopted by Colorado Department of Public Health and Environment (CDPHE) by Developer and copies of the same delivered to the Town Public Works Department not less than every two weeks during the course of construction. At all times during construction on the Property, or off-site projects associated with development of the Property, Developer shall maintain all streets, drainage and drainage facilities in an orderly and workmanlike fashion. Developer shall remove all construction debris and waste, shall sweep or otherwise remove mud and debris from existing streets and shall maintain an orderly and clean construction site.

C. Preconstruction Meeting. Developer agrees that prior to commencement of construction of Development Improvements for each phase; a preconstruction meeting will be conducted. This meeting shall include the following: Developer's construction team including project and construction contractor, Town Public Works, Town Community Development, any Third Party Firm employed by the Town, including engineering, landscaping, forestry, water and wastewater department representatives, and representatives of all applicable utility companies or agencies. At least two weeks prior to the commencement of construction Developer shall provide written schedule, all construction specifications and other submittal materials to the Town engineer. The construction schedule shall include time frames and completion dates and indicate the anticipated scheduling of the construction of the Development Improvements, including, but not limited to, excavating, grading, sewer, water, storm sewer, streets, sidewalks, trails, curb, gutter, landscaping, electric, cable, gas, and telephone.

D. Inspection and Notice to Town. Developer agrees to notify the Town at least two full working days prior to the commencement of installation of Development Improvements. The Town shall also be given not less than 48 hours (during at least 2 working days) notice prior to the closure/covering of any infrastructure. In the event that any Development Improvements are covered and/or concealed from inspection prior to approval by the Town, the Developer shall, if requested by the Town Engineer/Authorized Town Representative, expose any and all improvements at Developer's expense. If the Town cannot complete inspections in a timely manner, the Town will use contract inspection services, the cost of which Developer shall be reimbursed to the Town

801.4 Over-lot Grading.

Developer shall complete all development lot grading generally referred to as "over-lot" grading as depicted in the development grading and drainage plan(s) approved by the Town (the "Development Grading and Drainage Plans") prior to either Construction Acceptance or issuance of building permits for a particular phase.

A. Grading Plans Upon completion of over-lot grading and prior to issuance of any building permit, Developer shall submit two original development grading and drainage "as-built" construction plans stamped by a qualified professional engineer. The development grading and drainage as-built construction plans shall include:

i. Top of foundation wall (not finished floor) elevations at the building envelope for the primary structure and for attached and detached garages for each lot.
ii. A statement within the building envelope stating the type of lot grading (Type "A" or Type "B") intended for the lot.
iii. Finished grade elevations at all property corners.
iv. Finished grade elevations at all lot corners and at mid-points on all side lot lines.
v. Highest elevation points (HP) on each lot denoted with an "X" and "HP".

801.5. Timing of Installation of Improvements

A. Improvements Required. All public and private improvements including, as required by the Berthoud Development Code, these Engineering and Infrastructure Standards and as a condition of development approval, shall be required before the release of building permits with each platted phase. This shall include installation of all trails, sidewalks, Subdivision Identity Standards, Open Space Elements, Parks, common area landscaping and seeding of open space.

Exceptions include

1. All open space, open space and common area landscaping, and disturbed areas must be seeded or sod laid before the issuance of the first building permit if pulled from April to September; or at the beginning of the first planting season (April-Sep) if pulled from October- March

2. All common open space trees and shrubs, and street trees and shrubs, must be planted before the issuance of the first building permit if pulled from April to September; or at the beginning of the first planting season (April-Sep) if pulled from October- March

801.6 Development Agreements

For standards and procedures governing development agreements, which may—among other things—allow vesting of property rights attached to an approved final subdivision plat for more than the statutory three-year period, or specific phasing standards for public improvements for major developments at the Town's discretion, please refer to the Development Code.

TOWN OF BERTHOUD

APPENDIX A
CONSTRUCTION SPECIFICATIONS

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SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing, grubbing and site preparation

B. Removal and disposal of debris

C. Handling, storage, transportation, and disposal of excavated material

D. Sheeting, shoring, bracing and protection work

E. Pumping and dewatering as required or necessary

F. Backfilling

G. Pipe embedment

H. Construction of fills and embankments

I. Excavation for buildings & structures

J. Pavement Subgrade preparation

K. Trench Stabilization

L. Final grading

M. Slope Stabilization

N. Appurtenant work

1.2 REFERENCES

A. AASHTO – American Association of State Highway and Transportation Officials

B. ASTM – American Society for Testing and Materials
   1. C33 – Concrete Aggregates
   2. C136 – Sieve Analysis of Fine and Coarse Aggregates
   3. D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-Inch Drop
   4. D1241 – Material for Soil Aggregate Subbase, Base and Surface Courses

5. D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
6. D4253 – Test Methods for Maximum Index Density of Soils and Unit Weight of Soils Using a Vibratory Table
7. D4254 – Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
8. D4318 – Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
9. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

C. ACI – American Concrete Institute
   1. 229 – Controlled Low-Strength Materials

D. CABO/ANSI – Council of American Building Officials/American National Standards Institute
   1. A117.1 – Accessible and Useable Buildings and Facilities Standards

E. CDOT – Colorado Department of Transportation

F. OSHA – Occupational Safety and Health Administration
   1. Part 1926 – Safety and Health Regulations for Construction

1.3 SUBMITTALS

A. Product Data: Submit on all products or materials supplied herein

B. Test Reports: Indicate supplier, sieve analysis, optimum moisture content and density in accordance with ASTM D698 if appropriate for crushed rock or gravel, pipe embedment and material for fills and embankment

1.4 REGULATORY REQUIREMENTS

A. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

B. Obtain and comply with all requirements of the Town of Berthoud Permit for all land disturbing activities and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

C. Excavation work will be performed in compliance with current OSHA requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling

B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for subsequent contractors' use.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising

D. Do not use frozen materials, snow, or ice in any backfill or fill area

E. Do not backfill or construct fill on frozen surfaces

F. Protect excavated material from becoming frozen

G. Do not backfill or construct fills or embankments during periods of heavy rainfall or precipitation when soil moisture conditions will not allow proper compaction to be achieved

H. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities

I. Provide temporary bridges for roadways, walkways, driveways, etc.

1.6 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, "clean" as defined by EPA, and approved for its intended use by the Owner or project Geotechnical Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Soil materials, whether from sources on or off the site must be approved by the Geotechnical Engineer as suitable for intended use and specifically for required location or purpose.

B. Fills and Embankments
1. To the maximum extent practical use excess earth from onsite excavation for fills and embankments.
2. Free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
3. Fill and embankment material must be acceptable to Engineer
4. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

C. Imported Fill for Fills and Embankments:
1. The Contractor is responsible for obtaining additional material for fills and embankments as necessary to meet the requirements shown on the approved drawings.
2. Imported fill conforming to the following:
   a. Gradation (percent finer by weight ASTM C136): 3" – 100% passing, No. 4 Sieve – 50-100% passing, and No. 200 Sieve – 35% passing (maximum)

b. Liquid Limit: 35 (maximum), Plasticity Index: 15 (maximum), Group Index: 10 (maximum)

D. Structural Fill
1. Imported structural fill, such as a ½-inch minus, CDOT Class 7 Aggregate Road Base, conforming to the following:
   a. Gradation: 1" – 100% passing (percent finer by weight ASTM C136), No. 8 Sieve – 20-85% passing, and No. 200 Sieve – 15% (maximum)
   b. Liquid Limit: 30 (maximum), Plasticity Index: 6 (maximum)

E. Topsoil
1. Topsoil is defined as fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted.
2. Clean topsoil free of plants and seeds will be spread to 4-inch minimum depth or as specified by approved drawings, whichever is greater, for areas of the site as detailed by the landscape plans.

F. Grubbings
1. Grubbings are defined as the first 1 inch of surface vegetation and topsoil consisting of primarily existing grass groundcover free of roots, brush, and other objectionable material and debris.
2. Reuse grubbing and surface topsoil containing plants and seeds in designated revegetation areas only.

G. Pipe Embedment: Graded gravel
1. Comply with requirements for pipe embedment for public utilities.

2. 1-1/2" Washed rock

Sieve Size (Inch)	Percent Passing by Weight
2"	100
1-1/2"	95-100
1"	80-95
3/4"	30-45
1/2"	10-25
3/8"	<1

3. 3/4" – 1" Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4"	90-100
1/2"	25-60
3/8"	20-55
NO. 4	0-10
NO. 8	0-5
NO. 200	0-2

4. Well-Graded Sand

Sieve Size	Percent Passing by Weight
3/8”	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	10-30
No. 200	2-10

5. Squeegee (for 8-inch pipe and smaller only)

Sieve Size	Percent Passing by Weight
3/8”	100
No. 4	85-100
No. 8	30-70
No. 16	5-40
No. 30	0-15
No. 50	0-10
No. 100	0-5
No. 200	<1

6. Drain Gravel
   a. Crushed rock, granular material with a maximum size of 1-1/2 inch.
   b. Minimum 50% passing No. 4 sieve, maximum 5% retained on No. 200 sieve

H. Compacted Trench Backfill
1. Job excavated material finely divided, free of debris, organic material, and stones larger than 6 inches in greatest dimension without masses of moist, stiff clay, or topsoil
2. In upper 18 inches, no rock or rock excavated detritus, larger than 6 inches except with specific approval from Geotechnical Engineer.
3. No rock greater than 3 inches in greatest dimension within 3 feet of top of pipe
4. Graded gravel: as specified or shown on the approved drawings for pipe embedment.

I. Coarse Base Rock
1. Granular material, maximum 3 inches, less than 10% passing 1-inch sieve.
2. Free of trash, clay and dust
3. Compaction as specified by Geotechnical Engineer

J. Road Base
1. Will meet ASTM specification for Class II aggregate base and CDOT Class 6 gradation

Sieve Size	**Percent Passing by Weight**
1”	100
3/4"	90-100
No. 4	30-65

Sieve Size	Percent Passing by Weight
No. 8	22-55
No. 200	3-12

K. Clay for irrigation channels, cut-off walls or clay for use as barrier material in utility trenches
    a. USCS Classification: CL, CH or OH
        a. Percent passing No. 200 Sieve: 30% or greater by weight
        b. Plasticity Index: 15 or greater
        c. Maximum Permeability: 1 x 10-5 cm/sec
        d. Maximum Particle Size: 3/4-inch
        e. Minimum Clay Liner Thickness: 2 feet at side slopes and end of wing walls or as specified in plans and details.
        f. Maximum horizontal loose lift thickness: 12-inches or less

2.2 ACCESSORIES

A. Controlled Low Strength Material (Flow Fill)
    1. Comply with Utility Provider's specifications and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
    2. Product will be a lean, sand-cement slurry, "flowable fill" or similar material with a 28-day unconfined compressive strength between 50 and 200 psi.

B. Non-woven geotextile fabric
    1. Needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Product must be inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Product must meet AASHTO M288-06 Class 3 for elongation > 50%.

PART 3 EXECUTION

3.1 EXAMINATION

A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE — GENERAL

A. Perform work in a safe and proper manner with appropriate precautions against hazard

B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

C. Contain all construction activity on the designated site and within the limits of work. Cost of restoration offsite will be the responsibility of the Contractor

D. Maintain service to pipelines and utilities indicated on Approved drawings during construction

3.3 PREPARATION

A. Clearing and Grubbing
   1. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris.
   2. Strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil. Strip and stockpile all on-site material meeting the topsoil definition for all areas receiving grading where shown on Approved drawings
   3. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.
   4. Remove and dispose of tree stumps and roots over 3 inches in diameter to a minimum depth of 18 inches below the natural surface or 5 feet below finished surface level, whichever is lower.
   5. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted
   6. Backfill all excavated depression include grub holes with approved material

B. Preservation of Trees
   1. Do not remove trees outside fill or excavated areas, except as authorized by Engineer
   2. Protect trees and their roots within the drip line that are to remain from permanent damage by construction operation
   3. Trim standing trees in conflict with construction operations as directed by the Town.

C. Topsoil Stripping
   1. Strip onsite material meeting the topsoil definition to minimum depth of 6 inches from areas to receive grading as shown on the approved drawings.
   2. At the completion of work in each area, place and grade topsoil to maintain gradient as indicated and required. Roughen surface as required for erosion control.

D. Waste and Debris
   1. Stockpile all acceptable grubbing for reuse in native revegetation areas
   2. Remove and dispose of all waste materials and debris from clearing, grubbing, stripping and demolition off site

E. Stockpiles
   1. Segregate materials suitable for the following:
      a. Topsoil
      b. Embankments and fills
      c. Backfill
      d. Spoils and waste only
   2. No excavation will be deposited or stockpiled at any time so as to endanger stability of banks or structures, health of trees and shrubs to be protected, or portions of the Work,

either by direct pressure or indirectly by overloading banks contiguous to the operation
3. Stockpile soil materials away from edge of excavations
4. Do not obstruct or prevent access to roads, driveways, ditches, natural drainage channels, and utility control devices

3.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations will be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work.

B. Backfill will be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs will be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition.

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage will be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Town, will be borne by the Contractor.

3.5 DEWATERING

A. General
1. All dewatering activities in accordance with all federal, state, and local regulations regarding site drainage, dewatering, and erosion and sediment control including permitting requirements
2. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, including water treatment prior to discharge, if necessary

B. Design
1. Contractor will be responsible for the accuracy of the approved drawings, design data, and operational records required
2. Contractor will be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system

C. Damages
1. Contractor will be responsible for and will repair any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result

from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system
2. Remove sub grade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Town.

D. Maintaining Excavation in Dewatered Condition
1. Dewatering will be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to the Town.
4. System maintenance will include supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition

E. System Removal
1. Remove dewatering equipment from the site, including related temporary electrical service
2. Wells will be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction

3.6 SHEETING, SHORING AND BRACING

A. All sheeting, shoring and bracing in accordance with OSHA and IBC requirements

B. Prevent undermining and damage to all structures, buildings, underground facilities, pavements and slabs

C. Contractor will responsible for obtaining all required permits or easements for encroachments into the public right-of-way and for coordinating any encroachments onto adjacent properties.

D. If sheet pile cut off walls are required, submit design calculations, stamped by a Colorado licensed Professional Engineer

E. Contractor will be solely responsible for proper design, installation, operation, maintenance, and any failure of any system component

F. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities

G. Design, furnish, build, maintain and subsequently remove, to extent required a system of temporary supports for cut and cover, open cut, temporary bypass road, or trench excavations, including bracing, dewatering, and all associated items to support the sides and ends of excavations where excavation slopes may endanger in-place or proposed improvements, extend beyond construction right-of-ways or as otherwise specified or indicated in the approved drawings.
   1. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure
   2. Design and build sheeting, shoring and bracing to be rigid, maintain shape and position under all circumstances.

H. Design excavation support system and components for the following to allow safe and expeditious construction of permanent structures without movement/settlement of the ground and to prevent damage to or movement of adjacent buildings, structures, other improvements and underground facilities
   1. To support lateral earth pressures
   2. Loads from utilities, traffic, construction, buildings and surcharge loads

I. Provide sheeting, shoring and bracing equipment and materials onsite prior to start of excavation in each section, making adjustments as required to meet unexpected conditions

J. Contractor will make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods, and will select and design support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.

K. Space and arrange sheeting and bracing as required to exclude adjacent material and according to the stability of excavation slopes

L. Do not pull trench sheeting before backfilling

M. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe

N. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

3.7 TRENCH STABILIZATION

A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities

B. Remove all mud and muck during excavation

C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities

D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on the approved drawings.

E. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

3.8 PAVEMENT OVEREXCAVATION AND SUBGRADE PREPARATION

A. Excavate subgrade for asphalt pavement areas per the lines, grades, and dimensions indicated on approved drawings within a tolerance of plus or minus 0.10 foot. Excavate subgrade for concrete pavement areas per the lines, grades, and dimensions indicated on Approved drawings within a tolerance of plus or minus 0.05 foot.

B. Overexcavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications herein to depth shown on approved drawings or as specified by a project Geotechnical Engineer.

C. Extend subgrade preparation a minimum of one foot beyond back of proposed pavement, slabs, curbs and walks.

D. Proof roll at a maximum of 24 hours prior to paving to locate any soft spots that exhibit instability and deflection beyond subgrade tolerances listed above. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Geotechnical Engineer, will be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture. After recompaction, these areas will be proof rolled again and all failures again corrected.

E. If the Contractor fails to place the sub base, base course, or initial pavement course within 24 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction will be performed again.

3.9 FILLS AND EMBANKMENTS

A. Using suitable approved materials, shape, trim, and finish cut slopes to conform with contours and elevations indicated on approved drawings.

B. Will not be placed on frozen surface. Do not place snow, ice or frozen materials in fill

C. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment
   1. Plow and scarify subgrade to a minimum depth of 6 inches until uniform and free of large clods

D. Place in horizontal layers at maximum uncompacted depth per compaction specifications herein.

E. Spread and level material deposited in piles and windrows before compacting

F. Thoroughly compact each layer by rolling or other means acceptable to Geotechnical Engineer to meet the moisture and compaction specifications herein.

G. Alter compaction methods if material fails to meet specified density

H. Where a trench passes through a fill or embankment, place and compact fill or embankment to 12 inch above the top of the pipe before excavating the trench

I. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction

3.10 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.

C. Comply with a project Geotechnical Engineer's additional requirement for site development material, subexcavation, compaction and related earthwork operations.

D. Percentage of Maximum Dry Density Requirements: Moisture treat and compact soil to not less than the following percentages of maximum dry density and to within the specified moisture content range of optimum moisture content according to ASTM D698 as follows:

Public Surface Improvement	Compaction %	Moisture Content
Paved Areas	95%	-2 to +2
Lawns or Unpaved Areas	90%	-2 to +2

E. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.

F. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

3.11 BORROW OR SPOIL AREA

A. The location, size, shape, depth, drainage, and surfacing of borrow or spoil pits will be acceptable to the Town.

B. Make all areas regular in shape with graded and surfaced side and bottom slopes when completed

C. Cut side slopes not steeper than 1:1 and uniform for the entire length of any one side

D. Final grade disturbed areas of borrow to uniform slope (maximum slope = 4:1, minimum slope = 50:1).

E. Use material free of debris and deleterious material

F. Contractor is responsible for compliance with Colorado Discharge Permit System and local erosion control permitting requirements for any and all onsite and offsite, disturbed spoil and borrow areas. Upon completion of spoil and/or borrow operations, clean up spoil and/or borrow areas in a neat and reasonable manner to the satisfaction of the offsite property owner and the Town.

3.12 BLASTING

A. Blasting or other use of explosives is not permitted without the Town's approval

3.13 TRENCH EXCAVATION

A. Establish alignment and grade or elevation from offset stakes provided by the Contractor's surveyor.

B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the approved drawings.

C. Comply with pipe specification sections regarding vertical and horizontal alignment and maximum joint deflection

D. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation

E. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 100 feet

F. Total length of open trench will be limited to 200 feet unless otherwise approved by the Town Engineer/Inspector.

G. Except where tunneling or boring is indicated on the approved drawings, specified, required by jurisdictional agency or permitted by Engineer, excavate trenches by open cut from the surface

H. Limiting trench widths
   1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
   2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
   3. Stipulated minimum clearances are minimum clear distances, not minimum average distances

4. Maximum trench width from six inches above the top of pipe to trench bottom is the pipe outside diameter plus 24 inches
5. Limiting trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping

Pipe Size (inch)	Minimum Trench Width	Maximum Trench Width
3	1’ 6”	2’ 6”
4	1’ 6”	2’ 6”
6	1’ 6”	2’ 6”
8	1’ 8”	2” 8”
10	2’ 0”	3’ 0”
12	2’ 0”	3’ 0”
16	2’ 8”	3’ 8”
18	3’ 0”	4’ 0”
24	3’ 6”	4’ 6”
36	4’ 6”	5’ 0”

6. If the width of the lower portion of the trench exceeds the maximum permitted, provide special pipe embedment, or concrete encasement as required by loading conditions
7. No excessive trench widths will be allowed to avoid the use of sheeting or shoring and bracing

I. Trench Side Walls
1. Will be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the federal, state, and local ordinances and regulations
2. Sheet and brace where necessary and as specified herein
3. Excavate without undercutting

J. Trench Bottom
1. Will be thoroughly protected and maintained when suitable natural materials are encountered
2. Will be thoroughly compacted and in approved condition prior to placing gravel bedding, if required
3. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support between bell holes or end joints of the installed pipe at the Contractor's option
4. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined
5. PVC pipe will not be laid directly on trench bottom

K. Mechanical excavation
    1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
    2. Use mechanical equipment of a type and design which can be operated to provide the following:
        a. Rough trench bottom to a controlled elevation
        b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
        c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
    3. Do not undercut trench sidewalls
    4. Recompact trench bottom disturbed by bucket teeth prior to placement of embedment material

L. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the approved drawings to provide for installation of granular embedment pipe foundation material

M. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support (between bell holes or end joints) of the installed pipe, Contractor's option

N. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined

O. Cuts in existing surface construction
    1. No larger than necessary to provide adequate working space
    2. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area
    3. Remove pavement and base pavement to provide shoulder not less than 6 feet wide between cut edge and top edge of trench
    4. Do not undercut trenches, resulting in bottom trench width greater than top widths
    5. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation
    6. Remove pavement for connections to existing lines or structures only to the extent required for the installation
    7. Replace the pavements between saw cuts to match original surface construction

3.14 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated on the approved drawings and as specified herein

B. Granular embedment
   1. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
      a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout length
      b. Barrel of pipe will have a bearing for its full length
   2. Form depressions under each joint to permit the proper jointing. No part of joint will be in contact with trench when pipe is placed in position
   3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent operations
   4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent displacement
   5. Complete embedment promptly after jointing operations and approval to proceed by Town Engineer/Inspector
   6. Granular embedment compaction by slicing with shovel or vibrating
      a. Maximum uncompacted thickness of layers: 6 inches
   7. Compacted embedment will be compacted to 90 percent maximum density per ASTM D1557
      a. Maximum uncompacted depth thickness of horizontal layers: 8-inch

C. Ground Water Barriers and Cut-off Walls
   1. To impede passage of water through bedding material, construct ground water barriers
      a. Horizontally extending one (1) foot minimum past either side of the full trench width and approximately two (2) feet of minimum thickness along the length of the utility pipe.
      b. Vertically, extending one (1) foot minimum from the bottom of granular bedding material and one (1) foot minimum above the top of granular bedding material.
   2. Spacing:
      a. Approximately 10 feet downstream of each manhole for sanitary sewers and storm drains.
      b. Every 400 feet on water lines and force main.
      c. Place a groundwater barrier 20 feet downstream of the edge of all drainage ways, streams and water courses
   3. Minimum Compaction: 95% proctor
   4. Moisture Content: -1% to 2% Optimum Moisture Content

D. Arch and concrete encasement
   1. Include in locations indicated on Approved drawings or where over-width trench conditions need correction as approved by Engineer
   2. Install and form as indicated on Approved drawings or as specified
   3. Concrete will have a 28-day minimum 3,000 psi compressive strength

E. Do not backfill until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems

3.15 TRENCH BACKFILL

A. Backfilling will be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible.

B. Compacted backfill
   1. Provide full depth of trench above embedment at all locations
   2. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
   3. In street or highway shoulders
   4. In established sodded areas
   5. Beneath fills and embankments

C. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

D. Site excavated materials
   1. Place job excavated materials in 8 inches maximum uncompacted thickness, uniform layers
   2. Increased layer thickness may be permitted for incohesive material if Contractor demonstrates to the Town Engineer's/Inspector's satisfaction that specified compacted density will be achieved
   3. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
   4. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

E. Graded gravel
   1. Deposit in uniform layers of 8 inches maximum uncompacted thickness
   2. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254

F. Uncompacted backfill
   1. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement
   2. May be placed by any method acceptable to Town Engineer/Inspector which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe
   3. Until compacted depth over conduit exceeds 3 feet, do not drop fill material over 5 feet. Distance may be increased 2 feet for each additional 1 foot of cover

G. Finish the top portion of backfill with at least 4 inches of topsoil or as specified by landscaping specifications, whichever is greater, corresponding to, or better than, that underlying adjoining turf areas.

H. Trench backfill within the public right-of-way will conform to municipal street and utility standards.

I. Trench backfills through unimproved areas should be restored to previous conditions and left 3" above adjacent grades to allow for settlement. Seed all disturbed areas according to erosion control and landscape specifications.

J. Protection of trench backfill
   1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion
   2. Install ditch checks where the ditch grade exceeds 1 percent
      a. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
      b. Minimum width: 18 inches into the side slopes
      c. Minimum thickness: 12 inches

3.16 DRAINAGE MAINTENANCE

A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid

B. Backfill so that water does not accumulate in unfilled or partially filled trenches

C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours

D. Do not obstruct surface drainage any longer than necessary

E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

F. Provide adequate storm flow conveyance through the site at all times during construction to avoid flooding of any buildings or adjacent property. Provide overland drainage routing when storm sewer inlets are not fully functioning due to erosion and sediment control measures.

3.17 FINAL GRADING

A. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations, slopes and contours, all areas being graded on site

B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work

C. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the approved drawings

D. Provide a smooth transition between adjacent existing grades and new grades

E. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances

F. Slope grades to direct water away from buildings and prevent ponds from forming where not intended

G. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch

H. Finish grades will be no more than 0.1 foot above or below those indicated

I. Finish all ditches, swales and gutters to drain readily

J. Coordinate final subgrade depth with finish landscape treatment and required topsoil depths

3.18 SLOPE AND CHANNEL STABILIZATION

A. Cover channel banks, slopes, bottom and thalweg (water flowline at lowest point in channel) with erosion control fabric mat where grade is steeper than 4H to 1V and where indicated on the approved drawings

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48-inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric

G. Prior to laying fabric, seed disturbed areas under provisions of related seeding and landscaping specification sections or as specified on approved drawings.

3.19 SETTLEMENT

A. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed

B. Repair or replace within 30 days after notice by the Town.

3.20 FIELD QUALITY CONTROL

A. Provide under provisions of General Conditions and Division One Specifications

B. Fills and Embankment Testing
   1. Two moisture-density relationship tests, ASTM D698, on each type of fill material
   2. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
   3. Additional in-place compaction tests at the discretion of the Town

C. Pipe Embedment and Backfill Testing
   1. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
   2. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, per ASTM D6938
   3. One in-place compaction test near top of trench for trench depth of 2 feet or less, per ASTM D6938
   4. Additional in-place compaction tests at the discretion of the Owner

D. Pavement and Structural Subgrade Testing
   1. At a minimum, two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type backfill material proposed.
   2. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every 100 linear feet of subgrade of foundation walls, retaining walls, and every 150 feet for curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every 2,000 square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less than 3 tests). Test at subgrade and at every vertical lift of backfill materials placed.
   3. Additional in-place compaction tests at the discretion of the Town

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Minimum requirements for soil erosion and sedimentation control on all project sites where soil will be disturbed

B. Temporary measures needed to control erosion and water pollution. These temporary measures will include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the project and during site restoration, and as directed by Town Engineer/Inspector, and as shown on the approved drawings.

C. The Erosion Control Plan presented in the drawings serves as a minimum for the requirements of erosion control during construction.

D. Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. Therefore, if the provided plan is not working sufficiently to protect the project areas, then Contractor shall provide additional measures as required to obtain the required protection.

1.2 REFERENCES

A. CDOT – Colorado Department of Transportation

B. MHFD – Mile High Flood District

C. CDPHE – Colorado Department of Public Health and Environment

D. Weld County Engineering Construction Criteria Guidelines

E. LCUASS – Larimer County Urban Area Street Standards

1.3 SUBMITTALS

A. Submit the following information:
   A. Erosion Control Plan,
   B. Construction schedule for Erosion Control per Scheduling paragraph below
   C. Sequencing Plan per Scheduling paragraph below
   D. All applicable permits for Grading and Erosion Control.

B. Product data: Submit on all products or materials supplied herein.

1.4 REGULATORY REQUIREMENTS

A. Obtain and comply with all requirements of the Town issued Grading/Construction permits and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

B. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):
   A. Contractor shall apply for and obtain a Construction Dewatering Permit 401 from the Colorado Department of Public Health and Environment.
   B. All costs for this permit shall be the responsibility of Contractor.
   C. This permit requires that specific actions be performed at designated times.
   D. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
   E. Contractor shall allow the Colorado Department of Public Health and Environment or other representatives to enter the site to test for compliance with the permit.
   F. Non-compliance with the permit can result in stoppage of all work.

C. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.5 SCHEDULING

A. Sequencing Plan:
   A. Contractor shall submit a sequencing plan for approval for erosion control in conformance with Contractor's overall Construction Plan for approval by the Town
   B. Changes to the Erosion Control Sequencing Plan may be considered by the Town only if presented in writing by the Contractor.

B. Temporary Erosion Control:
   A. When so indicated in the Contract Documents, or when directed by the Town. Contractor shall prepare construction schedules for accomplishing temporary erosion control work including all maintenance procedures.
   B. These schedules shall be applicable to clearing and grubbing, grading, structural work, construction, etc.

C. Contractor shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

D. Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.

E. Work shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials shall be submitted for approval prior to installation.

B. Natural or biodegradable materials shall be reasonably clean, free of deleterious materials, and certified weed free. Materials may include, but are not limited to, hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel.

C. Grass Seed:
   A. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
   B. In accordance with Section 33 47 00 of the **Town of Berthoud Standards and Specifications** prior to installation
   C. All grass seed shall be approved by the Town prior to installation

D. Fertilizer and soil conditioners shall be approved by the Town and in accordance with Section 33 47 00 of the Town of Berthoud Standards and Specifications prior to installation

E. Silt Fence Fabric: woven polypropylene
   A. Mirafi 100X, "Envirofence"
   B. Or accepted substitution

F. Temporary Slope Stabilization Mat (short term):
   A. Biodegradable
   B. Longevity of 12 months

G. Temporary Slope Stabilization Mat (extended term):
   A. Biodegradable
   B. Longevity of 24 months

PART 3 EXECUTION

3.1 GENERAL

A. All temporary and permanent erosion and sediment control practices will be maintained and repaired as needed to ensure continued performance of their intended function.

B. The Town Engineer/Inspector will monitor Contractor's erosion control methods. If the overall function and intent of erosion control is not being met, the Town will require Contractor to provide additional measures as required to obtain the desired results.

C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

3.2 WORKING IN OR CROSSING WATERCOURSES AND WETLANDS:

A. Construction vehicles shall be kept out of watercourses to the extent possible.
B. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.
    1. The channel, including bed and banks, shall always be restabilized immediately after in-channel work is completed.
C. Where a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing shall be provided for this purpose.

3.3 PROTECTION OF ADJACENT PROPERITES

A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.

B. In addition to the erosion control measures required on the drawings, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
    A. Vegetated buffer strip around the lower perimeter of the land disturbance.
        a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
    B. Sediment barriers such as straw bales, erosion logs, and silt fences.
    C. Sediment basins and porous landscape detention ponds.
    D. Combination of above measures.

3.4 CONSTRUCTION

A. Stabilization of Disturbed Areas:
    A. Temporary sediment control measures shall be established within five (5) days from time of exposure or disturbance.
    B. Permanent erosion protection measures shall be established within five (5) days after final grading of areas.

B. Stabilization of Sediment and Erosion Control Measures:
    A. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
    B. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
    C. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.

C. Stabilization of Waterways and Outlets:
    A. All onsite stormwater conveyance channels used by Contractor for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
    B. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.

E. Construction Access Routes:
   A. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
   B. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
   C. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment-controlled disposal area.
   D. Street washing shall be allowed only after sediment is removed in the manner described above.

3.5 DISPOSITION OF TEMPORARY MEASURES

A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by the Town

B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.

C. Contractor will be responsible for maintaining temporary erosion control measures until such time as work has been accepted by the Town and as specified in the Grading Permit.

END OF SECTION

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SECTION 32 12 00

FLEXIBLE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Full depth and/or composite hot bituminous pavement (asphalt) over prepared subgrade

B. Overlay, patch and/or pavement rehabilitation applications for streets, parking lots and other miscellaneous asphalt pavement

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. T 230: Standard Method of Test of Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures

B. American Society for Testing and Materials (ASTM):
   1. C29: Unit Weight and Voids in Aggregate
   2. C88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   3. C117: Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
   4. C128: Specific Gravity Test and Absorption of Fine Aggregate
   5. C131: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
   6. C136: Sieve or Screen Analysis of Fine and Coarse Aggregates
   7. D70: Specific Gravity of Semi-Solid Bituminous Materials
   8. D2726: Bulk Specific Gravity of Compacted Bituminous Mixtures
   9. D2041: Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
   10. D4462: Viscosity of Asphalts (Bitumens)
   11. 2172: Quantities Extraction of Bitumens from Bituminous Paving Mixtures
   12. D2419: Sand Equivalent Value of Soils and Fine Aggregate
   13. D290: Bituminous Mixing Plant Inspection
   14. D6373: Performance Graded Asphalt Binder
   15. D692: Course Aggregate for Bituminous Paving
   16. D1073: Fine Aggregate for Bituminous Paving Mixtures
   17. D1241: Materials for Soil-Aggregate Subbase, Base and Surface Courses
   18. D2026: Cutback Asphalt (Slow-Curing Type)
   19. D2027: Cutback Asphalt (Medium-Curing Type)
   20. D2028: Cutback Asphalt (Rapid-Curing Type)
   21. D2950: Density of Bituminous Concrete in Place by Nuclear Methods

C. Surface Preparation Standards (SSPC)
   1. SP-2: Superior Performing Asphalt Pavement System (Superpave) Level 1 Mix Design

D. Colorado Department of Transportation (CDOT)

E. Colorado Asphalt Pavement Association (CAPA)

F. Larimer County Urban Area Street Standards (LCUASS)

G. Town of Berthoud Standards and Specifications

1.3 SUBMITTALS

A. Record of Work: Maintain record of time and date of placement, temperature, and weather conditions. Retain until completion and furnish a copy to Town of Berthoud.

B. Proposed Design Job Mix Formula for each mixture required by the contract. The mixture design shall be determined using AASHTO T-312 or Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design.

C. Test Reports: Proposed Design Job Mix testing shall be performed in a materials laboratory under the direct supervision of; and shall be stamped and signed by a Professional Engineer licensed in the State of Colorado practicing in this field. In addition, the General Contractor shall submit as part of the Proposed Design Job Mix, documents to verify the following:
   1. Source of materials
   2. Gradation, specific gravity, source and description of individual aggregates and the final blend
   3. Aggregate physical properties
   4. Source and Grade of the Performance Graded Binder (PG Binder)
   5. Proposed Design Job Mix – aggregate and additive blending, final gradation shown on 0.45 power graph, optimum asphalt content
   6. Required mixing and compaction temperatures
   7. Mixture properties determined at a minimum of four asphalt contents and interpolated at optimum and graphs showing mixture properties versus asphalt content.
   8. Sampling and testing of asphalt concrete mixtures for quality control during paving operations
      a. Uncompacted asphalt concrete mix
         i) Asphalt cement content: ASTM D2172 (AASHTO T164)
         ii) Maximum Specific Gravity: ASTM D2041 (AASHTO T209)
      b. Compacted asphalt concrete mix
         i) Bulk density: ASTM D1188 (AASHTO T166)
      c. Perform at least one test for each day's paving but not less than one test per each 4000 sf of each lift.

1.4 QUALITY ASSURANCE

A. Materials and installation shall conform to applicable portions of CDOT, LCUASS, and Town of Berthoud construction specifications, standards and details as applicable.

1.5 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way, conform to the requirements of Town of Mead Standards and Specifications and details.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

1.6 DELIVERY, STORAGE AND HANDLING

A. Transport mixture from mix plant in trucks with tight, clean, smooth, non-sticking compartments. Thinly coat hauling compartments with lime-water mixture, paraffin oil or other approved release agent to prevent sticking. Petroleum distillates such as kerosene or fuel oil are not approved release agents. Elevate and drain compartment of excess solution before loading mix.

B. Cover to protect from weather and prevent loss of heat

C. Provide insulated truck beds during temperature below 50 degrees F on long distance deliveries

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply when underlying surface is muddy, frozen or wet

B. Place material only when weather conditions permit pavement to be properly placed and compacted

C. The hot mix asphalt will be placed only when both the air and surface temperatures are equal to or exceed the temperatures specified in LCUASS.

D. Air temperature shall be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Pavement shall be asphalt of the plant hot mix type. Materials and construction shall comply with LCUASS Standards and Specifications or CDOT Standards and Specifications when applicable.

B. Weed Control:
   1. First application: “Roundup” or accepted substitute
   2. Second application: Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Traffic Control Devices

1. Comply with LCUASS standards and specifications for signs, sign posts, and pavement markings within the public right-of-way.

2.3 MIXES/SOURCE QUALITY CONTROL

A. Determine full depth design mix based upon aggregates furnished
   1. Test mix by independent laboratory at Contractor's expense
   2. Submit mix designs for review and acceptance by Town Engineer

B. Submit mix design giving unit weight prior to placement of asphalt.

C. Establish a single percentage passing each sieve size, a single percent of asphalt and a mix temperature. Maintain job mixes within following percentages of design mix as specified in LCUASS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Establish and maintain required lines and elevations. Provide grade and location stakes under this section as required for asphaltic concrete paving work.

B. Operate heavy, rubber-tired front loader over subgrade of paved areas. Where soft spots occur, remove loose materials and replace with road base aggregate compacted to level of subgrade.

3.2 PREPARATION

A. Prepare subgrade under provisions of these Specifications

B. Loose and Foreign Material
   1. Remove loose and foreign material from compacted subgrade surface immediately before application of paving. Clean surface with mechanical sweeper, blowers, or hand brooms, until surfaces are free from dust

C. Weed Control
   1. If weeds or vegetation exist at or on the subgrade, apply “Round-up” at rates following manufacturer’s instructions. Apply “Round-up” three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow “Round-up” to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.

2. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing asphalt or aggregate base course, all subgrade soil in the area to receive asphalt pavement shall be thoroughly treated with Casoron soil sterilant (in addition to "Round-up" and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
3. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor's expense.
4. Do not apply within 20 feet of trees or shrubs

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to minimum depth of 1 ½-inches, or as indicated on the plans.
   2. Mill to a uniform finished surface free of gouges, grooves, and ridges of more than ¼ inch depth.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
   5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
   6. Transport milled hot-mix asphalt to asphalt recycling facility.
   7. Keep milled pavement surface free of loose material and dust.

3.4 RING/FRAME ADJUSTMENTS

A. Set ring/frames of subsurface structures to final grade as a part of this work.

B. Placing Ring/Frames
   1. Surround ring/frames set to elevation with a ring of compacted asphalt concrete base prior to paving
   2. Place asphalt concrete mixture up to 1-inch below top of ring/frame, slope to grade, and compact by hand tamping

C. Adjust frames to proper position to meet paving

D. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations

E. Set ring/frames to grade, flush with surface of adjacent pavement

3.5 PREPARING THE MIXTURE

A. Comply with ASTM D995 for material storage, control, and mixing and for plant equipment and operation

B. Stockpile
   1. Keep each component of the various sized combined aggregates in separate stockpiles
   2. Maintain stockpiles so that separate aggregate sizes will not be intermixed and to prevent segregation.

C. Heating
   1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
   2. Use lowest possible temperature to suite temperature viscosity characteristics of asphalt
   3. Do not exceed 350 degrees F

D. Aggregate
   1. Heat-dry aggregates to acceptable moisture content
   2. Deliver to mixer at recommended temperature to suite penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture
   3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements

E. Mix aggregate and asphalt cement to achieve 90-95 percent coated particles for base mixtures and 85-90 percent coated particles for surface mixture, per ASTM D2489

3.6 EQUIPMENT

A. Bituminous Pavers:
   1. Pavers shall be self-propelled, spread material without tearing surfaces, be equipped with an activated screed assembly, be heated if necessary, control pavement edges to true lines without use of stationary forms and capable of spreading and finishing the asphalt plant mix material in widths applicable to the typical sections and thicknesses for the work.
   2. Pavers used for roadway shoulders, recreational paths and similar construction will be capable of spreading and finishing the courses of asphalt plant mix material in width shown in the contract documents.
   3. Pavers will be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line and maintaining the screed at the specified longitudinal grade and transverse slope. The sensor will be constructed to operate from either or both sides of the paver and will be capable of working with the following devices:

a. Ski-type device at least 30 feet in length
b. Short ski or short shoe
c. At least 5,000 feet of control line and stakes

4. The controls will be capable of maintaining the screed at the specified transverse slope within plus or minus 0.1 percent.
5. Manual operation will be permitted:
   a. For constructing irregularly shaped or minor areas
   b. If the automatic controls fail or malfunction the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained. However, if specified surface tolerances cannot be achieved, paving operations will be suspended until satisfactory correction, repairs of equipment replacements are made.
6. Placement of hot mix asphalt on a waterproofed bridge deck shall be accomplished with equipment that will not damage the membrane or other protective covering

B. Rolling Equipment
1. Steel-wheel roller: Self-propelled, contact pressure of 250 to 350 psi per inch of width of roller wheel, equipped with adjustable scrapers and means for keeping wheel wet to prevent mix from sticking
2. Pneumatic-tired rollers: Self-propelled, contact pressure under each tire of 85 to 110 psi, wheels spaced so that one pass will accomplish one complete coverage equal to rolling width of machine, oscillating wheels. Remove and replace immediately tires picking up fines

C. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools as required.

3.7 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine

B. Complete placement over full width of section on each day's run

C. Spread mixture at minimum temperature specified by CDOT Table 401-5 for the specific binder used in the asphalt mix:
1. PG 64-22: 320 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
2. PG 58-28: 275 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
3. The maximum mix discharge temperature will not exceed the minimum discharge temperature by more than 30 F.
4. Delivered mix temperature will be measured behind the paver screed
5. Hot asphalt mixture will be produced at the lowest temperature with the specified temperature range:
   a. A workable mix that provides for uniform coating of aggregates, in accordance with AASHTO T195

b. Allowing the required compaction to be achieved

D. Inaccessible and small areas may be placed by hand

E. Conform to the grade, cross section, finish thickness, and density indicated.

F. Lift Thickness
1. Place in multiple lifts. Place asphalt in lifts such that each compacted lift thickness is no less than 2.0" thick and no greater than 3.0" thick. Top lift to be 2" thick.
2. Typical Lift Thickness Sequencing:

Final Asphalt Section Required (inches)	No. of Lifts	Thickness of each Lift (inches) from bottom to top lift
2"	1	2
3"	1	3
4"	2	2-2
5"	2	3-2
6"	3	2-2-2
7"	3	3-2-2
Final Asphalt Section Required (inches)	No. of Lifts	Thickness of each Lift (inches) from bottom to top lift
8"	3	3-3-2
9"	4	3-2-2-2
10"	4	3-3-2-2
>10	Review with Town Engineer	

G. Paver Placing
1. Unless otherwise directed, place pavers along centerline of areas in crowned section and at high side on one-way slope and in direction of traffic flow.
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
3. Complete base courses before placing surface courses.
4. Place mixture in continuous operation as practicable.

H. Hand Placing
1. Spread, tamp, and finish mixing using hand tools in areas where machine spreading is not possible as acceptable to Town Engineer.
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

I. Joints
1. Construct transverse joint at right angles to centerline when operations are suspended long enough for mixture to chill.
2. Construct joints to have same texture, density, and smoothness as adjacent sections of asphalt concrete course.

3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
4. Offset transverse joints in succeeding courses not less than 24 inches.
5. Cut back edge of existing pavement or previously placed course to expose an even, vertical surface for full course thickness.
6. Offset longitudinal joints in succeeding courses not less than 6 inches.
7. When the edges of longitudinal joints are irregular, honeycombed or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.
8. Wearing course constructed in even number of strips; place 1 longitudinal joint on centerline of road.
9. Wearing course constructed in odd number of strips; place the centerline of 1 strip on centerline of road.
10. Joints shall not be placed in traffic wheel paths.

J. Gutter: Finish surface high adjacent to concrete gutter so when compacted surface is slightly higher than edge of curb and flashing

3.8 COMPACTING THE MIX

A. All paving will be compacted to the required density as required by LCUASS.

B. Provide pneumatic and steel-wheel type rollers to obtain the required pavement density, surface texture and rideability

C. Begin rolling operations when the mixture will bear weight of roller without excessive displacement and complete as quickly as possible after placement occurs.

D. Compaction operations will be continuous until the required density is achieved, or the density requirements are not met, and the mix temperature falls below 185˚ F or there is obvious surface distress or breakage. Minimum compaction temperatures may be adjusted according to the asphalt binder supplier recommendations. Adjusted minimum compaction temperatures must be shown on the approved mix design or on the asphalt binder supplier documentation kept on file at the jobsite.

E. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set

F. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers

G. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

H. Do not roll centers of sections first under any circumstances

I. Breakdown Rolling
   1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
   2. Operate rollers as close as possible to paver without causing pavement displacement
   3. Check crown, grade, and smoothness after breakdown rolling
   4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

J. Second Rolling
   1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction
   2. Continue second rolling until mixture has been thoroughly compacted.

K. Finish Rolling
   1. Perform finish rolling while mixture is still warm enough for removal of roller marks by combination of steel and pneumatic rollers.
   2. Continue rolling until roller marks are eliminated and course has attained specified density and required surface texture and surface tolerances.
   3. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness.

L. Patching
   1. Remove and replace defective areas.
   2. Cut-out and fill with fresh, hot asphaltic concrete.
   3. Remove deficient areas for full depth of course.
   4. Saw cut sides perpendicular and parallel to direction of traffic with edges vertical.
   5. Apply tack coat to exposed surfaces before placing new asphaltic concrete mixture.
   6. Compact by rolling to specified surface density and smoothness.

3.9 JOINING TO EXISTING WORK

A. Saw cut sides vertically and apply tack coat to exposed asphalt surfaces before placing new pavement. Meet existing thickness of surface and base courses, but not less than specified for new work.

B. All joints shall be compacted to meet the density requirements specified in LCUASS.

3.10 FIELD QUALITY CONTROL

A. The Contractor will engage a certified testing agency to perform field testing to determine compliance of in-place asphaltic concrete paving materials and compaction in accordance with LCUASS.

B. It is the Contractor’s responsibility to initiate, coordinate and accommodate all required tests and inspections

C. Testing Agency will test in-place pavement for density and thickness.

D. Contractor to verify final surfaces are of uniform texture, conforming to required grades and cross sections.

E. Thickness: Variations from drawings
   1. Base course: 1/4-inch +
   2. Remove and replace paving less than minimum thickness

F. Grade Tolerance:
   1. Lawn or Unpaved Areas ±0.25 feet
   2. Walks: ±0.1 feet
   3. Pavements: ±0.04 feet

G. Surface Smoothness
   1. Test using a 10-foot straight edge applied parallel to direction of drainage.
   2. Areas showing high spots greater than 1/4 inch as measured with a 10-foot straight edge, but less than 1/2 inch, may be diamond ground to within the specification of 1/4 inch. High spots more than ½ inch must be approved by the Town Engineer
   3. Do not permit pockets or depressions where water may pool.
   4. Remove and replace areas, deficient in smoothness. Overlay corrections may be permitted only if acceptable to the Engineer.

H. Inspection: The work of this section is subject to the inspection and approval of the Town. The following inspections are required:
   1. Protection of adjacent property
   2. Staking and establishment of elevations
   3. Establishment and compaction of subgrade
   4. Placement and compaction of bituminous base course and wearing surface
   5. Final inspection
   6. Obtain approval of each element of work listed above in sequence of its completion before proceeding with the next item

3.11 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Town.

3.12 PROTECTION OF FINISHED WORK

A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened and in no case sooner than 6 hours.

B. Provide barricades and warning devices as required to protect pavement and the general public.

3.13 WARRANTY

A. Provide installer's 2-year written warranty endorsed by the contractor warranting the pavement from creeping, shoring, cracking, softening, settling, ponding and other defects

due to improper placing or defective materials. Replace defective materials upon notification by the Town in accordance with the requirements of the original work.

3.14 SCHEDULE OF MIX PLACEMENT:

A. Refer to approved drawings for asphalt thickness and subgrade requirements.

END OF SECTION

SECTION 32 13 00

RIGID PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Forming, jointing, placing and curing of concrete pavements, curbs, gutters, cross pans, islands and sidewalks.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M171 – Sheet Materials for Curing Concrete

B. American Concrete Institute (ACI)
   1. 214 – Recommended Practice for Evaluating Compression Test Results of Field Concrete
   2. 301 – Specifications for Structural Concrete for buildings
   3. 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
   4. 305/305R – Hot Weather Concreting
   5. 306/306R – Cold Weather Concreting
   6. 308 – Standard Practice for Curing Concrete

C. American Society for Testing and Materials (ASTM)
   1. A1064 – Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed for Concrete
   2. A615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   3. C31 – Making and Curing Concrete Test Specimens in the Field
   4. C33 – Concrete Aggregates
   5. C39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens
   6. C94 – Ready Mix Concrete
   7. C143 – Test Method of Slump of Hydraulic Cement Concrete
   8. C150 – Portland Cement
   9. C260 – Air-Entraining Admixtures for Concrete
   10. C309/AASHTO M148 – Liquid Membrane-Forming Compounds for Curing Concrete
   11. C494 – Chemical Admixtures for Concrete
   12. C618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
   13. C1116 – Fiber Reinforced Concrete
   14. D994 – Preformed Expansion Joint Filler for Concrete (Bituminous Type)
   15. D6690 – Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
   16. C979 – Pigments for Integrally Colored Concrete

17. D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
18. D1752 – Preformed Sponge Rubber Cork Expansion and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

D. CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

E. Colorado Department of Transportation (CDOT)

F. Larimer County Urban Area Street Standards (LCUASS)

G. Town of Berthoud Standards and Specifications

1.3 SUBMITTALS

A. Product Data: Provide sufficient information on mix design and products specified to verify compliance with specifications. Provide data on joint filler admixtures and curing compounds.
1. Existing data on proposed design mixes, certified and complete
2. Submit reports of field quality control testing

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, Conform materials and installation to applicable portions of LCUASS, CDOT, and the Town of Berthoud Standards and Specifications

1.5 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way conform to the requirements of Town of Mead Standards and Specifications and details for the construction of curbs, gutters, sidewalks, driveways, Street Paving, and other public right-of-way Improvements.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain cementitious materials and aggregate from same source for all work

1.6 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing steel: Store on supports which will keep materials from contact with the ground and cover.

B. Rubber and plastic materials: Store in a cool place. Do not expose to direct sunlight.

C. Prepare a delivery ticket for each load of ready-mixed concrete.

D. Contractor shall submit tickets for all concrete delivered to site which document the following:
   1. Quantity delivered
   2. Actual quantity of each material in batch
   3. Outdoor temp in the shade
   4. Time at which cement was added
   5. Numerical sequence of the delivery
   6. Quantity of water that can be added in the field based on mix design
   7. Free moisture in fine and coarse aggregate in percent by weight
   8. Temperature of batch

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Protect concrete from rapid loss of moisture during hot water placement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Form Materials
   1. Plywood: PS 1, waterproof resin-bonded, exterior type Douglas Fir; face adjacent to concrete Grade B or better
   2. Fiberboard: FS LL-B-810, Type IX, tempered, waterproof, screen back, concrete form hardboard
   3. Capable of supporting loads imposed by construction equipment, straight and free from warp. Clean and strong enough to resist pressure of concrete when placed and retain horizontal and vertical alignment. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete
   4. Joint filler: ASTM D1751 or D1752 type; 3/4-inch thick unless indicated otherwise

B. Reinforcement
   1. Where reinforcement is specified herein or indicated on the plans:
      1. Bars: ASTM A615, Grade 60
      2. Reinforcing Welded Wire Fabric (WWF): ASTM A1064, steel, 16 gage minimum
         i) Furnish in flat sheets
      3. Dowels: ASTM A615; 40 ksi yield, Grade 60, plain steel, unfinished finish
      4. Fibrous reinforcement: Collated, fibrillated, polypropelyne fibers, tensile strength 70,000 psi
         i) ASTM C1116
         ii) Use 1.5 lbs. Per cubic yard minimum
         iii) Fibermesh or accepted substitution

C. Weed Control: First application, “Roundup.” Second application, Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Curing Compound: ASTM C309, AASHTO M-148, white pigmented liquid membrane

B. Joint Sealers: Polyurethane base, elastomeric, self leveling, chemical cure, handling 50% joint movement; Sikaflex-2C-SL or accepted substitutions

C. Sheet Materials: AASHTO M171, 4 mil

2.3 CONCRETE MIX

A. Comply with ASTM C94

B. Maximum Coarse Aggregate Size: 1 1/2-inch

C. Portland Cement: ASTM C150, Type II; 555 pounds minimum per cubic yard of concrete

D. Water/Cementitious Material (Cement and Fly Ash) Ratio: Less than or equal to 0.45

E. Slump: 4-inch maximum
   1. May be increased to 4.5 inches for hand work, acceptable to Town
   2. As low as possible consistent with proper handling and thorough compaction

F. Volumetric Air Content: Air content between 5 and 8% by volume with a maximum course aggregate size for 1-1/2 inches
   1. Vary air content with maximum size aggregate, ASTM C94, Table 3.

G. Strength: Compressive strength as determined by ASTM C39, 4,000 psi minimum at 28 days

H. Consistency: Uniform slump, suitable for the placement conditions with aggregate floating uniformly throughout the concrete mass, flowing sluggishly when vibrated or spaded

I. Adjust mix as required to meet specifications.

J. Approved fly ash may be substituted for ASTM C150 cement up to a maximum of 25 percent Class C or Class F by weight of the cementitious material content. Fly ash for concrete shall conform to the requirements of ASTM C618 with the following exceptions:
   1. The loss on ignition shall not exceed 3.0 percent
   2. The CaO in Class F fly ash shall not exceed 18 percent

K. Admixtures: Content, batching method, and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification.
   1. Include a water reducing admixture
   2. Calcium chloride content shall not exceed 0.05% of the cement content by weight

2.4 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design to the Town of Berthoud for review prior to commencement of work.

B. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify that the gradients and elevations of base are correct.

C. Check completed formwork for grade and alignment to the following tolerances:
   1. Top of forms not more than 1/8-inch in 10 feet
   2. Vertical face on longitudinal axis, not more than 1/4-inch in 10 feet

3.2 PREPARATION

A. Subgrade
   1. Prepare subgrade in accordance with Section 31 00 00 – Earthwork and the most recent version of LCUASS
   2. Moisten subgrade to depth of 6 inches at optimal moisture not more than 12 hours prior to placement to minimize absorption of water from fresh concrete.
   3. Check for soft spots by proof-rolling or other means prior to setting forms. Remove soft yielding material and replace. Compact to specifications under provisions of Section 31 00 00 – Earthwork and the most recent version of LCUASS
   4. Check crown and/or elevation of subgrade to assure specified thickness. Compact to specification additional material used to bring to correct elevation. Remove excess material where subgrade is too high
   5. Clean subgrade of all loose materials before placement of concrete. Do not disturb area inside forms after fine grading is complete.

B. Weed Control:
   1. If weeds or vegetation exist at or on the subgrade, apply “Round-up” at rates following manufacturer’s instructions. Apply “Round-up” three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow “Round-up” to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.

2. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing pavement, all subgrade soil in the area to receive pavement shall be thoroughly treated with Casoron soil sterilant (in addition to "Round-up" and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
3. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor's expense.
4. Do not apply within 20 feet of trees or shrubs.

C. Frame Adjustment
1. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement for concrete collars.
2. Set frames of structures in full grout bed to provide bearing. Set to final grade.
3. Form construction joints and blockouts as indicated on approved drawings.

3.3 PERFORMANCE AND INSTALLATION

A. Transporting mixed concrete
1. Transporting of mixed concrete shall conform to ACI 305R
2. Do not exceed manufacturer's guaranteed capacity of truck agitators. Maintain the mixed concrete in a thoroughly mixed and uniform mass during handling
3. Do not incorporate additional mixing water into the concrete during hauling or after arrival at the delivery point, unless ordered by the Town If additional water is to be incorporated into the concrete, revolve the drum not less than 30 revolutions at mixing speed after the water is added and before placing concrete.
4. Furnish a water measuring device in good working condition, mounted on each transit mix truck, for measuring the water added to the mix on the site by the Town.
5. Provide delivery ticket and comply with delivery requirements of this Section.

B. Forming.
1. Place and secure forms to correct location, dimension, profile, and gradient
2. Install sufficient quantity of forms to allow continuous progress of work so that forms can remain in place at least 24 hours after concrete placement.
3. Join neatly and mechanically tamp to assure firm placement. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
4. Oil forms prior to concrete placement.
5. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

6. Set dowels, expansion joints, preformed construction joints and header boards as specified or indicated on the drawings.
7. Low roll or mountable curbs may be formed without the use of face form by using a straight edge and template to form curb face.
8. Backfill behind forms as required to prevent water from entering subgrade.

C. Reinforcement
1. Add fiber reinforcement to mix at plant prior to delivery to jobsite.
2. Place bar or WWF reinforcement at mid-height of slabs-on-grade or as shown on the approved drawings.
    1. Install in as long lengths as possible. Lap adjoining pieces at least one full mesh and lace with wire.
    2. Support with metal chairs, brick or stone is unacceptable.
3. Hold all tie and marginal dowels in proper position by sufficient supports or pins.
4. Mechanically install dowels or place on supports if center longitudinal joint is sawed in lieu of placing plastic strip.
5. Interrupt reinforcement at expansion joints.
6. Place dowels to achieve pavement and curb alignment as detailed.
7. Provide doweled joints inch at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.
8. Grease dowels on one side of joints with caps on greased end.

D. Placing concrete
1. Place concrete in accordance with ACI 301.
2. Lightly moisten subgrade or base course immediately before placing concrete.
3. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed
4. during concrete placement.
5. Deposit concrete near final position. Minimize segregation and damage to subgrade.
6. Place concrete continuously over the full width of the panel and between predetermined construction joints. Spread mechanically to prevent segregation and separation of materials.
7. Consolidate concrete with vibrators and spade next to forms to remove air spaces or honeycombs.
8. Do not place concrete in forms that has begun to set.
9. Do not place more concrete in one day than can be finished before dark the same day.
10. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified
11. Walks: Construct sidewalks with a minimum thickness of 4 inches for sidewalks less than 8 feet wide and 6 inches for sidewalks greater than 8 feet wide. Tool edges to rounded profile and finish as specified or as shown on the approved drawings. Pitch walks 1/4-inch per foot for cross drainage unless otherwise indicated

E. Cold weather concreting
   1. Refer to the most recent version of LCUASS for cold weather concreting

F. Hot weather concreting
   1. Conform to ACI 305/305R, except as modified herein.
   2. At air temp of 90 degrees F and above keep concrete as cool as possible during placement and curing. Fog sprayers or special wetting agents may be required for protection
   3. Do not allow concrete temperature to exceed 70 deg F at placement.
   4. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
   5. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 lbs per sq ft per hr as determined from ACI 305, Fig 2.1.4.

G. Joints
   1. Provide concrete joints per LCUASS or CDOT Standard Details, as required
   2. Sidewalk and pavement
      1. Contraction joints: At intervals not to exceed 10 feet and 1 1/2 inches deep, tooled or sawcut
      2. Expansion joints: 1/2-inch premolded joints where sidewalks end at curb returns, against fixed objects, at points of sharp radius, and between sidewalk and driveway slabs. Place expansion joint at minimum of every 100 feet.
      3. Construction joints: At all separate pours, and around all appurtenances such as manholes, utility poles, and other penetrations extending into and through sidewalks. Place backer rod and polyurethane sealant for entire joint length.
   3. Curb and Gutter
      1. Contraction joints: At intervals not to exceed 10 feet made by insertion of 1/8-inch template at right angles to curb and 1 1/2-inch deep.
      2. Expansion joints: At curb returns, against fixed objects, at points of sharp radius, between adjacent sidewalk and curb at all curb returns, between sidewalk and all driveway slabs, and along straight lengths every 200 linear feet. Install expansion joint filler between concrete sidewalks and any fixed structure. Extend expansion joint material for full depth of concrete, except stop 1/2-inch below finish surface.
      3. Construction joints: At all separate pours, place backer rod and polyurethane sealant for entire joint length.
   4. Place expansion joint filler between paving components and buildings or other appurtenances at temperatures above 50 deg F. Clean all dust, debris and water from joint. Recess top of filler 1/2-inch for sealant placement.
   5. Provide keyed joints as indicated in approved drawings

H. Finishing
   1. Run straight-edge over forms with sawing motion to fill all holes and depressions.
   2. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
   3. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth finish

4. Finish surfaces with a wooden or magnesium float. Plastering of surfaces is not permitted
5. Immediately after float finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine hair fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Town before application.
6. On inclined slab surfaces and steps, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic
7. Edge all outside edges of the slab and all joints with a 0.25-inch radius edging tool.
8. Work edges of gutters, back top edge of curb, and formed joints with an edging tool, and round to 0.5-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface
9. Brush with soft bristle brush to remove trowel marks and leave a uniform appearance just before concrete takes initial set.
10. Direction of Texturing:
    1. Curb and Gutter: At right angles to the curb line
    2. Sidewalk: At right angles to centerline of sidewalk.
11. Place curing compound on exposed concrete surfaces immediately after finishing. Apply under pressure at the rate of one gallon to not more than 135 square feet by mechanical sprayers in accordance with manufacturer's instructions acceptable to Town.

I. Joint sealing
1. Seal joints and clean concrete prior to opening to traffic.
2. Seal all expansion joints.
3. Separate concrete from other structures with 3/4-inch thick joint filler.
4. Place joint filler in concrete pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
5. Extend joint filler from bottom of pavement to within 1/4-inch of finished surface.

J. Curing and protection
1. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
2. Have plastic sheeting, straw, burlap and/or canvas materials available at all times to protect fresh uncured surfaces from adverse weather conditions.
3. Do not permit pedestrian traffic over sidewalks for 7 days minimum after finishing. Do not permit vehicular traffic over pavement for 14 days minimum after finishing or until 75 percent design strength of concrete has been achieved.

3.4 FIELD QUALITY CONTROL

A. Comply with Division One Specifications - Quality Assurance: Field inspections and testing

B. It is the Contractor’s responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing

requirement with testing agency and provide testing agency sufficient advance notification to schedule tests

C. Tolerances
   1. Maximum Variation of Surface Grade: 1/4- inch in 10 ft
   2. Maximum Variation from True Alignment: 3/8-inch in 10 ft

D. Take cylinders and perform slump and air entrainment tests as required by Division One Specifications in accordance with ACI 301. Unit weight and mix temperature will also be taken

E. The first three loads will be tested for slump and air content. If any one test fails to meet requirements, that load will be rejected and tests will continue on each load until three consecutive loads meet requirements. Thereafter, five concrete test cylinders will be taken for every 75 cu yds or less cu yds of concrete placed each day.

F. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

G. One slump and air entrainment test will be taken for each set of test cylinders taken.

H. Cylinders will be tested as follows: 1 at 7 days, 2 at 28 days and one at a later date should the test at 28 days fail. All tests shall be in accordance with the most recent version of the LCUASS.

I. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

J. Thickness of fresh concrete may be checked by Owner at random. Coring will be conducted in accordance with Town of Berthoud requirements. Where average thickness of concrete is deficient in thickness by more than 0.20-inch, but not more than 1.0-inch, payment to Contractor will be adjusted based on amount indicated in schedule of values for Portland cement concrete paving as specified in the contract documents and/or the documented material costs of the concrete in question.

K. Failure of Test Cylinders or Coring Results: Engineer may order removal and replacement of concrete as required upon failure of 28-day tests or if thickness of pavement is less than 95% of specified thickness.

3.5 SCHEDULE OF CONCRETE

A. See plans for concrete thicknesses and subgrade preparation. Concrete thicknesses and subgrade preparation shall be per approved drawings and applicable LCUASS standard drawings

3.6 SCHEDULE OF CONCRETE REINFORCEMENT

A. Fiber reinforcement required for all concrete flatwork, including curb and gutter, sidewalk and pavement.

B. Rebar reinforcement shall be in accordance with the most recent version of LCUASS

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SECTION 33 10 00

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Buried pipe, fittings, hydrants, valves, appurtenances, and associated accessories for water distribution and transmission lines

B. Precast vaults

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. A36 – Standard Specification for Carbon Structural Steel
2. A48 – Standard Specification for Gray Iron Castings
3. A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
4. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
5. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
6. A242 – Standard Specification for High-Strength Low-Allow Structural Steel
7. A276 – Standard Specification for Stainless Steel Bars and Shapes
8. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
9. A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
10. A536 – Standard Specification for Ductile Iron Castings
11. A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
12. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
13. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
14. B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
15. B88 – Standard Specification for Seamless Copper Water Tube
16. B96 – Standard Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels
17. B763 – Standard Specification for Copper Alloy Sand Castings for Valve Applications
18. B843 – Magnesium Alloy Anodes for Cathodic Protection
19. C33 – Standard Specification for Concrete Aggregates

20. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
21. C150 – Standard Specification for Portland Cement
22. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
23. C1227 – Standard Specification for Precast Concrete Septic Tanks
24. D429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
25. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kn-m/m3))
26. D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
27. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
28. D1330 – Standard Specification for Rubber Sheet Gaskets
29. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
30. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
31. D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
32. D2000 – Standard Classification System for Rubber Products in Automotive Applications
33. D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
34. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
35. D2467 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
36. D2454 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
37. D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
38. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
39. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
40. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
41. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
42. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
43. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
44. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
45. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
46. D3950 – Standard Specification for Strapping, Nonmetallic (and Joining Methods)

47. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
48. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
49. D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
50. E8 – Standard Test Methods for Tension Testing of Metallic Materials
51. F412 – Standard Terminology Relating to Plastic Piping Systems
52. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
53. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
54. G97 – Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications

B. American Water Works Association (AWWA)
1. B300 – Standard for Hypochlorites
2. B301 – Standard for Liquid Chlorine
3. B302 – Standard for Ammonium Sulfate
4. B303 – Standard for Sodium Chlorite
5. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
6. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
7. C110 – Standard for Ductile-Iron and Gray-Iron Fittings
8. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
10. C116 – Standard for Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
11. C150 – Standard for Thickness Design of Ductile-Iron Pipe
12. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
13. C153 – Standard for Ductile-Iron Compact Fittings
14. C200 – Standard for Steel Water Pipe 6 In. (150 mm) and Larger
15. C203 – Standard for Coal-Tar Protective Coatings & Linings for Steel Water Pipes
16. C206 – Standard for Field Welding of Steel Water Pipe
17. C207 – Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
18. C213 – Standard for Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
19. C214 – Standard for Tape Coatings for Steel Water Pipelines
20. C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
21. C500 – Standard for Metal-Seated Gate Valves for Water Supply Service
22. C502 – Standard for Dry-Barrel Fire Hydrants
23. C504 – Standard for Rubber-Seated Butterfly Valves
24. C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service
25. C515 – Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
26. C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants
27. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances

28. C604 – Standard for Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
29. C605 – Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
30. C651 – Disinfecting Water Mains
31. C700 – Standard for Cold-Water Meters – Displacement Type, Metal Alloy Main Case
32. C800 – Standard for Underground Service Line Valves and Fittings
33. C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm) for Water Transmission and Distribution
34. C901 – Standard for Polyethylene (PE) Pressure Pipe and Tubing 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service
35. C905 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution
36. C906 – Polyethylene (PE) Pressure Pipe and Fittings 4 in. (100 mm) Through 63 In. (1,600 mm) for Water Distribution and Transmission
37. M11 – Steel Pipe: A Guide for Design and Installation
38. M17 – Standard for Installation, Field Testing, and Maintenance of Fire Hydrants
39. M23 – Standard for PVC Pipe Design and Installation
40. M41 – Standard for Ductile-Iron Pipe and Fittings

C. Berthoud Fire Protection District (BFPD)

D. Colorado Department of Transportation (CDOT)

E. National Fire Protection Agency (NFPA)

F. Occupational Safety and Health Administration (OSHA)

G. NSF International:
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects
   2. Standard 61 – Drinking Water System Components – Health Effects

H. Surface Preparation Standards (SSPC)

I. National Association of Corrosion Engineers (NACE):
   1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

J. Uni-Bell PVC Pipe Association:
   1. Uni-Pub-8: Tapping Guide for PVC Pressure Pipe

K. Plastics Pipe Institute (PPI):
   1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe

2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
3. Handbook of Polyethylene Pipe
4. Material Handling Guide

L. Ductile Iron Pipe Research Association (DIPRA):
1. Thrust Restraint Design for Ductile Iron Pipe

1.3 SUBMITTALS

A. Shop Accepted drawings: Provide piping layout and assembly accepted drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications. Provide sufficient data to verify compliance with the specifications and to illustrate construction and assembly of precast vault

B. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight. Indicate pressure ratings for pipe, fittings, valves
1. Pipe materials
2. Special, fitting, and coupling details
3. Joint restraint system
4. Valves
5. Laying and installation schedule
6. Specifications and data sheets
7. Affidavits of compliance for protective shop coatings and linings
8. Provide manufacturer catalog information on castings, grating, and accessories to indicate compliance with specifications of recast vault

C. Design Data: Include calculations prepared by precast manufacturer indicating design loads and material requirements for reinforcement

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

E. Test Reports: Submit reports of field pressure and disinfection tests under provisions of Section 01340

F. Test Reports: Indicate disinfection results comparative to specified requirements

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, top of pipe elevations, and any mapped or unmapped utilities

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.5 QUALITY ASSURANCE

A. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

B. All [PVC, ductile iron, etc.] pipe, regardless of diameter, shall be supplied by a single manufacturer

C. Perform Work in accordance with AWWA C651, and the Colorado Department of Public Health and Environment (CDPHE), Larimer County and/or Weld County, and the Town of the Berthoud.

D. Contractor shall conduct visual inspection before installation

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational water lines

1.6 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Larimer County and/or Weld County, the Town of Berthoud, CDPHE, the notes and details on the accepted drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. Conform to AWWA C651, as appropriate, and CDPHE Design Criteria for Potable Water Systems for performing the work of this Section

C. In case of apparent conflict, CDPHE requirements govern over these specifications

D. In absence of State and local regulations, International Plumbing Code applies

E. NFPA Compliance: Install fire water systems in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances”

F. UL Compliance: Provide fire hydrants that comply with UL 246 “Hydrants for Fire-Protection Service,” and are listed by UL.

G. Contractor, not the Town, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct sunlight

B. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: direct sunlight, mud, etc.
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

C. Storage: Use the following precautions for valves, during storage:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage
      a. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

D. Handling
   1. Handle so as to insure installation in sound undamaged condition
   2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection.
   3. Use hooks or straps with broad, well-padded contact surfaces for lifting sections of pipe

E. Preparation for Transport: Prepare valves, for shipping as follows: Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends, flange faces, and weld ends. Set valves in best position for handling. Set valves closed to prevent rattling

F. Deliver and store valves and accessories in shipping containers with labeling in place in accordance with AWWA C500

G. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation

H. Seal valve ends to prevent entry of foreign materials into valve body

I. During loading, transporting and unloading, exercise care to prevent damage to material
   1. Use nylon slings only
   2. Do not drop pipe or fittings
   3. Do not roll or skid against pipe already on ground
   4. Repair any damage done to coating or lining
   5. Handle per manufacturer's recommendations
   6. Store rubber gaskets in cool dark location
   7. Store all material on wood pallets or timbers

J. Adequately tag or otherwise mark all piping, fittings, and valves as to size per AWWA C509 and C900

K. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Town.

L. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Town Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Town.

M. Precast Concrete Structures
   1. Transport and handle precast concrete units with equipment to protect from dirt and damage
   2. Do not place precast concrete units in position which will cause damage
   3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer's yard until curing is complete.

1.8 JOB CONDITIONS

A. All work which requires the interruption of active water service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the Town.

B. Underground Obstructions
   a. Locations shown may prove inaccurate and other obstructions not known may be encountered
   b. Contractor shall field locate and verify all obstructions where or not shown on the Accepted drawings
   2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
   3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
      a. Notify the Engineer in case of a conflict
      b. In case of a conflict, the proposed work may be changed by Engineer
   4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

C. Verify existing system operation, pressures, and valve settings (open or closed) prior to construction

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ACCESSORIES

A. Comply with Town of Berthoud Standards and Standard Details.

2.2 PVC PIPE – 4" TO 12" DIAMETER

A. Manufacturers:
   1. JM Eagle
   2. Georg Fischer Piping Systems
   3. North American Pipe Corporation
   4. Diamond Plastics Corporation
   5. Vinyltech Corporation
   6. Or accepted substitution

B. Pipe: AWWA C900, DR 18 with nominal laying length of 20-ft except as otherwise specified or indicated on the Accepted drawings

C. Marking: Identification markings on pipe shall conform to AWWA C900

D. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
   1. Working pressure rating: 350 psi rating
   2. Joint: Mechanical joints with restraints
   3. Coating:
      a. Exterior: AWWA C111, Asphalt coated
      b. Interior: AWWA C104 and C111, lined with double thickness cement seal coated
      c. Or interior and exterior: AWWA C116, fusion bonded epoxy coating

E. Joints: ASTM D3139, integral bell with restraint or mechanical joint
   1. Integral Bell with Restraint:
      a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
      b. Suitable for buried service
      c. Gaskets:
         i) Material: Virgin SBR rubber suitable for potable water conforming to AWWA C111
         ii) Lubricant shall be suitable for potable water contact
   2. Restraint device for PVC integral bell joint
      a. Restraint material: ASTM A536, ductile iron
      b. A split ring shall be used behind the pipe bell. A serrated ring shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
      c. Nuts and bolts torqued to requirements of manufacturer
      d. Pressure rating consistent with pipe pressure rating
      e. Restraint coatings shall be consistent with manufacturer's standard
      f. Manufacturers:
         i) EBAA Iron Inc. "Series 1600"
         ii) Romac Industries "Series 611"
         iii) Or accepted substitution
   3. Mechanical joint restraint
      a. Provide mechanical joint restraint for all fittings

b. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/C110
c. Pressure rating consistent with pipe pressure rating
d. Restraint coatings shall be consistent with manufacturer's standard
e. Manufacturer:
    i) EBAA Iron "MEGALUG 2000 PV"
    ii) Romac Industries "Roma-Grip"
    iii) Or accepted substitution

F. Couplings
1. Mechanical couplings:
    a. Dresser Style 38
    b. Rockwell 411
    c. Or accepted substitution
2. Insulated Mechanical Couplings:
    a. Dresser Style 39
    b. Or accepted substitution
3. Transition Couplings:
    a. Rockwell 415
    b. Dresser Style 39
    c. Or accepted substitution
4. Glands color coded: Black

G. Couplings
1. Provide for connection between dissimilar water distribution pipe
2. Material: Ductile Iron, ASTM A536 Grade 65-45-12
3. End Rings: Ductile Iron, ASTM A536
4. Gaskets: Virgin SBR rubber suitable for potable conforming to AWWA C111
5. Bolts and Heavy Hex Nuts: UNC 5/8" rolled threads with black finish.
6. Manufacturer:
    a. JCM
    b. EJ Prescott
    c. Or accepted substitution

2.3 PVC SADDLE TAP

A. Provide saddle tap for connection to air release/vacuum breaker combination valves as shown on the Accepted drawings

B. Use tapping saddle manufactured specifically for C900 PVC pipe with stainless steel wide band straps, nuts and washers

C. Manufacturer:
1. Mueller
2. Or accepted substitution

2.4 DUCTILE IRON PIPE

A. Manufacturers
   1. U.S. Pipe
   2. American Cast Iron Pipe Company
   3. Griffin Pipe Products Company
   4. Or accepted substitution

B. Pipe: ANSI A21.51/AWWA C151:
   1. Class 51, pressure rating 350 psi
   2. Nominal Laying Length of 18 or 20 feet
   3. For mechanical joints, or restrained joints: Class 50 for 6-inch or larger; Class 51 for 3-inch and 4-inch, single gasket
   4. Lining: cement mortar, AWWA C104
   5. External coating for buried pipe: asphaltic coating, 1 mil

C. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
   1. Working pressure rating: 350 psi rating
   2. Joint: Mechanical joints with restraints
   3. Coating:
      a. Exterior: AWWA C111, Asphalt coated
      b. Interior: AWWA C104 and C111, lined with double thickness cement seal coated
      c. Or interior and exterior: AWWA C116, fusion bonded epoxy coating
   4. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
      a. Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeves that mate with size and type of pipe material being tapped. Outlet flange shall be of a size required for branch connection.

D. Joints
   1. Mechanical joints: ANSI A21.11/AWWA C111
      a. Bolts and nuts: High strength, low alloy steel, "Cor-Ten" or approved substitution
   2. Restrained joints: ANSI A21.11/AWWA C111
      a. Pressure rated 350 psi
      b. Lubricant: Heavy vegetable soap solution suitable for potable water contact
   3. Gaskets: Butyl rubber gaskets in conformance with ANSI A21.11/AWWA C111. Natural rubber is not acceptable.
      a. Pressure rated 350 psi
   4. Restraint device for joint
      a. Restraint material: ASTM A536 , ductile iron
      b. A split ring shall be used behind the pipe bell. A serrated ring shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
      c. Nuts and bolts torqued to requirements of manufacturer

d. Pressure rating consistent with pipe pressure rating
e. Restraint coatings shall be consistent with manufacturer's standard
f. Manufacturers:
i) EBAA Iron Inc. "Series 1600"
ii) Romac Industries "Series 611"
iii) Or accepted substitution

5. Threaded connections: ANSI B1.20.3 NPT: provide boss or tapping saddle at all tapped connections
6. Mechanical couplings:
a. Dresser, Style 38
b. Rockwell, 411
c. Romac, 501
d. Or accepted substitution
7. Insulated Mechanical Couplings:
a. Dresser, Style 39
b. Rockwell, Style 416
c. Romac, IC501
d. Or accepted substitution
8. Mechanical joints with restraint device
a. Provided for all ductile iron fittings
b. 360° serration lock engagement type
c. Nuts and bolts torqued to requirements of manufacturer
d. Working pressure rated at 350 psi minimum
e. Glands color coded: Black
f. Manufacturers:
i) EBBA Iron Inc., Meg-a-Lug Series 1100
ii) Uni-Flange Corporation, 1400 Series
iii) Romac Industries Inc., RomaGrip™
iv) Or accepted substitution

2.5 COPPER TUBING – 3 INCHES OR LESS

A. Manufacturers:
1. Mueller
2. Or accepted substitution

B. Copper Tube: ASTM B88; Type K, soft-annealed temper with flared connections.
1. Fittings: Wrought-copper solder-joint fittings, ANSI B16.22; soldered joints, pressure type. Compression fitting will not be accepted.

2.6 POLYETHYLENE TUBING

A. Manufacturers:
1. Centennial Plastics, Inc.
2. Or accepted substitution

B. Service lines shall be Polyethylene (PE) Copper Tube Size (CTS) potable water tubing
   1. Service line pipe sizes are indicated on Accepted drawings.
   2. Resin formulation: PE 3608
   3. Cell Classification of 4345464C per ASTM D2239 and ASTM D2737
   4. Hydrostatic Design Basis (HDB)
      a. HDB: 1600 psi @ 73.4 °F
      b. HDB: 800 psi @ 140 °F

C. Joining:
   1. Shall be by butt-fusion
   2. All personnel conducting butt-fusion should be experienced and follow guidelines published by the pipe manufacturer or by PPI in TR-33

D. Installing:
   1. To be direct buried
   2. Buried pipe must be supported by proper embedment material as shown on Accepted drawings
   3. Refer to PPI's "Handbook of Polyethylene Pipe" and follow all local, state, and/or federal guidelines

E. Safe Handling:
   1. To safely handle and store PE pipe, refer to PPI's "Material Handling Guide"

F. Disinfection:
   1. Disinfection of service line should follow specifications herein

G. Testing:
   1. All pipe shall be hydrostatically tested after installation as specified herein.

2.7 SERVICE LINE ACCESSORIES

A. Corporation Stops: Corporation stops shall have inlet threaded CC type, and outlet shall be copper compression or flare. No soldering will be allowed

B. Curb Stops: Curb stop style shall be compression or flared with copper on both ends. Minneapolis pattern valve threads are required to allow for Minneapolis style curb box.

C. Curb box: Curb Box shall have Minneapolis base extension type curb boxes, cast iron lid and base with brass pentagon head plug using a 1.5-inch upper section. Include cover with lettering "WATER."

D. Service Clamps for ¾-inch to 2-inch Copper: Complete assembly, including double band service clamp (bolted or hinge pin), corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.
   1. O-ring gasket
   2. Counterclockwise thread
   3. Manufacturers:
      a. Mueller Co.

b. Romac Industries, Inc.
c. Or accepted substitution

E. Meter box:
1. 18-inch diameter meter box with minimum 0.30-inch thick PVC shell for 3/4" or 1" meter
2. Lid: cast-iron with closed cell insulating pad
3. Provide with shell extensions as required to satisfy 9 foot bury depth requirements
4. Manufacturers:
a. Mueller Co.
b. Hunt
c. Ford
d. Or accepted substitution

2.8 PIPE ACCESSORIES

A. Identification Marker Tape: Provide metallic core tape, blue with black letters "CAUTION – WATER LINE BELOW" continuously printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide identification markers of one of the following:
1. Allen Systems, Inc.
2. Emed Co., Inc.
3. Seton Name Plate Corp.
4. Or accepted substitution

B. Tracer Wire
1. Provide tracer wire for all PVC pipe
2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water
3. UL listed

C. Tracer Wire Test Stations
1. 4-inch with locking lid
2. Manufacturers:
a. CP Test Services
b. Glenn Series "Glenn-4"
c. Or accepted substitution

D. Corrosion Control
1. Rust inhibitive primer:
a. Tnemec "Series 77H Chem-Prime"
b. Or accepted substitution
2. Rust preventative compound:
a. Houghton "Rust Veto 344"
b. Rust-Oleum "R-9"
c. Or accepted substitution

2.9 GATE VALVES – 3" TO 12" AND ACCESSORIES

A. Manufacturers:
   1. Mueller
   2. American AVK
   3. American Flow Control
   4. Clow
   5. Kennedy
   6. Or accepted substitution

B. AWWA C509, Iron body, bronze trim, two O-ring stem seals, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, extension stem, and extension valve box, pressure rating of 250 psi. For installation in horizontal or near horizontal pipe lines
   1. Non-adjustable elastomeric stem seals
      a. Adjustable packing glands are not permitted
   2. Direct operation of stem from above via 2-inch square nut
      a. No gear box provided
   3. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut

C. Rotation: Contractor to verify the operating direction with the jurisdictional water district or department
   1. Provide the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut.
   2. Contractor to confirm nut size with the jurisdictional water district or department

D. Valve stem material: ASTM B763, UNS alloy C99500 minimum yield strength of 40,000 psi
   1. Valve stem extensions: Provide valve stem extensions as necessary for proper valve operation with a 7-foot key with tee handle
   2. Provide one (1) key to the Town prior to project closeout

E. Extension stems
   1. Provide for buried valves with operating nuts more than 5 feet below grade
   2. Non-rising stems
      a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
      b. Connected to the valve by a flexible socket coupling
      c. All other connections pinned
      d. Extend stem to within 6-inch of grade
      e. Provide spacers to center stem in valve box
      f. Provide wrench nut

F. Coating
   1. AWWA C550 and NSF 61 certified
   2. Minimum 8 mils dry film thickness

3. Fusion bonded epoxy applied to all ferrous metal surfaces after cleaning surfaces of grease, dirt and moisture, and performing near-white blast cleaning following SSPC-SP10
4. Do not coat fasteners or machined surfaces subject to contact and relative movement against other surfaces during operation of valve or other surfaces where such coating would compromise proper installation or functionality of valve

G. Valve boxes, depth as required for valve
1. Three piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
2. Box, cover, and base coated by dipping in asphalt varnish.
3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
   a. Tyler Pipe Company "Series 6860 with #160 oval base"
   b. East Jordan Iron Works "8560 Series"
   c. Tyler Union "6860 Series"
   d. Or accepted substitution

2.10 BUTTERFLY VALVES – 16" TO 20" (DIRECT BURY) AND ACCESSORIES

A. Manufacturers:
1. Pratt
2. Milliken
3. Or accepted substitution.

B. AWWA C504 Class 150B for direct bury service
1. Valve body shall be constructed of cast iron ASTM A126 Class B and conform to AWWA C504 in terms of laying lengths and minimum body shell thickness
2. Mechanical joint ends following AWWA C111
3. Valve disc shall be cast iron or ductile iron furnished with Type 316 stainless steel seating edge to mate with rubber seat on body
   a. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow
   b. Disc shall not creep or flutter under service conditions
4. Seat: Buna-N-Rubber
   a. 16-inch to 18-inch: Bonded seats that meet ASTM D429 Method B
   b. 24-inch and larger: Seats retained in the valve body by mechanical means without metal retainers or other devices located in the flow stream
   c. Retaining hardware for seats: type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitation effects
5. Valve Shaft: type 304 SS, ASTM A276
   a. Shaft bearings: stainless steel in accordance with AWWA C504. Design valve shaft to withstand 3 times amount of torque necessary to open valve

b. Packing: Standard self-adjusting and wear compensating, split-V type, and replaceable without removing actuator assembly

6. Actuators:
   a. Provide manual actuators for single project, from same manufacturer
   b. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension to be fully enclosed and water tight
   c. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements
   d. Provide actuators for valves with size based on line velocity of 12 feet per second and unidirectional service.
      i) Equip with gear manual actuator
      ii) Fully enclosed, traveling-nut type. Traveling nut shall engage alignment grooves in the housing
      iii) Traveling nut actuator shall be self-locking and designed to transmit twice the required actuator torque without damages to faces of gear teeth or contact faces of nut
   e. Oil-tight and watertight actuator housing for valves, specifically designed for buried service and factory packed with suitable grease
   f. Equipped with 2-inch actuator nut
   g. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut
   h. Valve operating key: Provide one (1) for project, 7-foot length with tee handle
7. Coating
   a. Follow AWWA C550 and NSF 61
   b. Coat interior and exterior ferrous surfaces of valve with epoxy suitable for potable water conditions: in accordance with AWWA C550 and coating manufacturer's recommendations
   c. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils

C. Extension stems
   1. Provide as specified for buried valves with operating nuts more than 5 feet below grade
   2. Non-rising stems
      a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
      b. Connected to the valve by a flexible socket coupling
      c. All other connections pinned
      d. Extend stem to within 6-inch of grade
      e. Provide spacers to center stem in valve box
      f. Provide wrench nut

D. Valve boxes, depth as required for valve
   1. Three-piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
   2. Box, cover, and base coated by dipping in asphalt varnish.

3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
    a. Tyler Pipe Company "Series 6860 with #160 oval base"
    b. East Jordan Iron Works "8560 Series"
    c. Tyler Union "6860 Series"
    d. Or accepted substitution

2.11 TAPPING VALVE – 4” TO 12” MECHANICAL JOINT TYPE

A. Manufacturers:
    1. American AVK
    2. American Flow Control/American Cast Iron
    3. Pipe Company, Series 2500 RW
    4. Clow
    5. Kennedy
    6. Mueller Company
    7. U. S. Pipe and Foundry Company
    8. Or accepted substitution

B. Tapping valves shall be designed and manufactured in accordance with AWWA C509 or AWWA C515, as applicable, with the following additional requirements or exceptions.
    1. Valves shall be suitable for frequent operation and for long periods of inactivity.
    2. Valves shall operate with flows in either direction; the operating pressure for all sizes shall be 200 psi.

C. Valves:
    1. Valves shall be 150-pound class tapping valves – mechanical joint type
    2. Valves shall be iron body, resilient seated gate valves with non-rising stems.
    3. If the resilient seats are bonded to the gates, the gates shall be completely encapsulated with the material except for guide tabs or slots

D. Valve Stems
    1. Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No. C99500; stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420; or copper alloy in accordance with ASTM B 98, Copper Alloy No. C66100/H02
    2. Valves shall be furnished with 2-inch square wrench nuts. The stem seal shall consist of two O-rings.

E. Bolting Material
    1. The bonnet, gland bolts, and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanized process is not acceptable.

F. End Connections
   1. A. Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.
   2. Mechanical joint components shall be in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt.
   3. Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners and shall be furnished and packaged separately from valves. Each package shall be labeled in a manner that provides for proper identification, and the number of units listed per package or bundle.

G. Seat Ring Sizes
   1. The body of the valve and the seat opening shall be sized large enough to accommodate the following sizes of shell cutters:

Tapping Valve Nominal Diameter (Inch)	Shell Cutter Diameter (Inch)
4	3 7/8 ±1/32
6	5 13/16 ±1/32
8	7 7/8 ±1/32
10	9 3/4 ±1/32
12	11 7/8 ±1/32

H. Coatings
   1. Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10.
   2. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550.
   3. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

2.12 PRESSURE REGULATING VALVE - 4” TO 20” AND ACCESSORIES

A. Manufacturers:
   1. Cla-Val
   2. Singer
   3. Or accepted substitution

B. Pressure regulating valves shall be designed and manufactured in accordance with AWWA C530
   1. Working pressure shall be 150 psi
   2. The function of the pressure regulating valve is to reduce an upstream high pressure to a preadjusted lower downstream pressure to vary the rates of flow without causing shock or water hammer on the system.

C. Valves
   1. Valves shall be 150-pound class pressure regulating valves
   2. Pressure regulating valves shall be hydraulically operated and pilot controlled with a diaphragm activated globe or angle valve.
   3. A stainless-steel indicator rod shall be furnished as an integral part of the valve to show the valve position.
   4. The valve shall be designed to provide an access opening in the body for the removal of internal parts without the removal of the main valve body from the service line.

D. Body Material
   1. Valve body, flanges, and covers shall be CI in accordance with ASTM A 126, Class B, or ASTM A 48, Class 35B
   2. DI in accordance with ASTM A 536, grade 65-45-12

E. Internal Trim Materials
   1. Stem, nut, and spring shall be stainless steel.
   2. Bronze or brass alloys used for the internal trim or bushings shall comply with ANSI/NSF 61.

F. Diaphragm
   1. Flat or rolling diaphragm shall be nylon reinforced and bonded EPDM or Buna-N synthetic rubber.

G. Disc and Seats
   1. Resilient disc materials shall be Buna-N or EPDM to provide a drip-tight seal with a stainless-steel seat.

H. Valve Ends
   1. Valves shall be furnished with flanged ends sized and drilled in accordance with ANSI B16.1, Class 125.
   2. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 and coated with a rust-preventive compound.

I. PILOT SYSTEM
   1. The pilot valve for controlling the operation of the main valve shall be a single seated stainless-steel construction, EPDM diaphragm operated, and spring-loaded type.
   2. The pilot valve shall be attached to the main valve with stainless steel piping and isolation ball valves and threaded nipple extending inside the valve body covering all port threads at all port connections.
   3. Provide stainless steel strainer with minimum 40 mesh screen and blow down port upstream of the pilot valve.
   4. Provide 2 1/2-inch stainless steel, bourbon tube pressure gauge integral to the pilot system to show system pressure downstream of the pilot valve.
   5. Pilot piping shall be arranged for easy access for adjustments and with isolation valves for removal from the main valve while it is under pressure.

J. Needle Valve
   1. The needle valve shall be stainless steel and included with the main valve to control the speed of valve travel.

K. Coatings
   1. Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10.
   2. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550.
   3. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

2.13 VALVE INSERTION

A. Manufacturers:
   1. Romac
   2. Or accepted substitution

B. Resilient wedge designed for use in potable water systems

C. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The valve shall be equipped with a standard handwheel operator.

D. Valve Construction:
   1. The ductile iron body, bonnet, and wedge shall provide a strength and pressure rating that meets or exceeds the requirements of AWWA C515
   2. Valve shall be ductile iron construction and meet ASTM A536 Grade 65-45-12
   3. Chemical and modularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8
   4. Sizes 12" and smaller must be capable of working on Cast/Grey Iron or Ductile Iron Class A, B, C and D without changing either top or bottom portion of split valve body
   5. 250 psi maximum working pressure. The pressure rating markings must be cast into the body of the insert valve.
   6. After the installation of the insert valve body on to the existing pipe, a pressure test of 1.1 times that of the contents shall be sustained for 15 minutes. Once the pressure test is affectively achieved, the insert valve body must not be moved in accordance with AWWA Standards. If the insert valve is moved the pressure test must be completed again. The insert valve must not be moved or re-positioned once the pressure test is achieved.

E. Resilient Wedge Gate Assembly:
   1. The construction of the resilient wedge shall comply with AWWA C509 requirements

2. The ductile iron wedge shall be fully encapsulated with EPDM rubber by a high pressure and high temperature compression or injection mold process
3. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe.
4. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal
5. Pressure equalization on the down or upstream side of the closed wedge shall not be necessary to open the valve
6. The wedge shall be symmetrical and seal equally well with flow in either direction
7. The resilient wedge must ride inside the body channels to maintain wedge alignment throughout its travel to achieve maximum fluid control regardless of high or low flow pressure or velocity
8. The resilient wedge must have more support than the operating stem as the resilient wedge enters and exits the water (fluid) way

F. Fusion-Bonded Epoxy:
1. The insert valve is fully epoxy coated on the interior and the exterior. The fusion-bonded coating is applied prior to assembly so that even the bolt holes and body-to-bonnet flange surfaces are fully epoxy coated
2. Valve shall be coated with a minimum of 8 mils epoxy in compliance with AWWA C550 and certified to ANSI/NSF-61

G. Gaskets and Triple O-Ring Stem Seals:
1. This insert valve features triple O-Ring stem seals. One O-Ring is located above, and two O-Rings are located below the thrust collar.
2. The lower two O-Rings provide a permanently sealed lubrication chamber that will make the valve easier to operate over a longer period of time. The upper O-Ring ensures that sand, dirt or grit cannot enter the valve to cause damage to the lower O-Rings. This is especially important for buried and sewage service applications.
3. Side flange seals shall be of the O-Ring type of either round, oval, or rectangular cross- sectional shape

H. Valve Stem & Thrust Washers:
1. The gate valve stem and wedge nut shall be copper alloy in accordance with AWWA C515
2. The NRS stem must have an integral thrust collar in accordance with AWWA C515. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.
3. Two thrust washers are used. One is located above, and one is located below the stem thrust collar. Two thrust washers ensure easy operation at all times.
4. NRS with AWWA standard turns.
5. Operated by 2” square wrench nut according to ASTM A126 CL.B – open counter-clockwise.

I. Hardware:

1. Bolting materials shall develop the physical strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1.

J. Extended Life Value:

1. The stuffing box, operating stem and resilient wedge (complete bonnet and all moving parts) shall be removable, repairable and or replaceable under pressure. In other words, even while the valve is fully pressurized in the system all moving components can be removed under pressure. In the event the valve stem is broken or damaged the bonnet can be removed under pressure.
2. Internal pressure equalization system assures the safe entry and removal of the valve bonnet during initial installation as well as future maintenance

K. Split Restraint Devices:

1. Shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10
2. The devices shall have a working pressure rating of 350 psi for 4-12 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes
3. Chemical and modularity tests shall be performed as recommended by the Ductile iron Society, on a per ladle basis. Three test bars shall be incrementally poured per production shift as per U.L. specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
4. Gland body wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536
5. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
6. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts. Set screw pressure point type hardware shall not be used.
7. Restraint devices shall be listed by Underwriters Laboratories and Approved by Factory Mutual (3” through 12” inch size)

2.14 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

A. Manufacturers:

1. Vent-o-mat "RBX"
2. GA "Figure CAV"
3. Val-Matic "200C Series"
4. APCO "140C Series"
5. Or accepted substitution

B. Provide combination air release and vacuum breaker valves as indicated on Accepted drawings

1. Provide integral type that functions as both an air release and a vacuum breaker valve
2. Provide a shutoff valve
   a. 2" and smaller valve size: ball valve
   b. Larger than 2" valve size: gate valve

2.15 RESTRAINED COUPLING ADAPTER

A. Manufacturers:
   1. JCM Industries
   2. Romac
   3. Or accepted substitution

B. General:
   1. Must meet or exceed AWWA C219
   2. Used to transition between dissimilar pipe materials in 3” to 12”as indicated on Accepted drawings
   3. Rated for 250 psi working pressure
   4. Contractor to verify pipe material and diameter of all existing distribution pipelines

C. Sleeve and Flanges:
   1. Ductile iron per ASTM A536

D. Gasket:
   1. Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000
   2. Gasket temperature range -40^{o}F to 212^{o}F (-40^{o}C to 100^{o}C)
   3. Gasket suitable for water, salt solutions, mild acids, bases, and sewage

E. Bolts:
   1. 5/8” corrosion resistant, high strength low alloy oval neck track head bolts per ASTM A242 / ANSI 21.11 / AWWA C111 and heavy hex nuts per A563 or equal.
   2. Optional hardware: Stainless Steel 18-8 Type 304 or 316, Epoxy Coated Alloy Hardware, Powercron 590-534 black cationic electrocoat

F. Finish:
   1. Corrosion resistant shop coat paint primer
   2. Optional fusion applied epoxy coating per ANSI/AWWA C213

2.16 BLOW-OFF DRAIN

A. Provide blow-off drains where indicated on the Accepted drawings as shown on Details

2.17 FIRE HYDRANT

A. Fire hydrants to be provided for installation where indicated on the Accepted drawings

B. Manufacturers:
   1. Mueller
   2. Or accepted substitution

C. General
   1. Fire hydrants shall meet or exceed AWWA C502; latest revision
   2. Hydrants shall be manufactured and tested in ISO 9001 certified facility
   3. Fire hydrants shall be rated for a working pressure of 250 psi

4. A Higbee cut (blunt start) will be provided on the lead thread of the outlet nozzles, nozzle caps, seat ring, drain ring, and thrust nut.
5. Fire hydrants shall be of the compression type, opening against system pressure and closing with system pressure

D. Main Valves and Drain
1. The main valve and drain shall be of one-piece construction and completely encapsulated with EPDM.
2. Fire hydrants shall have a minimum 5-1/4 main valve opening.
3. Fire hydrants shall open right and be clearly marked.
4. The EPDM shall be permanently vulcanized to the main valve.
5. The main valve shall provide complete closing of the drains after 4 to 5 turns.
6. During initial stages of opening, the drains shall momentarily flush outward to remove any debris in the drain ports, in order to provide complete draining upon closing of the hydrant main valve.
7. The drain ring assembly shall be replaceable without removing the hydrant from the connecting pipe or having to dig.
8. Valve facings shall be of nontoxic materials suitable for potable water service.

E. Stems
1. Upper hydrant stems shall be made of stainless steel
2. Hydrant shall have one breakaway flange and stem coupling located 3-inches above finished grade.

F. Operating Nut
1. Operating nuts shall be one-piece bronze design with upper and lower anti-friction washers for ease of operation.
2. A protective weather shield shall be installed over the operating nut.
3. Operating nut shall be 1-1/2 inch and pentagon shape

G. Nozzles
1. Pumper nozzles shall be 4-1/2 inch NH / NST threaded having 6 threads per inch.
2. Fire hydrants shall have two 2-1/2 inch hose connection outlets NH/NST threaded.
3. Nozzles shall be of the 1/4 turn bayonet lug style, secured with a stainless steel locking screw.
4. Caps shall have 1-1/2 inch pentagon shape nuts.
5. Nozzle caps shall be chained to hydrant.

H. Lubrication
1. A lubrication port shall be provided for application of lubricant without disassembly of the bonnet section.
2. The reservoir shall be filled with NSF/FDA approved food grade grease or oil at the manufacture’s facility.
3. Valve stem seals shall be an o-ring type with not less than two o-rings below the thrust nut and two o-rings above the thrust nut.
4. O-ring and gaskets shall be made of an NBR rubber to help prevent the effects of permeation.

I. Protective Coatings
   1. All ferrous parts except the lower barrel and those parts made of stainless steel shall be fusion bonded epoxy coated yellow
   2. All epoxy coatings shall meet the requirements of ANSI/AWWA C550 (latest edition).
   3. The lower barrel shall be bitumen coated both internally and externally.
   4. A bury line shall be marked on the lower barrel below the break flange to indicate proper installation depth. Bury depth will be clearly stenciled on the standpipe section.
   5. Shop paint exterior of hydrants yellow

J. Shoe
   1. End connections shall be 6 inch mechanical joint unless specified
   2. Mechanical joints shall comply with AWWA C111

K. Break Flange and Couplings
   1. All fire hydrants shall be of the traffic Breakaway type and allow 360-degree rotation of the fire hydrant to position the pumper nozzle in the desired direction
   2. The break flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck

L. Warranty
   1. All fire hydrants shall be covered by a manufactured warranty for a minimum of 10 years for defects

M. Hydrant Gravel: Hydrant gravel shall be well graded crushed stone or gravel, conforming to AASHTO #67 gradation as listed below:

Sieve Size	Percent Passing
1”	100
3/4”	90-100
3/8”	20-55
No. 4	0-10
No. 8	0-5

2.18 CORROSION CONTROL

A. Shop paint all ferrous metal surfaces of valves and accessories, both interior and exterior for corrosion protection, epoxy interior coating for potable water contact.

B. Manufacturer's standard paint will be acceptable if it is functionally equivalent and compatible with specified field coatings

C. Exterior bituminous coating or asphalt varnish: Manufacturer's Standard epoxy coal tar

D. Ductile-iron Pipe and Fittings Shop lining: Cement-lined, AWWA C104/C205

E. Rust inhibitive primer: Tnemec "Series 77H Chem-Prime" or accepted substitution

F. Rust preventative compound: Houghton "Rust Veto 344", Rust-Oleum "R-9", or accepted substitution

2.19 ACCESSORIES – MISCELLANEOUS

A. Extension stems
   1. For valve installations with operating nuts over 5 five below grade, extend stem to 5 feet of final grade. Provide spacers to center stem in valve box.

B. Valve boxes for all buried valves, depth as required for valve.
   1. Valve boxes shall be the 3-piece adjustable screw type with a 16-inch top section, 18-inch extension, 24-inch stem, and 30-inch bottom and base.
   2. Valve box parts shall be made of grey CI in accordance with ASTM A 48, Class 35B. The use of an aluminum alloy as a casting material is not acceptable.
   3. Box, cover, and base coated by dipping in asphalt varnish.
   4. Cover marked with word, “WATER.”
   5. Provide threaded top section to permit 6-inch adjustment above finish grade.
   6. Series 6860 with #160 oval base as manufactured by Tyler Pipe Company or accepted substitution.

C. Concrete for Thrust Blocks: constructed of “Class B” Concrete as defined by CDOT Construction Specifications with maximum water to cement ratio of 0.63 by weight and 28-day compressive strength of 3,000 psi

D. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
   1. Clamps, straps and washers: Steel, ASTM A506
   2. Rods: Steel, ASTM A575
   3. Rod Couplings: Malleable-iron, ASTM A197
   4. Bolts: Steel, ASTM A307
   5. Cast-Iron Washers: Gray-iron, ASTM A126

2.20 DISINFECTION CHEMICALS

A. Calcium and sodium hypochlorite shall conform to AWWA B300 and B301

B. Store hypochlorite in a cool, dark place away from flammable materials

2.21 PRECAST CONCRETE VAULT

A. Manufacturers:
   1. Oldcastle Precast
   2. Front Range Precast Concrete
   3. Or accepted substitution

B. Materials
   1. Reinforcement

a. Reinforcing Steel: ASTM A615 Grade 60
b. Welded Wire Fabric: ASTM A185

2. Concrete:
   a. Cement: ASTM C150, Portland Cement, Type II
   b. Aggregates: ASTM C33, free of deleterious substances
   c. Minimum compressive strength: ASTM C39, 4500 psi minimum at 28 days
3. Precast Sections
   a. Specification: ASTM C1227
   b. Minimum wall thickness: 6 inch
   c. Grade rings as required
4. Gaskets: ASTM C923
   a. Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution
   b. Rubber: Neoprene, 40± 5 hardness when measured by ASTM D2240, Type A durometer
5. Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick
6. Manhole Steps: Steel bar, 1/2-inch Grade 60, drop-front type, with copolymer polypropylene plastic coating applied by manufacturer, Type MA Industries, Inc. "PS2-PF" or accepted substitution
7. Inlet Gratings and Manhole Ring and Cover
   a. Cast iron, heavy duty traffic type, ASTM A48, Class 30B. Grind bearing surfaces to ensure flat, true surfaces
   b. Manhole lids to be manufactured by East Jordan Iron Works, Deeter Foundry, or accepted substitution.
   c. Covers to seat at all points on ring
8. Pipe Penetrations:
   a. Cast-a-Seal gasket
   b. Link-Seal
   c. Or accepted substitution
9. Manhole Height Adjustment: Use precast concrete grade rings
10. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade
11. Water: Clean and free of deleterious substances

C. Fabrication
   1. Vault Section
      a. Precast concrete dimensions as shown on plans
      b. Precast lid: Same or greater reinforcement and wall thickness with capability for H20 loading
      c. Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
      d. Access opening: Minimum 24 clear
      e. Pipe connection: As indicated on Accepted drawings
      f. Pipe knockout: As indicated on Accepted drawings
   2. Grating and Metal Frame: As specified on Accepted drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify locations and inverts of tops of pipe for connections to existing system as well as crossings with other utilities as indicated on the accepted drawings. Report any discrepancies to the Town Engineer.

B. Carefully examine pipe and fittings for cracks, damage to linings, and other defects prior to installation

C. Remove all defective piping from site and replace

D. Examine areas for weak or structural defects or deviations beyond allowable tolerances for piping clearances that adversely affect excavation and quality of Work

E. Start installation only when conditions are satisfactory

3.2 PERFORMANCE - GENERAL

A. Perform work in a safe and proper manner with appropriate precautions against hazard

B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

C. Contain all construction activity on the designated site and within the limits of work. Cost of restoration of site will be the responsibility of the Contractor

D. Contractor to verify quantities to perform all earthwork required according to Accepted drawings, including but not limited to, additional import or export required to handle compaction, pavement subgrade preparation, and pipe bedding

E. Contractor shall take precautions to limit the removal of or damage to existing pavements, multi-use paths sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings, or other existing improvements to the least practicable amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted

3.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations shall be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work

B. Backfill shall be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Town.

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Town Engineer, shall be borne by the Contractor at no additional expense to the Town.

3.4 SITE PREPARATION

A. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris

B. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.

C. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted

3.5 DEWATERING

A. Comply with CDPHE Dewatering Requirements

B. Dewatering discharge to surface waterways requires CDPHE dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, if necessary

3.6 PIPE PREPARATION

A. Ream pipe and tube ends and remove burrs

B. Remove scale and dirt, on inside and outside, before assembly

C. Cut ends of metallic pipe, recoat with coating approved for potable water service and compatible with manufacturer's coatings.

3.7 PRECAST CONCRETE VAULT [OR MANHOLE] PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation, Backfill, Subgrade Compaction: Refer to Specification Section 33 00 00 - Earthwork for requirements

E. Rock Subbase
   1. Remove water and place 6-inch minimum depth
   2. Vibrate for compaction
   3. Level top to accept precast sections with uniform bearing all around
   4. If material below vault is unsuitable, excavate as directed by the Town Engineer and backfill to grade with 1-1/2 inch minus rock and compact

3.8 PLACING PRECAST SECTIONS

A. Thoroughly clean joints of sections to place gasket material

B. Place gasket material on base or lower section to ensure watertight fit between lower precast section and upper precast section

C. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

D. Cure non-shrink grout using approved methods as recommended by manufacturer

3.9 PREFORMED GASKETS

A. Remove and replace vault sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.10 PIPE INSTALLATION

A. Install PVC Pipe in accordance with AWWA M23 and AWWA C605

B. Install Ductile Iron Pipe in accordance with AWWA C600

C. Install Ductile Iron Fittings in accordance with AWWA M41

D. Route pipe as indicated on the Accepted drawings

E. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected

F. Install as specified or in accordance with the manufacturer's recommendations

G. Cutting Pipe
   1. Cut pipe to measurement taken at the site, not from the accepted drawings
   2. Cut pipe neatly without damage to pipe
   3. Cut smooth, straight, and at right angles to pipe axis
   4. Dress and bevel end of cut pipe to remove roughness and sharp corners
   5. Cut pipe with saw or abrasive wheel

6. Follow state and federal safety regulations pertaining to cutting asbestos concrete pipe as necessary

H. Provide an isolation or shutoff valve and union at the water connections to each fixture and unit of equipment, whether shown on the accepted drawings or not

I. Install pipe to indicated elevations. Maintain minimum 5.0 feet depth of ground cover and maintain minimum grade for drainage. Establish elevations of buried piping to ensure minimum cover is achieved. Add additional soil in areas of future fill to provide minimal cover at all times. Report any variations from plan to the Town.
   1. Provide air release valve at all high points and blow-offs or hydrant at all low points. Coordinate locations and details with the Town Engineer.
   2. Where minimum depth cannot be maintained, provide a minimum of 2 inch of specified insulation board per 1 foot of cover not provided. Contractor must have approval of the Town Engineer prior to installation.
      a. Place insulation board over bedding material for the width of the trench

J. Install pipe to allow for expansion and contraction without stressing pipe or joints

K. Protect from lateral displacement by placing embedment evenly on both sides of pipe

L. Do not lay pipe in water. Maintain groundwater level a minimum of 12 inches below pipe to be installed. Do not lay pipe under unsuitable weather or trench conditions

M. Make changes in horizontal, vertical, and curved alignment shown on accepted drawings by using joint deflections in the amount permissible by manufacturer and shown on accepted drawings

N. Do not bend pipe

O. Deflect pipe at joints

P. Do not deflect PVC pipe at connection to ductile iron fittings

Q. Form and place concrete for thrust blocks at hydrants, plugs, caps, tees and 90-degree bends. Thrust blocks are not required on bends 45 degrees or less when joint restraints are installed for the full alignment.

R. Utility crossings
   1. Whenever possible, lay water mains over sanitary and storm sewers to provide vertical separation of at least 18-inch between invert of water main and crown of sewer
   2. If standard crossing detail is not available and above separation cannot be met, provide one continuous length of watertight sewer pipe 20' long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inch either side of joint or encase sewer pipe in 6-inch of concrete completely around pipe, for not less than 10' either side of water main

3. Water Mains Passing Under Sanitary Sewers: If vertical separation is less than 18-inch, provide structural support for sewer. Provide concrete encasement where water lines pass under sanitary sewer line. Reference detail shown on Accepted drawings

S. Maintain a minimum 10 feet of horizontal separation and 18 inches of vertical separation between water main and storm or sanitary sewer lines in accordance with the CDPHE
   1. Provide concrete encasement if these clearances cannot be achieved and when water line is below sanitary sewer line

T. Tracer wire and marker tape
   1. Install tracer wire continuous over top of pipe
   2. Install tracer wire test stations at maximum 500 LF of water line per Town requirements. Locate test station at fire hydrants, gate valves, or special test station locations in a valve box
   3. Terminate tracer wire following drawing details
   4. Tape tracer wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of fitting
      a. Tape: minimum 2 inches wide and wrapping full circumference of pipe
   5. Install identification /warning marker tape in fill area of trench above all water lines

U. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

V. Install access fittings to permit disinfection of water system, subject to approval by the Town Engineer

W. Backfill trench in accordance to specifications herein

X. Protect pipe from floatation or movement until completely backfilled and put into service

3.11 WATER MAIN CONNECTIONS

A. Comply with the Town of Berthoud Standards and Specifications. Coordinate with the Town and fire department representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

B. Connect to water main per plans and referenced standards or details.

3.12 JOINTS

A. Make pipe joints carefully and neatly

B. Connect piping in accordance with manufacturer's recommendations

C. Push-on joints
   1. Lay pipe with bell ends facing the direction of laying except when the Town Engineer authorizes reverse laying

2. Assembly of PVC plain end into bell: follow PVC pipe manufacturer's recommendation
3. For PVC pipe, Contractor to ensure that pipe is not inserted into the bell ends beyond the push line
    a. Utilize EBAA Mega-Stop bell protection, or approved substitution, if necessary, to ensure previously laid pipe joints are not impacted by ongoing installation
4. Lubricate joint surfaces immediately before completing the joint
5. Bevel spigot ends of field cut piping
6. Groove spigot ends of field cut restrained joint piping if required by joint system
7. Install restrained joints following manufacturer's recommendations

D. Mechanical joints
1. Before assembling joint, clean both bell and plain end of rust and foreign matter
2. Assemble joint following AWWA C111, C600, C605 and as specified
3. Lubricate gasket and install in accordance with manufacturer's instructions
4. If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble
5. Do not over tighten bolts to compensate for poor installation
6. Carefully align holes in mechanical joints with restraint device to permit installation of the harness bolts
7. Install mechanical joint pieces so the mechanical joint holes straddle the top centerline for horizontal piping, or the side centerline for vertical piping

3.13 PROTECTIVE COATING

A. Provide polyethylene tube encasement on all buried ductile iron fittings, valves, and fire hydrant extensions
1. Encase ductile iron fittings and valves in polyethylene per AWWA C105, Method A, secured with polyethylene compatible adhesive tape. Overlap polyethylene onto PVC pipe a minimum of 6 inches
2. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105

B. Coat exposed ferrous metal surfaces of joints, couplings, and uncoated steel with primer and tape coating system after installation. Do not coat stainless steel or high strength low alloy steel nuts and bolts
1. Surface Preparation: Clean surfaces of rust, scale, soil, mud, oil, grease, and other contaminants by hand or power tool following SSPC-SP2 or SP3 and other appropriate means as recommended by coating manufacturer Remove excess moisture and provide surface dryness as recommended by coating manufacturer
2. Application: Apply primer in uniform manner to clean and dry surfaces following coating manufacturer's recommendations
    a. Fill complex and irregular surfaces with appropriate mastic or filler tape to eliminate bridging; then apply tape/wrap to primed and filled surfaces following coating manufacturer's recommendations.
    b. When coating restraining rods or strapping, apply tape wrap longitudinally

c. Where metal being coated enters concrete, overlap coating onto concrete by minimum of 2 inches after placement of concrete

3. Inspection: After field coating of specified items, conduct visual inspection to verify complete coverage has been accomplished.
   a. Repair damaged or incompletely coated surfaces following coating manufacturer's recommendations

C. Metal Surfaces not Protected by Poly Wrap
   1. Coat all steel clamp rods, bolts, and other metal accessories used in tapping saddles, anchorages, cut ends of pipe, follower rings and bolts or joint harnesses subject to submergence or contract with the earth and not concrete encased, but including pipe fittings and bolts in polyethylene tube protection
   2. Apply 2 coats of coal tar paint to clean, dry metal surfaces, allow first coat to dry before applying second coat

D. Metal Harness Rods
   1. Provide field applied primer and Polyken tape wrap

3.14 VALVES AND HYDRANTS INSTALLATION

A. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards

B. Center and plumb valve box over valve. Set box cover flush with finished grade.
   1. Backfill and compact under and around valve boxes to ensure no vertical loads are transmitted to valve operators or bonnets

C. Comply with AWWA M17 for fire hydrant installation. Install with gate valve and provisions for drainage

D. Install valves, hydrants, and accessories in accordance with the manufacturer's recommendations and in accordance with referenced standards and specifications.

E. Hydrants and valves to be set plumb on solid bearing surface

F. Locate hydrant flange a minimum of 3” and maximum 6” above adjacent finished grade or flush with the adjacent top of curb. Contractor to verify final grade or adjust flange height upon the completion of final grading

G. Drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least 12 inches above the barrel flange of the hydrant and to a distance of 12 inches around the elbow. The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be 6 inches. The minimum amount of rock placed shall be 1/3 cubic yard

3.15 VALVE INSTALLATION

A. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards.

B. Provide concrete collar for installations within landscaped areas

C. Protect valve box and cover during paving operations and clean any excess concrete, or asphalt, or road base from valve box and cover to ensure visibility and proper operation

D. Pressure regulating valves shall be installed in a horizontal position in an underground concrete manhole or concrete vault as applicable.

E. Tapping valves shall be installed with the stem positioned vertically in buried horizontal water lines without gearing, bypasses, rollers, or tracks. The valve bonnet shall be installed below frost line.

3.16 INSERTION VALVE INSTALLATION

A. Install according to Manufacturer's suggested procedures
   1. Clean the area of the pipeline that is to receive the insert valve
   2. Prepare the insert valve for assembly onto the pipeline per Manufacturer's recommendations
   3. Install the two insert valve body halves on the pipeline
   4. Bolt two body halves of insert valve together. Tighten bolts per Manufacturer's recommendations.
   5. After body bolts have been tightened, confirm that the insert valve is level
   6. Install mechanical joint gaskets to insert valve and complete assembly using split mechanical joint restraints
   7. Attach temporary insertion valve. A test port shall be attached, and the assembly should be pressure tested.
   8. Prepare tapping machine for mounting to temporary valve.
   9. Tapping machine shall be mounted to the temporary isolation valve with chip flushing valve attached.
   10. After completing the tap, close temporary isolation valve.
   11. Remove tapping machine and cut out pipeline section.
   12. Prepare insertion valve bonnet for live line insertion and attach to valve insertion tool per Manufacturer's recommendations
   13. Position and attach valve insertion tool to temporary insertion valve. Confirm proper orientation of valve bonnet.
   14. Open temporary isolation valve and advance travel of the bonnet to the body of the insert valve
   15. Install six set pins to secure bonnet to insert valve body
   16. Once set pins are in place, release the bonnet from the insertion tool

17. Use insertion tool blow off valve to release water with insertion tool housing and remove insertion tool from temporary insolation valve
18. Remove temporary isolation valve
19. Install O-Ring between valve body and bonnet to seal connection

3.17 TAPPING

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for saddle tapping as per "Uni-Pub-8: Tapping Guide for PVC Pressure Pipe by Uni-Bell PVC Pipe Association"

B. All connections requiring a larger diameter than that recommended by the pipe supplier, should be made with a pipe connection as specified and indicated on the accepted drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:
   1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited

3.18 WATER SERVICES

A. Water services are to be connected to the new water main per the Contract Accepted drawings and the Town Standards

B. Water services are to be tapped per the Contract Accepted drawings. Direct taps are not permitted.

3.19 THRUST BLOCKS

A. Installation:
   1. Thrust blocks shall be constructed at hydrants, 90 bends, tees, plugs, and caps that require support due to unbalanced line thrust. Care shall be taken to ensure that outlets, cover bolts, nuts, clamps, and other fittings are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. If a large thrust block is to be placed, it shall be separated into sections by a suitable material. Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If the soil bearing capacity is insufficient to provide adequate support based on minimum bearing areas established by Drawing Details, then the minimum bearing area shall be increased to a size that shall ensure support restraint. In every instance, the thrust block shall bear against undisturbed earth
   2. Before placing concrete, equipment used in the mixing and transport shall be cleaned. Debris, water, or ice shall be removed from the area to be occupied by concrete. Concrete shall not be placed on frozen subgrade.

B. Formwork for Thrust blocks:
   1. Forming for concrete thrust blocks and anchors shall be done by bulkheading around the shape of the thrust block or anchor with wood, burlap sacks, or reinforced paper sacks that are filled with sand or earth. Sacks shall be constructed of a size easily handled when full and left in place in the trench. Wood forms shall be removed before backfilling.
   2. Horizontal struts or braces required for trench shoring shall not remain in concrete thrust blocks. Prior to placing concrete, the forms and ditch bank will be inspected and approved by the Town Engineer.
   3. When concrete is deposited against the ground without the use of forms, the ground shall be thoroughly moistened, or other provisions made to prevent the ground from drawing water in from the concrete

C. Thrust block Curing Time:
   1. Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours

D. Compaction of Fill Over Thrust blocks
   1. Backfill may be placed over thrust blocks once the surface has set sufficiently and they are able to resist the weight of the backfill. However, tamping or compacting shall not be allowed above the thrust block for a minimum of 24 hours after placement

E. Hydrostatic testing shall not be conducted until thrust blocks have fully cured, a minimum of 7 days

3.20 ABANDONMENT

A. Cap ends of main as shown. Place required concrete blocking as shown on drawing details

B. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at fitting or valve
   1. When shown on accepted drawings, remove fire hydrants and valves, including lead joint tees when encountered; salvage and deliver removed fire hydrants and valves to the Town.
   2. Pipe, fittings, and other appurtenances that are removed, but are not required to be salvaged become property of Contractor
      a. Remove and dispose of offsite

3.21 FIELD QUALITY CONTROL

A. Comply with the Town of Berthoud Standards and Specifications. Test each line at the Contractor's expense in the presence and to the satisfaction of the Town inspectors.

B. Field inspection and testing will be performed under provisions set forth by the referenced standards

C. Test each line at the Contractor's expense in the presence and to the satisfaction of the Town at a maximum of 1,000-foot intervals

D. Water Line Disinfection
   1. Comply with AWWA C651 and provide the Town with results.
   2. Flush water lines prior to disinfection, except when tablet method is used. Acceptable chlorine disinfectants are calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite solutions, and calcium hypochlorite tablets.
   3. After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24-hour period, the water in the pipeline shall be tested by the local health authority having jurisdiction, or their designated representative, to ensure a residual chlorine content in compliance with the Town requirements. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. This activity requires a permit from the CDPHE WQCD prior to flushing. Comply with all provisions of the permit. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by the Town and the CDPHE.
   4. For fire lines, flush piping complying with NFPA 24
   5. If water in pipe does not meet the governing agency requirements, repeat disinfection procedure until acceptable. Furnish copies of acceptance forms from governing agency to the Town.

E. Valve Testing
   1. Conduct pressure and leakage tests on all newly installed valves
   2. Furnish all necessary equipment and material and make all connections to the pipe, as required. The Town shall monitor the tests.
   3. Each valve, after shop assembly, shall be operated and hydrostatic tested in accordance with AWWA C509 or AWWA C515. The body of a PRV shall be hydrostatic tested to 150% of the working pressure specified herein. A seat leakage test shall be made at the working pressure.
   4. The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards.
   5. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to the Town, if requested.

F. Hydrostatic Pressure Testing
   1. Provide all necessary pumping equipment, piping connections, pressure gauges with maximum of 5 psi increments, and other required equipment, facilities, and materials.
   2. Test only using potable water in conformance with the Town Standards.
   3. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Town.

4. Hydrostatic Test Conditions: At lowest point in the line or section under test, pressurize to 150 psi minimum. The pipeline shall be filled at a rate that does not create surges and does not exceed the rate at which air can be released.
5. While the test pressure is maintained, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.
6. After visible leaks are stopped, the full test pressure shall be maintained for 1 continuous hour. Allowable leakage for each section between line valves shall not exceed the Town requirements.

G. PVC Water Pipe Continuity Testing
1. Notify the Town five working days in advance to schedule testing
2. Continuity test to consist of locating the PVC water pipe with an electronic-type pipe locator
3. If test is negative for continuity, repair or replace as necessary to achieve continuity

H. Bac-T Testing
1. After completion of water line disinfection, Contractor shall take Bac-T samples to ensure pipe has been properly disinfected and submit results to the Town.
2. If water line fails Bac-T sampling, any repeat disinfection and Bac-T testing will be at the Contractor's expense
3. The Contractor shall receive Town approval before placing a water line in service

3.22 CLEANING

A. Verify that piping has been cleaned and inspected

B. Verify that piping has been successfully pressure tested and flushed

C. Perform scheduling and disinfection activity with start-up, testing, adjusting, demonstration procedures, including coordination with related systems

3.23 DISINFECTION

A. Provide and attach required equipment to perform the work of this Section

B. Tablet, continuous, or slug disinfection may be followed in accordance with AWWA C651

C. The preferred method is continuous disinfection, summarized as follows:
1. Inject treatment disinfectant, free chlorine in liquid form into piping system to obtain 50 to 80 ppm residual
2. Bleed water from outlets to ensure distribution and test for disinfectant residual
3. Maintain disinfectant in system for 24 hours
4. If final disinfectant residual tests less than 25 ppm, repeat treatment

5. Flush, circulate and clean until residual equal to that of incoming potable water or 1.0 mg/L is achieved

D. Replace permanent system devices removed for disinfection

3.24 FINAL FLUSHING

A. Maintain a flushing velocity of 2.5 feet per second in piping

B. Collect chlorinated water for proper disposal and/or dechlorinate to less than 0.1 ppm free chlorine prior to discharge in accordance with State, County, and local regulations

3.25 DISINFECTION FIELD QUALITY CONTROL

A. After final flush, and before main or equipment is placed in service, collect water samples from representative points along the main and field test for chlorine residual

B. Chlorine residual shall be within 50 percent of the chlorine residual prevailing in the source

C. If initial disinfection fails to provide satisfactory samples, repeat disinfection until satisfactory samples have been obtained

3.26 DISINFECTION TESTING AND ACCEPTANCE

A. The Contractor will perform Bacteriological (Bac-T) sampling and testing after pipes have been disinfected and flushed as specified herein

B. If any portion of the piping or equipment or tanks fails Bac-T testing, the Contractor is responsible for repeating disinfection procedures until passing Bac-T test is obtained

3.27 FINAL ACCEPTANCE

A. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.
   1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

B. Drain all test water from the new pipe system prior to placing in service

C. Provide water tap locations (x, y, z) on the Accepted drawings

D. Provide operation and maintenance manuals for air and line valves and fire hydrants

E. Provide final reports to the Town for:
   1. Bac-T results
   2. Residual chlorine tests
   3. Hydrostatic tests for each section or pipe
   4. Cathodic protection system test (if applicable)
   5. Tracer wire continuity test

END OF SECTION

SECTION 33 33 00

SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Polyvinyl chloride (PVC) non-pressure pipe for gravity sanitary sewer with all jointing materials, fittings, and other appurtenances required for a complete installation

B. [Polyvinyl chloride (PVC) pressure pipe [OR HDPE pressure pipe] for sanitary sewer force main with all jointing materials, fittings, and other appurtenances required for a complete installation]

C. All precast manholes complete with steps, ring and cover as required

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. A48 – Standard Specification for Gray Iron Castings
2. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
4. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
5. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. C33 – Standard Specification for Concrete Aggregates
7. C150 – Standard Specification for Portland Cement
8. C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
9. C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
10. C497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
11. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
12. C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete manhole Structures, Pipes, and Laterals
13. C1227 – Standard Specification for Precast Concrete Septic Tanks
14. C1619 – Standard Specification for Elastomeric Seals for Joining Concrete
15. C1821 – Standard Practice for Installation of Underground Circular Precast Manhole Structures
16. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
17. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

18. D1330 – Standard Specification for Rubber Sheet Gaskets
19. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
20. D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC)
21. D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
22. D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
23. D2240 – Standard Test Method for Rubber Property – Durometer Hardness
24. D2321 – Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
25. D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
26. D2774 – Standard Specification for Underground Installation of Thermoplastic Pressure Piping
27. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
28. D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
29. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
30. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
31. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
32. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
33. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
34. F412 – Standard Terminology Relating to Plastic Piping Systems
35. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
36. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
37. F679 – Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
38. F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
39. F2164 – Standard Specification for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

B. American Water Works Association (AWWA):
   1. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
   2. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
   3. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

4. C115 – Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
5. C150 – Standard for Thickness Design of Ductile-Iron Pipe
6. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
7. C504 – Standard for Rubber-Seated Butterfly Valves
8. C512 – Standard for Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
9. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
10. C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
11. C905 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution
12. M23 – PVC Pipe: Design and Installation

C. Colorado Department of Transportation (CDOT)

D. Occupational Safety and Health Administration (OSHA)

E. National Association of Corrosion Engineers (NACE):
1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

F. Plastics Pipe Institute (PPI):
1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
3. Handbook of Polyethylene Pipe
4. Polyethylene Piping Systems Field Manual for Municipal Water Applications
5. Material Handling Guide

1.3 SUBMITTALS

A. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications

B. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight.
1. Pipe materials
2. Special, fitting, and coupling details
3. Gasket materials
4. Valves
5. Laying and installation schedule
6. Specifications and data sheets

7. Affidavits of compliance for protective shop coatings and linings

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

D. Test Reports: Submit reports of field exfiltration/infiltration, mandrel and lamp tests

E. TV Inspection Files:
   1. Submit videos and reports
   2. For rehabilitation work, show cured liner, connections to mains, and reestablished service connections after relining work is complete

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, invert elevations, and any mapped or unmapped utilities

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

C. Sewer Rehabilitation Work: Accurately record actual locations of piping mains, laterals, and services that include CIPP liner. Indicate pipe inverts and top of pipe elevations

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Town of Berthoud and CDPHE Stormwater and/or Groundwater Discharge Permit, notes on the drawings and as specified herein.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

C. All PVC pipe, regardless of diameter, shall be supplied by a single manufacturer

D. Perform Work in accordance with the Colorado Department of Public Health and Environment (CDPHE), Larimer County and or Weld County, and the Town of Berthoud.

E. Contractor shall conduct visual inspection before installation

F. Provide manufacturer's name and pressure rating marked on piping and valves

G. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines

1.6 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Larimer County and/or Weld County, Town of Berthoud, CDPHE, the notes and details on the drawings

and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. In case of apparent conflict, CDPHE requirements govern over these specifications

C. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.7 DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading, exercise care to prevent damage to material
   1. Use nylon slings only
   2. Do not drop pipe or fittings
   3. Do not roll or skid against pipe already on ground
   4. Repair any damage done to coating or lining
   5. Handle per manufacturer's recommendations
   6. Store rubber gaskets in cool dark location
   7. Store all material on wood pallets or timbers

B. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

C. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

D. Pipe
   1. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation
   2. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling PVC pipe during cold weather
   3. Do not store PVC pipe uncovered in direct UV light
   4. Pipe stored along the trench side shall be suitably supported off the ground to avoid damage to the coating

E. Valves
   1. Prepare valves for shipping as follows:
      a. Ensure that valves are dry and internally protected against rust and corrosion
      b. Protect vales against damage to threaded ends, flange faces, and weld ends
      c. Seal valve ends to prevent entry of foreign materials into valve body
      d. Set valves in best position for handling
      e. Set valves closed to prevent damage
   2. Deliver and store valves and accessories in shipping containers with labeling in place

3. Storage: Use the following precautions for valves during storage:
    a. Do not remove end protectors unless necessary for inspection; then reinstall for storage
    b. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

F. Precast Concrete Structures
1. Transport and handle precast concrete units with equipment to protect from dirt and damage
2. Do not place precast concrete units in position which will cause damage
3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer's yard until curing is complete.

1.8 JOB CONDITIONS

A. All work which requires the interruption of active sanitary sewer service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the Town of Berthoud and coordinated with the Town

B. Underground Obstructions
1. Underground Obstructions known to Engineer are shown on Drawings
    a. Locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered
    b. Contractor shall field locate and verify all obstructions where or not shown on the Drawings
2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
    a. Notify Engineer and Owner in case of a conflict
    b. In case of a conflict, the proposed work may be changed by Engineer
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

PART 2 PRODUCTS

2.1 PIPE, MANHOLES, AND ACCESSORIES

A. Comply with Town of Berthoud Standards and Standard Details.

2.2 PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

A. The PVC piping shall be non-pressure PVC pipe for gravity sanitary sewer application of sizes indicated in the approved drawings

B. Pipe and fittings:
   1. ASTM D3034, T-1 wall, SDR 35, non-pressure pipe
   2. Cell classification: ASTM D1784
   3. Pipe length: 12-20 feet standard manufactured length for construction

C. Joints: ASTM D3212 and F477 - Rubber gasket with one compression gasket ring, integral bell and spigot type
   1. Designed to hold pipe in alignment, provide flexibility, separate the ends of pipe lengths, resist applied earth pressures, and provide fluid tightness
   2. Rubber rings: ASTM F477

2.3 SOURCE QUALITY CONTROL

A. Identification Marks: Clearly and permanently marked at not greater than 5 foot intervals with pipe diameter, PVC cell classification (if applicable), manufacturer, plant, shift, ASTM, date designations and service designation

B. Testing per ASTM D3034
   1. Test products not manufactured in the U.S. at an acceptable laboratory in the U.S.

2.4 PIPE ACCESSORIES

A. Underground Type Plastic Line Marker
   1. Manufacturer's standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SANITARY SEWAGE LINE BURIED BELOW." Provide identification markers of one of the following:
      a. Allen Systems, Inc.
      b. Emed Co., Inc.
      c. Seton Name Plate Corp.
      d. Or accepted substitution

B. Tracer Wire for Buried Pipe
   1. Provide tracer wire for all HDPE pipe and PVC pipe
   2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water
   3. UL listed

C. Tracer Wire for Horizontal Directional Drilling
   1. Non-UL listed tracer wire specifically developed for Horizontal Directional Drilling application
   2. 1/4-inch 304 Stainless Steel tracer wire
      a. Performance Wire & Cable Inc.: "Tracer wire, Stranded SS /45 mil HMW-HDPE, 30 Volt, HDD direct bury use only"
   3. #12 AWG Solid Carbon Clad Steel Extra High Strength tracer wire
      a. Copperhead Industries, LLC: "Direct Burial #12 AWG Solid (.0808" diameter), 21% conductivity copper-clad hard drawn high carbon steel extra high strength

horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil. high molecular weight-high density polyethylene jacket complying with ASTM D1248, 30 volt rating”

b. Pro-Line Safety Products Co.: “Pro-Trace HDD-CCS PE45”

D. Tracer Wire Test Stations
1. 4-inch with locking lid
2. Manufacturers:
   a. CP Test Services
   b. Glenn Series "Glenn-4"
   c. Or accepted substitution

E. Corrosion Control
1. Rust inhibitive primer:
   a. Tnemec "Series 77H Chem-Prime"
   b. Or accepted substitution
2. Rust preventative compound:
   a. Houghton "Rust Veto 344"
   b. Rust-Oleum "R-9"
   c. Or accepted substitution

2.5 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

A. Manufacturers:
1. Val-Matic “Model 801A”
2. Dezurik/APCO "Series 440 SCAV"
3. Or accepted substitution

B. Provide combination air release and vacuum breaker valves as indicated on acceptedrawings
1. Provide single body type that functions as both an air release and a vacuum breaker valve
2. Valves shall be manufactured and tested in accordance with AWWA C512
3. Provide a shutoff valve and transition piece from HDPE to NPT threaded connection on valve
   a. Ball valve: compatible with butt fusion, HDPE fitting

C. General
1. Usage: Recommended for service up to a pressure rating indicated by approved drawings
2. Bodies and covers:
   a. Gray iron meeting requirements of ASTM A126 Class B
   b. Globe style of 1-inch valves to increase float clearance and reduce clogging
3. Exterior coating: universal alkyd primer
4. Valve cleanout: 2" NPT
5. Valve drain connection: 1" NPT
6. Inlet and Outlet:

a. Inlet: NPT, 2-inch on 1-inch valves
b. Outlet: NPT equal to valve size, 1-inch

7. Internals:
   a. Metal internal parts only
   b. Float sensitive skirt provided
   c. Float, plug, guide shafts, and bushings: Type 316 stainless steel
   d. Resilient seats: Buna-N

2.6 ECCENTRIC PLUG VALVES

A. Manufacturers:
1. DeZurik
2. Henry Pratt Company
3. Milliken
4. Val-Matic Valve and Manufacturing Corporation
5. Or accepted substitution

B. Provide plug valves as indicated on Drawings

C. General
1. Quarter-turn non-lubricated eccentric plug valves
2. Resilient faced plug
3. Valves with vane type seat rings are not acceptable
4. Valve ends to match connecting piping
   a. Buried: Mechanical joint, ANSI A21.11/AWWA C111
   b. Flanged: 125 lb, ANSI B16.1
   c. Screwed valve ends shall be to the NPT standard
5. Minimum Working Pressure Rating:
   a. 175 psi
6. Opening motion eccentric, lifting plug away from body seat
7. Valve alignment
   a. Valve shall be installed so that the plug is horizontal and rotates upward as the valve opens
   b. Valve shall be installed with seat on low pressure side of valve
8. Provided with fully adjustable plug position stops
9. Plugs shall be eccentric type with no backing ring or frame
10. Valve body cavity shall be smooth without protrusions or baffles
11. Valve body plainly marked to indicate seat end
12. Valve packing adjustment accessible without removing actuator from valve

D. Valve Materials
1. Plug and body: Cast iron, ASTM A126, Class B
2. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications
3. Seat rings shall be threaded, or welded of corrosion-resistant stainless steel (18-8), nickel, or Monel conforming to AWWA C504

4. Sprayed or plated mating seat surfaces are not acceptable
5. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze
6. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504
7. Pull-down packing is not acceptable
8. Shaft seals shall be field adjustable or replaceable without valve disassembly
9. Plug seat: Chloroprene (Neoprene)
10. Packing: Acrylonitrile Butadiene V-Type Cup
    a. Dual U-cup
11. Upper thrust bearing: TFE
12. Body seat: Welded-in overlay seat of no less than 90% nickel
13. Upper and lower trunnion bearings: Sleeve type, 18-8 stainless steel
14. Valves complete with epoxy coating on the interior and exterior, manufacturer's standard corrosion resistant coating shall be acceptable

E. Testing
1. Valves shall be capable of drip-tight shut-off up to the full leak test rating
    a. Test and certify pressure capacity in the reverse direction

2.7 MANHOLES

A. Precast Concrete Units:
1. Manufacturers:
    a. Rinker Materials
    b. Old Castle Precast
    c. Or accepted substitution
2. Specification: ASTM C478
3. Minimum wall thickness: greater of 6 inch or 1/12 of internal diameter
4. Reinforced
5. Grade rings as required

B. Precast Units or Cast-in-place: Use concrete that will attain a 28-day compressive strength of not less than 4000 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan. Sawcut in field only if no other option.

2.8 FABRICATION

A. Vault/Manhole Sections
1. Precast concrete dimensions as shown on plans
2. Minimum manhole inside diameter: 48 inch
3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly

6. Access opening: Minimum 24 clear or as indicated
7. Pipe connection: As indicated on Drawings
8. Pipe knockout: As indicated on Drawings
9. Precast or Cast-in-place base: As indicated on Drawings
10. Manhole steps: 12-inch (up to 16-inch maximum) on center, vertical alignment above largest bench or open area

B. Grating and Metal Frame: As specified on drawings

2.9 ACCESSORIES

A. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stubouts

B. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word “SANITARY”

C. Reinforcement:
1. Reinforcing Steel: ASTM A615 Grade 60
2. Welded Wire Fabric: ASTM A185

D. Concrete: Refer to Division 3 Specifications if applicable
1. Minimum compressive strength: ASTM C39, 4500 psi at 28 days
2. Cement: ASTM C150, Portland Cement, Type II
3. Aggregates: ASTM C33, free of deleterious substances

E. Gaskets and Plastic Sealing Compound
1. Mastic: FS SS-S-210A, "RAM-NEK" or approved substitution
2. Rubber: Neoprene, 40+5 hardness when measured by ASTM D2240, Type A durometer
3. Compression Gaskets: ASTM C443
4. Boot Connectors: ASTM C923
   a. Flexible rubber boots shall provide a watertight seal between the pipe and concrete structure.
   b. Z-LOK connector by A-LOK Products, Inc. or approved substitution

F. Frames and Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick Class 30b

G. Manhole Rings and Covers
1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
2. Covers to seat at all points on ring
3. Lids
   a. All sanitary sewer lids shall be forged with the following: "Sanitary Sewer". Sewer manhole lids must be Denver Pick slot style model #1156 manufactured by

Deeter Foundry, A-1480 by D&L Foundry, East Jordan Iron Works, or accepted substitution unless a bolted lid is required.

b. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes.

4. Provide type as indicated on the drawings

H. Manhole Height Adjustment: Use precast concrete grade rings

I. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade

J. Water: Clean and free of deleterious substances

K. Grout: Provide under provisions of Division 3 Specifications

2.10 GROUT MANUFACTURERS

A. Non-Shrink, Non-Metallic Grout
1. Master Builders: Masterflow 928
2. Burke: Non-Ferrous Non-Shrink
3. M.R. Meadows: Sealtight 588
4. Sonneborn: Sonogrout G.P.
5. Tamms: Tammsgrout 621
6. Sika: SikaGrout 212
7. Or accepted substitution

B. Epoxy Grout
1. Burke: BurkEpoxy Anchoring Grout
2. L&M Inc.: Epogrout
3. Sika: Sikadur 42, Grout Pack
4. Or accepted substitution

2.11 SOIL MATERIALS

A. Furnish pipe bedding and cover as specified in Section 31 00 00 - Earthwork

PART 3 EXECUTION

3.1 INSPECTION

A. Examine pipe and fittings and do not use individual sections containing cracks, dents, abrasions, and other defects

3.2 INSTALLATION OF PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

A. Trenching, Pipe Embedment, Backfill, and Compaction: See Section 31 00 00 - Earthwork

B. Install pipe in accordance with ASTM D2321 as modified herein or on the drawings

C. Cutting
   1. Cut and bevel ends in accordance with manufacturer's standard recommendations
   2. Machine cut ends smooth and square to proper dimensions
   3. Do not cut with a cold chisel, iron pipe cutter, flame or any other method that may fracture the pipe or leave ragged, uneven edges
   4. Remove burrs and wipe off all dust and dirt from jointing surfaces

D. Pipe Laying
   1. Inspect pipe and accessories for cracks and other defects before lowering into trench
   2. Repair or replace any defective, damaged or unsound pipe
   3. Remove all dirt and foreign material from the inside of pipe before laying
   4. Check bedding for firmness and uniformity of surface immediately before laying each section of pipe
   5. Carefully lower pipe, fittings, valves, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage
   6. Do not dump or drop pipe or accessories into trench
   7. Lay to lines and grades indicated on drawings or as specified
      a. Lay piping beginning at a low point of system, true to line and grade with unbroken continuity of invert.
      b. Closely joint to form a smooth flow line
      c. Place bell end or groove ends of piping facing upstream
      d. Maximum length of pipe that can be used without exceeding the allowable deflection at a coupling shall be determined
   8. Utilize implements, tools, and facilities as recommended by the manufacturer
   9. Keep pipe clean during and after laying
   10. Close all open ends with watertight expandable type sewer plugs or test plugs
   11. Remove and relay any pipe which has floated
   12. Do not lay pipe when
      a. There is water in the trench
      b. Trench conditions are unsuitable
      c. Weather conditions are unsuitable
   13. Use acceptable adaptors at manhole and structure connections to provide a watertight seal
   14. Protect from lateral displacement by placing and compacting bedding material under provisions of Section 31 00 00 - Earthwork

E. Jointing
   1. Assemble in accordance with the manufacturer's instructions
   2. Wipe clean pipe ends, gasket and gasket groove before inserting gasket
   3. Apply lubricant furnished by the pipe manufacturer to the gasket and the outside of the spigot end
   4. Insert the spigot end to the reference mark

F. Fittings
   1. Install utilizing standard methods
   2. Lower into trench with rope or other means to prevent damage
   3. Attach rope around the exterior

4. Do not attach rope through the interior
5. Carefully connect to pipe or other facility
6. Check joint to insure a sound and proper joint

G. Water Line and Sanitary Sewer Crossings
1. Whenever possible lay water mains over sanitary sewers to provide vertical separation of at least 18-inches between invert of water main and crown of sewer.
2. If above separation cannot be met, provide one continuous length of watertight sewer pipe 20 feet long centered on water main with concrete encasement. See Town standard detail D4.07 for pipe encasement.
3. Water Mains Passing Under Sewers: If vertical separation less than 18-inches provide structural support for sewer

3.3 MANHOLE PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation, Backfill, Subgrade Compaction: Refer to Section 31 00 00 - Earthwork for requirements

E. Rock Subbase
1. Remove water and place 6-inch minimum depth
2. Vibrate for compaction
3. Level top to accept precast sections with uniform bearing all around
4. If material below vault is unsuitable, excavate as directed by the Engineer and backfill to grade with 1-1/2 inch minus rock and compact

3.4 PLACING MANHOLE

A. Place manhole sections plumb and level. If not level, remove and re-level the grade.

B. Clean ends of sections and place double mastic gasket

C. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Engineer

D. Completed manholes shall be rigid and watertight

E. Coordinate with other sections of work to provide correct size, shape, and location

F. For case-in-place:
1. Place base pad, trowel top surface level to accept manhole section with uniform bearing all around

2. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base of place first manhole section directly in wet concrete

3.5 PREFORMED GASKETS

A. Remove and replace manhole sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.6 MANHOLE INVERT

A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1/2 inch per foot for drainage to invert.

B. Invert shape to conform to radius of pipe it connects

C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D. Construct in conformance with standard drawings

3.7 MANHOLE RINGS AND COVERS

A. Place rings in bed of non-shrink grout on top of manholes

B. Ensure no infiltration will enter manhole at this location

C. Carry non-shrink grout over flange of ring

D. Manhole Lid Elevation
1. If manholes are in cultivated fields, they should be left twenty (20) inches below grade unless directed otherwise by Town Engineer. Manholes in parks or detention basins must be above the flood plain. All other manholes in these types of areas should be no more than six (6) inches above grade. In these circumstances, bolt down ring and cover are to be used and properly marked carbonite composite utility marker located by a property line or other suitable site as close to the manhole as possible, with the off-set marked in feet to the centerline of the manhole cover.
2. In paved roads, the manhole ring and cover shall be designed to final grade. In unpaved roads, the manhole ring and cover shall be designed to be six (6) inches below final grade.

E. Use precast grade rings for height adjustment of manhole ring and cover

3.8 CONNECTION TO EXISTING MANHOLES

A. Maintain flow at all times

B. Prior approval of proposed method for maintaining flow must be obtained from the Town

C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D. Make connection during low flow periods

E. The contractor shall core drill the existing manhole as necessary to insert a “Kor-N-Seal or approved gasket and new sewer pipe.

F. The existing concrete foundation bench shall be ground to the cross-section of the new pipe in order to form a smooth, continuous invert similar to what would be formed in a new concrete base. Portland cement grout shall be used as necessary to smoothly finish the new invert.

3.9 NEW MANHOLE CONNECTIONS TO ACTIVE SEWER LINES

A. When connecting to an active line, the connecting manhole shall be poured in place, Class "B” 4,500 psi concrete with a minimum thickness of eight inches (8) below the flow line of the pipe and four inches (4) above the crown is required.

B. Manhole inverts shall be formed to the full diameter of the pipe to insure full and unobstructed flow. Each pipe must extend no more than four (4) inches into the manhole wall to a formed concrete invert.

C. Pre-cast bases may be used when specifically authorized by the Town. Pipes extended through manholes and cut to form an invert are not acceptable without prior written permission from the Town.

3.10 FIELD QUALITY CONTROL – GENERAL TESTING REQUIREMENTS

A. Testing shall be accomplished through a combination of visual inspections, deflection tests, low-pressure air tests, and leakage test methods.

B. Sanitary sewer pipe and appurtenances shall be cleaned and tested after backfill operations have been completed and acceptable compaction test results have been submitted to the Town Engineer. All testing shall be completed and approved by the Town prior to placement of permanent resurfacing.

C. All testing shall be witnessed by the Town Engineer. The Contractor shall provide a minimum of 48 hours’ notice to Town Engineer prior to testing. Tests performed in the absence of the Town’s representative shall be considered invalid and shall be repeated at the Contractor’s expense.

D. The Contractor shall provide the Town a final report of all testing completed.

E. New sanitary sewer installations shall be televised and as-built shots taken to verify design slope requirements by the Contractor after backfill operations have been completed. The results of the inspection and video shall be submitted to the Town Engineer for approval. Digital video files to be provided with reach noted, footage, inverts, and manhole number at each end, and pipe size and type. Water line installation may not begin until acceptable televised testing video and as-built shots have been submitted and reviewed by the Town

F. The Contractor shall have sewers jet washed on new installation prior to the initial television inspection. Debris resulting from the cleaning shall be removed before entering the Town's existing sewer, by either some type of plug or elbow to catch debris. Material shall be removed from the site and disposed of by the Contractor. If on the initial television inspection, the cleaning is unsatisfactory and prevents the television inspection from being completed, the Contractor shall reclean the sewer and shall be responsible for costs incurred by a second television inspection.

G. Any damages to the pipe caused by cleaning or testing operations shall be repaired or replaced by the Contractor at their own expense. Should the pipe fail to meet the requirements of the low-pressure air test or infiltration of ground water is noted, the Contractor shall determine the source or sources of the leakage and shall replace defective materials or workmanship. Replacement of defective materials or workmanship as above noted shall be the financial responsibility of the Contractor. Pipe which fails to meet these requirements shall be repaired or replaced and retested in accordance with these requirements.

H. New sanitary sewer installations may also be televised by the Town for initial acceptance after the installation, cleaning, testing, and final lift of asphalt are complete. Inspection reports and videos shall be available for review by the Responsible Party. The Responsible Party shall be responsible for any repairs or replacement of any portions of the pipeline that are determined defective by the television inspections.

I. Prior to the final acceptance there may be another television inspection performed by the Town. If there are any discrepancies, a punch list shall be formulated and sent to the Responsible Party. Any discrepancies must be repaired prior to final acceptance being granted.

3.11 PIPE TESTING

A. Low Pressure Air Test
   a. The Contractor shall perform a low-pressure air test on each reach of sanitary sewer pipe between manholes. The low-pressure air test shall be required on the entire length of pipe installations. The test shall conform to the recommended practice and calculations established by the ASTM C-828.
   b. Pipe outlets shall be plugged with suitable test plugs. Pipe may be tested without pre-wetting. If the pipeline to be tested is submerged in groundwater, the Responsible Party shall determine the groundwater elevation at the test location and provide it to the Town Engineer. The backpressure on the pipe due to

groundwater shall be determined and the internal pipeline test pressure shall be established at 4.0 psi (gauge) in excess thereof. Add air slowly to the portions of the pipe being tested. After the pipe has been filled to the required pressure, allow at least two (2) minutes for the air-temperature to stabilize, adding only the amount of air necessary to maintain the test pressure. After the two (2) minute period, disconnect the air supply and allow the initial pressure to drop to 3.5 psi (gauge) in excess of the groundwater back pressure.

c. The time interval required for the sewer internal pressure to drop from 3.5 psi (gauge) to 2.5 psi (gauge) above the excess of ground water backpressure shall be measured and recorded.

d. The basis for acceptance of the air test shall be the minimum time required for the internal pressure to drop 1.0 psi (gauge). The calculations generated by ASTM C-828 shall then be used to check the adequacy of the pipe installation. The minimum allowable time in seconds shall be in accordance with the following tables. The minimum allowable pressure drop time is computed based upon an allowable leakage rate not to exceed 0.003 cfm per square foot of internal pipe surface. Sewers 15 inches in diameter and smaller shall be tested from manhole to manhole. Sewers 18 inches in diameter and larger shall be tested in lengths such that the total loss is no less than two (2) cfm when computed using an allowable rate of 0.003 cfm per square foot of internal surface.

e. Minimum allowable pressure drop times for pipe 15 inches in diameter and smaller (in seconds) per table below

Pipe Diameter (Inches)	**Length of Pipe Being Tested (Feet)**			
	100	200	300	400
8	38	76	114	152
10	47	94	141	188
12	56	113	170	226
15	71	141	212	283

f. Minimum allowable pressure drop times for pipe 18 inches in diameter and larger (in seconds) per table below:

Pipe Diameter (inches)	**Length of Pipe Being Tested (feet)**					**Maximum Testing Length (feet)**
	25	50	75	100	126	
18	21	42	64	85	106	140
21	25	50	74	99		120
24	28	56	85	113		106
27	32	64	95			94
30	35	71	106			84
36	42	85				70

The minimum allowable pressure drop time when using the maximum testing length is 120 seconds.

g. Sewers 36 inches in diameter shall be tested one (1) joint at a time.

h. The Responsible Party shall follow precautions necessary to perform a safe and successful test. Plugs used to isolate the line for the air test must be securely braced to avoid the unintentional release of the plug. Gauges, air piping manifolds, and control valves shall be located above ground. No one shall be permitted to enter a manhole when a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure relief device designed to relieve the pressure when in excess of six (6) psi (gauge)

B. Exfiltration/Infiltration Test
   a. Contractor shall perform an exfiltration test on each reach of sanitary service and sanitary sewer pipe between manholes or discharge.
      a. Test the first reach prior to backfilling and before installing any of the remaining pipe
   2. Procedure
      a. Block off all manhole openings except those connecting with the reach under test
      b. Fill the line
         i. Average depth: 10 feet above invert except as required by manhole depth
         ii. Maximum depth at lower end: 25 feet above crown
         iii. Minimum depth at upper end: 5 feet above crown
      c. Add and measure water as required to maintain a constant level
         i. Air pocket entrapment shall be avoided when filling the line with water. Once filled with water, the system shall be allowed to stabilize for a period of one or two hours before starting the test.
         ii. Maximum exfiltration/infiltration: 0.039 gallons per inch of nominal diameter per hour per 100 feet of pipe.
         iii. For the purposes of exfiltration leakage, manholes shall be considered to be concrete pipe of the same diameter as the manhole i.e. 48, 60 or 72 – inch diameter
         iv. Maintain test for a minimum of 2 hours or as long as necessary, in the inspector's opinion, to locate all leaks
   3. Repair and retest any reach which exceeds the allowable exfiltration/infiltration
      a. If excessive ground water is encountered during construction of a sanitary sewer section or as requested by the Town Engineer, the infiltration test for leakage shall be used
      b. Maximum infiltration: 0.039 gallons per inch of nominal dimeter per hour per 100 feet of pipe
   4. Repair and retest any reach which exceeds the allowable infiltration

C. Infiltration
   3. If excessive ground water is encountered during construction of a sanitary sewer section or as requested by the Town Engineer, the infiltration test for leakage shall be used.
   4. Maximum infiltration: 0.039 gallons per inch of nominal diameter per hour per 100 feet of pipe.
   5. Repair and retest any reach which exceeds the allowable infiltration

D. Pipe Deflection Test
   1. Pipe deflection test shall be completed if video inspection shows defects or as required by the Town Engineer.
   2. No sooner than 30 days after placement and compaction of backfill, but prior to placement of permanent surface materials, clean and mandrel each line to detect obstructions (deflections, joint offsets, lateral pipe intrusions, etc.)
   3. Use a rigid mandrel with diameter of at least 95 percent of the pipes specified average inside diameter and a length of the mandrel circular portion at least equal to the nominal pipe diameter
   4. Maximum allowable deflection is 5 percent of the base internal diameter. Mandrel outside diameters in inches are as follows:

Pipe Size	Base I.D.	Mandrel O.D.
6	5.792	5.50
8	7.764	7.38
10	9.711	9.23
12	11.558	10.98

   5. Pull the mandrel through the pipe by hand
   6. Relay or replace all pipe exceeding the 5 percent deflection
   7. Retest repaired sections
   8. Maximum allowable deflection at end of one-year correction period, 7-1/2 percent of the base internal diameter tested in the same manner. Uncover and repair sections exceeding the allowable deflection

E. TV Inspection shall be provided as requested by the Town. Digital video files to be provided with reach noted, footage, inverts, and manhole number at each end, and pipe size and type

F. All sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe should be visible when viewed between consecutive manholes. The method of test can be photography, closed circuit television or visually lamping with mirrors and lights.

G. Lamp Test
   1. Each section between manholes will be lamped by Contractor in the presence the Town Engineer if requested
   2. A true circle will be required in the lamp tests to indicate a properly constructed sewer line
   3. Repair any sections not passing the lamp test at Contractor's expense.

3.12 MANHOLE TESTING

A. Test all manholes:
   1. Vacuum test:
      a. Plug all inlets and outlets in such a manner as to prevent displacement of plugs

b. Install and operate vacuum tester head assembly in accordance with equipment specifications and manufacturer instructions
c. Attach the vacuum pump assembly to the proper connection on the test head assembly. Ensure that vacuum inlet/outlet valve is closed
d. Inflate sealing element to twice the pressure test to be used. Do not over inflate
e. Start vacuum pump assembly engine and allow preset RPM to stabilize
f. Open vacuum inlet/outlet valve and evacuate manhole to 5-inches Hg (mercury)
g. Close vacuum inlet/outlet valve, disconnect vacuum pump and monitor vacuum. Record time for vacuum to drop from initial 5 inches Hg to 4 inches Hg.
h. Acceptance for 4-foot diameter manhole is when the time to drop from 5 inches Hg to 4 inches Hg meets or exceeds requirements as defined below:

Maximum Allowable Vacuum Drop		
Manhole Depth Rim to Invert	**Manhole Diameter in feet**	**Time for Vacuum to Drop 1 inch Hg**
10 feet or less	4	120 seconds
10 feet to 15 feet	4	150 seconds
15 feet to 25 feet	4	180 seconds

i. Adjust time to drop from 5 inches Hg to 4 inches Hg for other manhole diameters as follows:
   i) 5-foot diameter manhole: Add 30 seconds from time shown above
   ii) 6-foot diameter manhole: Add 60 seconds to time shown above
j. Repair all manholes that fail leakage test and retest until manhole passes test
k. If joint mastic or gasket is displaced during vacuum test, disassemble manhole and replace seal
l. If the manhole fails the initial test, necessary repairs should be made with a non-shrink grout. Repairs and retesting shall proceed until a satisfactory test is obtained.

2. All testing shall be witnessed by the Town Engineer or Town Inspector. Contractor shall provide a minimum 48-hour notice prior to testing.

3.13 TRACER WIRE TESTING

The Contractor shall provide test report for tracer wire continuity.

3.14 CLEANUP AND RESTORATION

A. Restore pavements, curbs and gutters, utilities, and other improvements to condition equal to or better than before work began and to satisfaction of the Town.

B. Deposit waste material in designated waste areas and disposal site graded and shaped.

3.15 FINAL ACCEPTANCE

A. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.

1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

B. Provide record drawings with manhole number, inverts, and location (x, y, z) for each service connection

C. Provide test report for tracer wire continuity

D. Provide pipe and manhole tests and results

E. Provide video files of TV inspection on a DVD

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping and concrete structures for storm sewer system, roof drainage, and culverts

B. Riprap for channel lining, outlet protection and rock check dams

1.2 REFERENCES

A. ACPA - American Concrete Pipe Association

B. ASTM – American Society for Testing and Materials
1. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
2. ASTM C150 - Portland Cement
3. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
4. ASTM C478 – Precast Concrete Structures
5. ASTM C497 - Testing Concrete Pipe, Manhole Sections, or Tile
6. ASTM A48 - Gray Iron Castings
7. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
8. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
9. ASTM C33 - Concrete Aggregates
10. ASTM C478 - Precast Reinforced Concrete Manhole Sections

C. Urban Storm Drainage Criteria Manual, Mile High Flood District (MHFD)

D. Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction

1.3 SUBMITTALS

A. Shop Drawings: Provide drawings with pipe and structure details, design standards, reinforcement, dimensions, etc. Provide additional detailed information (including elevations, fittings, specialty materials or fabrications, etc.) for special or custom features, structures, junctions and/or pipes. Provide pipe-laying schedule.

B. Product Data: Provide sufficient data on features, pipe, joints, gasket material, lubricant and accessories to verify compliance with specifications.

C. Manufacturers Certificate: Certify that pipe, meets or exceeds specified requirements. Confirm all materials comply with applicable standards.

D. Provide sufficient data to verify compliance with these specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun

B. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: (direct sunlight, mud, etc.)
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

C. Handling
   1. Handle so as to insure installation in sound undamaged condition.
   2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection
   3. Use hooks or straps with broad, well-padded contact surfaces for lifting sections of pipe

1.5 ENVIRONMENTAL REQUIREMENTS

A. Weather limitations: Do not install piping over frozen surfaces or in standing water.

PART 2 GENERAL PRODUCTS

2.1 PIPE MATERIALS

A. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated

B. Fittings: Furnish bends, ells, tees, wyes, couplings and other fittings of the same type and class of material having equal or superior physical and chemical properties as acceptable to the Engineer

C. Reinforced Concrete Pipe: ASTM C76,
   1. 12-inch RCP Class V, with modified tongue-and-groove compression gasket joints complying with ASTM C443.
   2. 15-inch RCP Class IV (Class V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.
   3. 18-inch thru 24-inch RCP Class III (Class IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

4. 24-inch thru 36-inch RCP Class II (Class III, IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

D. PVC Sewer Pipe: ASTM D3034, Type PSM, SDR 35 with PVC, elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

E. HDPE Sewer Pipe: smooth interior, corrugated exterior piping conforming to ASTM D 2412, ASTM D 3212, AASHTO specifications M252 and M 294, joints to conform to ASTM F 477.

F. Corrugated Metal Pipe (CMP): AASHTO M218 or ASTM A444, helically or circumferentially corrugated, mill galvanized steel.
   1. Furnish galvanized sheet metal, 16 gauge, 0.064-inch galvanized thickness, 0.0598-inch base metal thickness and size of conduit as indicated. Sizes indicated are minimal inside diameters.
   2. Furnish width and lap depths and corrugations conforming to AASHTO M36.

G. Corrugated Aluminum Pipe (CAP): ASTM M197 helically or circumferentially corrugated.
   1. Aluminum alloy, 16-gauge, Size shown on approved drawings
   2. Furnish width and lap depths and corrugations conforming to AASHTO M196.

H. Perforated PVC Sewer Pipe: ASTM D3034, Type PSM, SDR 35 with PVC, elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

2.2 MATERIALS

A. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stubouts.

B. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word “STORM”.

C. Reinforcement
   1. Reinforcing Steel: ASTM A615 Grade 60
   2. Welded Wire Fabric: ASTM A185

D. Concrete:
   1. Minimum compressive strength: ASTM C39, 4500 psi at 28 days
   2. Cement: ASTM C150, Portland Cement, Type II
   3. Aggregates: ASTM C33, free of deleterious substances

E. Gaskets: ASTM C923
   1. Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution

2. Rubber: Neoprene, 40+ 5 hardness when measured by ASTM D2240, Type A durometer

F. Inlet Gratings and Manhole Rings and Covers
   1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
   2. Provide bike/pedestrian-safe grates where such traffic is anticipated
   3. Set grate on frame such that openings maximize inlet intake
   4. Covers to seat at all points on ring
   5. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes.
   6. Covers to be cast with "STORM SEWER" in 1 1/2" tall flush letters in addition to the symbol of a fish with the phrase “DUMP NO WASTE, DRAINS TO WATERWAYS”.
   7. Manhole lids to be manufactured by East Jordan Iron Works, or accepted substitution.
   8. Manhole covers to receive asphalt varnish coating hot dip applied at foundry, 6 mils thick

G. Manhole Height Adjustment: Use precast concrete grade rings

H. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade

I. Water: Clean and free of deleterious substances

J. Grout:
   1. Non-Shrink, Non-Metallic Grout: Factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 4000 psi in one day and 8000 psi in 7 days
   2. Epoxy Grout: Three Component Epoxy Resin System
      i) Two liquid epoxy components
      ii) One inert aggregate filtered component
      iii) Each component furnished in separate package for mixing at job site

2.3 CONCRETE CATCH BASINS AND MANHOLES

A. Comply with Town of Berthoud Standard Details and CDOT standards and specifications for public storm sewer products.

B. Precast Concrete Units:
   1. Manufacturers: Carder Concrete Products, Amcor Precast, or accepted equal
   2. Specification: ASTM C478 and C789, wall “B
      a. Minimum wall thickness: greater of 6 inch 1/12 of internal diameter
      b. Reinforced
      c. Grade rings as required
      d. Cast steps into units.

C. Precast Units or Cast-in-place as shown. Use concrete that will attain a 28-day compressive strength of not less than 4500 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan or sawcut in field.

D. Cast-in-place Concrete Units: As shown on the drawings complying with the Town of Berthoud, LCUASS, and Colorado Department of Transportation drainage and design standards.

2.4 PVC PLASTIC INLINE DRAINS AND DRAIN BASINS

A. Manufacturer: Nyloplast America Inc. or accepted substitution.

B. Inline drains and drain basins shall be manufactured from PVC pipe stock, utilizing a thermo molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212.

C. Surface drainage products shall meet the mechanical property requirements for fabricated fittings as described in ASTM F794, F949 and F1336.

D. Inline drain and drain basin adapters and accessories
   1. Adaptable to SDR-35 PVC piping.
   2. Watertight adaptors.

E. Cast iron or ductile iron frames and grates:
   1. Light –traffic rated
   2. Pedestrian rated
   3. Hinged and locking
   4. Made specifically for use with the specified inline drains and drain basins
   5. Painted black
   6. ASTM A-48-83 Class 30B or A536 grade 70-50-05 grade iron
   7. Size indicated on the approved drawings

2.5 CONCRETE FABRICATION

A. Vault/Manhole Sections
   1. Precast concrete dimensions as shown on plans
   2. Minimum manhole inside diameter: 48 inch
   3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
   4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
   5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly
   6. Access opening: Minimum 24 clear or as indicated
   7. Pipe connection: As indicated on Drawings
   8. Pipe knockout: As indicated on Drawings
   9. Precast concrete, monolithic base or cast-in-place base
   10. Manhole steps: 12 inch on center, vertical alignment above largest bench or open area

B. Grating and Metal Frame: As specified on approved drawings

2.6 SOIL MATERIALS

A. Furnish pipe bedding and cover as specified in Section 31 00 00 – Earthwork.

B. Riprap Materials:
1. Hard, dense, durable stone, angular in shape and resistant to weathering
2. Minimum specific gravity of 2.5
3. Material may be approved by Engineer, if by visual inspection, the rock is determined to be sound and durable
4. Town Engineer may require Contractor to furnish laboratory test results if the material appears to be marginal or unacceptable
5. Tested material shall meet the following requirements for abrasion resistance or compressive strength:

Test	Test Method	Requirement
Abrasion Resistance by Los Angeles Machine	ASTM C 535	50% loss, max
Unconfined Compressive Strength of Drilled Core Specimen	AASHTO T 24	2500, min

6. Gradation:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	Mean Particle Size,d_{50} (Inches)
Type L	70-100 50-70 35-50 2-10	15 12 9 3	9
Type M	70-100 50-70 35-50 2-10	21 18 12 4	12
Type H	70-100 50-70 35-50 2-10	30 24 18 18 6	18

7. Granular Riprap Bedding:
   a. 3/4” – 1” Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4”	90-100
1/2”	25-60
3/8”	20-55
NO. 4	0-10
Sieve Size (Inch)	Percent Passing by Weight
NO. 8	0-5
NO. 200	0-2

C. Pipe Bedding:
   1. Refer to Section 31 00 00 – Earthwork
   2. Minimum 6 inch deep, unless specified otherwise

D. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
   2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
   3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
   4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
   5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

PART 3 EXECUTION

3.1 REGULATORY REQUIREMENTS

3.2 PIPE PREPARATION

A. Shape trench and place bedding as specified in Section 31 00 00 and as shown on the drawings.
   1. Dig bell or coupling holes
   2. Do not support pipe on blocks or mounds of earth.
   3. Provide uniform and continuous bearing and support for full length of pipe between bell holes
   4. Minor disturbance over a maximum length of 18 inches near the middle of each length of pipe will be permissible by the withdrawal of pipe slings or other lifting tackle

B. Alignment and Grade
   1. Except as indicated on the Drawings, lay all pipe straight and at a uniform grade.
   2. Use batter boards to determine and check pipe subgrades.

3. Other methods of maintaining alignment and grade may be acceptable if approved by the Town Engineer.

3.3 PIPE INSTALLATION

A. Inspect pipe and accessories for defects before lowering into trench.

B. Replace any defective, damaged or unsound pipe.

C. Carefully lower pipe, fittings, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage. Do not dump or drop pipe or accessories into trench.

D. Pipe embedment shall be as specified in Section 31 00 00 for pipe.

E. Protect from lateral displacement by placing the specified pipe embedment material.

F. Do not lay pipe in water, under unsuitable weather conditions or under unsuitable trench conditions

G. Joint to form true and smooth line.

H. Remove any pipe not making a good fit.

I. Begin pipe laying at the lowest point unless reverse laying is accepted by Engineer.

J. Utilize implements, tools and facilities as recommended by the manufacturer and/or catch basins if required to remove debris.

K. Keep pipe clean during and after laying.

L. During construction, close all open ends with watertight expandable type plugs.
   1. At the end of each day's operations.
   2. Whenever pipe ends are left unattended.
   3. Deposit adequate backfill on pipe to prevent flotation.
   4. Do not use wood, burlap or other similar temporary plugs.

M. Remove and re-lay any pipe which has floated.

3.4 PRECAST STRUCTURE PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation and Backfill: Refer to Section 31 00 00 - Earthwork for requirements

E. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

F. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction

3.5 CATCH BASINS

A. Construct catch basins to the sizes and shapes indicated, and to conform to requirements of authorities having jurisdiction.
   1. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction
   2. For precast units, set in place to accurate elevations on firm, solid bed, plumb and level.
   3. Pipe openings, elevations and alignment per plans
   4. Seal and grout all pipe penetrations
   5. Set cast iron frames and gratings to the elevations indicated.

3.6 PLACING MANHOLE SECTION OR CAST-IN PLACE BASE

A. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction

B. Place base pad, trowel top surface level to accept manhole section with uniform bearing all around

C. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base or place first manhole section directly in wet concrete

D. Place manhole sections plumb and level, trim to correct elevations

E. Clean ends of sections and place double mastic gasket

F. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

G. Cure non-shrink grout using approved methods

H. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Town Engineer

I. Completed manholes shall be rigid and watertight

J. Coordinate with other sections of work to provide correct size, shape, and location

3.7 PREFORMED GASKETS

A. Remove and replace manhole sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.8 MANHOLE INVERT

A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1/2 inch per foot for drainage to invert.

B. Invert shape to conform to radius of pipe it connects

C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D. Construct in conformance with standard drawings

3.9 MANHOLE RINGS AND COVERS

A. Place rings in bed of non-shrink grout on top of manholes

B. Ensure no infiltration will enter manhole at this location

C. Carry non-shrink grout over flange of ring

D. Set top of ring flush with all surfaces subject to foot and vehicular traffic

E. Set top of ring 6 inches above surfaces in open, unraveled, non-pedestrian areas

F. Use precast grade rings for height adjustment

3.10 CONNECTION TO EXISTING MANHOLES

A. Maintain flow at all times

B. Prior approval of proposed method for maintaining flow must be obtained from Engineer

C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D. Make connection during low flow periods

3.11 GROUT

A. PREPARATION
   1. Non-Shrink, Non-Metallic Grout, General Use
      a. Clean concrete surface to receive grout
      b. Saturate concrete with water for 24 hrs prior to grouting and remove excess water just prior to placing grout

c. Cold weather conditions
    i) Warm concrete, substrate and base plate to 40 deg F, or above; store grout in warm area
    ii) Follow manufacturer's recommendations for cold weather application
d. Hot weather conditions
    i) Use cold mixing water and cool base plate if possible; store grout in cool area
    ii) Follow manufacturer's recommendations for hot weather application
e. Apply to clean, sound surface
f. Apply latex bonding agent to hardened concrete, mix-in-grout, or as directed by Engineer

2. Epoxy Grout: Apply only to clean, dry, sound surface
    a. Patching cavities in concrete including, but not limited to, tie holes, and structural and equipment support

B. APPLICATION
1. Non-Shrink, Non-Metallic Grout
    a. Mix in a mechanical mixer
    b. Use no more water than necessary to produce flowable grout
    c. Provide air vents where necessary to eliminate air pockets
    d. Place in accordance with manufacturer's instructions
    e. Where exposed to view finish grout edges smooth
    f. Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound
    g. Wet cure grout for 7 days, minimum
    h. Maintain the temperature at a minimum of 40 deg F until grout reaches 3000 psi
    i. After placement of grout, eliminate excessive external vibration
2. Epoxy Grout
    a. Mix and place in accordance with manufacturer's instructions
    b. Completely fill all cavities and spaces around dowels and anchors without voids
    c. Obtain manufacturer's technical assistance as required to insure proper placement

3.12 RIPRAP

A. Do not place riprap over frozen or spongy subgrade surfaces.

B. Place riprap at pipe outlets and in channels as indicated on plans. Top of riprap to match invert of outlet pie and channels.

C. Excavate and prepare subgrade.

D. Place geotextile fabric per plans under all bedding. Place bedding and place riprap on bedding per plans.

E. Material may be machine placed and then arranged as necessary by use of a Gradall with multi-prong grapple device or by hand to minimize voids. Dumping alone is not sufficient to achieve properly placed riprap.

3.13 FIELD QUALITY CONTROL

A. Field inspection and testing including a lamp test will be performed for every section of pipe after backfill has occurred
   1. Contractor shall furnish suitable assistance to the Engineer
   2. A minimum of 75% of a true circle will be required to indicate a properly constructed line
   3. Contractor will repair any section not passing the lamp test.

B. Request inspection immediately after placing cover over pipe.

C. Backfilling and testing as required per Section 31 00 00 - Earthwork.

END OF SECTION

TOWN OF BERTHOUD

APPENDIX B
STANDARD DETAILS

DRAFT

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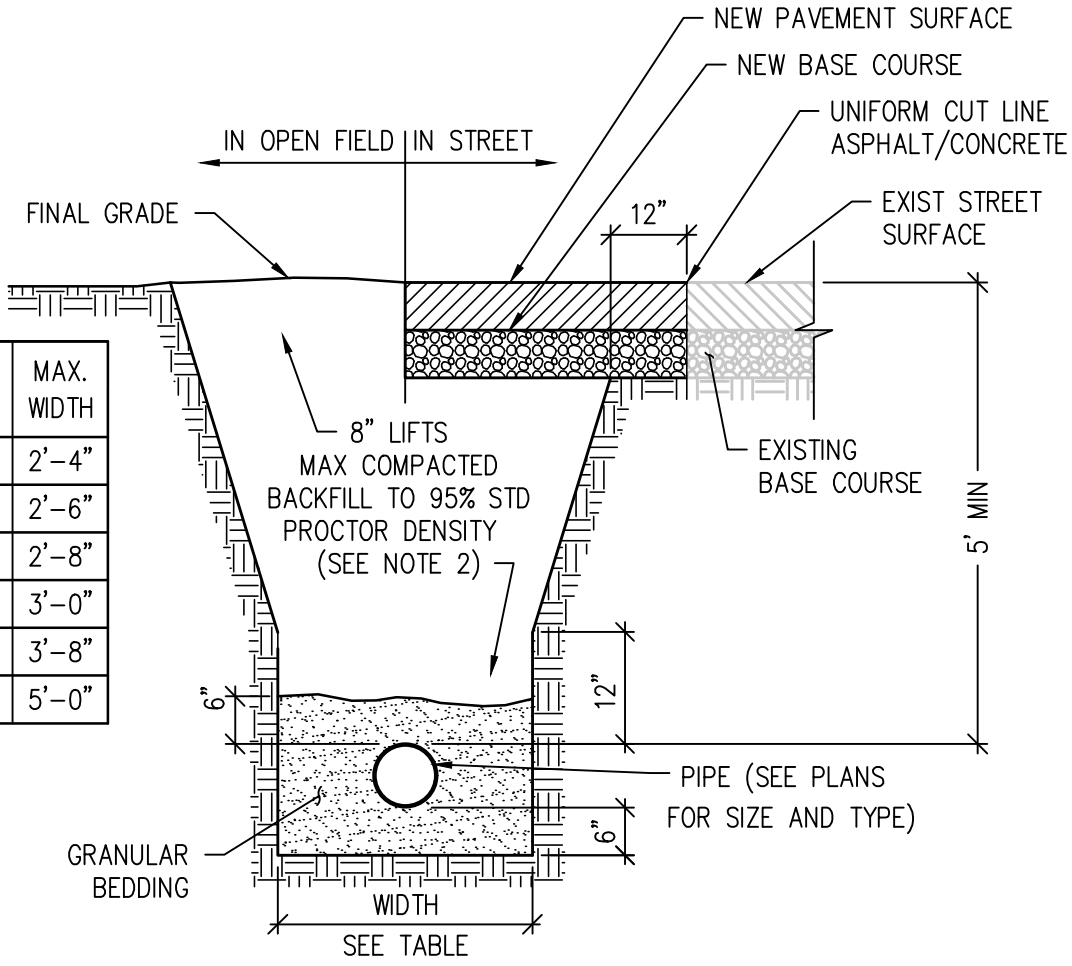
DRAFT

DETAILS

D0.01	Typical Trench Detail
D0.02	Trench (Dipping Bedrock & Expansive Soils)
D0.03	Standard Manhole
D0.04	Manhole Ring and Cover – Non-Bolted
D0.05	Manhole Ring and Cover - Bolted
D0.06	Plastic Manhole Step
D0.07	Manhole Base
D0.08	Manhole Base and Deflector
D0.09	Utility Marker Post
D0.10	Trench Stop
D0.11	Town of Berthoud Approval Block
D4.01	Sanitary Drop Manhole
D4.02	Monitoring Sanitary Manhole
D4.03	Monitoring Sanitary Manhole Diagrams
D4.04	Sanitary Cleanout
D4.05	Typical Service Connection
D4.06	Tapping Saddle
D4.07	Pipe Encasement
D4.08	Concrete Collar Underdrain
D5.01	Fireline Connection with Main Extension
D5.02	Fire Hydrant Profile
D5.03	Fireline Tracer Wire
D5.04	PRV Rectangular Vault Plan View
D5.05	PRV Rectangular Vault Cross Section
D5.06	PRV Manhole Plan View
D5.07	PRV Manhole Cross Section
D5.08	2-inch Air and Vacuum Valve Installation
D5.09	Blow-Off Installation – 12-inch And Smaller Pipe
D5.10	Blow-Off Detail
D5.11	Crossing Over or Under Conflicting Utility
D5.12	Meter Vault Assembly
D5.13	Service Line, Stop Box, Outside Meter Installation
D5.14	Outside Setting for 0.75-inch and 1-inch Meter
D5.15	Outside Setting for 1.5-inch and 2-inch Meter
D5.16	Direct Bury Butterfly Valve Installation
D5.17	Gate Valve
D5.18	Floor Pipe Support
D5.19	Residential Vent Assembly
D5.20	Wall Penetration with Core Hole
D5.21	Pressure Gauge
D5.22	Mechanical Joint Restraint
D5.23	Concrete Thrust Blocks 1 of 2
D5.24	Concrete Thrust Blocks 2 of 2
D5.25	Tapping Tee and Valve
D5.26	Insulated Joint, Rod, and Coupling
D5.27	Polyethylene Wrap
D6.01	Storm Cleanout
D6.02	Storm Sewer Bedding Detail
D6.03	CMP Type 1 Flared End Section

D6.04	Riprap Apron Sizing & Placement at Flared End Section
D6.05	Type C Inlet
D6.06a	Combination Inlet (1 of 2)
D6.06b	Combination Inlet (2 of 2)
D6.07	Direct Connection RCP To PVC Connection
D6.08a	Valley Inlet (CDOT Type 13) (1 of 2)
D6.08b	Valley Inlet (CDOT Type 13) (2 of 2)
D6.09a	Type R Curb Inlet (1 of 3)
D6.09b	Type R Curb Inlet (2 of 3)
D6.09c	Type R Curb Inlet (3 of 3)
D6.10	Small Pipe Headwall
D6.11	Headwall with Circular Pipe
D6.12	Low Flow Channel
D6.13	Emergency Overflow



PIPE DIA	MIN. WIDTH	MAX. WIDTH
3", 4"	1'-4"	2'-4"
6"	1'-6"	2'-6"
8"	1'-8"	2'-8"
12"	2'-0"	3'-0"
20"	2'-8"	3'-8"
24"	4'-0"	5'-0"

NOTES:

1. MINIMUM COVER 5' FOR WATER AND SANITARY SEWER
2. COMPACTED BACKFILL TO 90% STD PROCTOR DENSITY IN NON-DRIVING SURFACES AND 95% UNDER PAVEMENT
3. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500PSI CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE
4. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND THE PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH LOCAL, STATE, FEDERAL, & OSHA SAFETY REGULATIONS
5. PAVING SHALL COMPLY WITH LOCAL AUTHORITY JURISDICTION

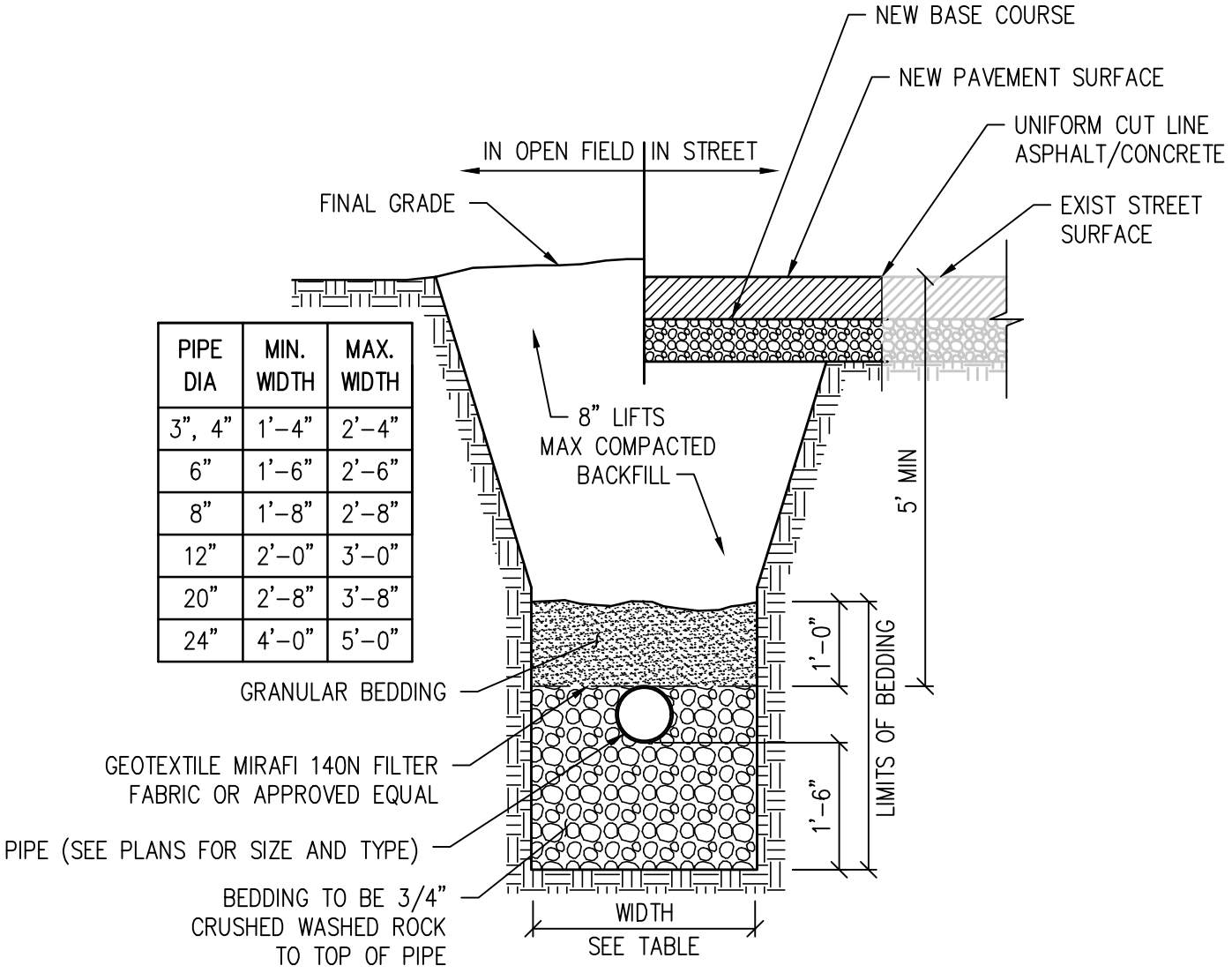
SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
GENERAL DETAILS

TYPICAL TRENCH DETAIL

D0.01

DATE: 12/2020



PIPE DIA	MIN. WIDTH	MAX. WIDTH
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4. COMPACTION SHALL BE AS FOLLOWS: PIPE ZONE BEDDING 18" UNDER AND 12" OVER PIPE WILL REQUIRE 90% SPD TRENCH ZONE ABOVE BEDDING MATERIALS, OUTSIDE OF STREET ROW WILL REQUIRE 90% SPD, INSIDE OF STREET ROW WILL REQUIRE 95% SPD

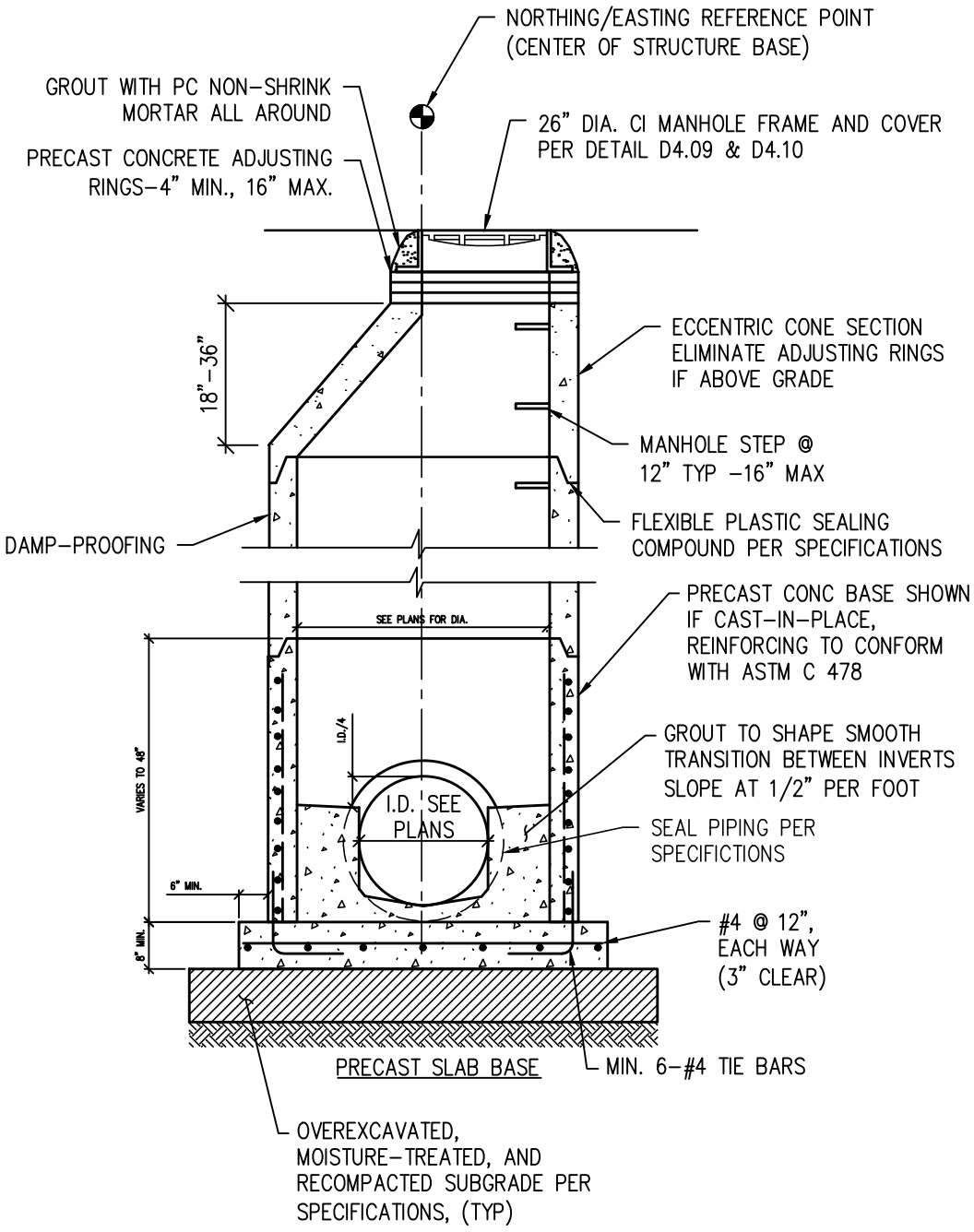
SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
GENERAL DETAILS

TRENCH (DIPPING BEDROCK & EXPANSIVE SOILS)

D0.02

DATE: 12/2020

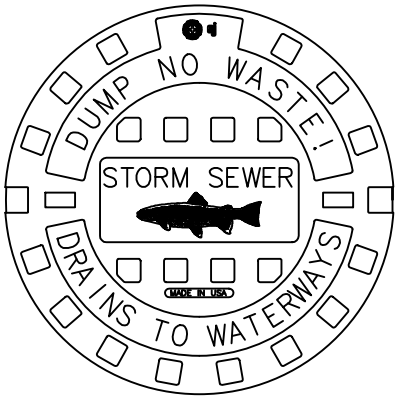


NOTES:

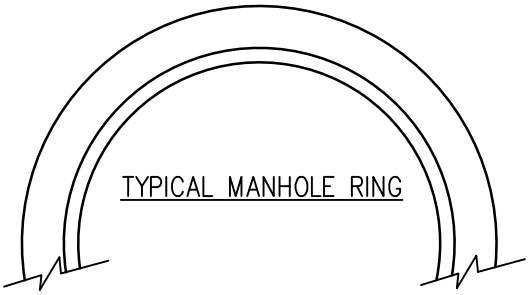
1. SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING OR SHAPING BASE CONCRETE.
2. BLOCK-OUTS WHEN APPROVED SHALL EXTEND A MAX OF 6" PAST MANHOLE OD AND BE SATISFACTORILY PLUGGED AND SEALED.
3. CONCRETE MANHOLE BASES MAY BE POURED IN PLACE ONLY WITH PRIOR APPROVAL.
4. ALL MORTAR SHALL BE MIXED WITH A TYPE II CEMENT.
5. BENCH MUST HAVE A BRUSHED, NON-SKID SURFACE.

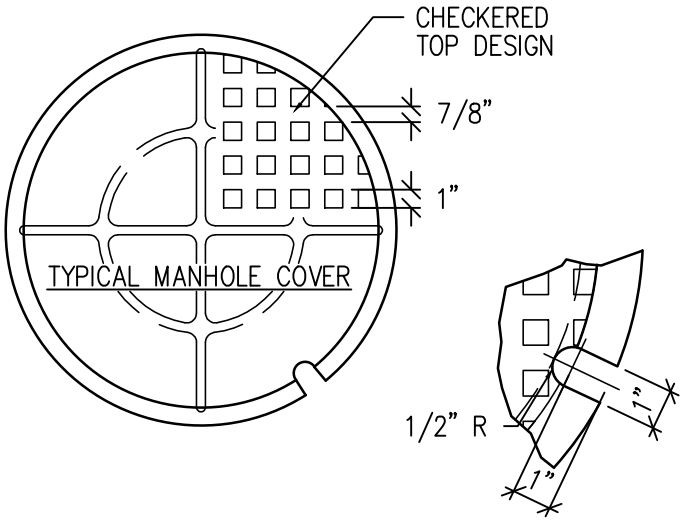
SCALE: NTS

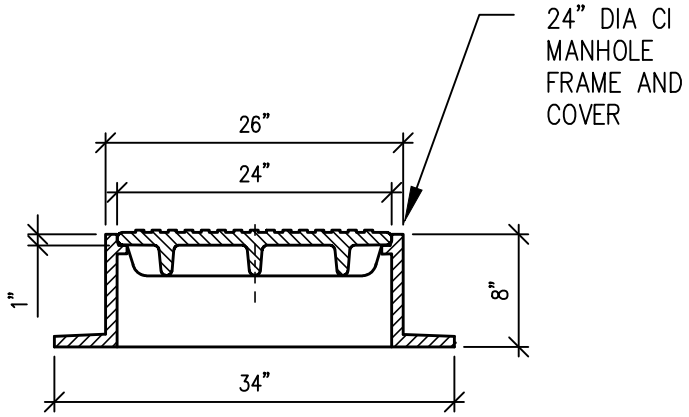
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.03
	STANDARD MANHOLE	DATE: 12/2020



TYPICAL STORM COVER





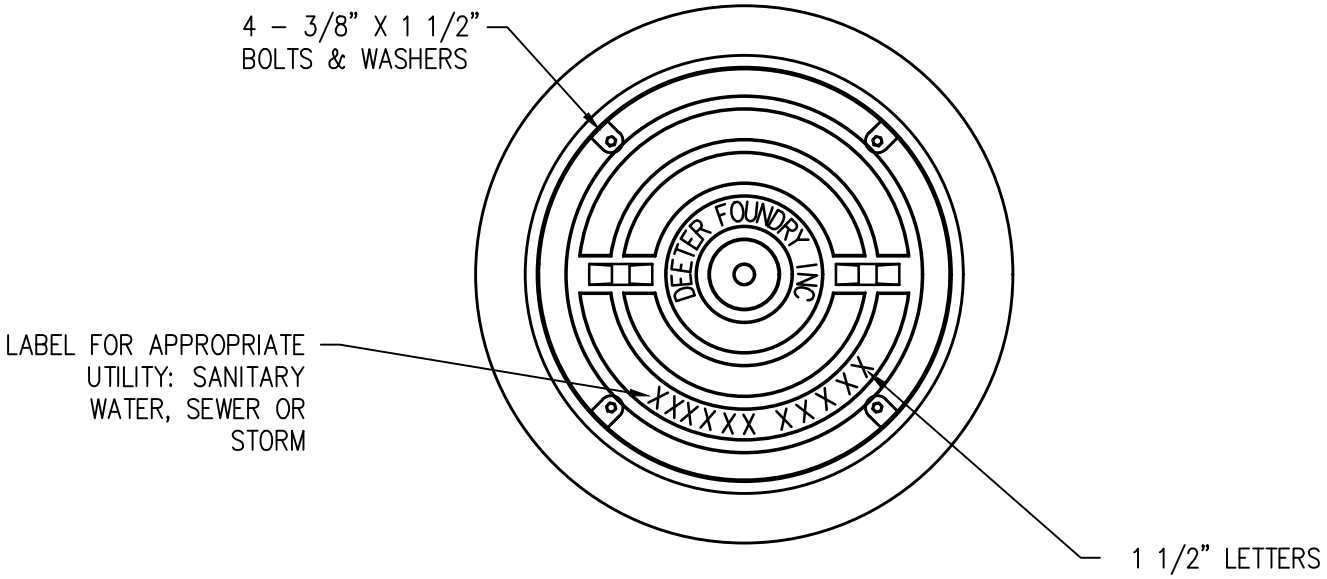


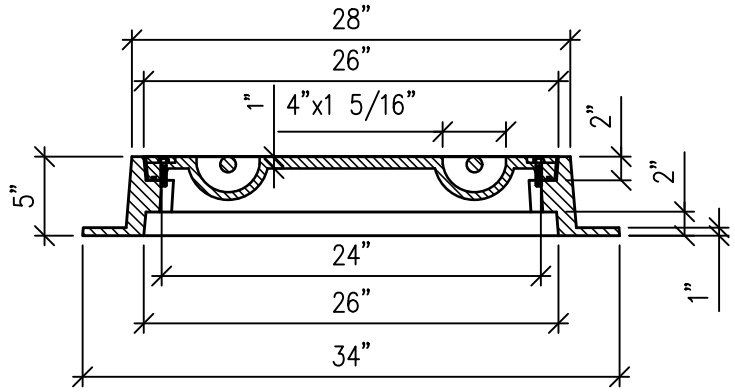
NOTES:

1. ASTM DESIGNATION A-48 CLASS 35B (UNPAINTED) W/ MIN TENSILE STRENGTH KSI (CLASS 25)
2. 1-1/2" LETTERING ON COVER AS REQUIRED (WATER, SEWER, OR STORM). SEE STORM COVER DETAIL ABOVE FOR ADDITIONAL REQUIREMENTS
3. ALL BEARING SURFACES TO BE MATCHED
4. TOTAL MINIMUM WEIGHT APPROXIMATELY 400 LBS CAST IRON ONLY
5. LIFTING NOTCH SHALL NOT EXTEND PAST INSIDE FACE OF RING SEAT
6. MIN FRAME WEIGHT 235 LBS, MIN LID WEIGHT 165 LBS

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.04
	MANHOLE RING AND COVER – NON-BOLTED	DATE: 12/2020



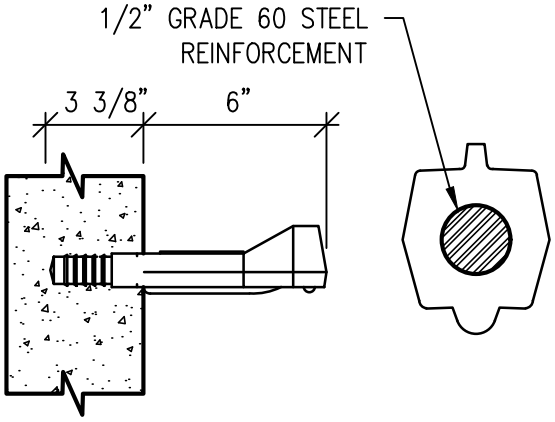


NOTES:

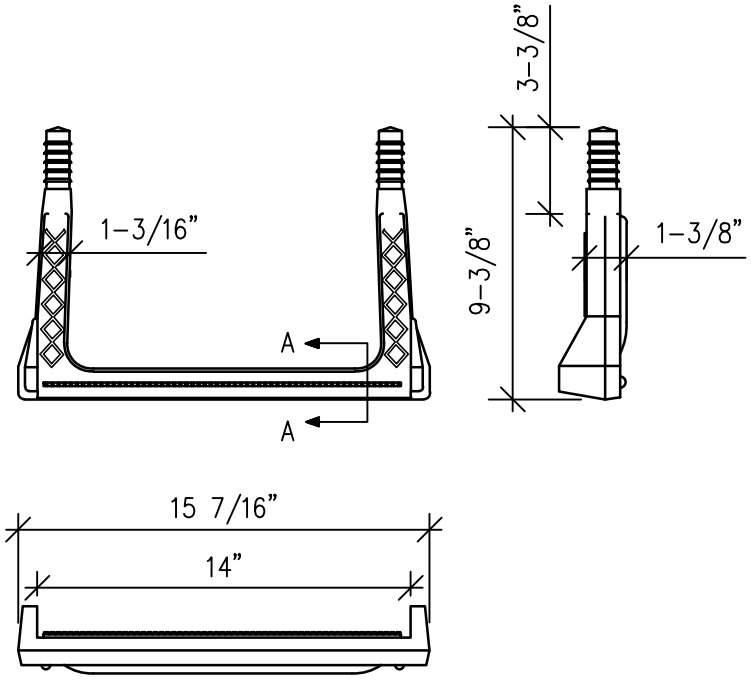
1. RING AND COVER SHALL BE IRON (AS MANUFACTURED FOR CURRENT AWWA STANDARD).
2. 1–1/2" LETTERING ON COVER AS REQUIRED (WATER, SEWER OR STORM).
3. COVER SHALL BE BOLTED, WATER RESISTANT IF LOCATED IN 100 YEAR FLOOD PLAIN, BACK YARDS, OPEN SPACE AND/OR DITCHES BELOW GROUND OR AS SPECIFIED BY THE TOWN.
4. MANHOLE LID AND RING SHALL BE FURNISHED WITH MACHINED HORIZONTAL BEARING SURFACES.
5. COVER IS BOLTED TO FRAME.
6. MANHOLE LID AND RING SHALL BE FURNISHED WITH GASKET.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.05
	MANHOLE RING AND COVER – BOLTED	DATE: 12/2020



SECTION–A



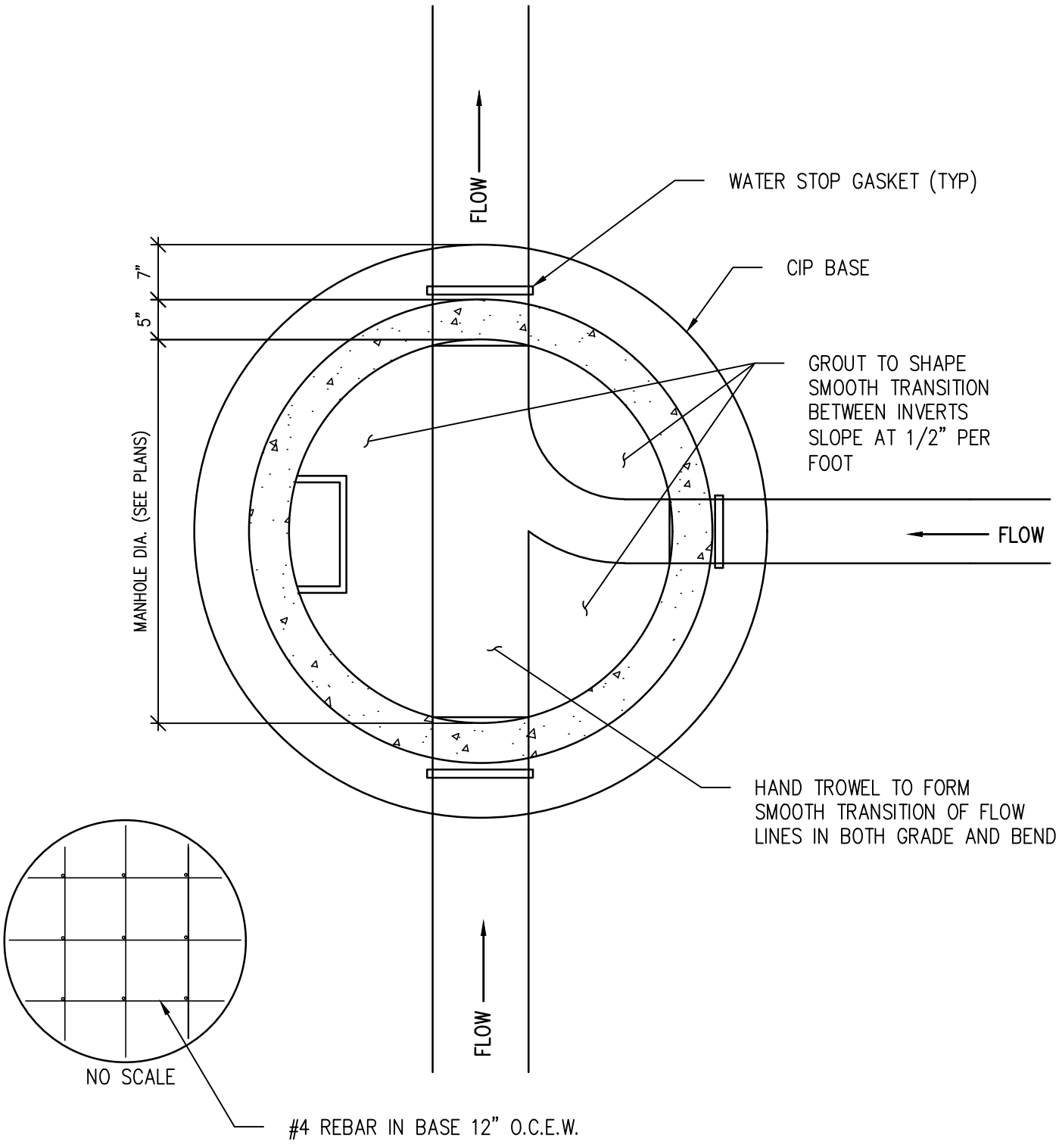
COPOLYMER POLYPROPYLENE PLASTIC

NOTES:

1. AS MANUFACTURED BY M.A. INDUSTRIES (MODEL NO. PS2–PF) OR APPROVED SUBSTITUTION SPACED AT 12" NOT GREATER THAN 16"

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.06
	PLASTIC MANHOLE STEP	DATE: 12/2020

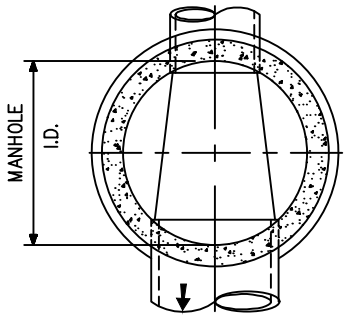


NOTES:

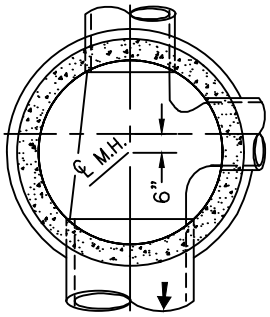
1. FLOW DIRECTION CHANGE 90 DEGREES, MINIMUM

SCALE: NTS

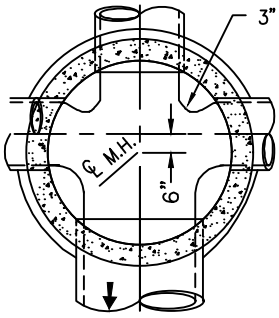
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.07
	MANHOLE BASE	DATE: 12/2020



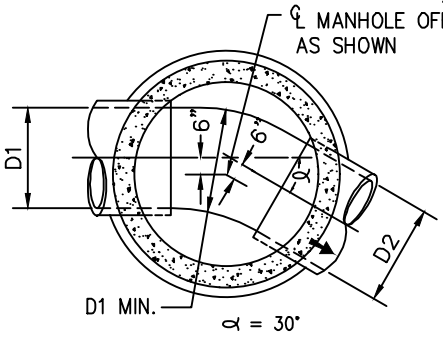
THROUGH MANHOLE



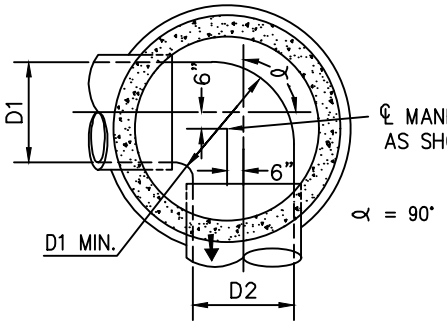
THROUGH MANHOLE
ONE COLLECTION LINE



THROUGH MANHOLE
TWO COLLECTION LINES

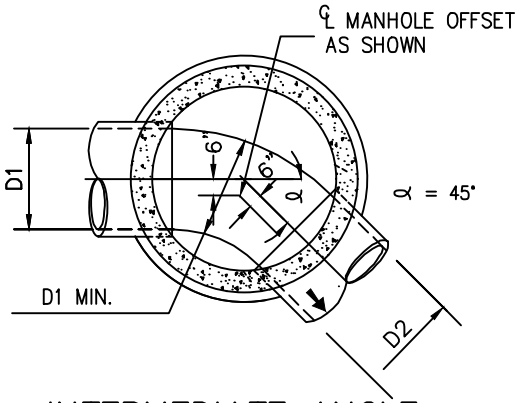


INTERMEDIATE ANGLE

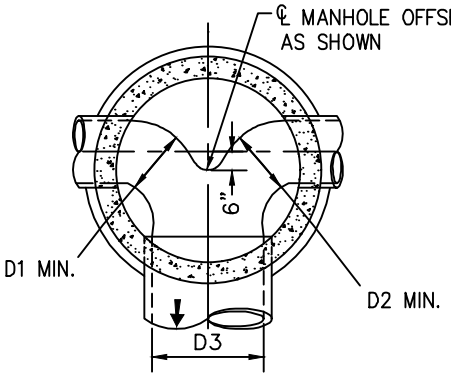


SHARP ANGLE

CURVED DEFLECTOR "POINTS" SHALL EXTEND COMPLETELY ACROSS THE OPPOSED LATERALS AS SHOWN.



INTERMEDIATE ANGLE



OPPOSED LATERALS

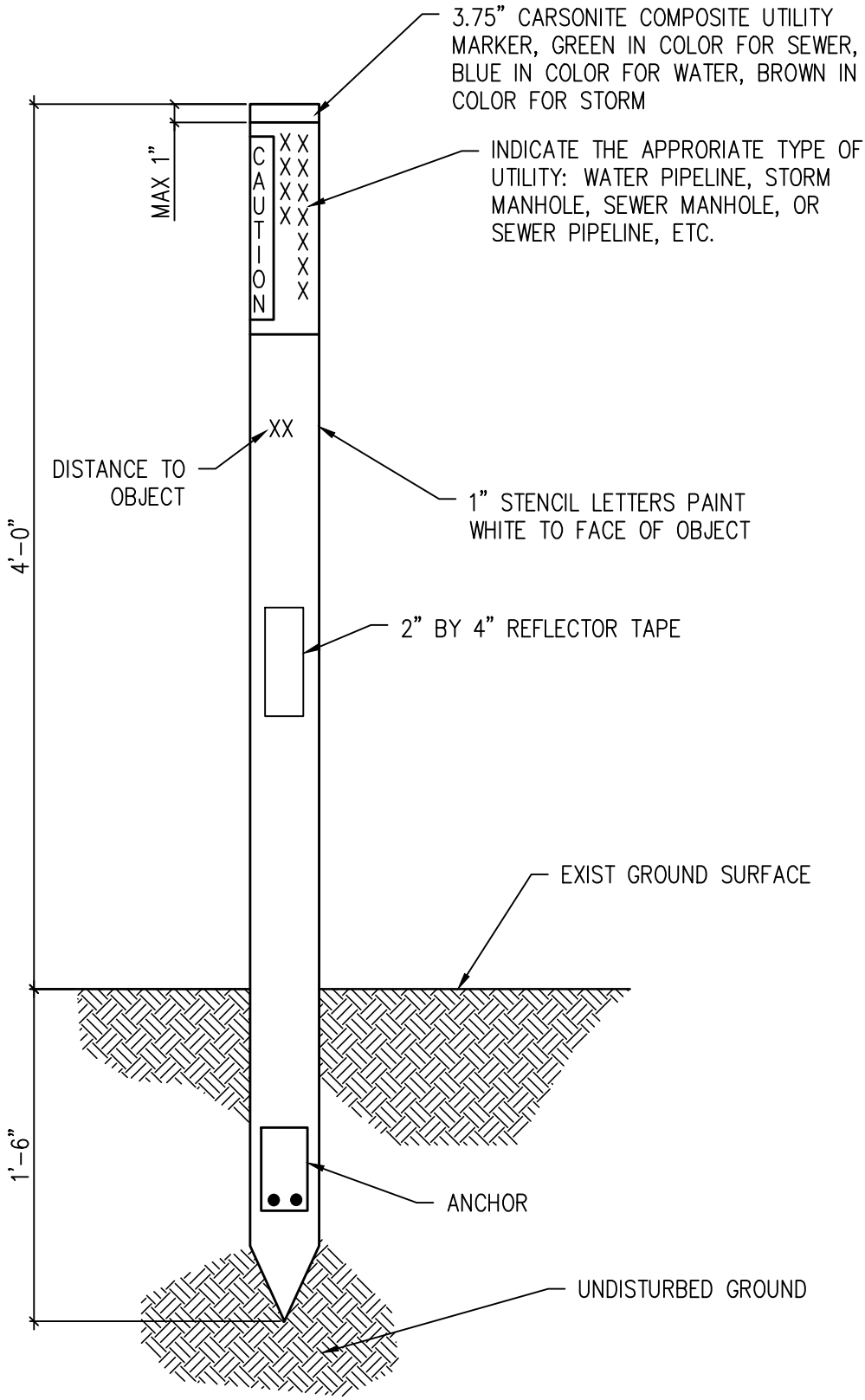
CURVED DEFLECTOR "POINTS" SHALL EXTEND ACROSS THE CENTERLINE OF THE OPPOSING PIPES AS SHOWN.

NOTES:

1. PIPE INVERT ELEVATION AND DROP THROUGH MANHOLES SHALL BE IN CONFORMANCE WITH THE REVIEW AND SIGNED CONSTRUCTION PLANS. THE INTENTION IS TO PROMOTE SMOOTH, NON-TURBULANT FLOW THROUGH THE MANHOLES BY KEEPING THE LARGER LINES LOWER IN THE MANHOLE AND BRINGING THE SMALLER LINES IN SLIGHTLY HIGHER.
2. MAX INSIDE DROP THROUGH ANY MANHOLE SHALL BE 18 INCHES
3. MIN DROP THROUGH ANY MANHOLE SHALL BE 0.2 FEET FOR STRAIGHT RUNS AND 0.2 FEET FOR CHANGES IN DIRECTION
4. ALL INVERT DEFLECTORS SHALL BE CURVED IN SHAPE TO PROVIDE SMOOTH FLOW TRANSITIONS AS SHOWN IN THIS DETAIL
5. MINIMUM ANGLE BETWEEN THE CENTERLINE OF ANY INCOMING PIPE AND THE CENTER OF THE OUTGOING PIPE SHALL BE 90 DEGREES
6. GROUT TO SHAPE SMOOTH TRANSITION BETWEEN INVERTS. SLOPE AT 1/2" PER FOOT.

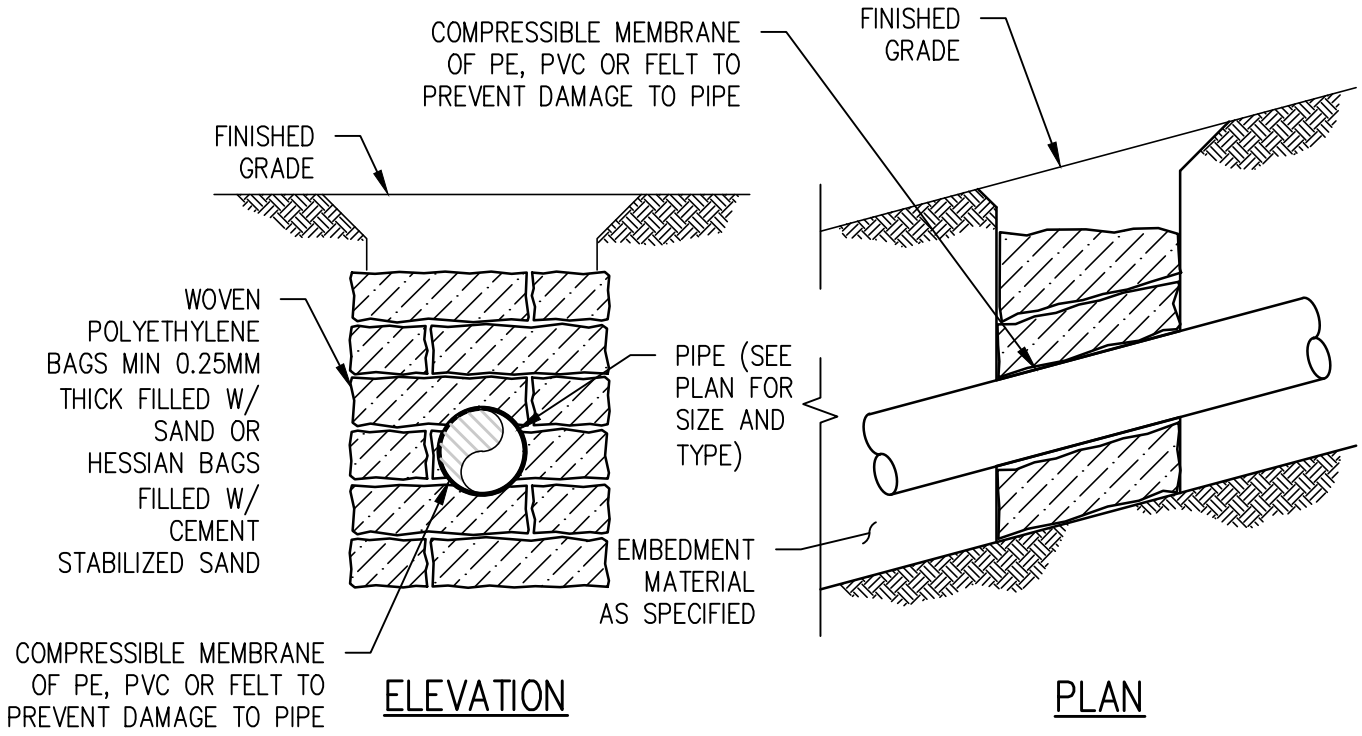
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.08
	MANHOLE BASE AND DEFLECTOR	DATE: 12/2020



SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.09
	UTILITY MARKER POST	DATE: 12/2020



REQUIREMENT TRENCHSTOPS		
GRADE (%)	REQUIREMENT	SPACING(S) IN FEET
5–14	TRENCHSTOP	S=500/GRADE%

NOTES:

1. FLOWFILL MAY BE USED WITH APPROVAL OF TOWN ENGINEER

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA GENERAL DETAILS	D0.10
	TRENCH STOP	DATE: 12/2020

TOWN OF BERTHOUD APPROVAL

ALL WORK SHALL BE CONSTRUCTED TO THE TOWN STANDARDS AND SPECIFICATIONS. THESE PLANS HAVE BEEN REVIEWED BY THE TOWN OF BERTHOUD FOR CONCEPT ONLY AND GENERAL CONFORMANCE WITH THE TOWN'S STANDARDS AND SPECIFICATIONS. THE REVIEW BY THE TOWN OF BERTHOUD DOES NOT IMPLY RESPONSIBILITY BY THE TOWN OF BERTHOUD OR THE TOWN ENGINEER FOR ACCURACY AND CORRECTNESS OF THE PLANS OR CALCULATIONS.

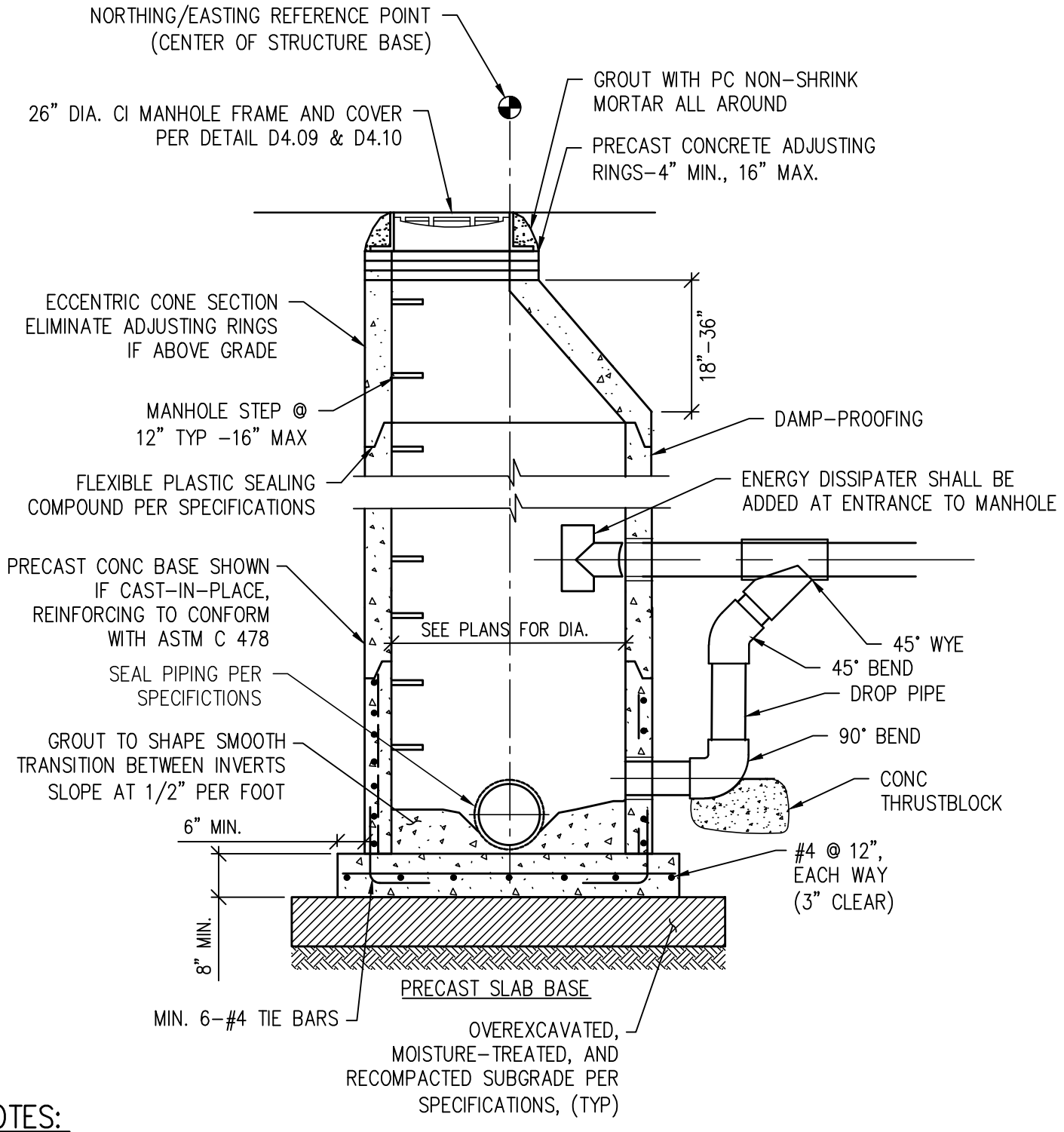
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF THE TOWN ENGINEER'S APPROVAL.

APPROVED BY:

_____

TOWN ENGINEER DATE

SCALE: NTS

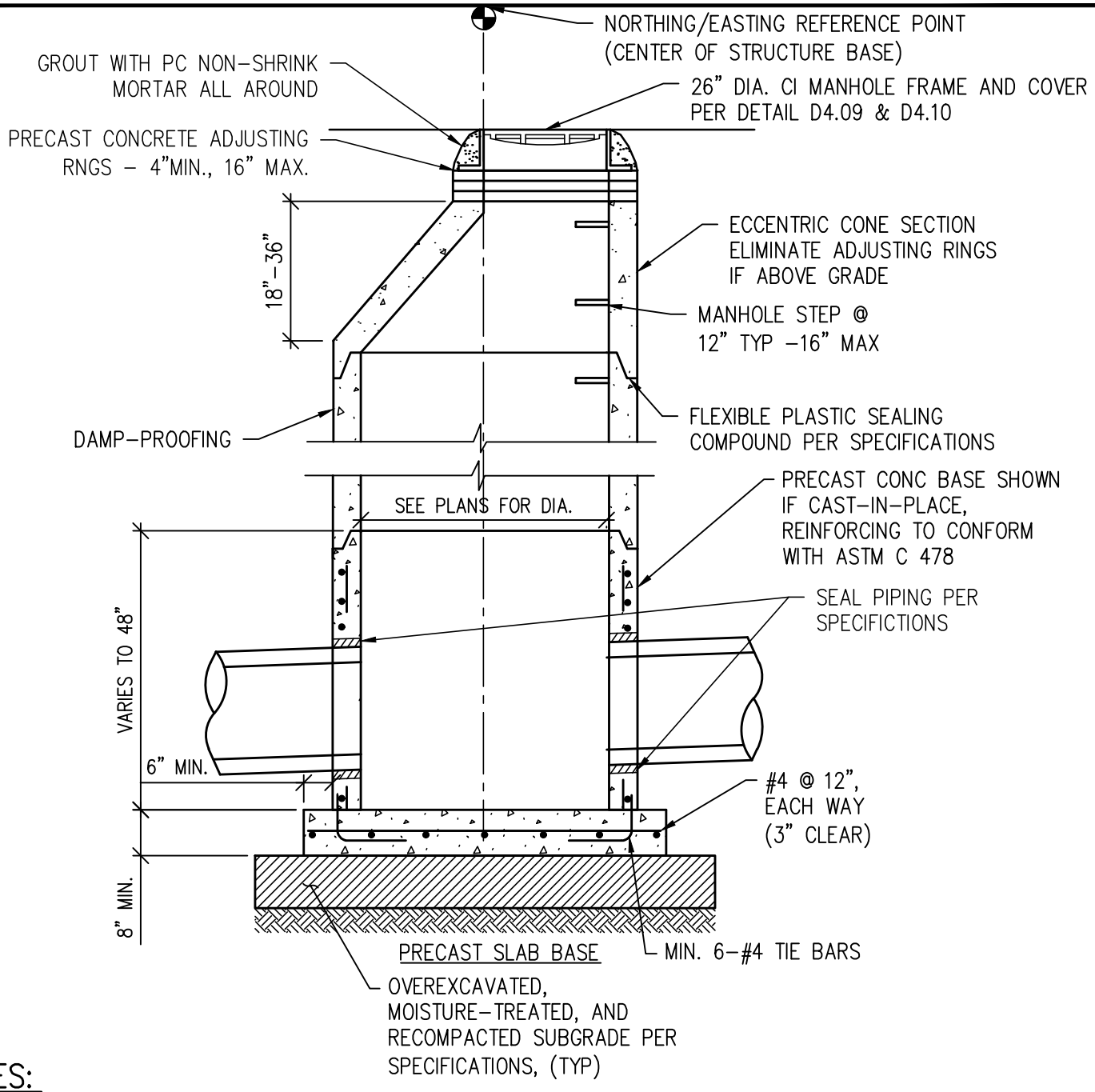


NOTES:

1. SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING OR SHAPING BASE CONCRETE.
2. BLOCK-OUTS WHEN APPROVED SHALL EXTEND A MAX OF 6" PAST MANHOLE OD AND BE SATISFACTORILY PLUGGED AND SEALED.
3. CONCRETE MANHOLES BASES MAY BE POURED IN PLACE ONLY WITH PRIOR APPROVAL.
4. ALL MORTAR SHALL BE MIXED WITH A TYPE II CEMENT.
5. BENCH MUST HAVE A BRUSHED, NON-SKID SURFACE.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.01
	SANITARY DROP MANHOLE	DATE: 12/2020

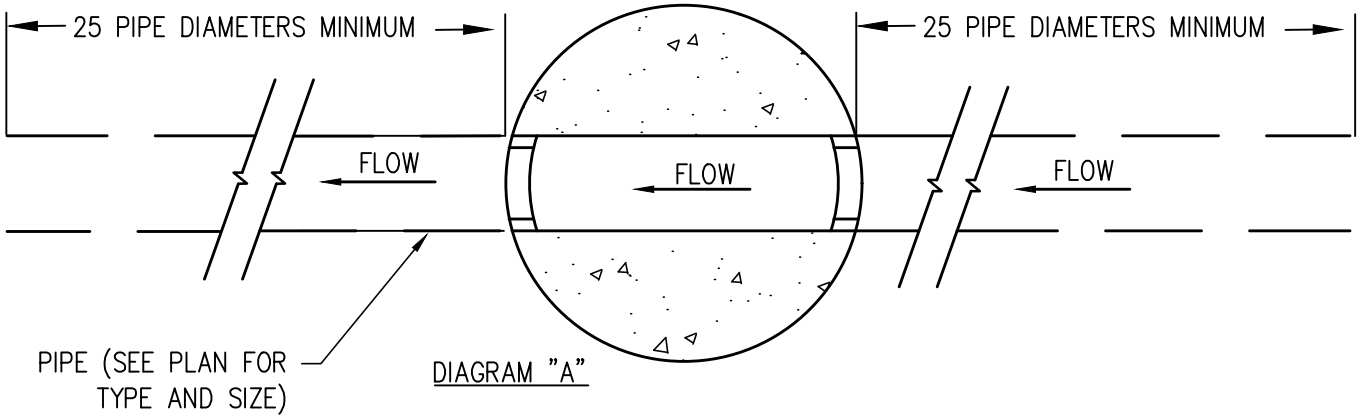


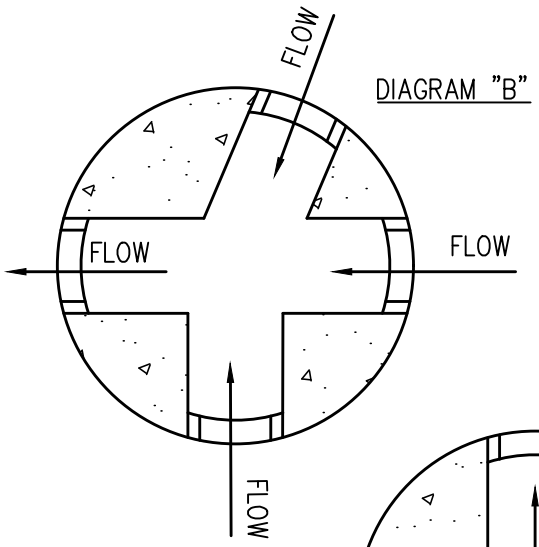
NOTES:

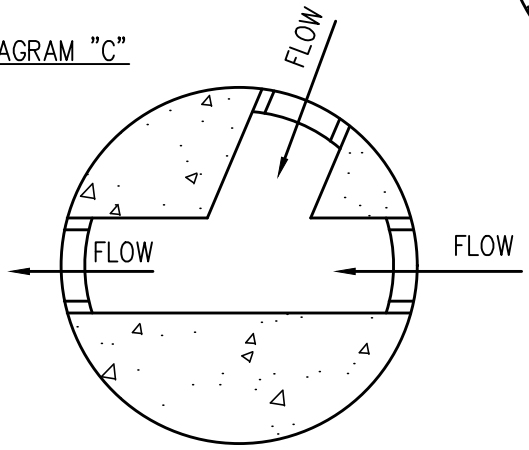
1. MANHOLES SHALL BE SEALED WATERTIGHT. NO GROUT ALLOWED. MANHOLE EXTERIORS SHALL BE DAMP-PROOFED.
2. DROP THROUGH MANHOLE TO BE EQUAL TO SLOPE OF SURROUNDING PIPE. FOR FLUME INSTALLATIONS, FLUME MUST BE SET LEVEL.
3. MONITORING MANHOLE TO BE LOCATED OUTSIDE OF PUBLIC RIGHT-OF-WAY, ON DISCHARGER'S PROPERTY. THE MANHOLE MUST BE SAFELY AND INDEPENDENTLY ACCESSIBLE FOR TOWN USE AT ALL TIMES.
4. FOR MANHOLE DEPTHS LESS THAN FOUR FEET FROM RIM TO TOP OF BENCH, VERTICAL MANHOLE BARRELS OR MINIMUM 30-INCH BY 30-INCH PRECAST BOX WITH PRECAST FLAT TOP SECTONS ARE REQUIRED.
5. DESIGN AND LOCATION OF MONITORING MANHOLE SUBJECT TO DISTRICT APPROVAL.
6. THERE SHALL NOT BE ANY BENDS, DROP MANHOLES FLOW JUNCTIONS, CHANGES IN PIPE DIAMETER, ETC., WITHIN 25 PIPE DIAMETERS UPSTREAM OR DOWNSTREAM OF THE MANHOLE.

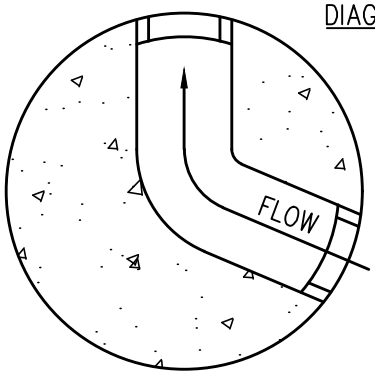
SCALE: NTS

TOWN OF BERTHOUD	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.02
	MONITORING SANITARY MANHOLE	DATE: 12/2020







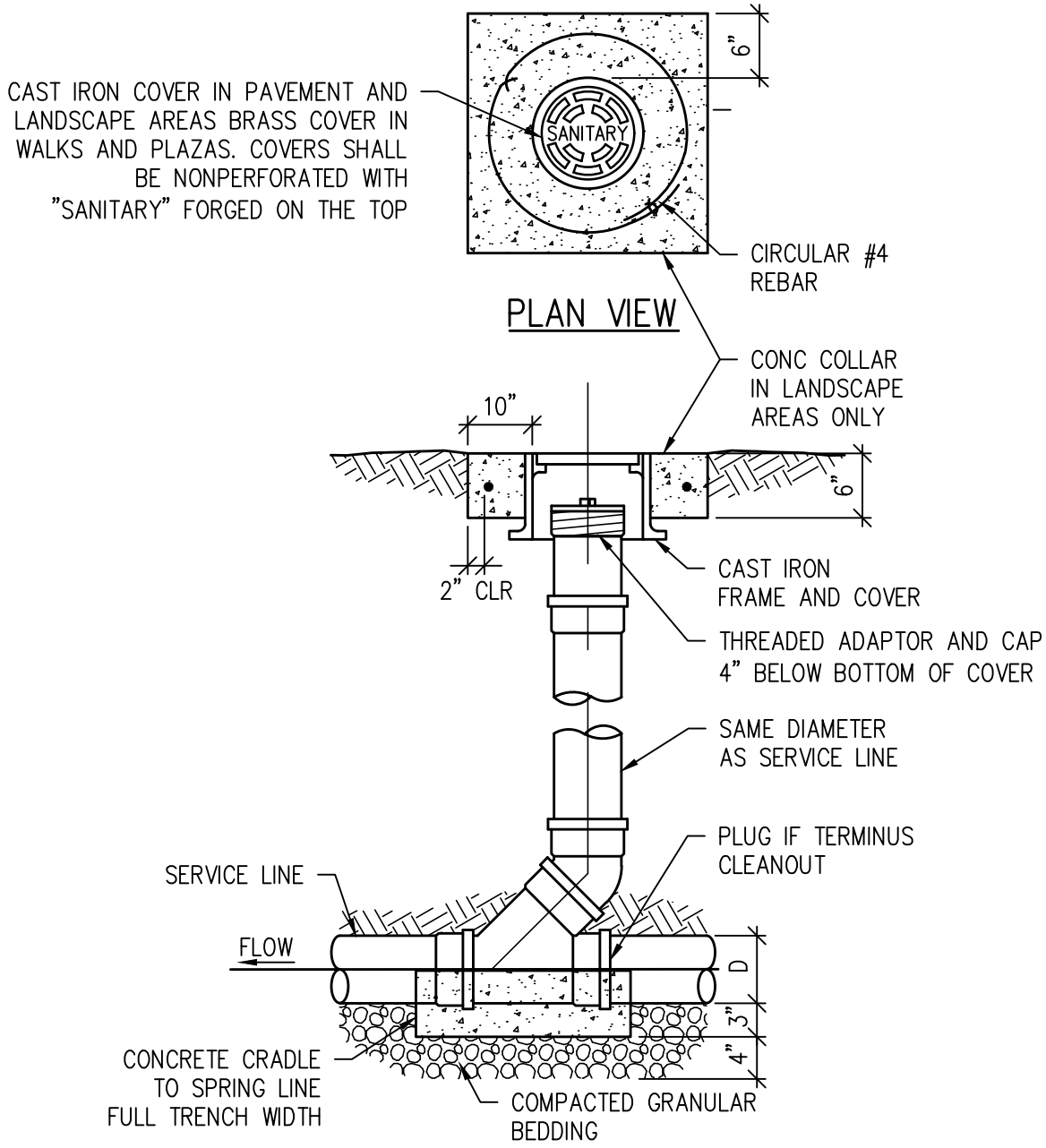


NOTES:

1. DIAGRAM "A" IS COMPATIBLE FOR THE INSTALLATION OF A FLOWMETER OR FLUME IN THE INVERT.
2. DIAGRAMS "B", "C", "D" ARE NOT SUITABLE FOR THE INSTALLATION OF A FLOW MEASURING DEVICE DUE TO THE LOCATION OF THE SIDE SEWERS OR A BEND IN THE INVERT CHANNEL.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.03
	MONITORING SANITARY MANHOLE DIAGRAMS	DATE: 12/2020

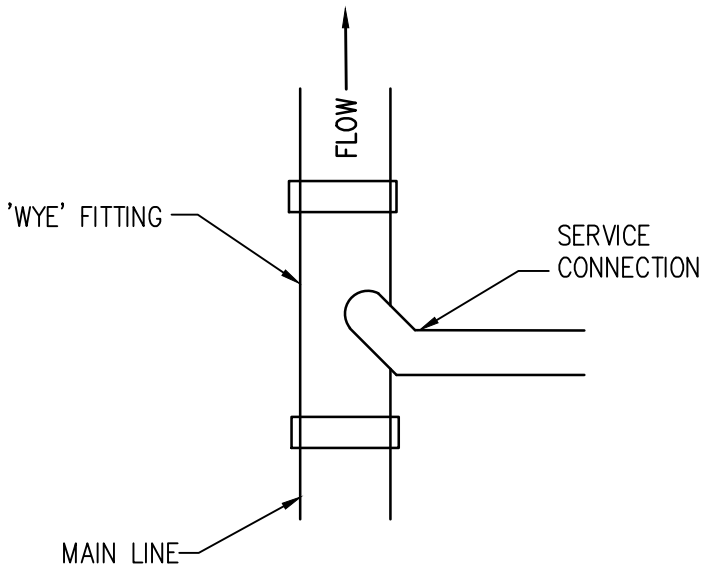


NOTES:

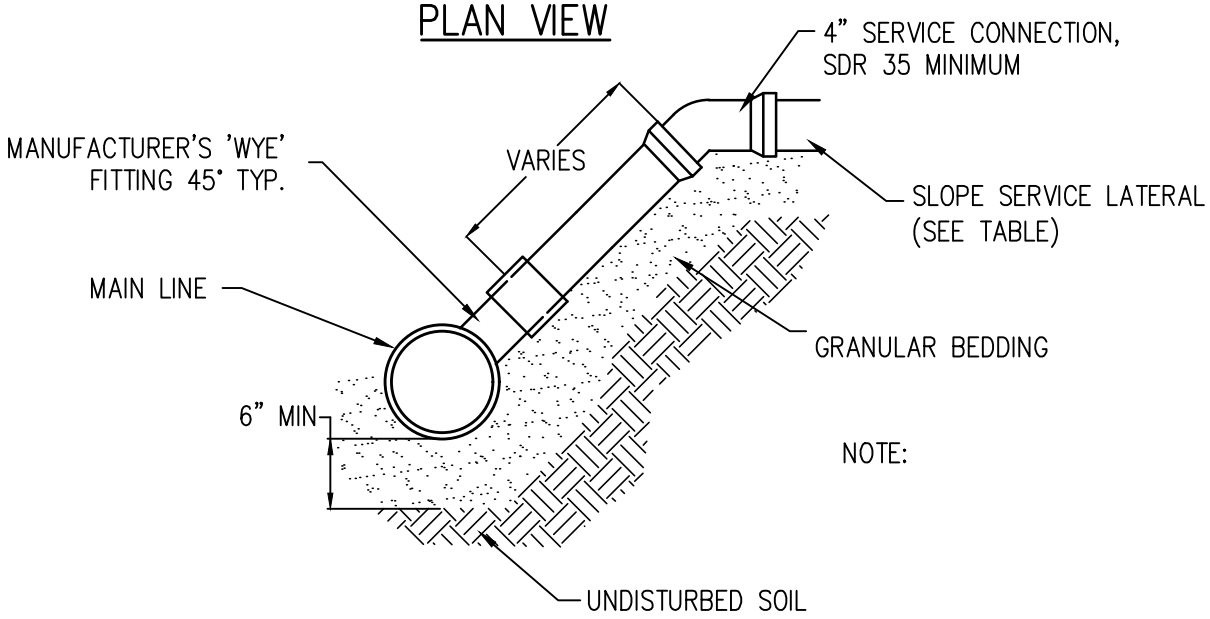
1. CLEANOUT SHALL BE CONSTRUCTED SO THAT SURFACE LOAD WILL NOT BE TRANSFERRED TO MAIN.
2. SERVICE LINE CLEANOUT MAY BE INSTALLED APPROXIMATELY 5 FEET OUTSIDE THE BUILDING FOUNDATION.
3. A CLEANOUT IS REQUIRED ON ALL SERVICE LINES EVERY 100 FEET, AT EVERY "Y" OR AFTER A COMBINED TOTAL 135 DEGREES OF BEND.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.04
	SANITARY CLEANOUT	DATE: 12/2020



PLAN VIEW



PIPE SIZE (INCHES)	MINIMUM SLOPE (INCH PER FOOT)
2 1/2 OR LESS	1/4
3 TO 6	1/8
8 OR LARGER	1/16

NOTES:

1. SANITARY SEWER SERVICE TAPS SHALL BE LOCATED ON THE MAIN AT 2'OCLOCK OR 10 O'CLOCK POSITION
2. THE MINIMUM DISTANCE BETWEEN ANY TWO CONSECUTIVE FITTINGS SHALL BE 3 FEET, MEASURED BETWEEN FITTING CENTERLINES
3. SANITARY SEWER SERVICE TAPS SHALL NOT BE MADE WITHIN 3 FEET OF A PIPE JOINT, OR 5 FEET FROM EDGE OF MANHOLE BASE.
4. A MAXIMUM OF FOUR SERVICE TAPS ARE ALLOWED PER 20–FOOT LENGTH OF PIPE
5. USE SDR 35 'WYE'. 'TEE'S NOT ALLOWED.

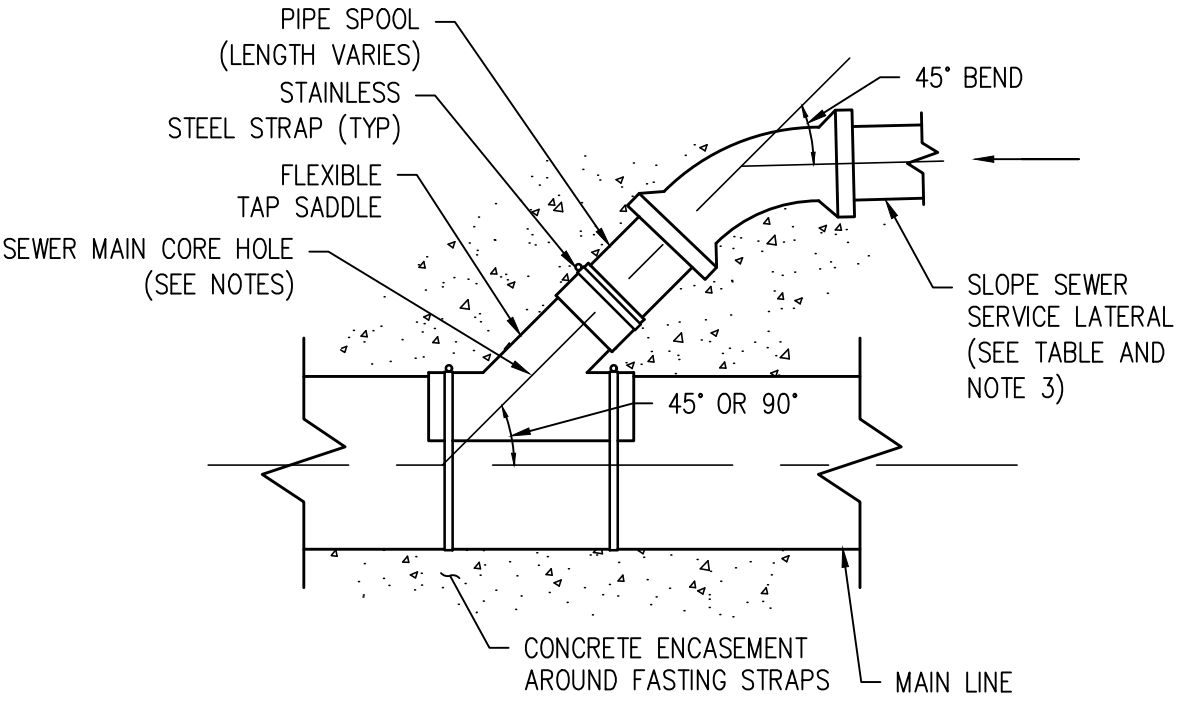
SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
SANITARY SEWER DETAILS

D4.05

TYPICAL SERVICE CONNECTION

DATE: 12/2020



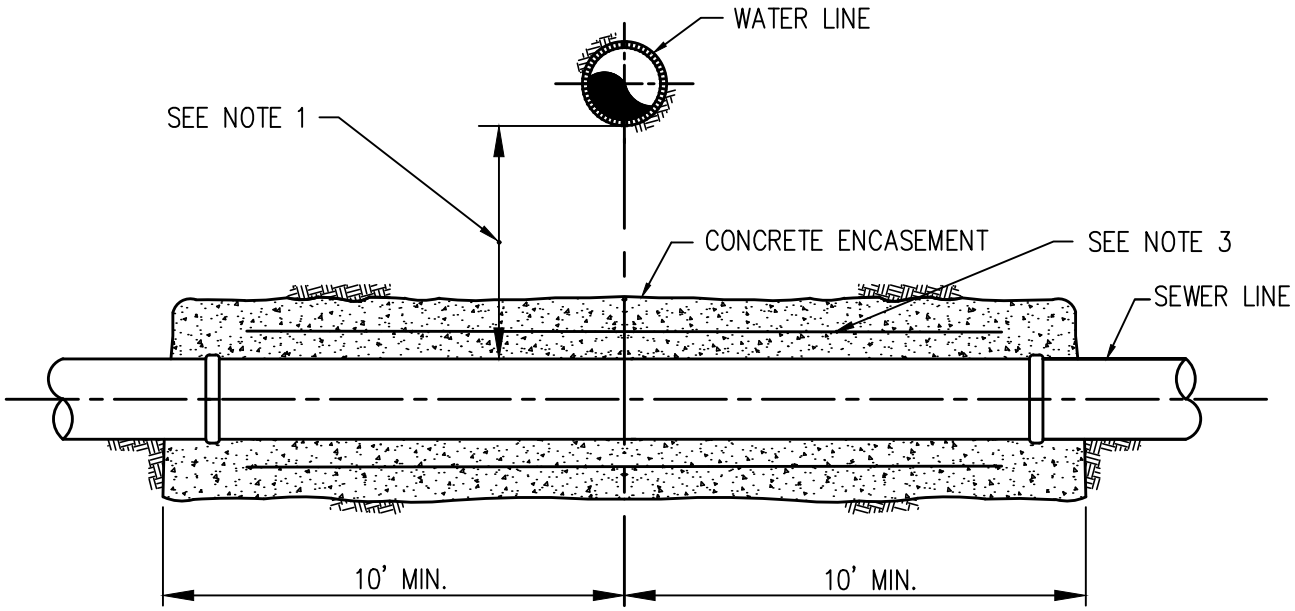
PIPE SIZE (INCHES)	MINIMUM SLOP (INCH PER FOOT)
2 1/2 OR LESS	1/4
3 TO 6	1/8
8 OR LARGER	1/16

NOTES:

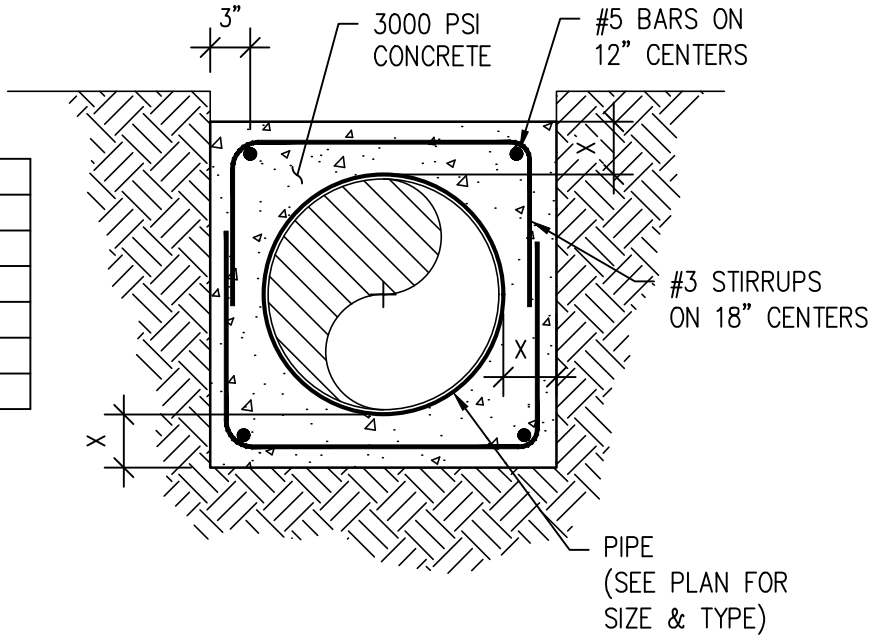
1. INSTALL TAPPING SADDLE PER MANUFACTURES RECOMMENDATIONS.
2. MAKE SURE CORED PIPE WASTE IS RETRIEVED.
3. AN INSERT A TEE MAY BE AN ACCEPTABLE SUBSTITUTION AS APPROVED BY THE TOWN ENGINEER.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.06
	TAPPING SADDLE	DATE: 12/2020



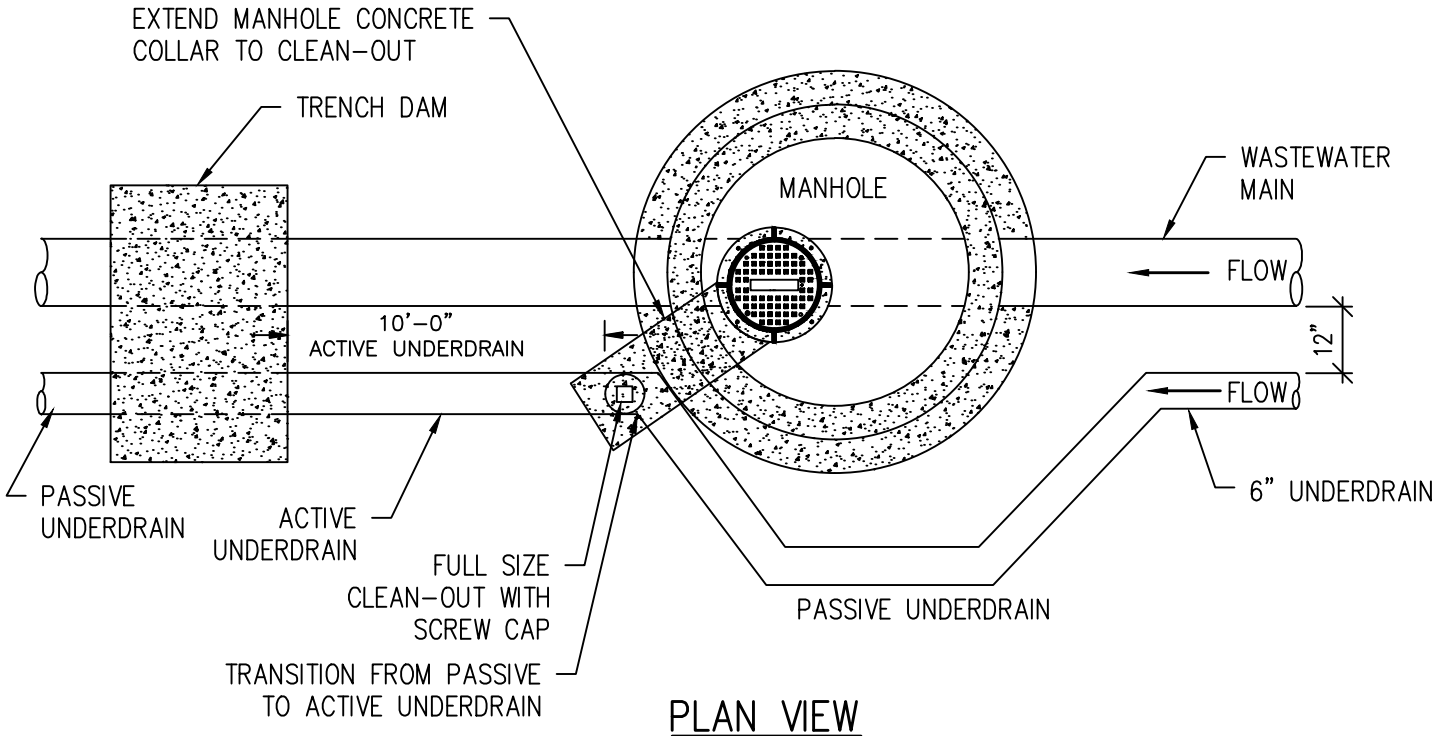
PIPE SIZE	X
6"	4"
8"	4"
12"	4"
18"	5"
24"	6"
36"	6"



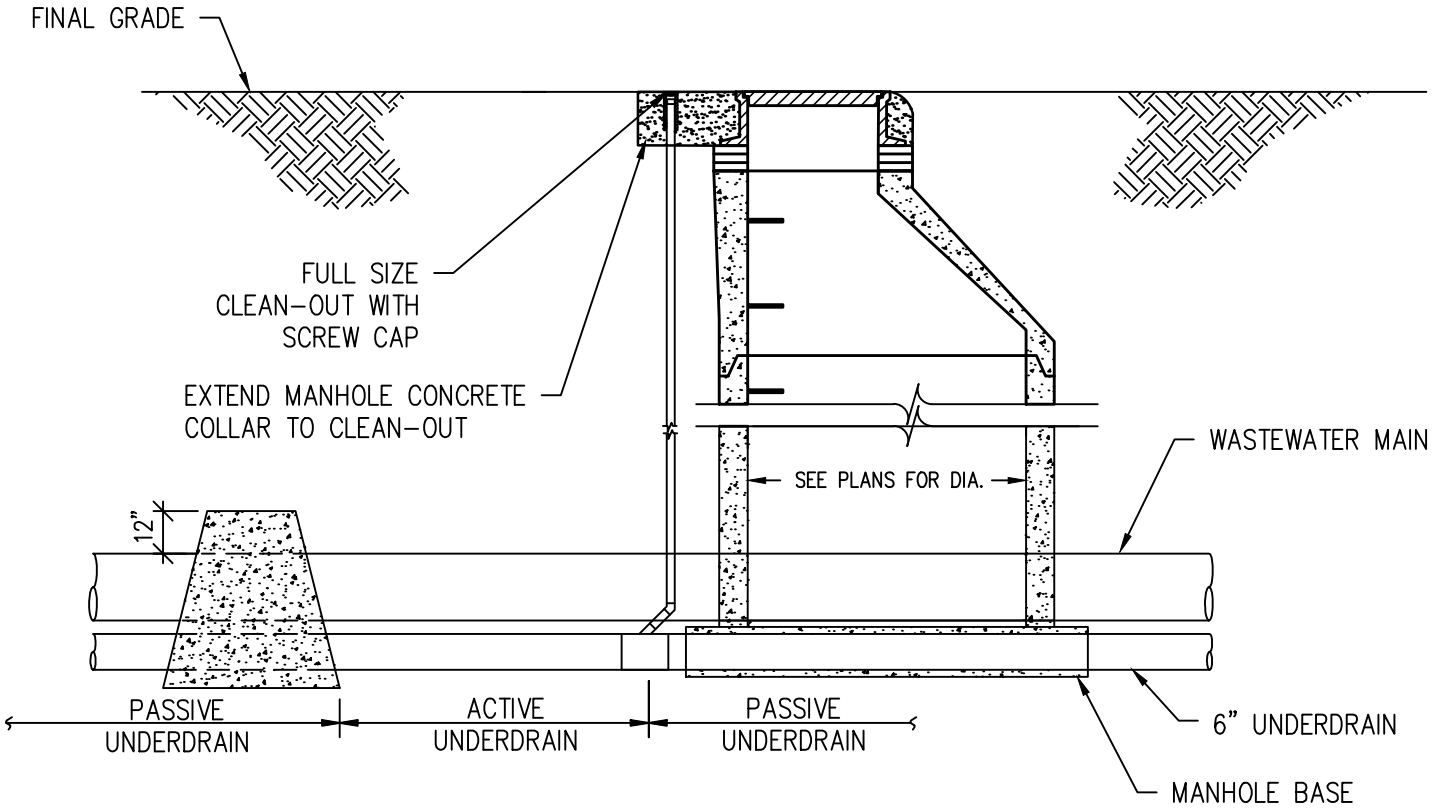
NOTES:

1. CONCRETE ENCASEMENT WILL BE REQUIRED WHEN CLEAR VERTICAL DISTANCE IS LESS THAN 1'6" OR HORIZONTAL DISTANCE IS LESS THAN 10' BETWEEN PARALLEL LINES
2. CONCRETE ENCASEMENT REQUIRED IN ALL CASES WHERE SEWER LINE IS ABOVE WATER LINE.
3. MINIMUM WIDTH AND DEPTH ARE 12" + PIPE O.D.
4. PROVIDE FLOWABLE FILL MATERIAL, NO REINFORCEMENT, AT ROAD AND DITCH CROSSINGS, 10' BEYOND EACH SIDE

SCALE: NTS



PLAN VIEW

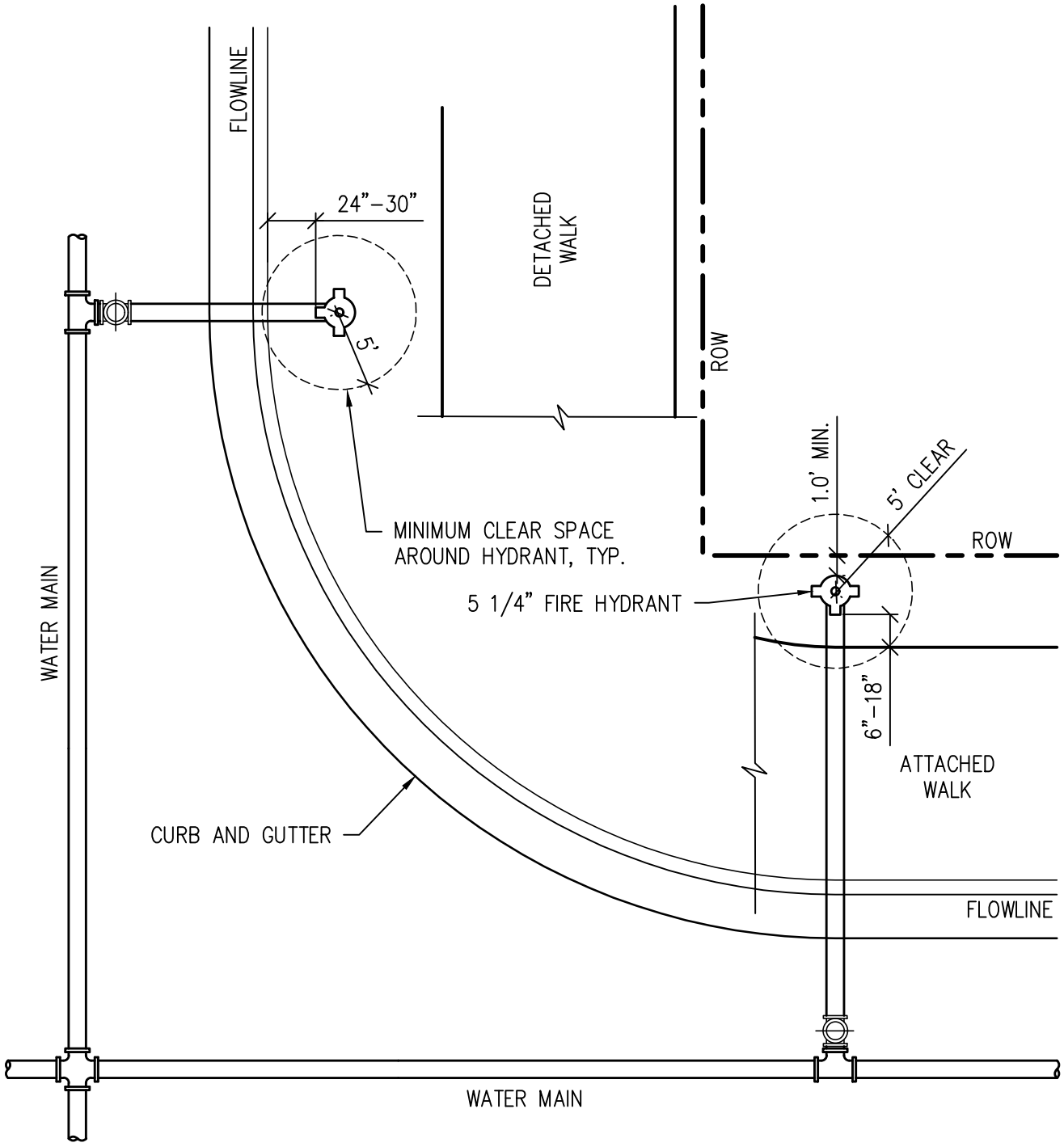


NOTES:

1. USE OF AN UNDERDRAIN SYSTEM IS ONLY ALLOWED WITH TOWN APPROVAL

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA SANITARY SEWER DETAILS	D4.08
	CONCRETE COLLAR UNDERDRAIN	DATE: 12/2020

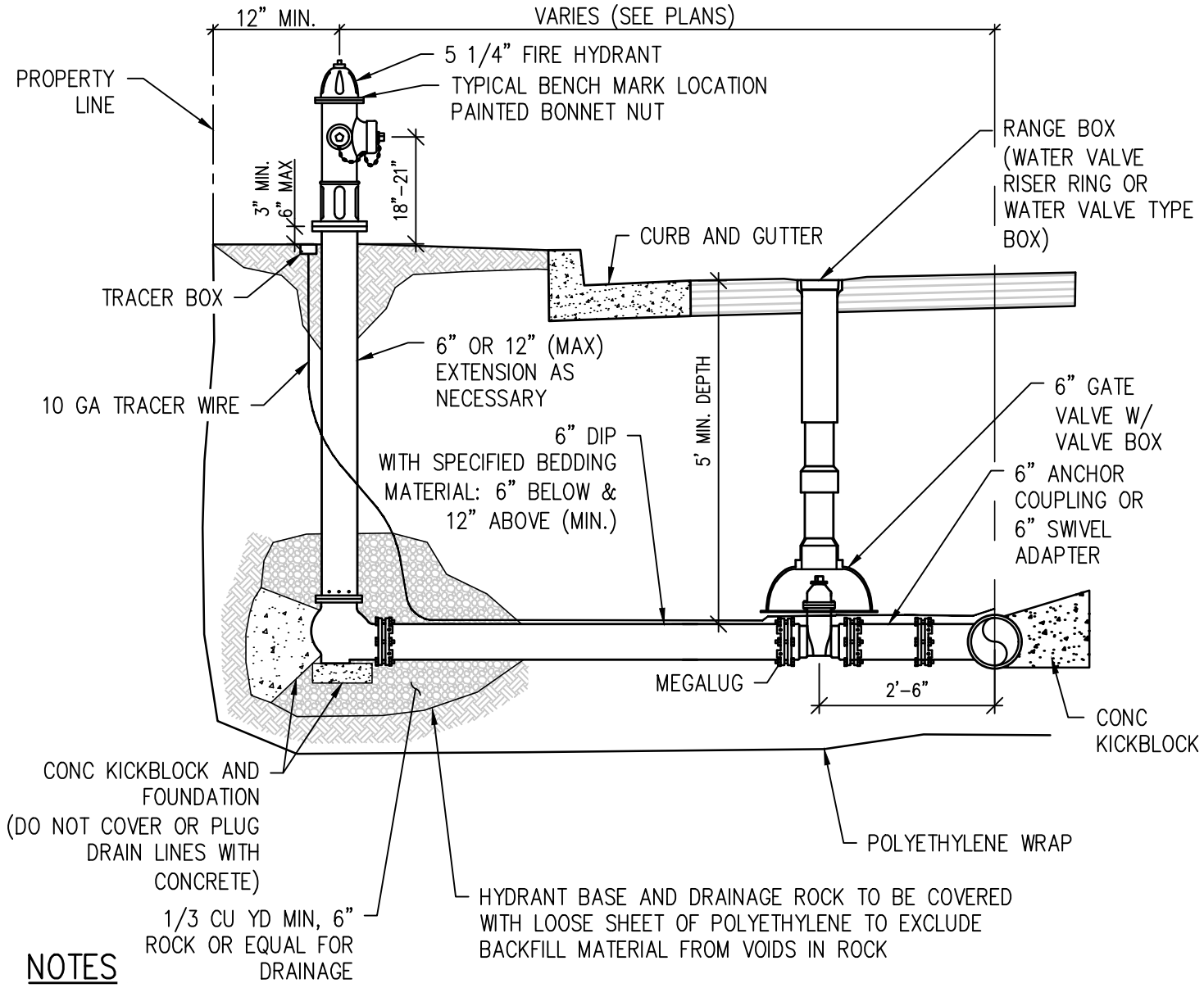


NOTES:

1. HYDRANT TO BE SET AT CURB RETURN
2. VALVES SHALL NOT BE LOCATED UNDER CURB AND GUTTER, OR CONCRETE PAN
3. A 5.0' CLEAR DISTANCE MUST BE MAINTAINED AROUND HYDRANT
4. ALL MEASUREMENTS ARE TO THE OUTSIDE OF THE PIPE

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.01
	FIRELINE CONNECTION WITH MAIN EXTENSION	DATE: 12/2020

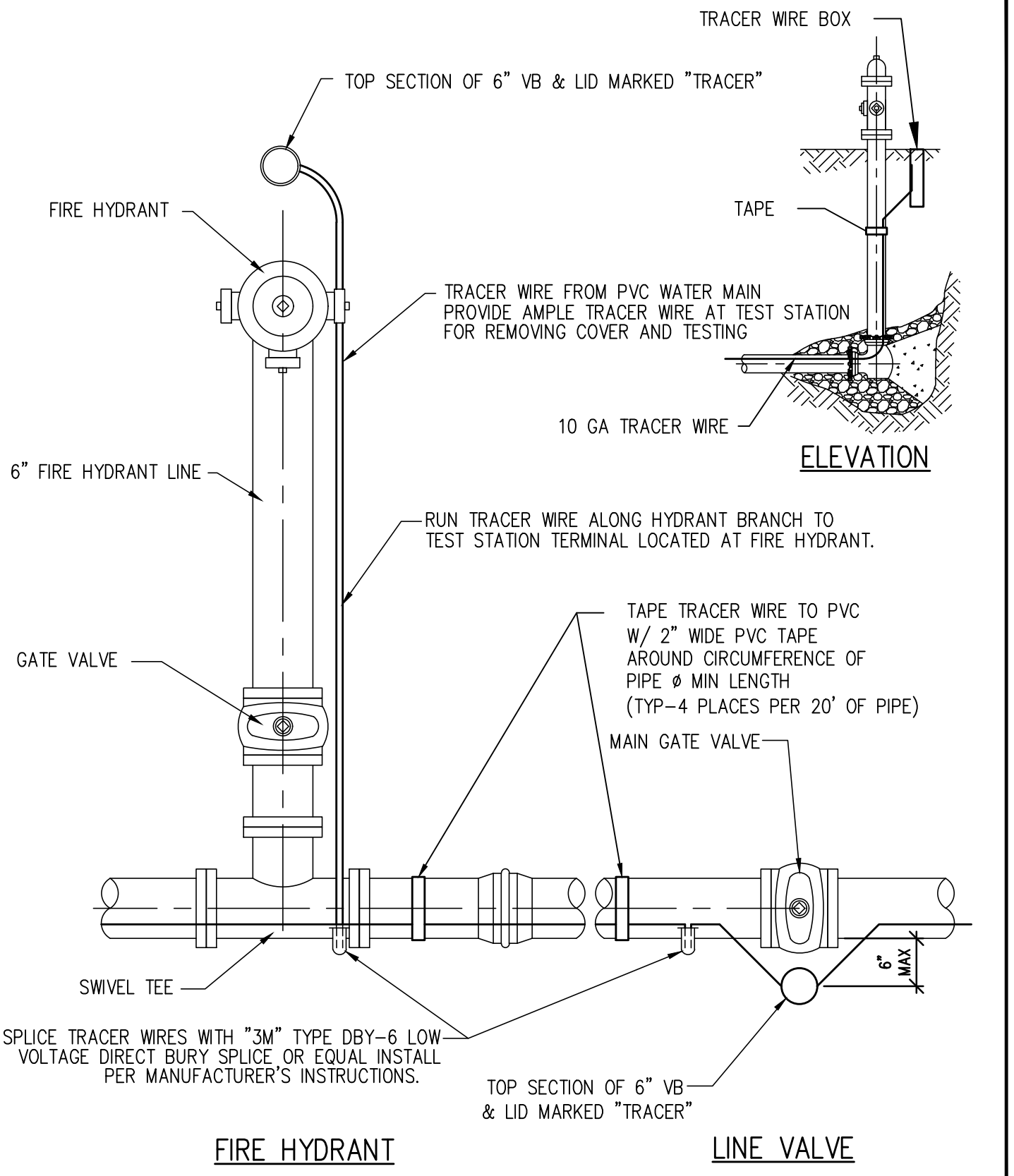


NOTES

1. SHOE AND BARREL SHALL BE CONNECTED WITH HIGH STRENGTH STAINLESS BOLTS AND NUTS
2. HYDRANT SHALL HAVE A FIVE (5') FOOT CLEAR ZONE ON EACH SIDE OF HYDRANT (TEN (10') FOOT EASEMENT AROUND).
3. PUMPER NOZZLE SHALL FACE THE PUBLIC RIGHT-OF-WAY OR REQUIRED FIRE ACCESS ROADWAY.
4. MINIMUM DISTANCE FROM DRIVEWAYS SHALL BE SIX (6) FEET.
5. HYDRANTS SHALL CONFORM TO AND BE TESTED IN ACCORDANCE WITH AWWA SPECIFICATIONS.
6. HYDRANTS SHALL BE MADE OF CAST IRON WITH FULL BRONZE MOUNTINGS.
7. INLET SHALL FIT SIX (6) INCH PIPE WITH BARREL LENGTH SUFFICIENT FOR A FIVE (5) FOOT TRENCH.
8. ONLY TWO (2) HEIGHT EXTENSIONS MAY BE USED PER HYDRANT.
9. HYDRANT BASES SHOULD NOT BE ANY DEEPER THAN SIX (6) FEET FROM THE TOP OF FINISHED GRADE.
10. MAIN VALVE OPENING IN THE HYDRANT SHALL BE NO LESS THAN FIVE (5) INCHES IN DIAMETER.
11. HYDRANTS SHALL BE PLUMBED VERTICALLY WITH PUMPER NOZZLE FACING STREET.
12. NO WATER SERVICE MAIN TAPS SHALL BE MADE TO A DISTRIBUTION MAIN WITHIN FIVE (5) FEET OF A FIRE HYDRANT BRANCH MAIN.
13. NO HORIZONTAL BENDS OR OFFSETS SHALL BE USED IN INSTALLING FIRE HYDRANT BRANCH MAINS.

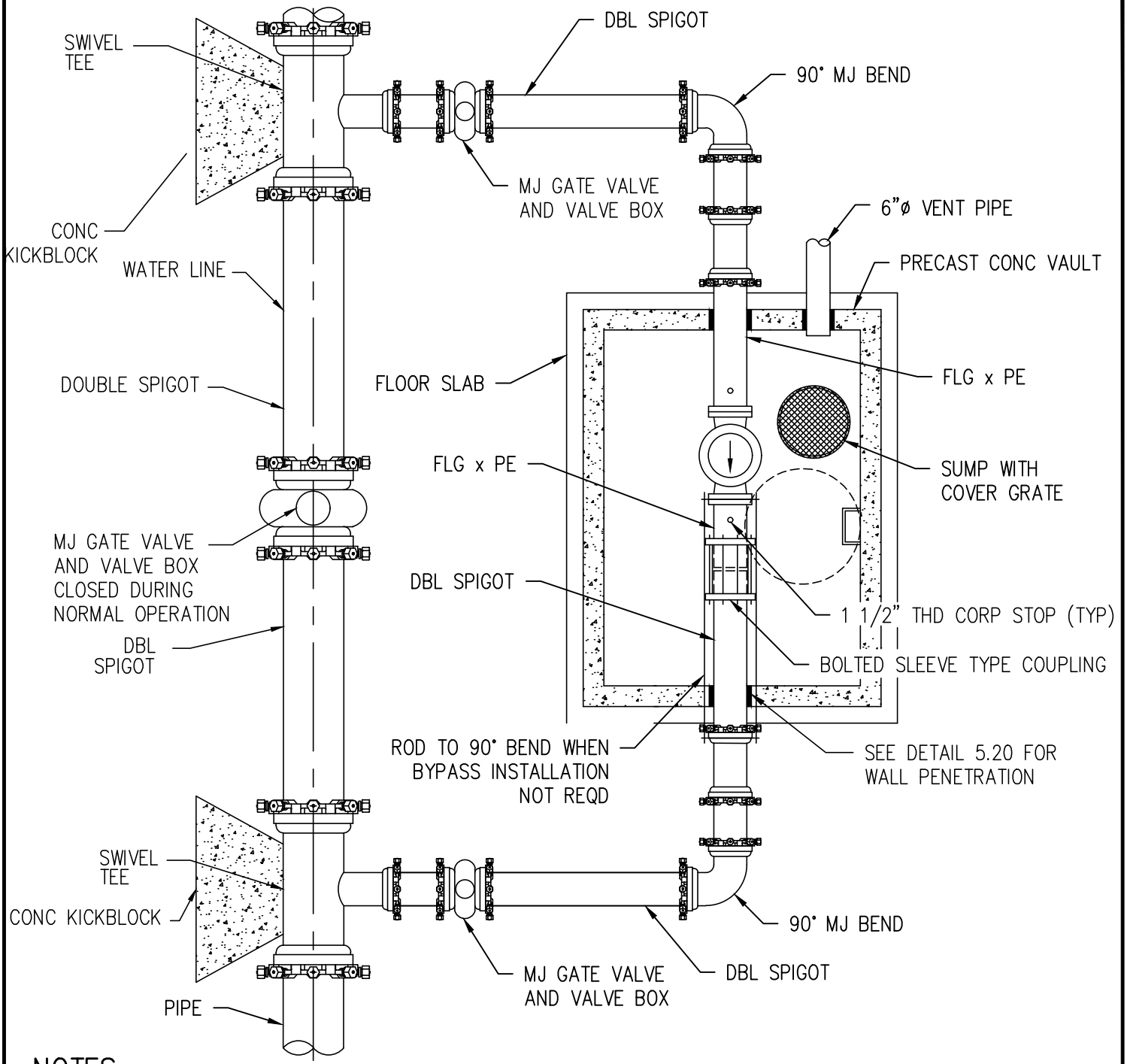
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.02
	FIRE HYDRANT PROFILE	DATE: 12/2020



SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.03
	FIRELINE TRACER WIRE	DATE: 12/2020

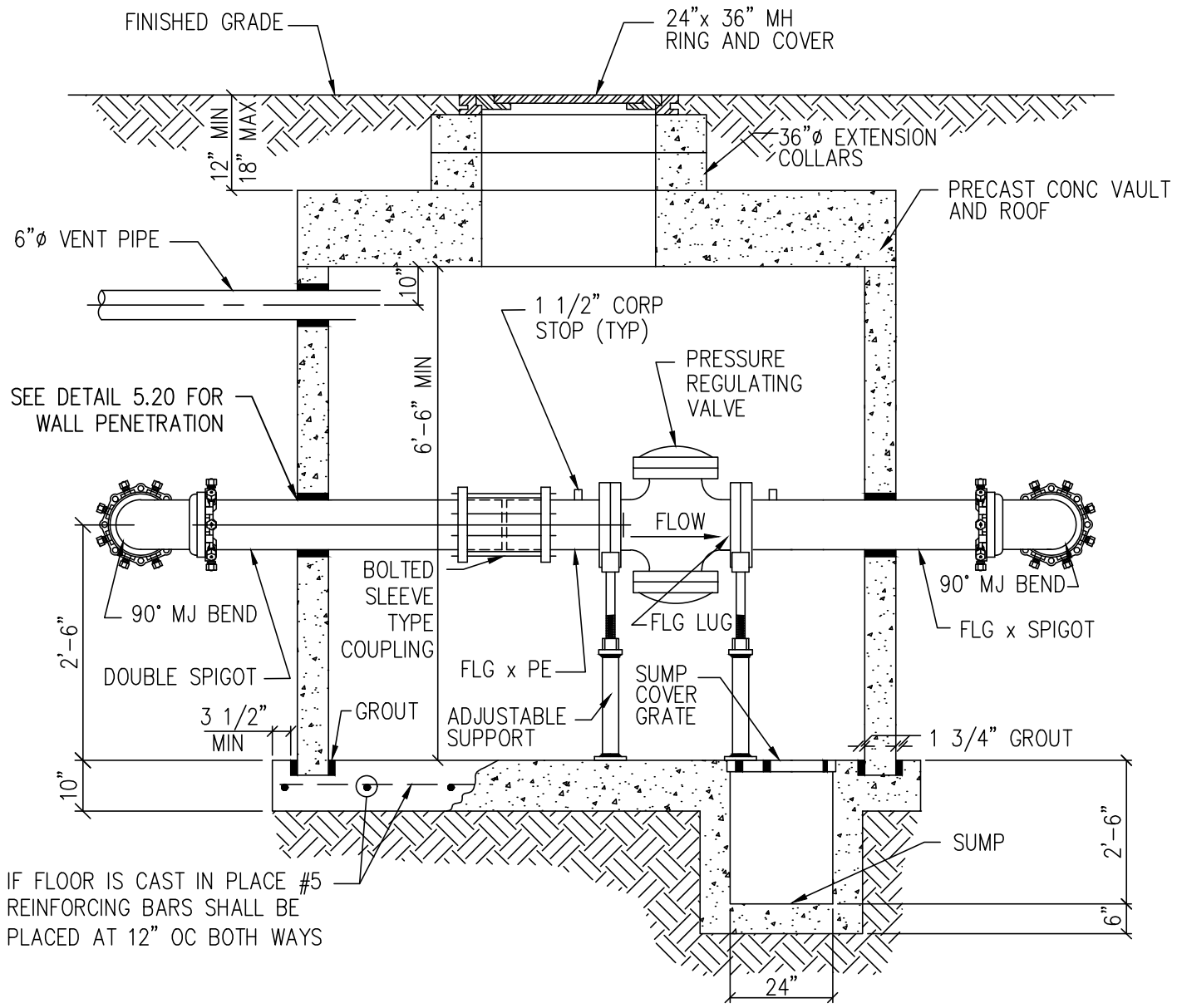


NOTES:

1. A RECTANGULAR VAULT IS REQD WHERE TELEMETRY OR ELECTRICAL EQUIPMENT IS ANTICIPATED INSIDE THE VAULT
2. ACCESS STAIRS WITH DOOR OUTSIDE OF PAVEMENT MAY BE REQD ON STREETS WITH HEAVY TRAFFIC
3. FOR CROSS SECTION VIEW SEE DETAIL D5.05
4. DO NOT PLACE SUMP DIRECTLY UNDER MH
5. PIPING FOR PRV AND CHECK VALVE INSTALLATIONS SHALL BE DI
6. PRV SHALL BE CLA-VAL MODEL 90-01, EPOXY COATED. TRIM (I.E. DISC GUID, SEAT, & COVER BEARING) SHALL BE STAINLESS STEEL TYPE 303. INCLUDE OPTIONAL FEATURES B, C, D, S, AND Y FOR REQUIRED CLA-VAL PRV.

SCALE: NTS

TOWN OF BERTHOUD	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.04
	PRV RECTANGULAR VAULT PLAN VIEW	DATE: 12/2020

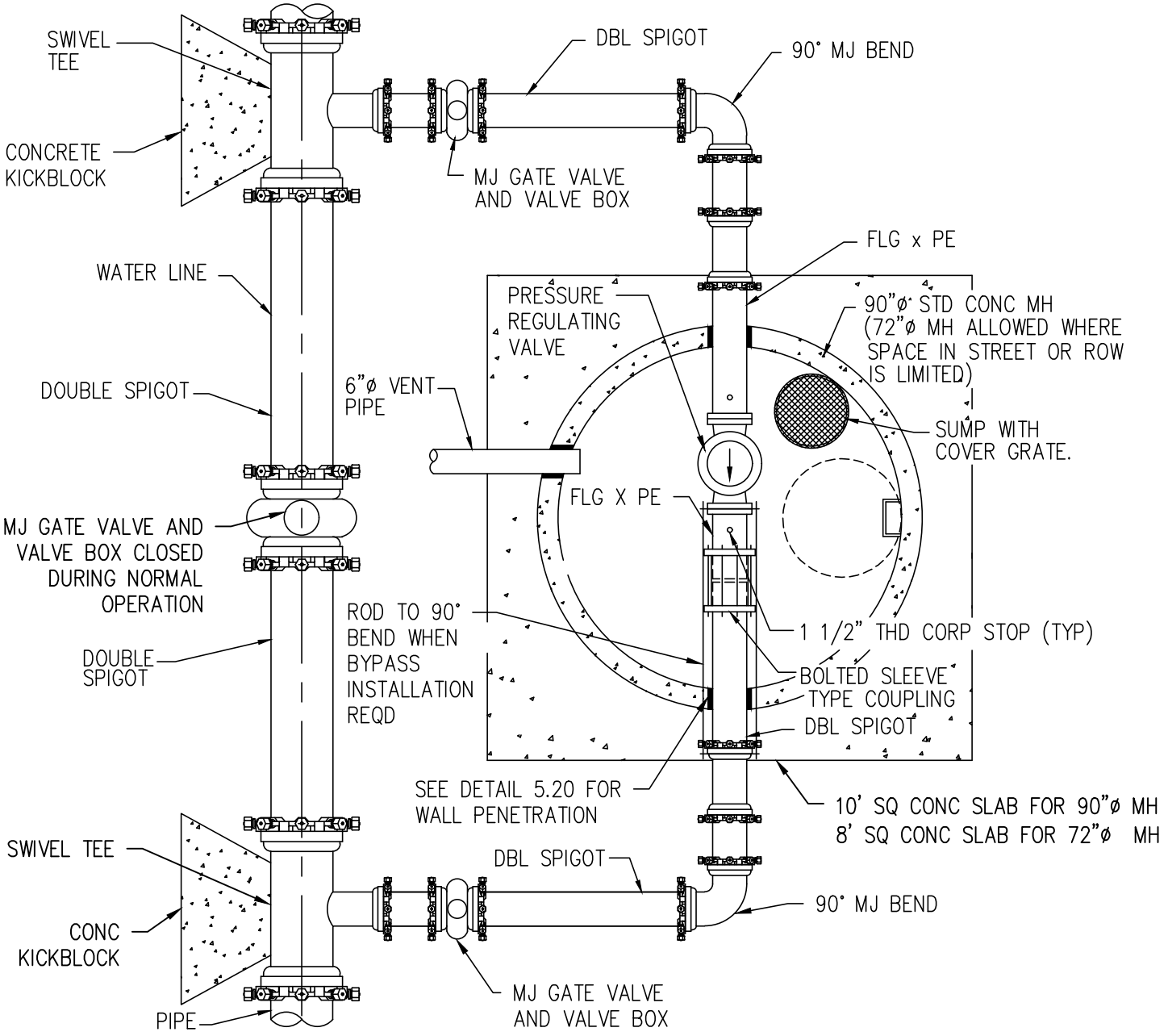


NOTES:

1. APPROVED PRECAST CONC VAULTS
2. SEE DETAIL D5.04 FOR PLAN VIEW OF VAULT AND D5.07 FOR PLAN VIEW OF MANHOLE AND ADDITIONAL NOTES
3. SEE DETAIL D5.18 THROUGH D5.21 FOR FLOOR PIPE SUPPORT, VENTILATION, CORE HOLE,A ND PRESSURE GAUGE DETAILS

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.05
	PRV RECTANGULAR VAULT CROSS SECTION	DATE: 12/2020

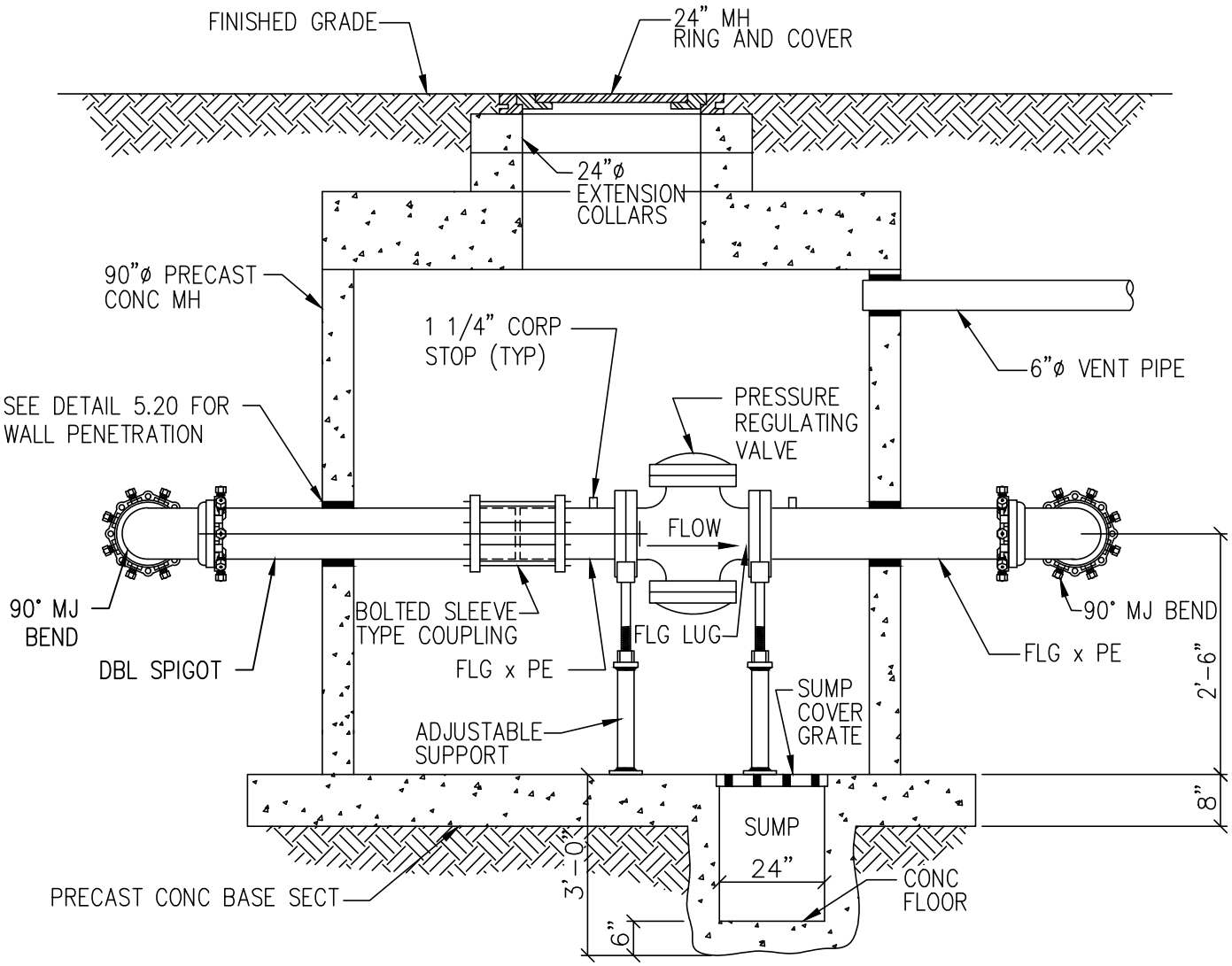


NOTES:

1. A RECTANGULAR VAULT IS REQD WHERE TELEMETRY OR ELECTRICAL EQUIPMENT IS ANTICIPATED INSIDE THE VAULT
2. ACCESS STAIRS WITH DOOR OUTSIDE OF PAVEMENT MAY BE REQD ON STREETS WITH HEAVY TRAFFIC
3. FOR CROSS SECTION VIEW SEE DETAIL D5.07
4. DO NOT POLACE DUMP DIRECTLY UNDER MH
5. THIS MH IS SUITABLE FOR CHECK VALVE INSTALLATIONS
6. PIPING FOR PRV AND CHECK VALVE INSTALLATIONS SHALL BE DI
7. MANHOLE STEPS ARE REQD IN PRE-CAST MANHOLE. SEE DETAIL D0.07 FOR MANHOLE STEP REQUIREMENTS
8. PRVE SHALL BE CLA-VAL MODEL 90-01, EPOXY COATED. TRIM (I.E. DISC GUIDE, SEAT, &COVER BEARING) SHALL BE STAINLESS STEEL TYPE 303. INCLUDE OPTIONAL FEATURES B, C, D, S, AND Y FOR REQUIRED CLA-VAL PRV.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.06
	PRV MANHOLE PLAN VIEW	DATE: 12/2020

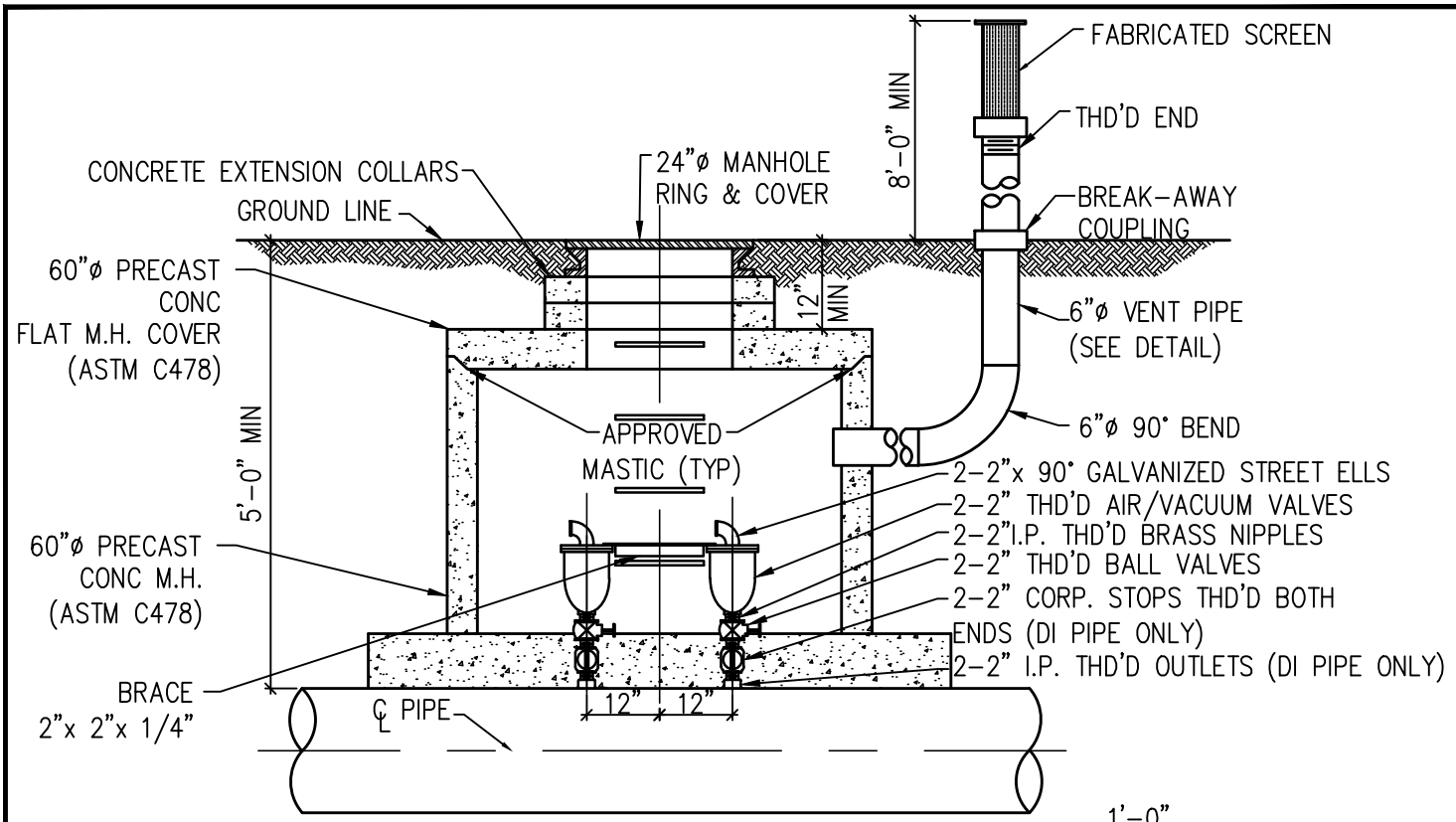


NOTES:

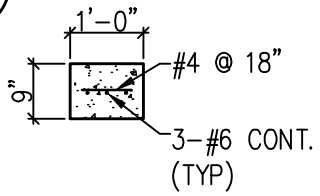
1. SEE DETAIL D5.06 FOR PLAN VIEW AND ADDITIONAL NOTES
2. SEE DETAIL D5.18 THROUGH D5.21 FOR FLOOR PIPE SUPPORT, VENTILATION, CORE HOLE, AND PRESSURE GAUGE DETAIL

SCALE: NTS

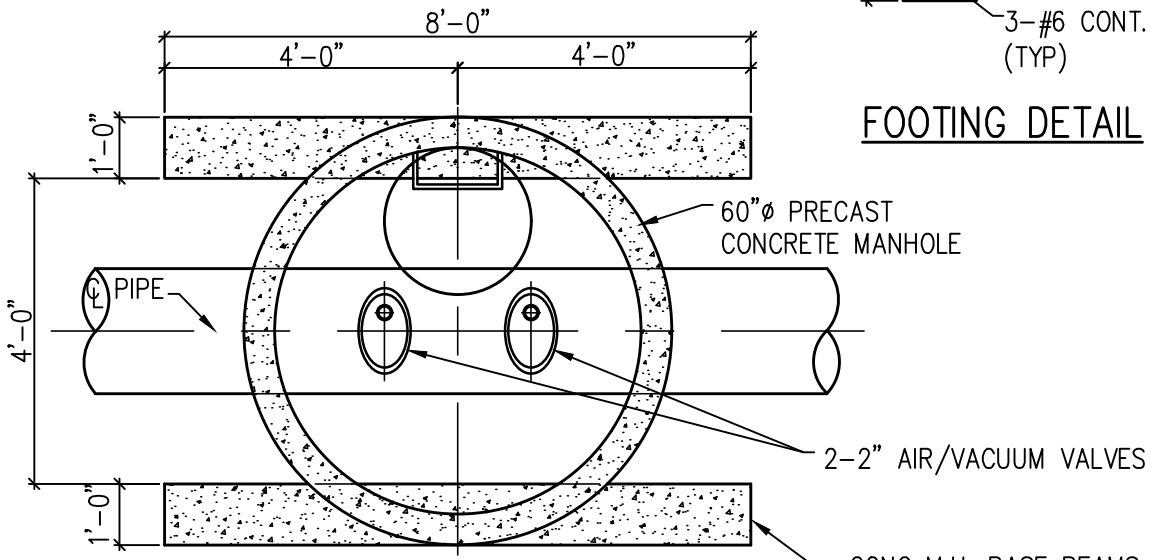
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.07
	PRV MANHOLE CROSS SECTION	DATE: 12/2020



ELEVATION



FOOTING DETAIL

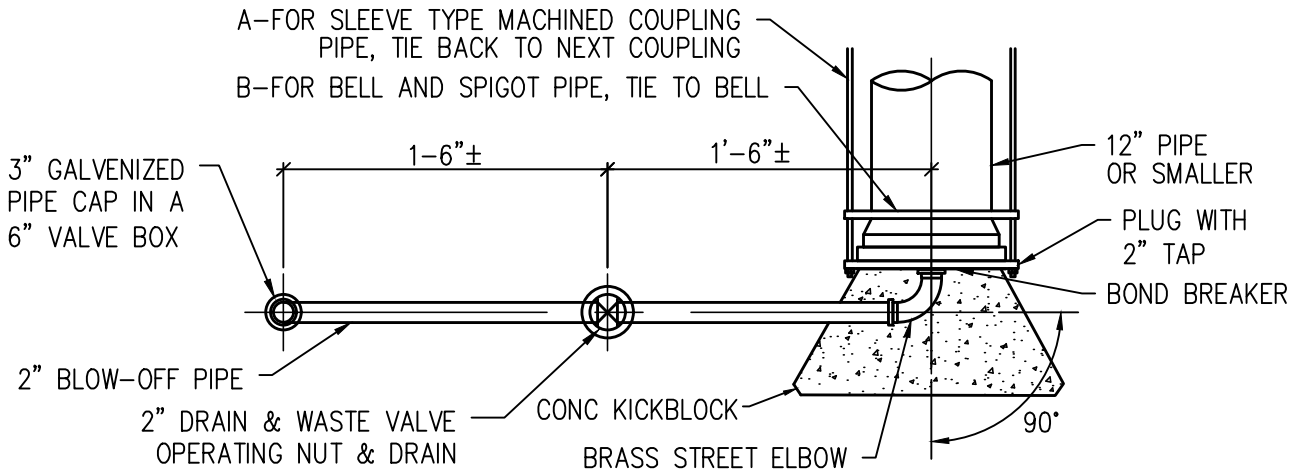


PLAN

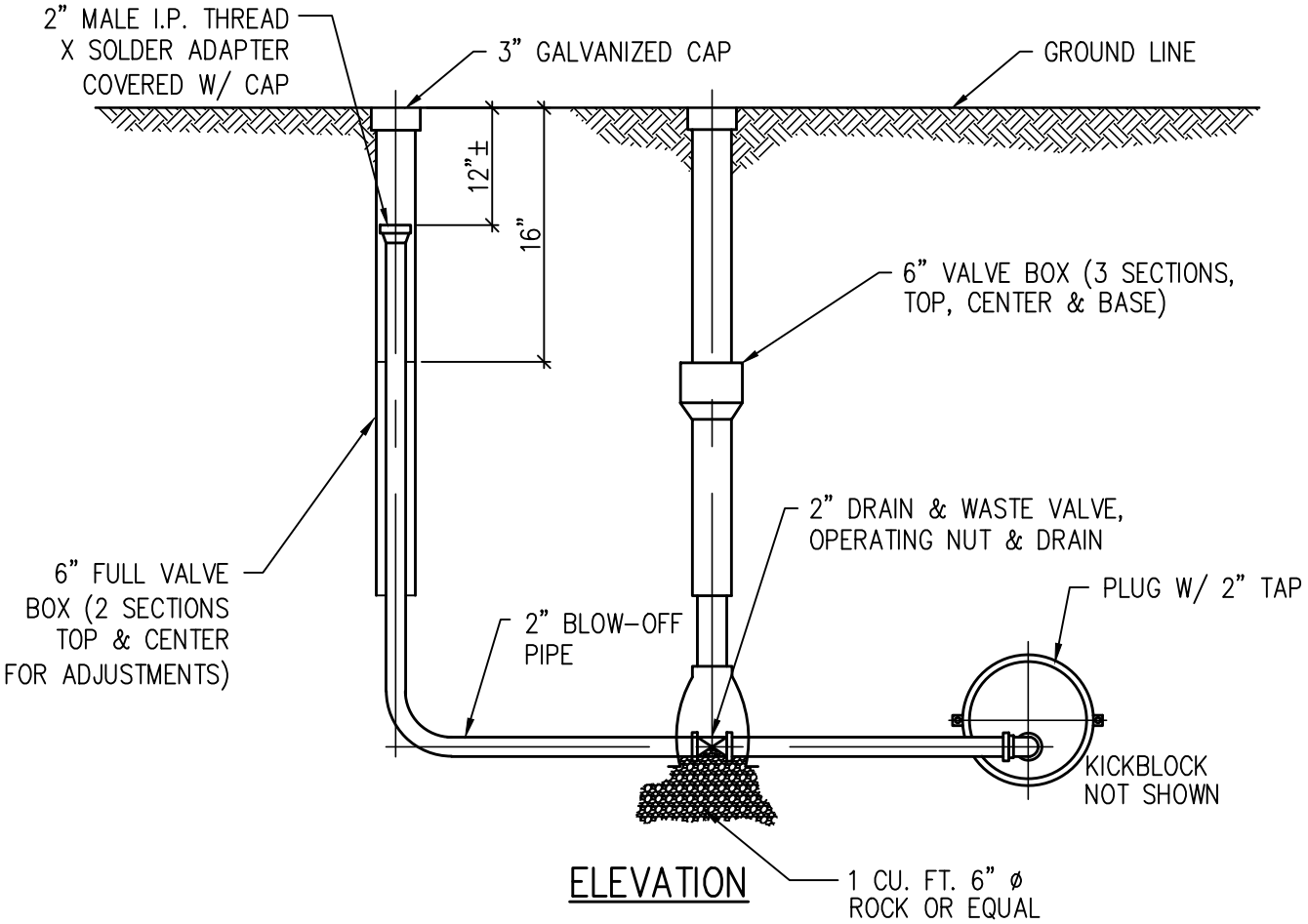
NOTES:

1. ONLY ONE AIR VACUUM VALVE REQUIRED ON 12-INCH PIPE AND SMALLER
2. USE 2" AIR VALVE ASSEMBLY ON 30" OR SMALLER PIPE.
3. THE DISTANCE BETWEEN RUNGS, CLEATS, AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
4. MANHOLE STEPS ARE REQUIRED IN PRECAST CONCRETE MANHOLES. SEE DETAIL D0.07 FOR REQUIREMENTS

SCALE: NTS



PLAN



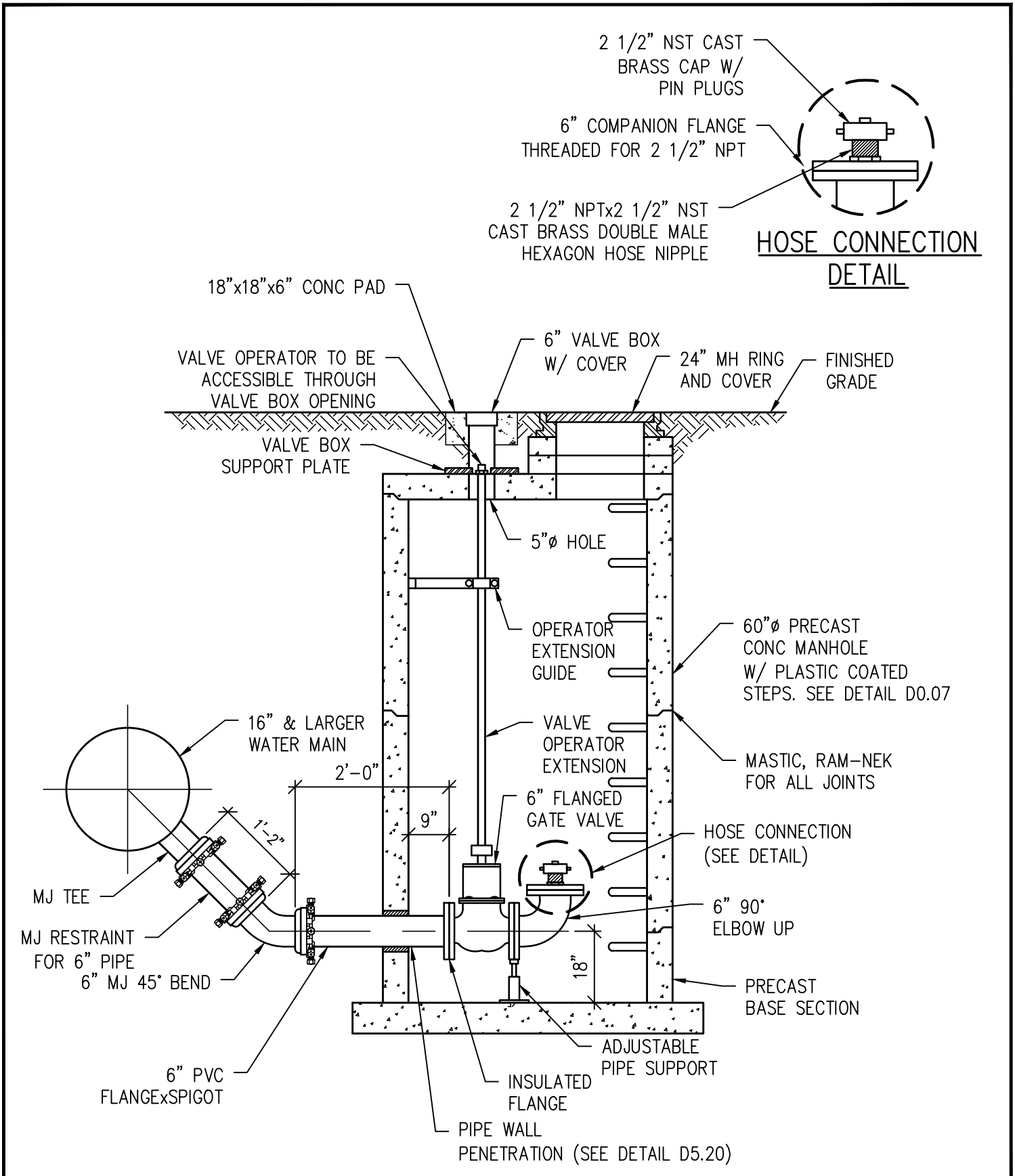
ELEVATION

NOTES:

1. BLOW–OFF PIPE TO BE TYPE K SOFT COPPER OR BRASS
2. ALLOWED IN MASTER METER AND READ AND BILL DISTRICTS ONLY
3. PLUG SHALL BE MECHANICALLY RESTRAINED.

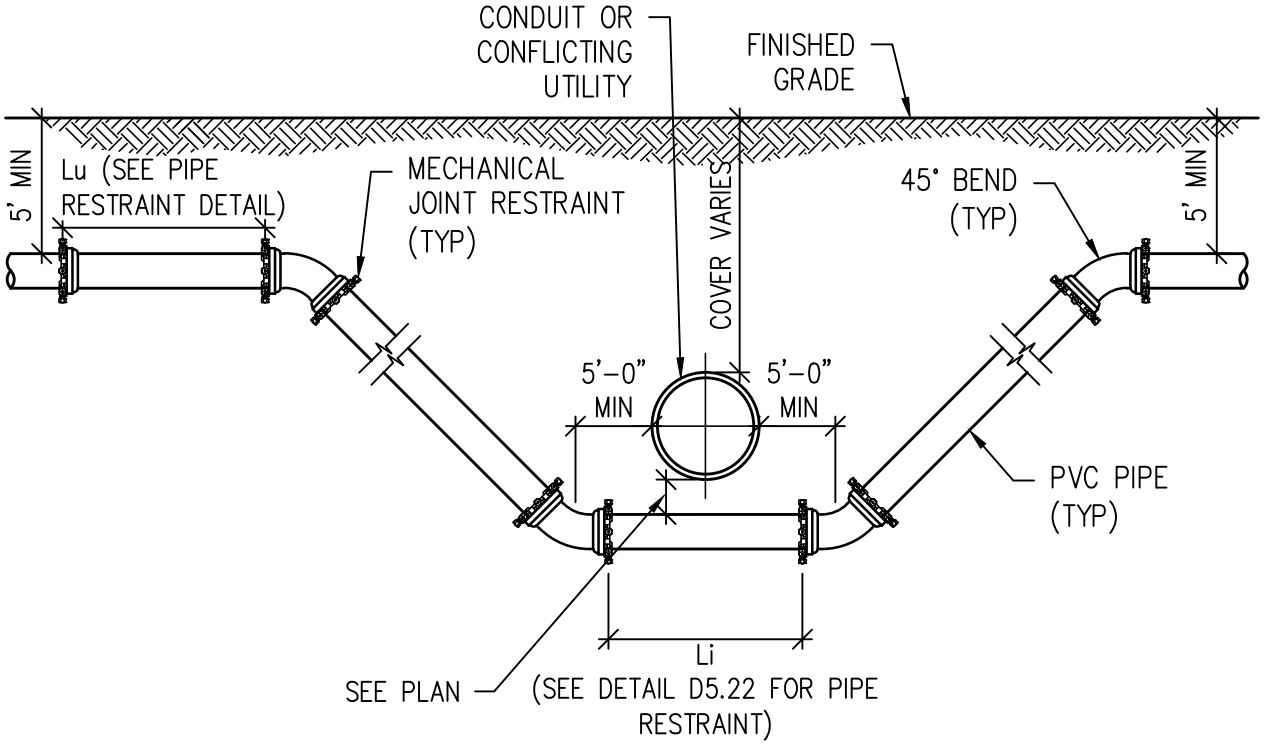
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.09
	BLOW–OFF INSTALLATION – 12–INCH AND SMALLER PIPE	DATE: 12/2020

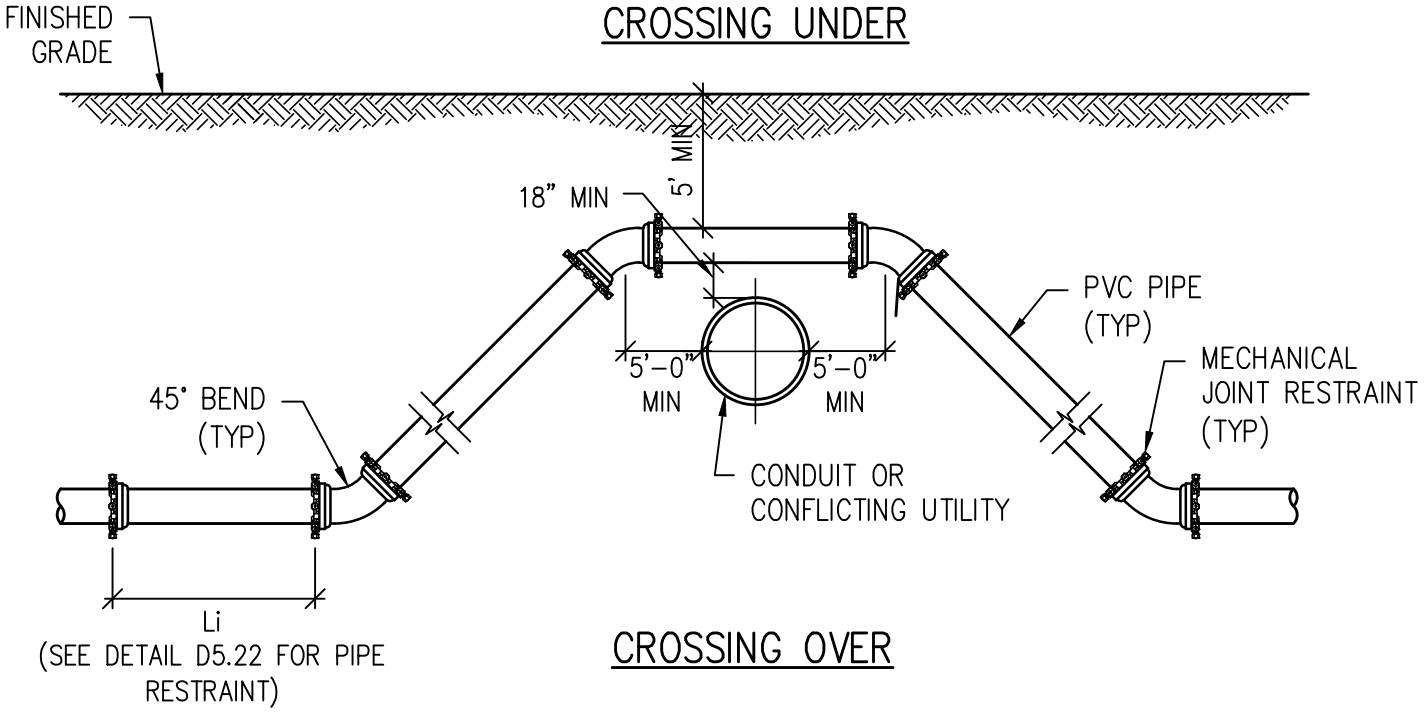


SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.10
	BLOW-OFF DETAIL	DATE: 12/2020



CROSSING UNDER



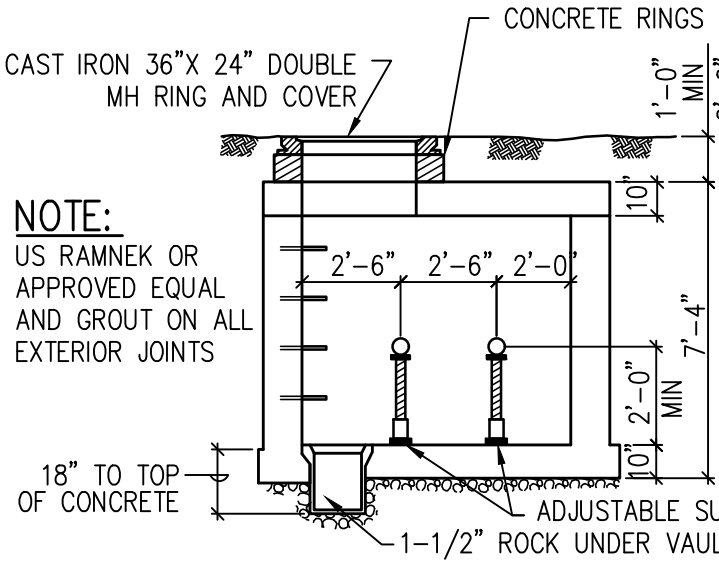
CROSSING OVER

NOTES:

1. CENTER WATER MAIN AT CROSSING TO POSITION JOINTS AS FAR FROM CROSSING AS POSSIBLE.

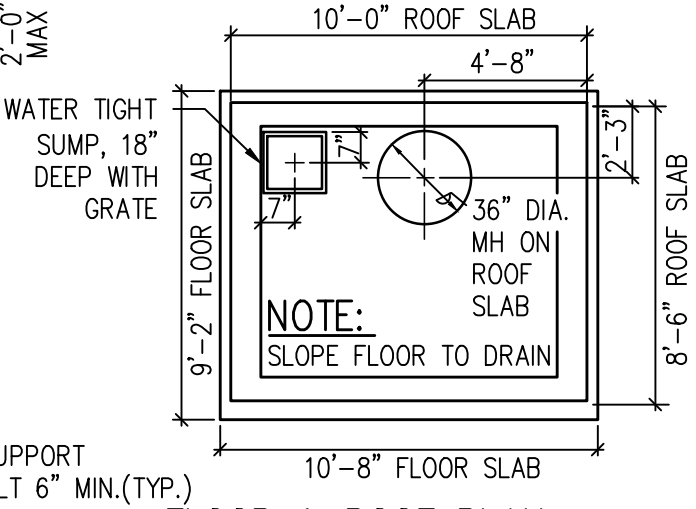
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.11
	CROSSING OVER OR UNDER CONFLICTING UTILITY	DATE: 12/2020

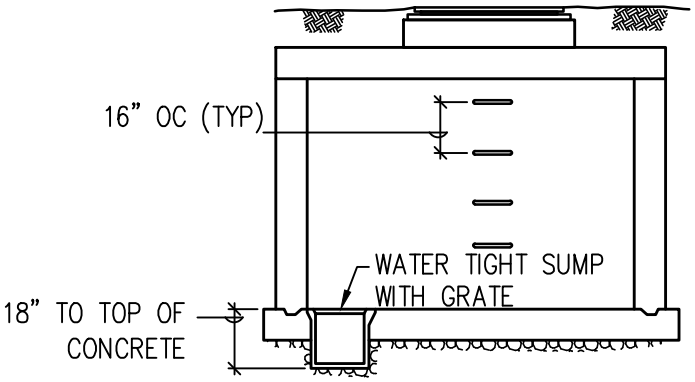


NOTE:
US RAMNEK OR APPROVED EQUAL AND GROUT ON ALL EXTERIOR JOINTS

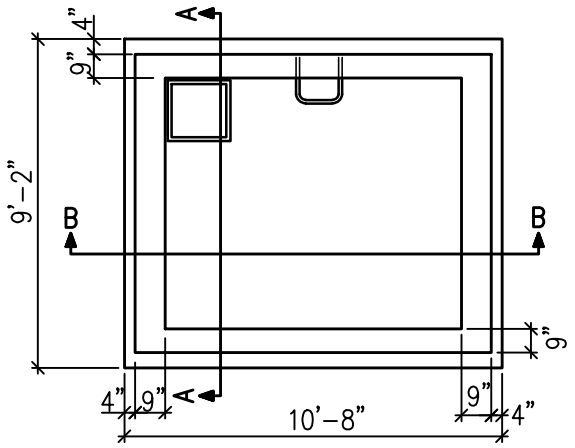
SECTION A



FLOOR & ROOF PLAN



SECTION B

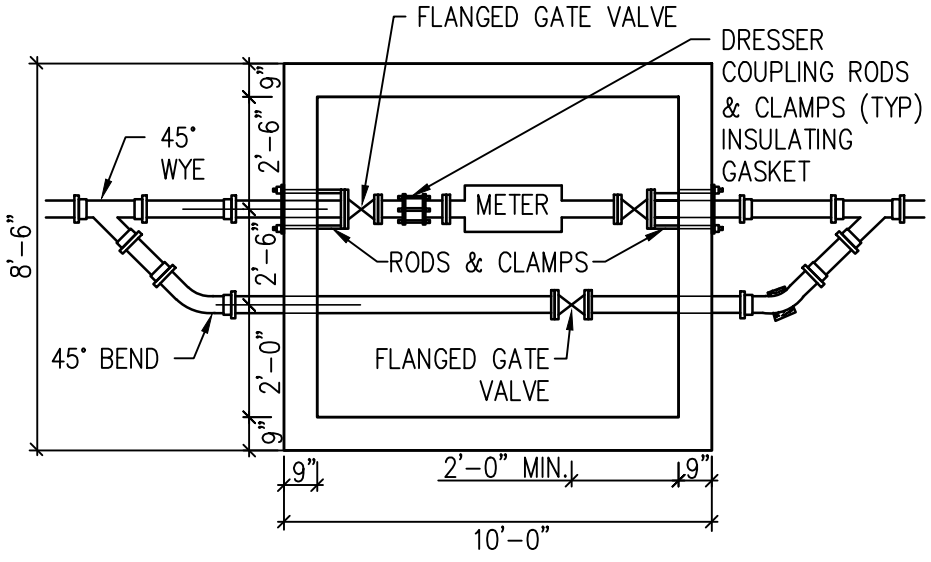


VAULT PLAN

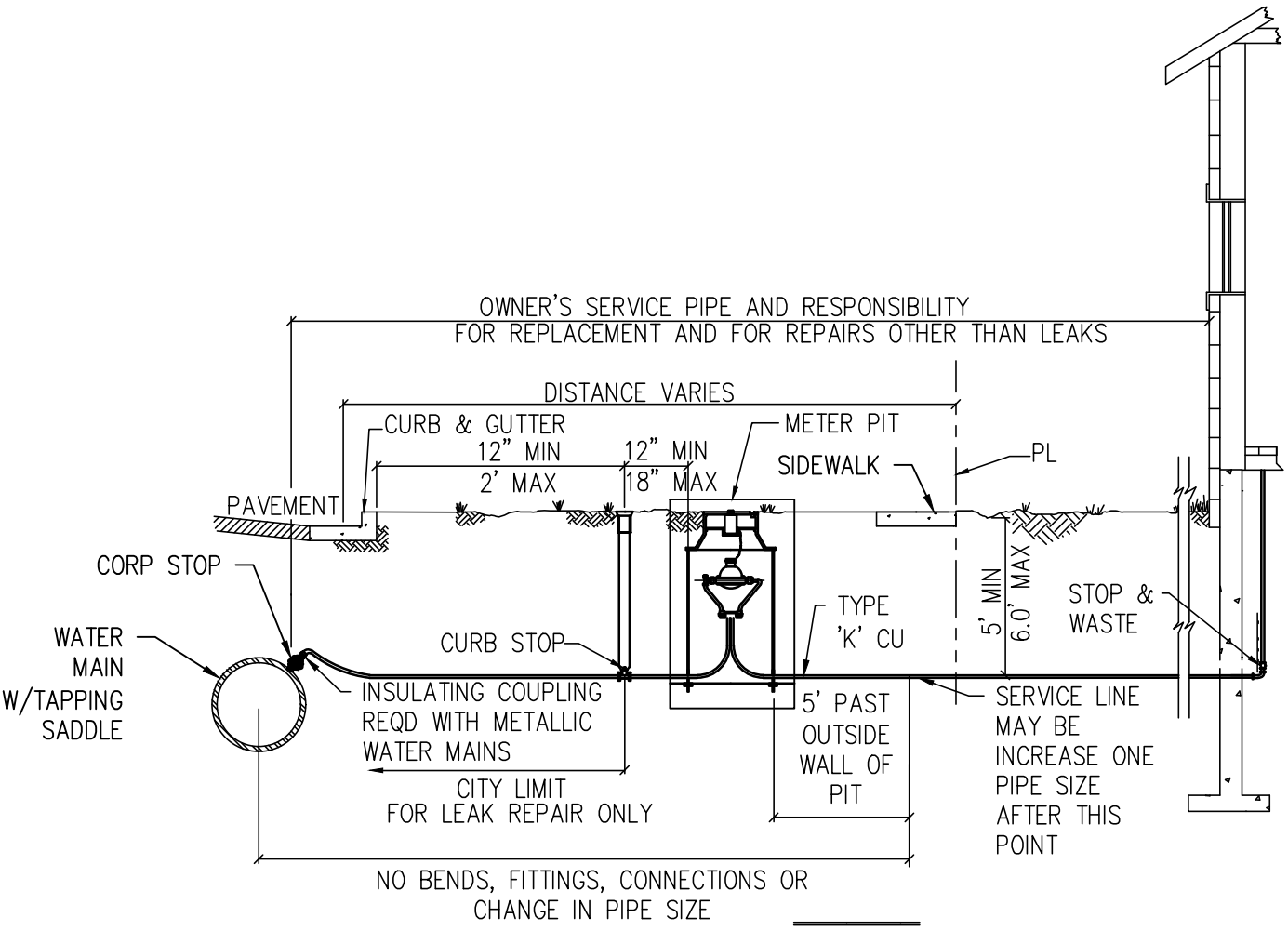
NOTES:

1. ALL MATERIALS, INSTALLATION AND CONSTRUCTION OF METER VAULT ASSEMBLY SHALL BE IN ACCORDANCE WITH CITY OR DISTRICT STANDARDS AND SPECIFICATIONS, TO INCLUDE METER, PIPING, FITTINGS, VALVES, VAULT AND APPARATUS ITEMS.
2. DOMESTIC SERVICE MUST BE INSTALLED BY LICENSED PLUMBER OR WATER SERVICE CONTRACTOR.
3. REFER TO REMOTE READOUT DETAIL IF REQUIRED.
4. BYPASS LINE REQUIRED FOR 1-1/2 INCH AND LARGER METERS EXCEPT THOSE USED FOR IRRIGATION ONLY.
5. PROVIDE ADJUSTABLE SUPPORTS FOR METER AND BY-PASS

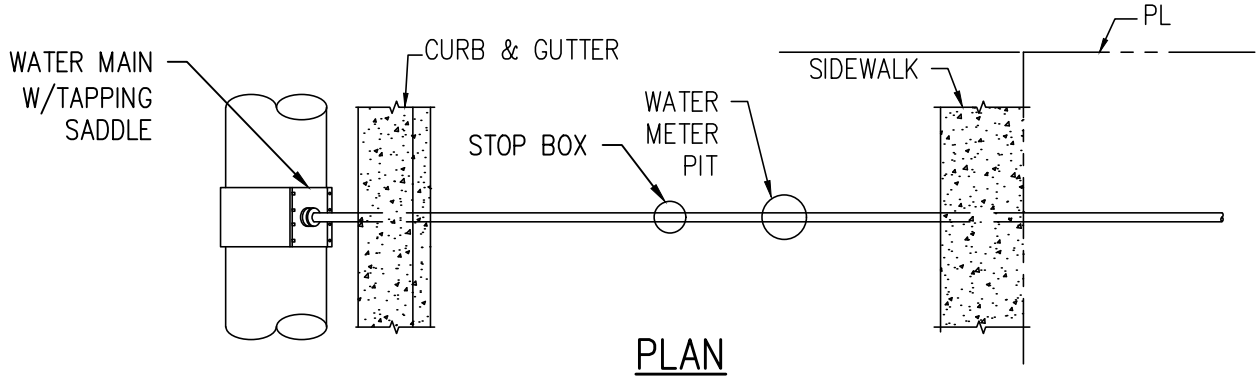
SCALE: NTS



TOWN OF BERTHOUD	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.12
	METER VAULT ASSEMBLY	DATE: 12/2020



ELEVATION



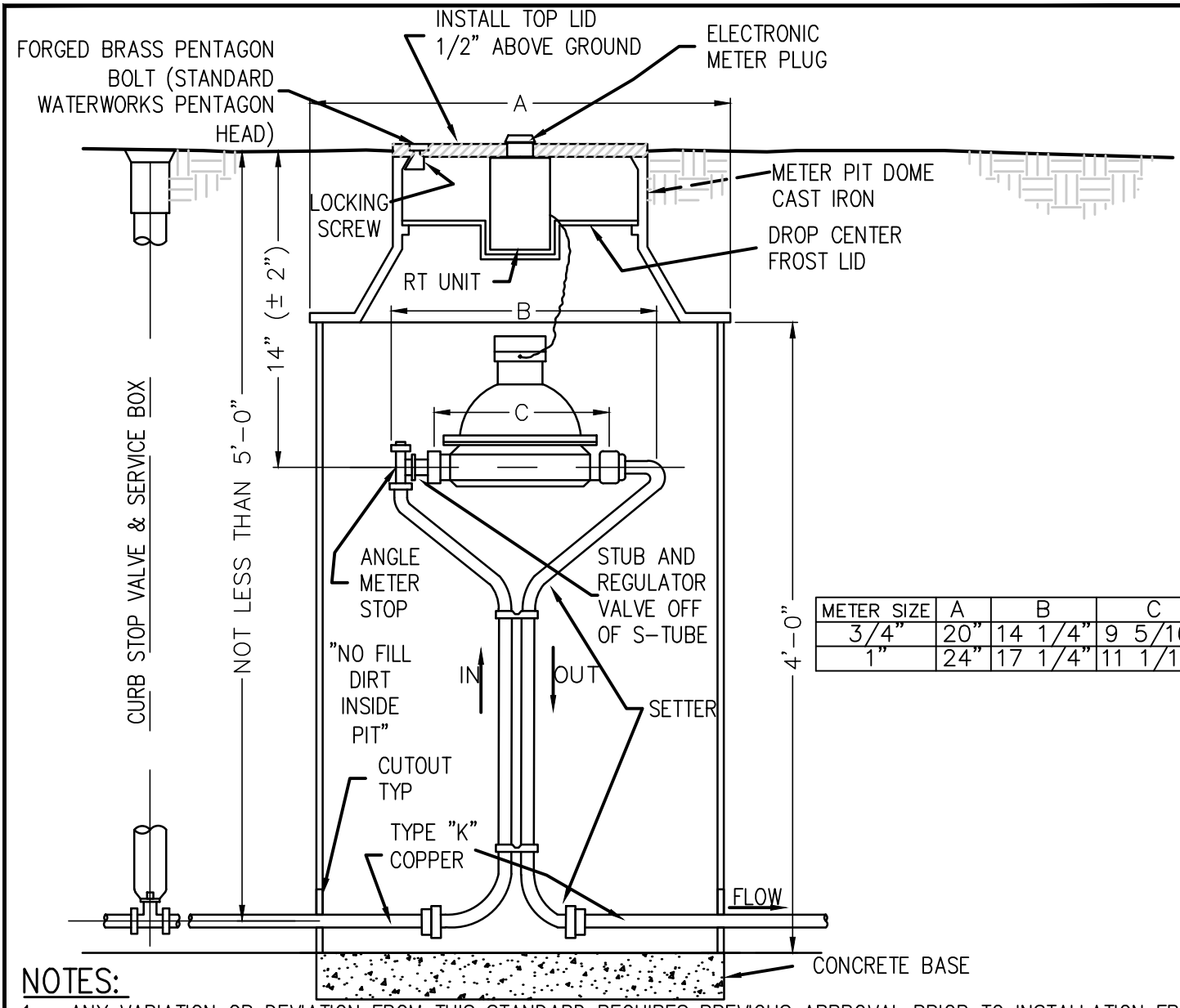
PLAN

NOTES:

1. IF THERE IS A TREE LAWN, BOTH CURB STOP AND METER PIT MUST BE LOCATED BETWEEN CURB AND SIDEWALK
2. STOP BOX SHALL BE LOCATED IN A PUBLIC RIGHT-OF-WAY AS CLOSE TO CURB AS POSSIBLE, IN A LANDSCAPED AREA 24" FROM THE INLET SIDE OF THE METER PIT UNLESS PRIOR APPROVAL IS OBTAINED FROM THE TOWN. FOR A CURB STOP LOCATED BENEATH PAVEMENT, USE A ROADWAY BOX OVER STANDARD STOP BOX WITH A BOND BREAKER. THE CURB STOP CANNOT BE LOCATED BENEATH PARKING AREAS.
3. 2 FT CLEAR FROM THE WATER METER PIT AND STOP BOX LID FOR PLANTINGS, SHRUBS, AND BUSHES
4. 7 FT CLEAR FROM WATER METER PIT AND STOP BOX LID TO PROPERTY LINE

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.13
	SERVICE LINE, STOP BOX, OUTSIDE METER INSTALLATION	DATE: 12/2020



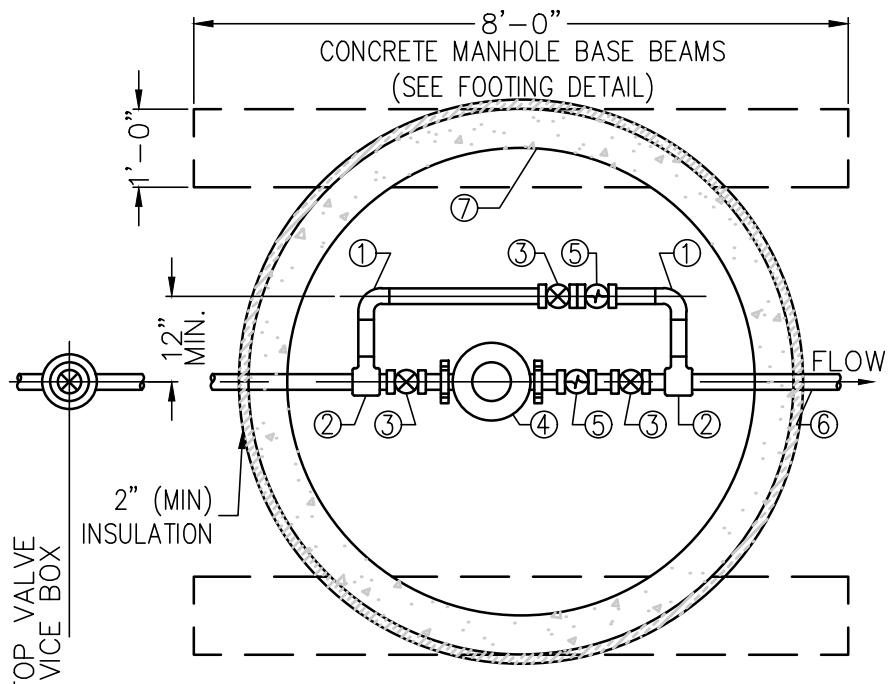
METER SIZE	A	B	C
3/4"	20"	14 1/4"	9 5/16"
1"	24"	17 1/4"	11 1/16"

NOTES:

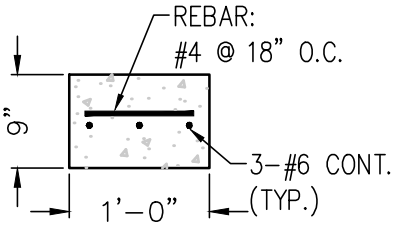
1. ANY VARIATION OR DEVIATION FROM THIS STANDARD REQUIRES PREVIOUS APPROVAL PRIOR TO INSTALLATION FROM METER INSPECTOR
2. METER PIT MUST BE INSTALLED IN LANDSCAPED AREA. PRIOR APPROVAL REQD FOR INSTALLATIONS IN ROADWAYS, DRIVEWAYS, OR SIDEWALKS, ROAD LIDS, OR OTHER SPECIAL MODIFICATIONS MAY BE REQD.
3. NO SHRUBS, BUSHES, OR PLANTS WITHIN 2 FT OF PIT LID AND STOP BOX. NO FENCES, WALLS, TREES, WITHIN 5 FT OF PIT WALL AND STOP BOX. STOP BOX AND METER MUST NOT BE BEHIND WALL OR FENCE.
4. ALL METER PITS SHALL BE FURNISHED WITH PLASTIC FROST LID WITH 3 INCH DEEP PAN, FIVE DRAIN HOLES, LIFTING HANDL, AND SLOT FOR AMR WIRE RUNNING FULL DEPTH OF LIP.
5. METER PIT SHALL BE CONSTRICTED IN ACCORDANCE WITH STANDARDS. TOTAL DEPTH OF PIT MUST BE AT LEAST 48" WITH ADJUSTMENT RINGS USED BETWEEN PIT TOP RING AND DOME SO PIT LID IS 1/2" TO 1" ABOVE FINISHED GRAD. TOP OF PIT RING SHALL NOT EXCEED 12" HEIGHT.
6. IN MOST CASES AMR DEVICE WILL MOUNT THROUGH CAST IRON LID OR UNDER COMPOSITE LID. IN SOME CASES REMOTE AMR DEVICE WILL BE NEEDED.
7. BENDING COPPER RISERS FOR GRAD ADJUSTMENT OF THE METER YOKE WILL NOT BE PERMITTED.
8. COPPER PIPE SHALL SHOW NO VISIBLE CRIMPING.
9. NO CONNECTIONS, BENDS, OR PIPE SIZE CHANGE.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.14
	OUTSIDE SETTING FOR 0.75-INCH AND 1-INCH METER	DATE: 12/2020

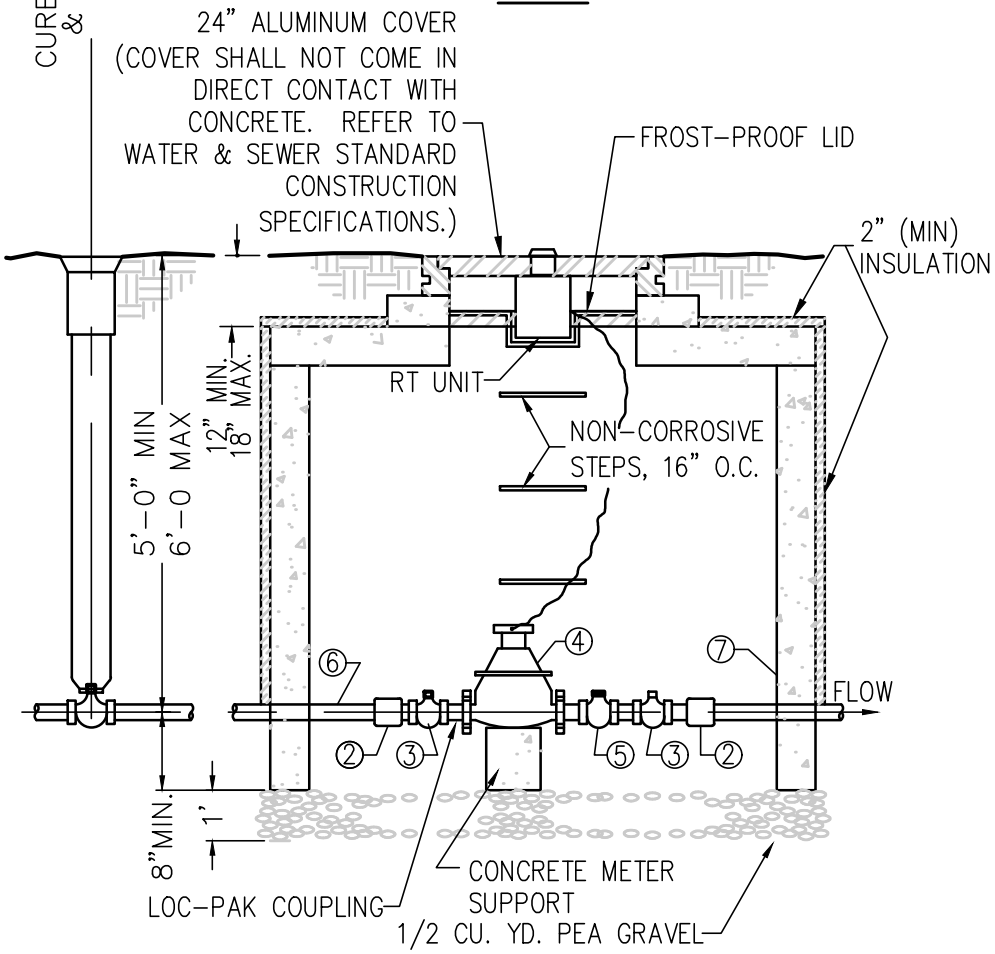


PLAN



FOOTING DETAIL

① – 90° ELL
② – TEE
③ – CURB STOP W/LOCK WING
④ – METER UNIT
⑤ – APPROVED SINGLE CHECK VALVE
⑥ – TYPE K COPPER TUBING
⑦ – 48" CONCRETE MANHOLE



ELEVATION

NOTES:

1. MANHOLE BASE BEAMS SHALL BE REQUIRED FOR ALL INSTALLATIONS.
2. A 48" DIA. MANHOLE PIT WILL ACCOMMODATE 1 1/2" & 2" SPLIT CASE METERS (LARGER PIT MAY BE REQUIRED DEPENDING ON CONDITIONS.)
3. JOINTS INSIDE METER VAULT SHALL BE EITHER THREADED OR SOLDERED W/SOLDER APPROVED FOR LEAD-FREE POTABLE WATER SYSTEMS.
4. INSULATION SHALL BE EITHER BLANKET/WRAP OR BOARD TYPE.
5. METER VAULTS LOCATED WITHIN TRAFFIC AREAS SHALL BE HS-25 LOAD RATED.
6. A SINGLE CHECK VALVE MY BE LOCATED BETWEEN BY-PASS AND EDGE OF PIT IF ROOM PERMITS INSTEAD OF TWO DOUBLE CHECK VALVES.
7. ALTERNATE BACKFLOW PREVENTION MY BE REQUIRED, DEPENDING ON HAZARD, & MAY BE LOCATED IN STRUCTURES BEING SERVED.

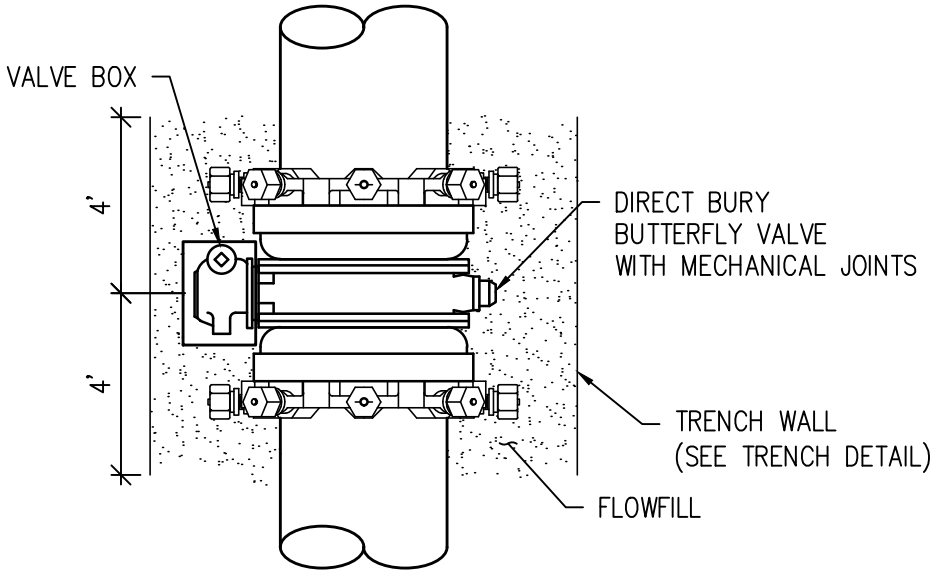
SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
WATER DETAILS

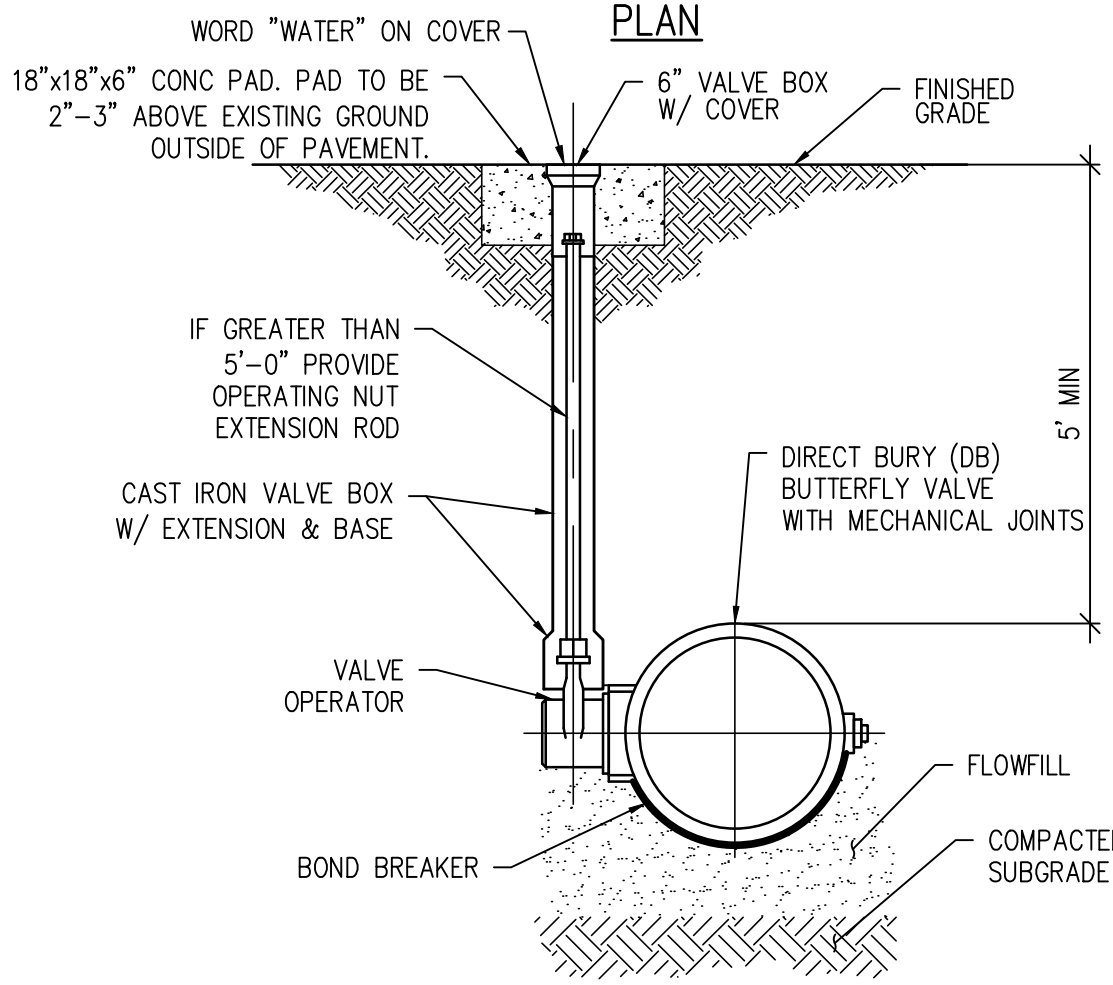
OUTSIDE SETTING FOR 1.5-INCH AND 2-INCH METER

D5.15

DATE: 12/2020



PLAN



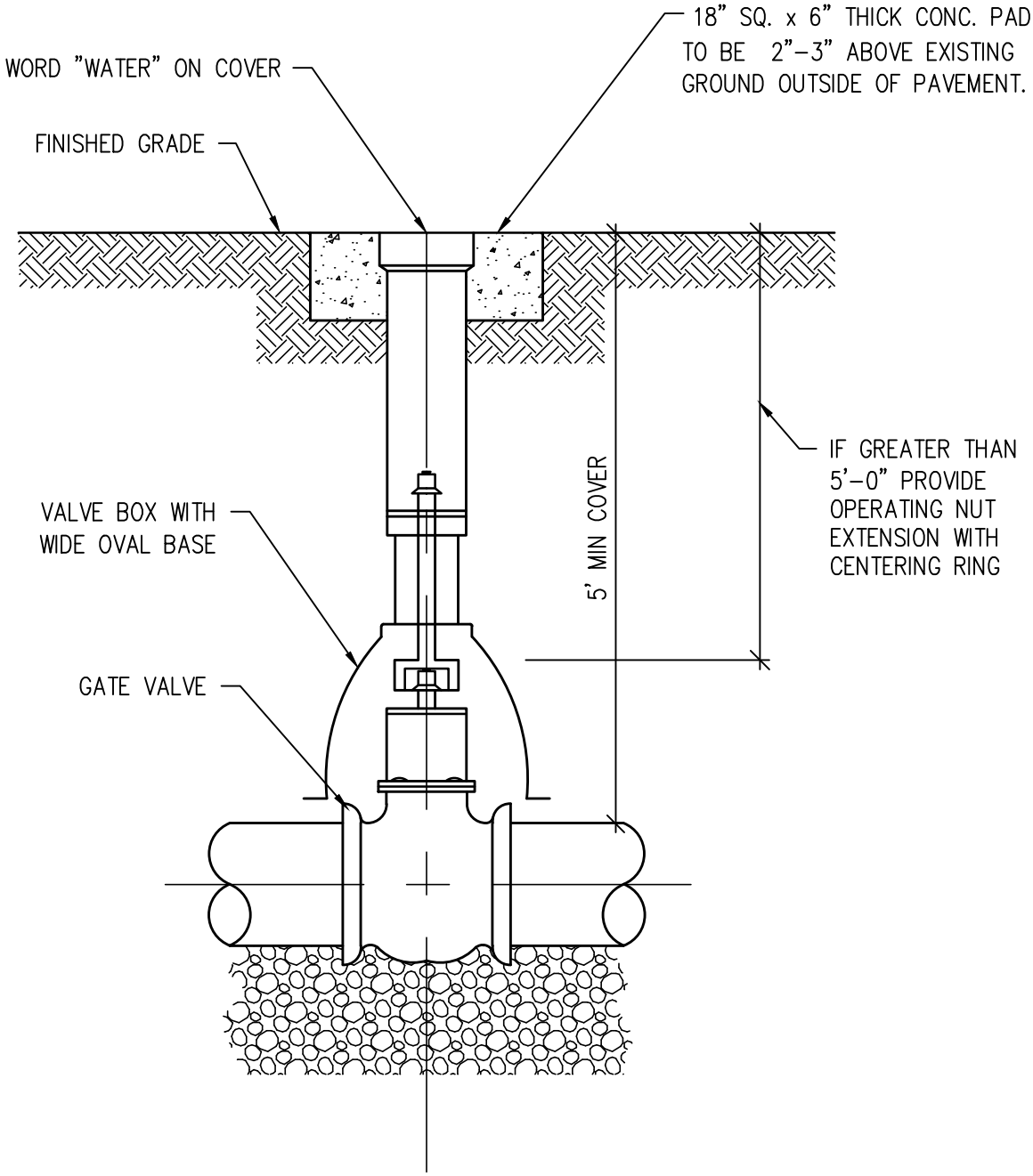
ELEVATION

NOTES:

1. ELEVATION FOR TOP OF COVER, PLACED IN PAVEMENT, SHALL BE SET IN ACCORDANCE WITH PAVING REQUIREMENTS OF LOCAL JURISDICTION.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.16
	DIRECT BURY BUTTERFLY VALVE INSTALLATION	DATE: 12/2020

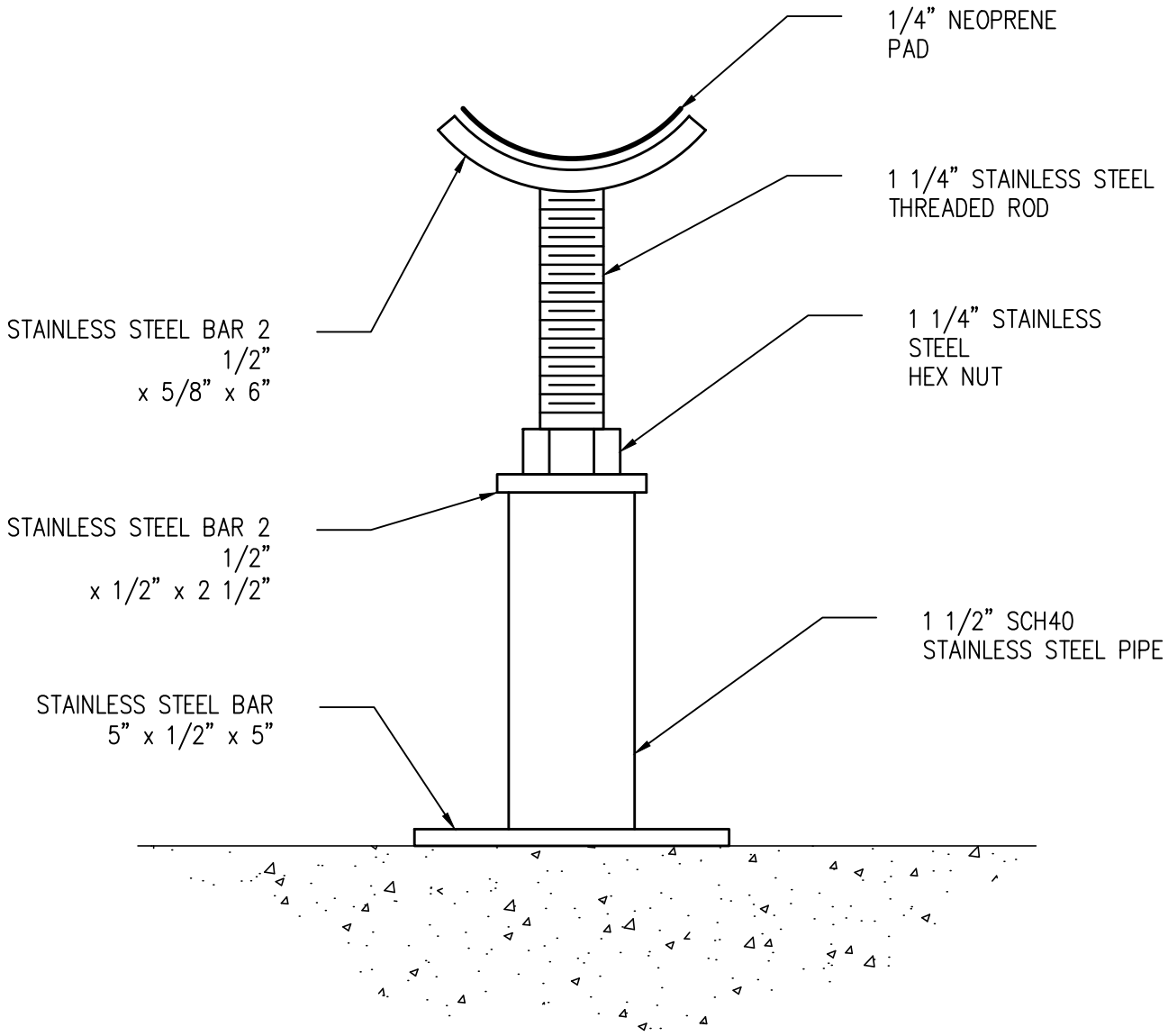


NOTES:

1. CARE SHALL BE TAKEN WHEN INSTALLING VALVES ON' LINES TO ASSURE PROPER SUPPORT OF THE VALVES.
2. WOOD BLOCKS OR 3/4" WASHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT WHERE REQUIRED.
3. VALVES SHALL NOT BE PLACED IN CONCRETE CROSS PANS.
4. ELEVATION FOR TOP OF COVER, PLACED IN PAVEMENT, SHALL BE SET IN ACCORDANCE WITH PAVING REQUIREMENTS OF LOCAL JURISDICTION.

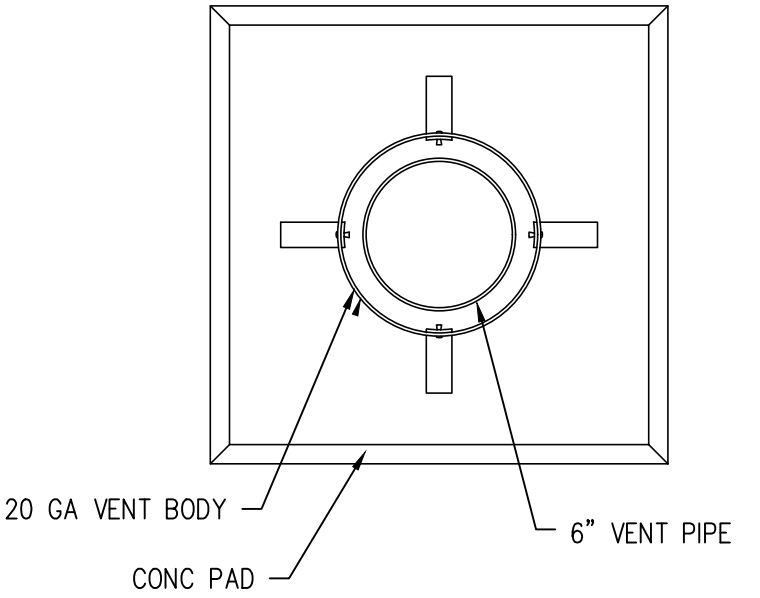
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.17
	GATE VALVE	DATE: 12/2020

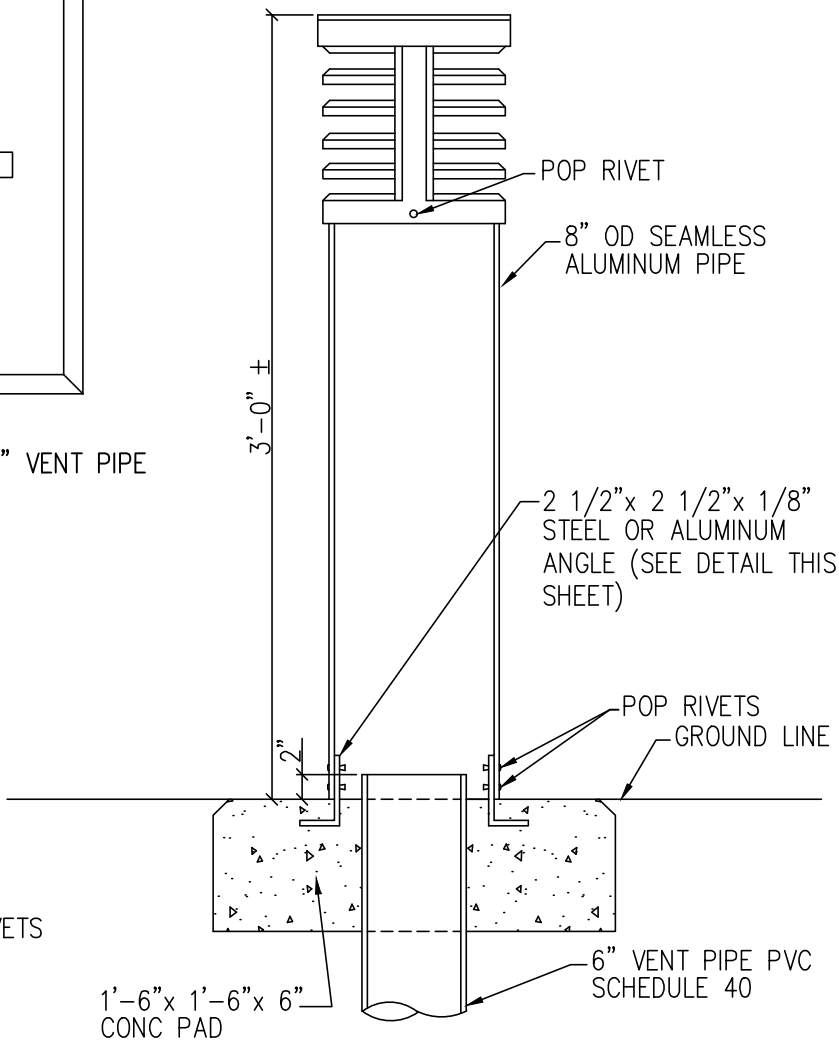


SCALE: NTS

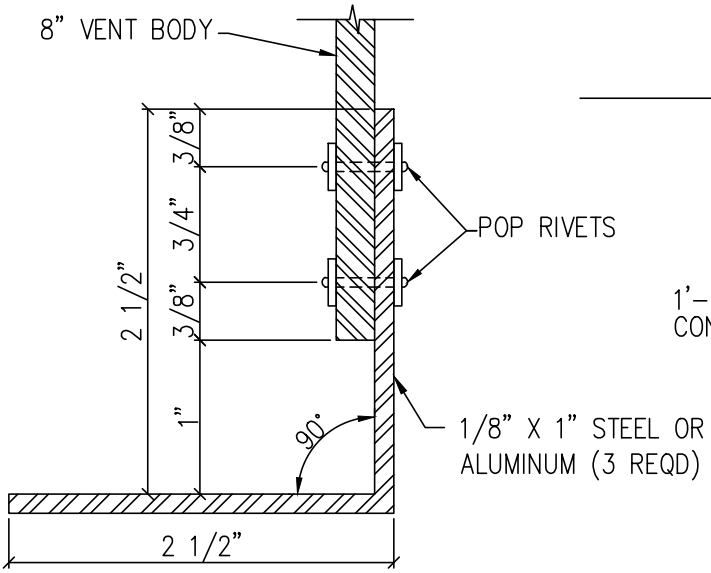
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.18
	FLOOR PIPE SUPPORT	DATE: 12/2020



BASE DETAIL



ROUND VENT SCREEN



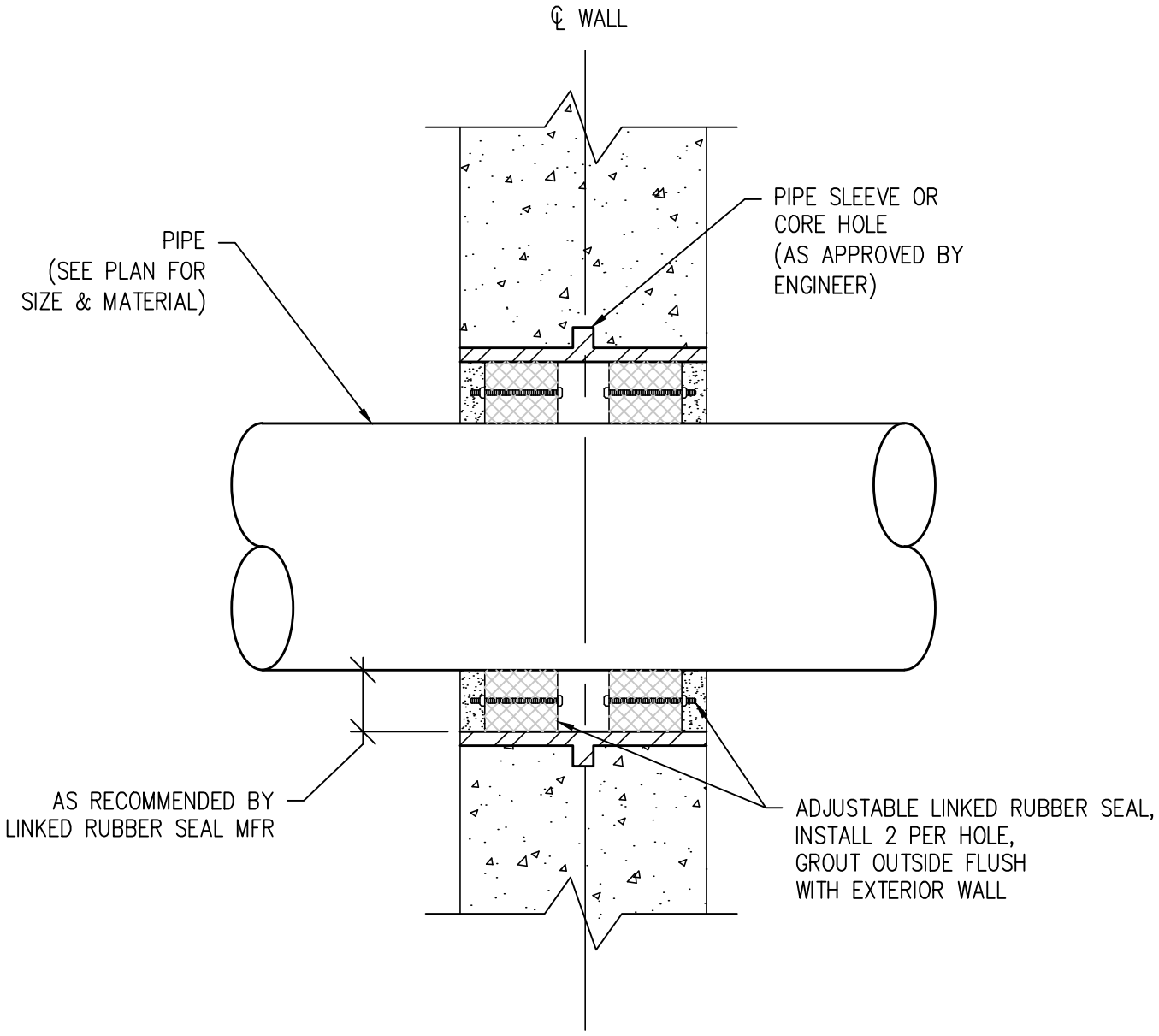
STEEL OR ALUMINUM ANGLE DETAIL

NOTES:

1. COLOR SHALL BE OLIVE GREEN OR FLAT BLACK TO MATCH SURROUNDINGS

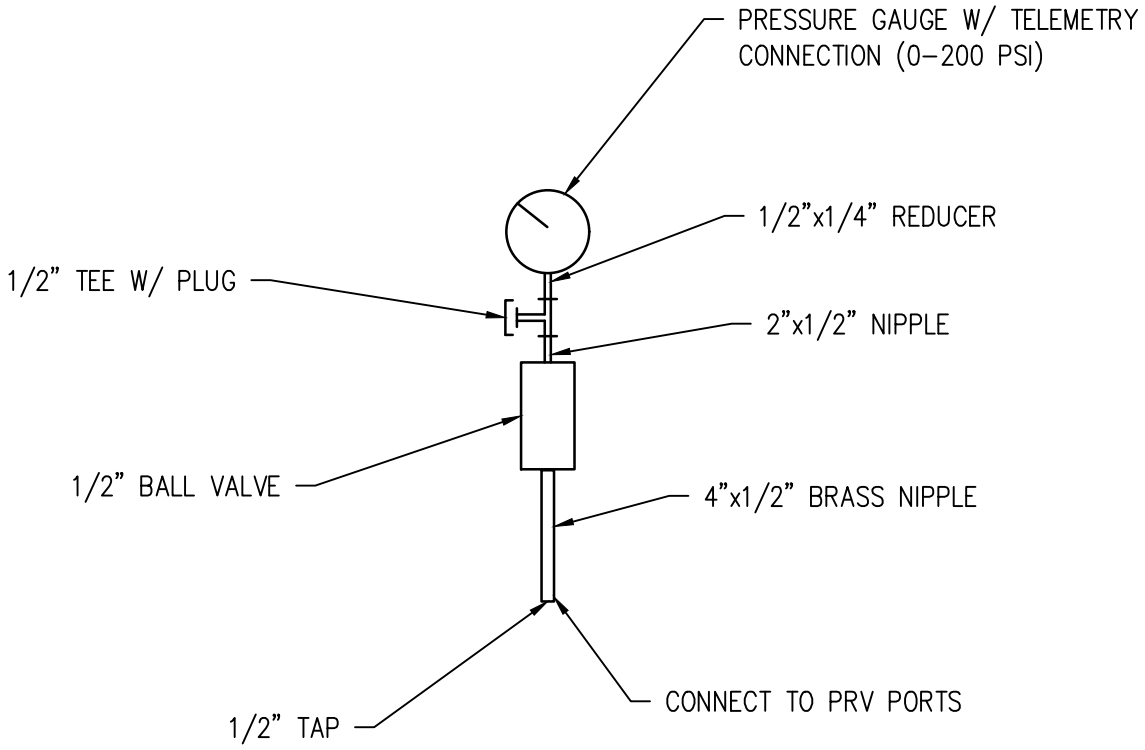
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.19
	RESIDENTIAL VENT ASSEMBLY	DATE: 12/2020



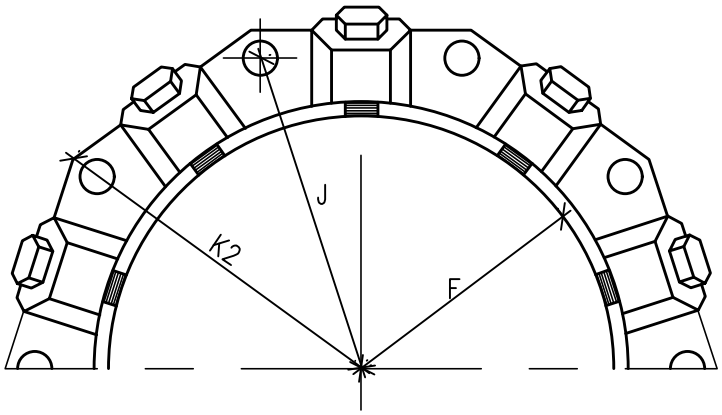
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.20
	WALL PENETRATION WITH CORE HOLE	DATE: 12/2020

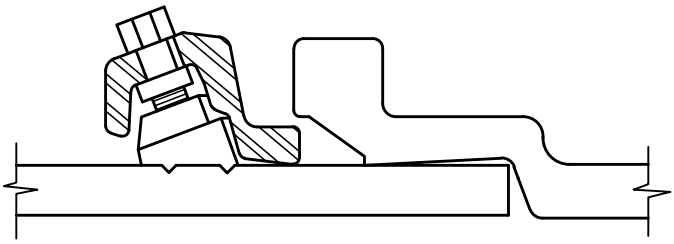


SCALE: NTS

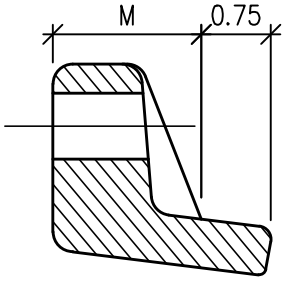
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.21
	PRESSURE GAUGE	DATE: 12/2020



MECHANICAL JOINT RESTRAINT



WEDGE DETAIL



BOLT HOLE DETAIL

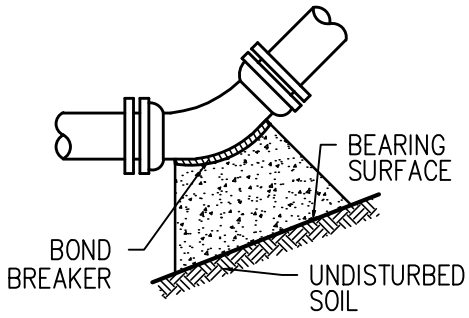
	NOMINAL PIPE SIZE	NO. OF BOLTS	NO. OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	2	2					PVC
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
DI	4"	4	2					DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
	16"	12	12	22.50	21.00	17.54	1.56	
	20"	14	14	27.00	25.50	21.74	1.69	

DIMENSIONS

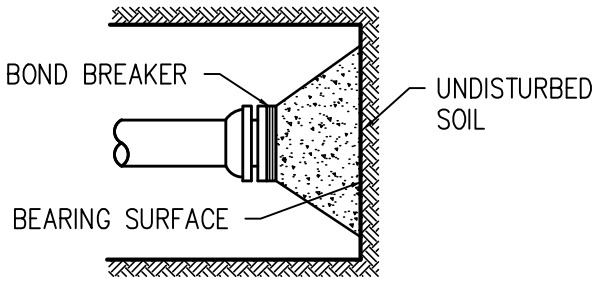
NOTE:

1. BASED ON "MEGA LUG" PIPE RESTRAINT SYSTEM BY EBAA IRON
2. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BY TOWN ENGINEER BEFORE INSTALLATION.

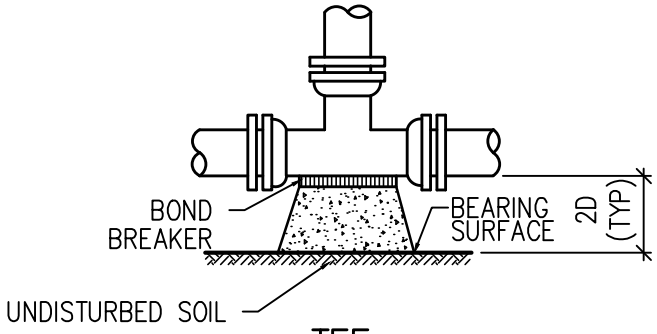
SCALE: NTS



90° BENDS ONLY



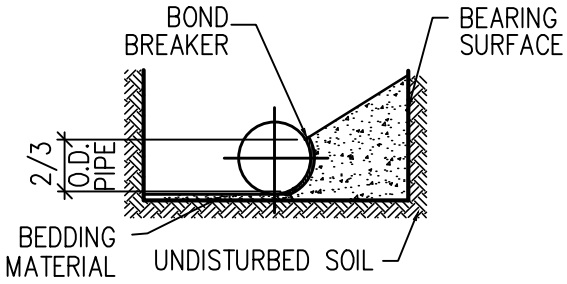
DEAD END



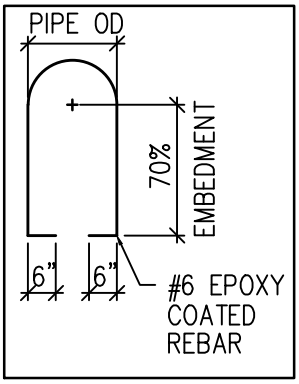
TEE

SIZE OF PIPE	SURFACE AREA (SQ FT)	
	TEE OR DEAD END	90° BENDS
4"	1.50	2.0
6"	3.00	4.5
8"	5.25	8.0
12"	11.25	17.0
16"	19.00	27.00
20"	25.00	35.50
24"	36.00	51.00

MINIMUM BEARING SURFACE AREA
(IN SQUARE FEET)



TYPICAL CROSS SECTION



NOTES:

1. BEARING SURFACES SHOWN IN CHART ARE MINIMUM
2. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER
3. 6", 8", &12" WATER HAMMER = 110 PSI
4. 16", 20" AND 24" WATER HAMMER = 70 PSI
5. BASED ON 3000 PSI SOIL BEARING CAPACITY
6. THRUST BLOCK SHALL NOT INTERFERE W/MECHANICAL JOINT BOLT OPERATOIN

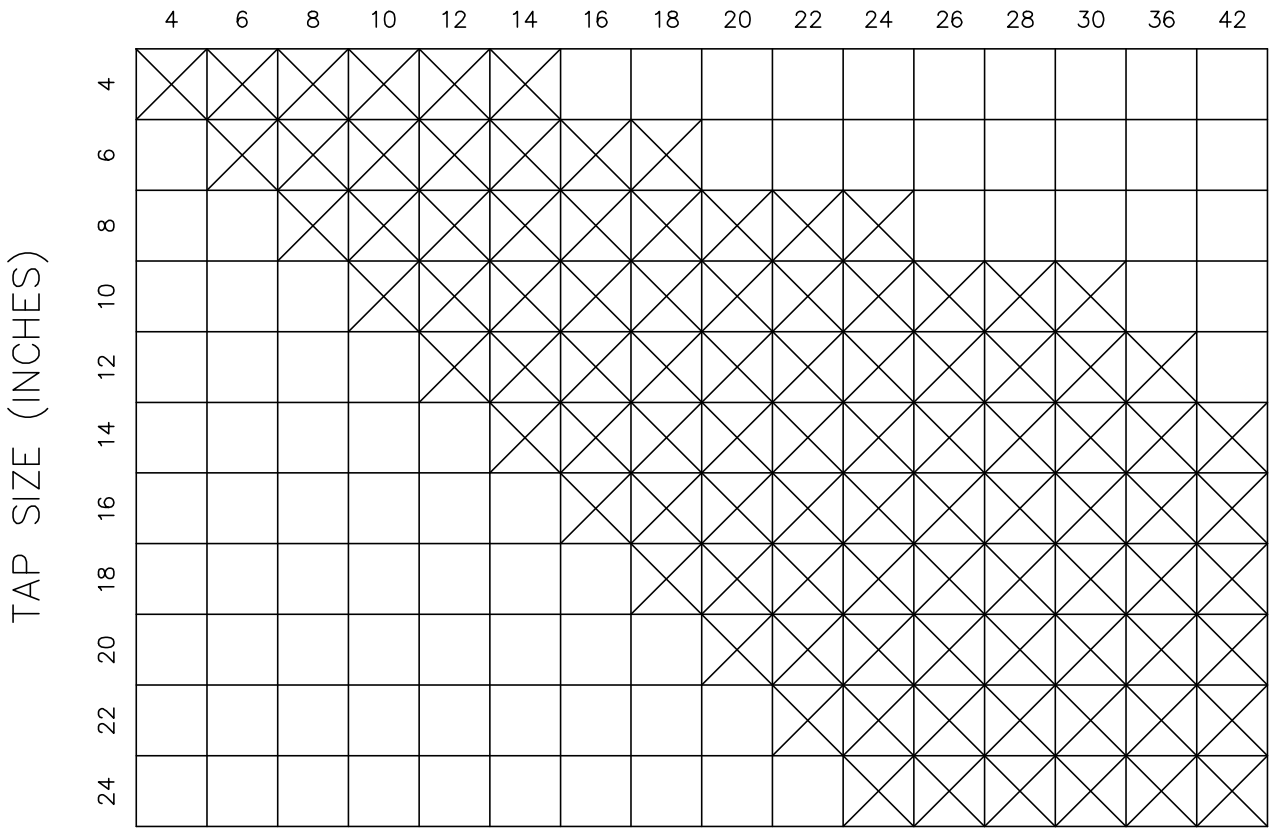
SCALE: NTS

CONCRETE THRUST BLOCKS

WATER MAIN AND TAP SIZE COMBINATIONS WHICH REQUIRE A CONC THRUST BLOCK BEHIND THE MAIN AT THE TAPPING SLEEVE OR SADDLE

ALL WATER MAINS

☒ INDICATED CONC THRUST BLOCK REQD

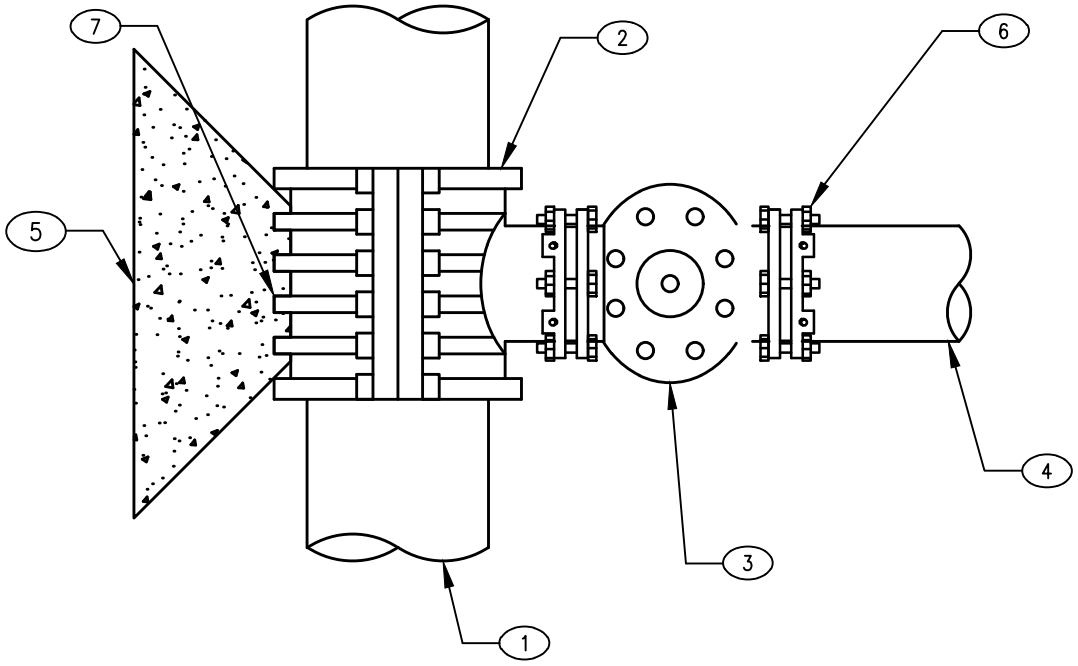


NOTES:

1. ANY THRUST BLOCK REQUIREMENTS FOR WATER MAIN AND TAP SIZED COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL REQUIRE SPECIAL DESIGN APPROVAL BY THE TOWN ENGINEER

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.24
	CONCRETE THRUST BLOCKS 2 OF 2	DATE: 12/2020



DETAILS:

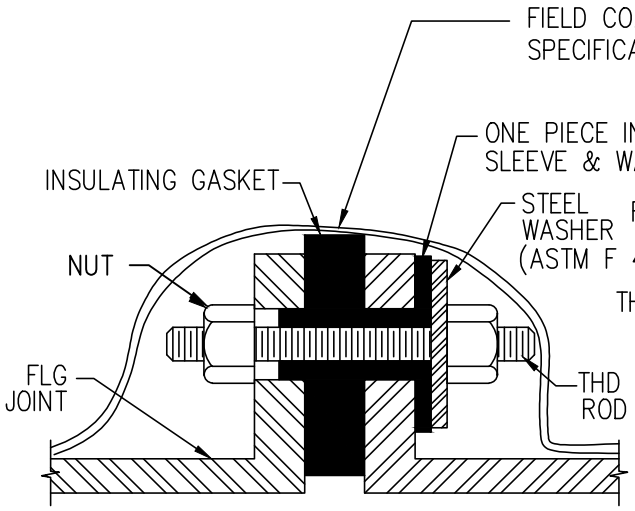
1. EXISTING MAIN
2. FABRICATED STEEL TAPPING SLEEVE WITH EPOXY SHOP COATING, STAINLESS STEEL BOLTS AND NUTS
3. TAPPING VALVE
4. DOUBLE SPIGOT PIPE
5. CONCRETE KICKBLOCK (SEE KICKBLOCK DETAIL)
6. MECHANICAL JOINT RESTRAINT (IF REQUIRED)
7. BOND BREAKER BETWEEN CONCRETE AND WET TAP SADDLE–8 MIL POLYETHYLENE

NOTES:

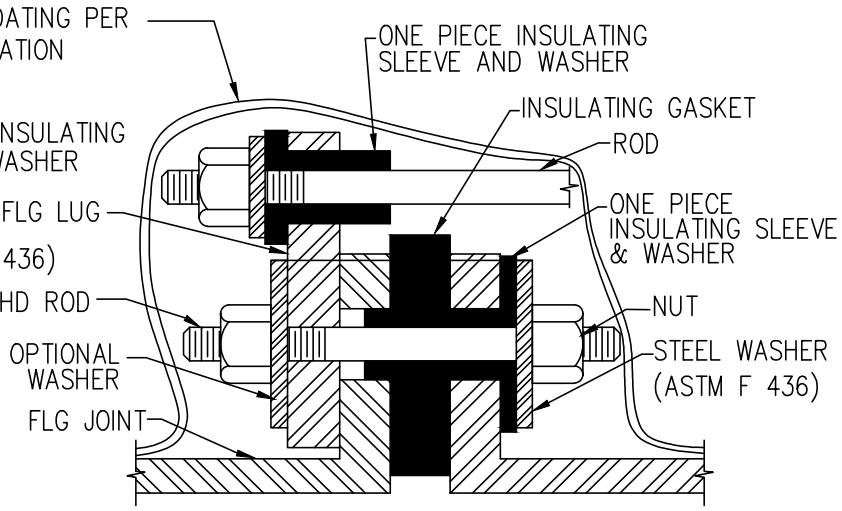
1. DISTRICT MUST BE NOTIFIED AT LEAST 24 HOURS BEFORE TAPPING
2. A TOWN REPRESENTATIVE MUST BE ONSITE DURING TAPPING.

SCALE: NTS

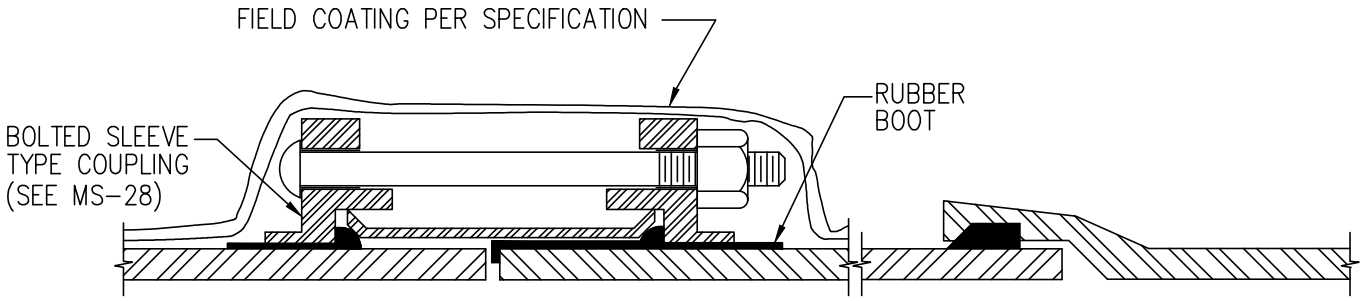
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.25
	TAPPING TEE AND VALVE	DATE: 12/2020



INSULATED JOINT



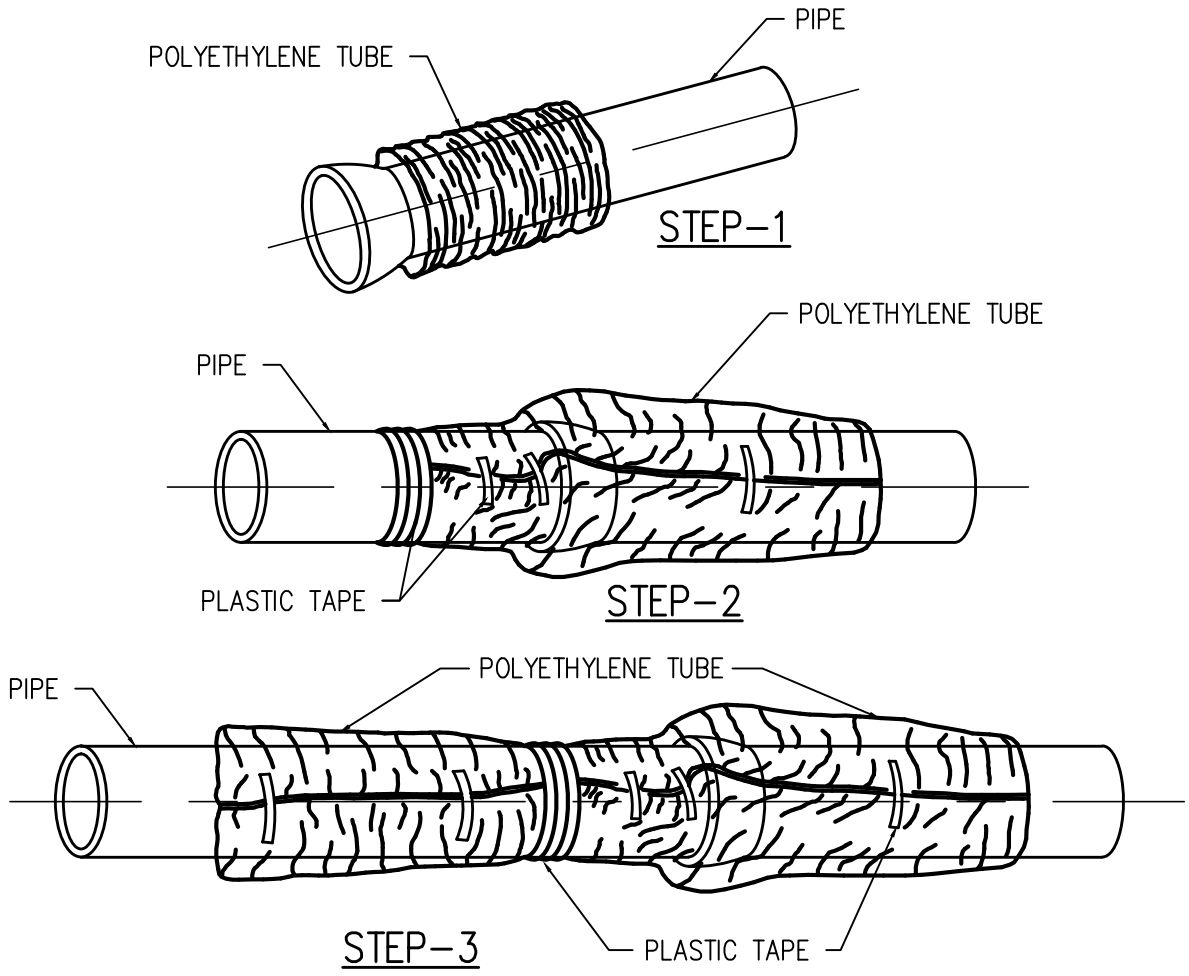
INSULATED ROD



INSULATED BOLTED SLEEVE TYPE COUPLING

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA WATER DETAILS	D5.26
	INSULATED JOINT, ROD, AND COUPLING	DATE: 12/2020



FIELD INSTALLATION–POLYETHYLENE WRAP

STEP–1 PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH

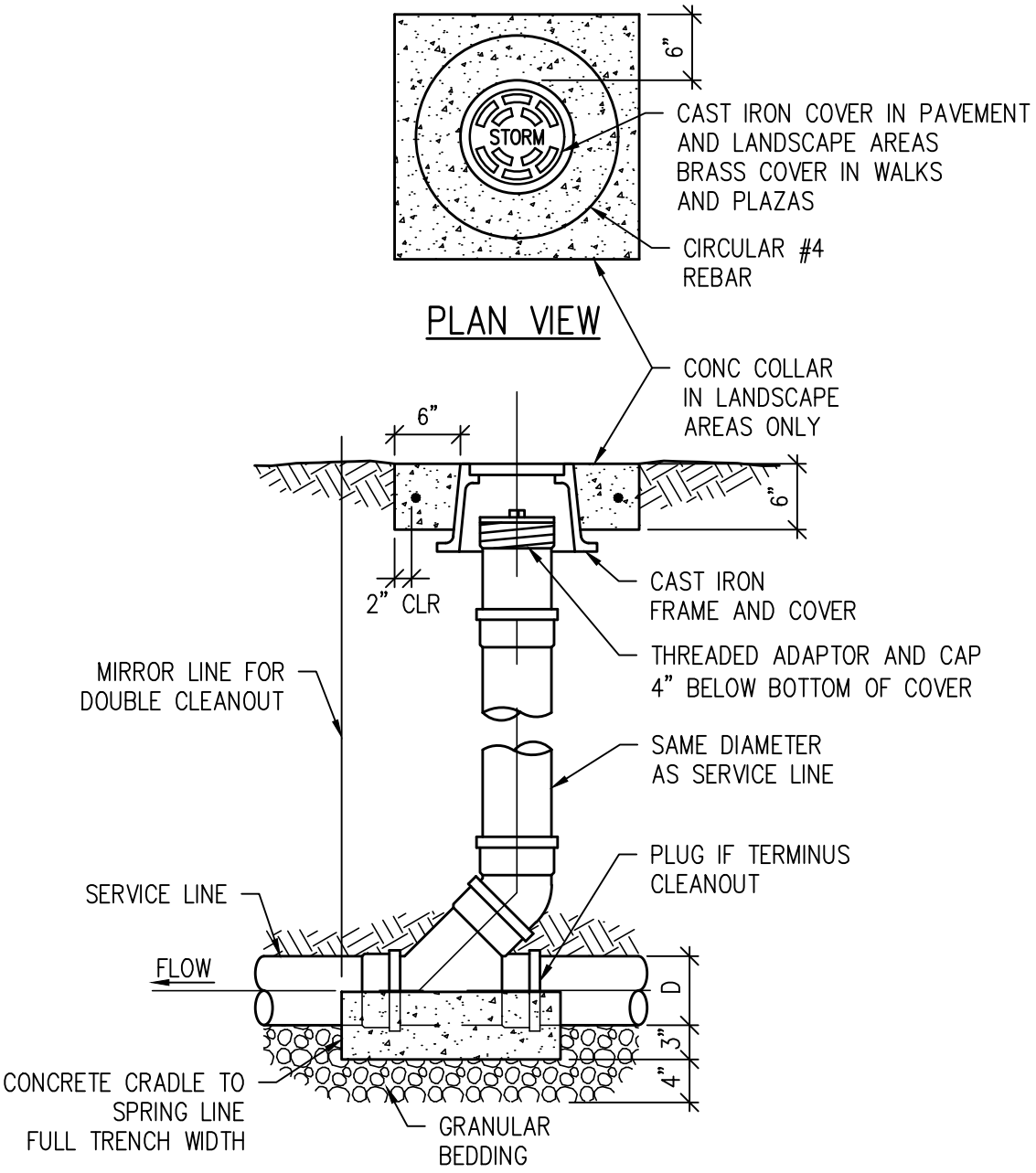
STEP–2 PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO–INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END

STEP–3 ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL AND SHOULD BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FOOT INTERVALS

NOTE:

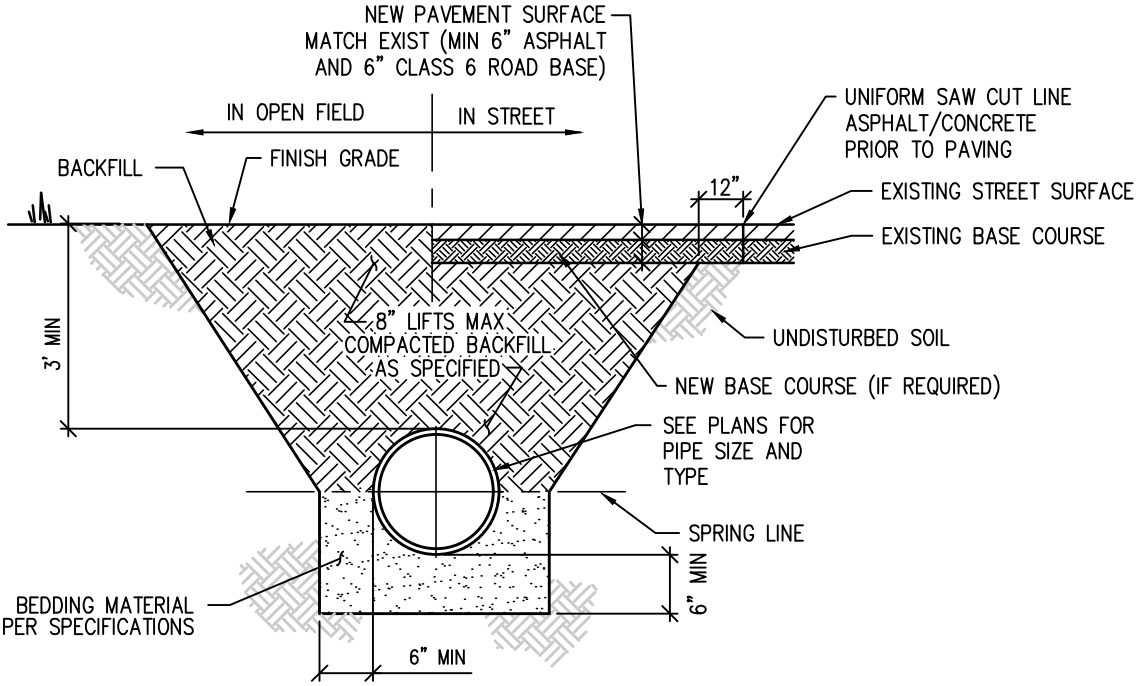
1. ALL RODDING TO BE ENCASED IN POLYETHYLENE SEPARATED FROM THE PIPE

SCALE: NTS

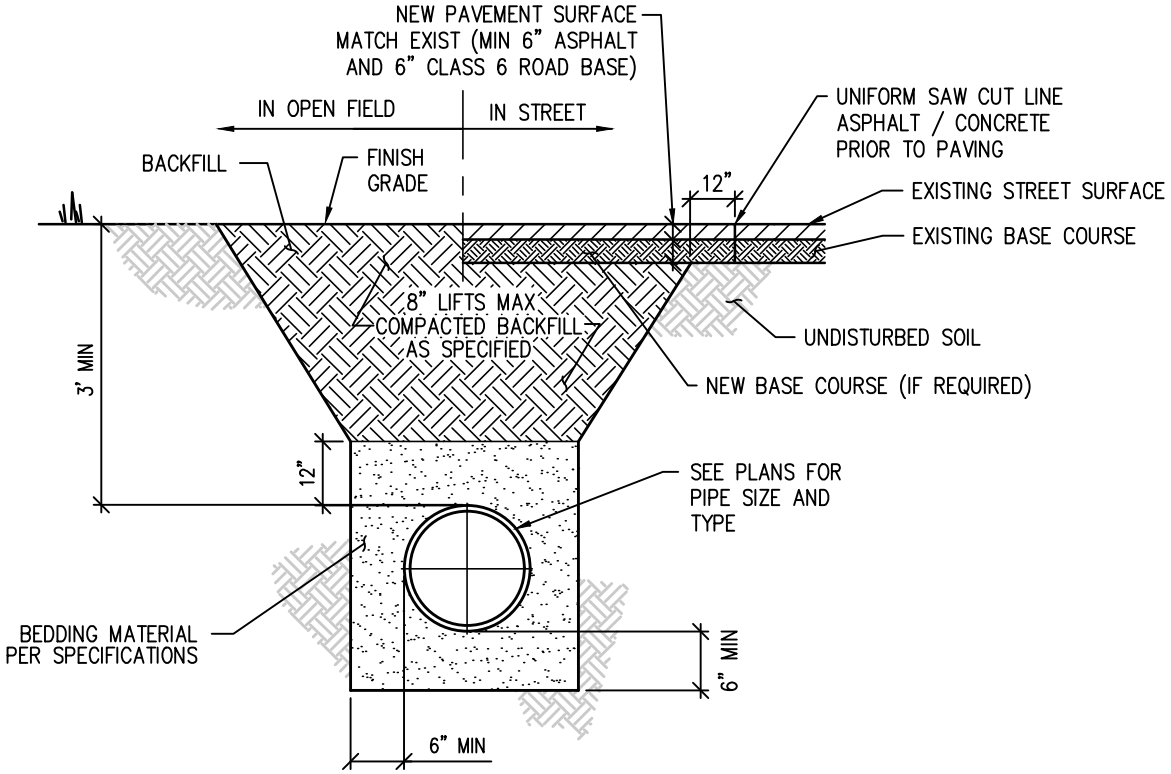


SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.01
	STORM CLEANOUT	DATE: 12/2020



REINFORCED CONCRETE PIPE



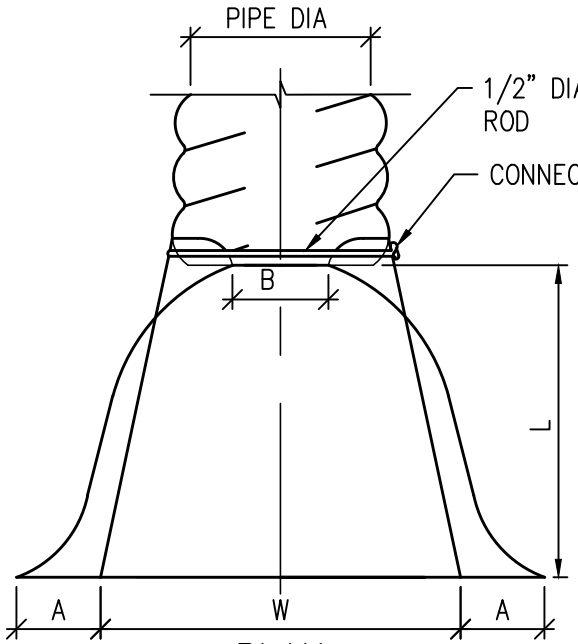
CMP/PVC/HDPE PIPE

NOTES:

1. IF UNSTABLE MATERIALS ARE FOUND IN TRENCH, OVEREXCAVATE PER SPECIFICATIONS OR AS REQUIRED.
2. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND THE PROTECTION OF OTHER UTILITIES.

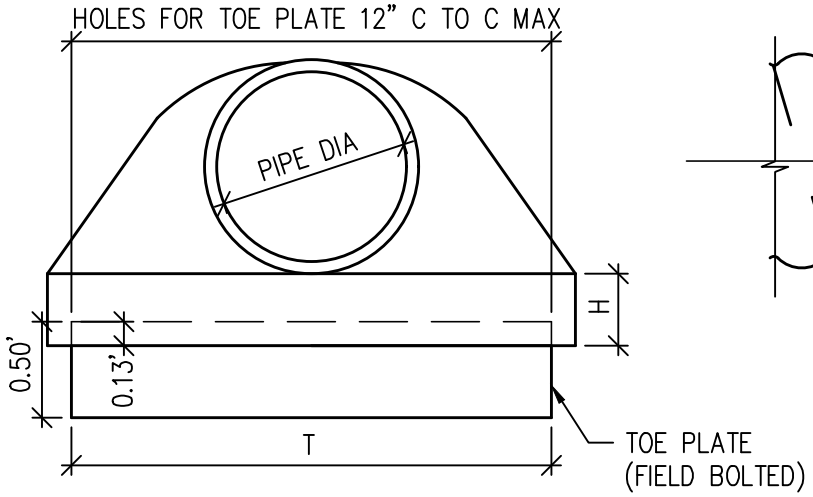
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.02
	STORM SEWER BEDDING DETAIL	DATE: 12/2020

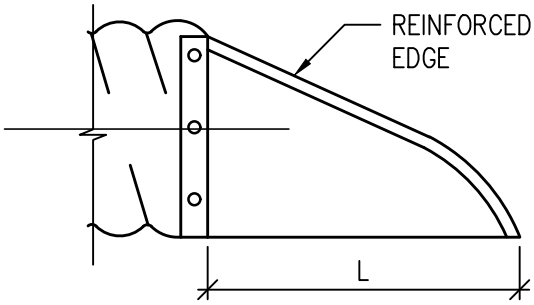


PLAN

PIPE DIA	GAUGE	A	B	H	L	W	T
6"	18	4"	1"	3"	8"	12"	20"
8"	18	5"	5"	4"	14"	16"	27"
10"	18	7"	6"	6"	14"	20"	35"
12"	16	6"	6"	6"	21"	24"	36"
15"	16	7"	8"	6"	26"	30"	44"
18"	16	8"	10"	6"	31"	36"	52"
21"	16	9"	12"	6"	36"	42"	60"
24"	16	10"	13"	6"	41	48"	68"



ELEVATION



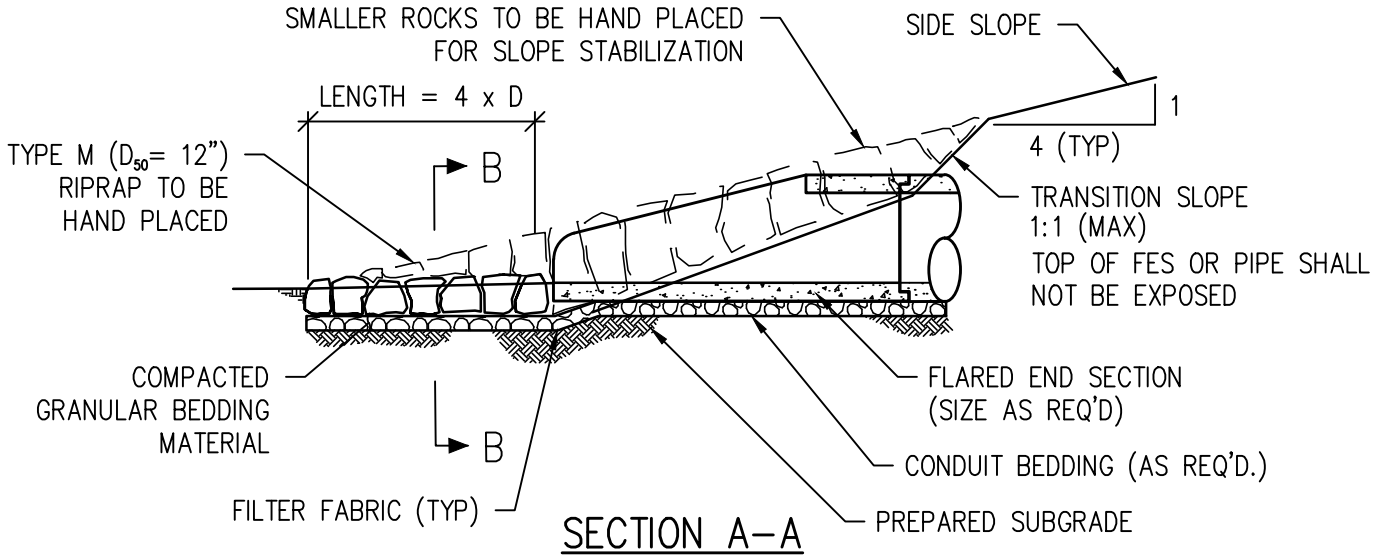
PROFILE

NOTES:

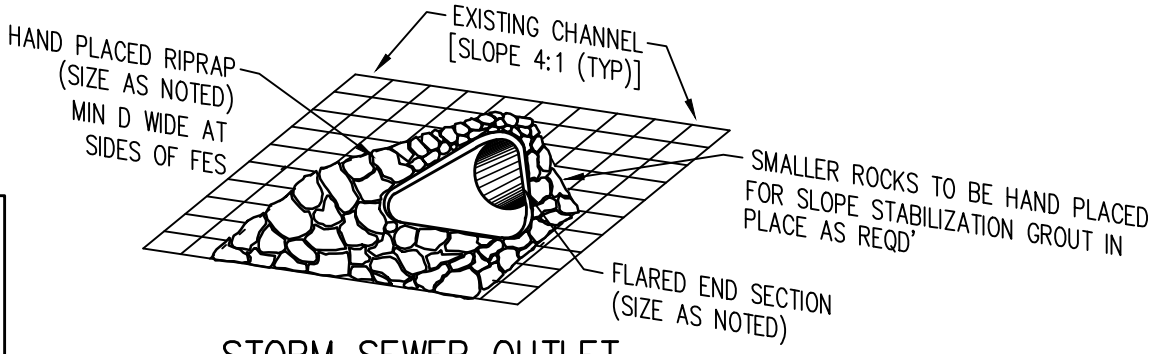
1. SEE DETAIL D6.04 FOR RIPRAP APRON SIZING AND PLACEMENT

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.03
	CMP TYPE 1 FLARED END SECTION	DATE: 12/2020



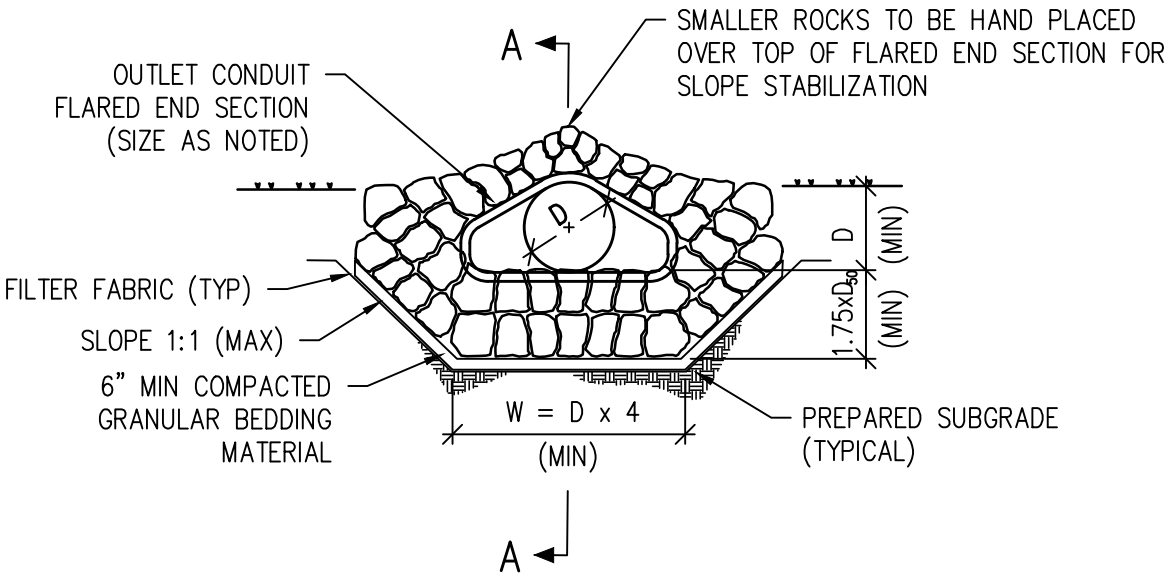
SECTION A–A



STORM SEWER OUTLET
ISOMETRIC VIEW

RIPRAP SIZING

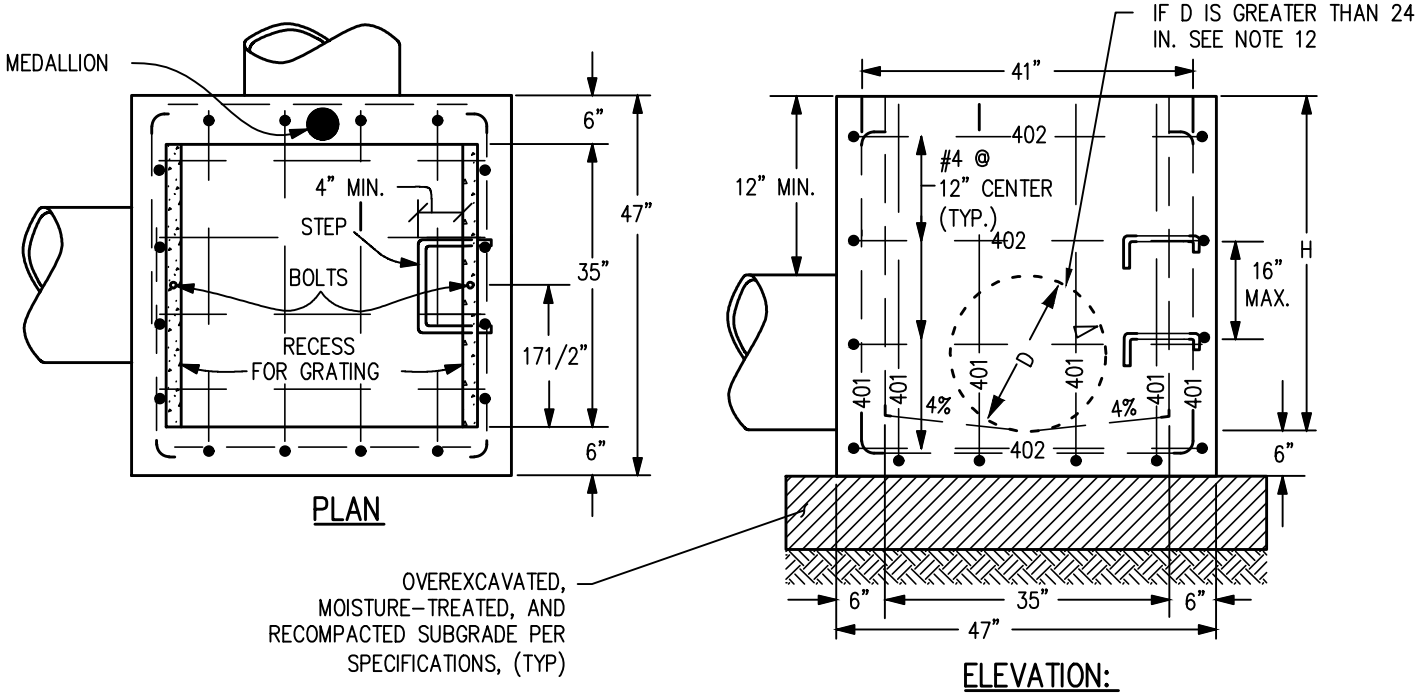
TYPE VL D50=6"
TYPE L D50=9"
TYPE M D50=12"
TYPE H D50=18"
TYPE VH D50=24"



SECTION B–B

SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS		D6.04
RIPRAP APRON SIZING & PLACEMENT AT FLARED END SECTION		DATE: 12/2020

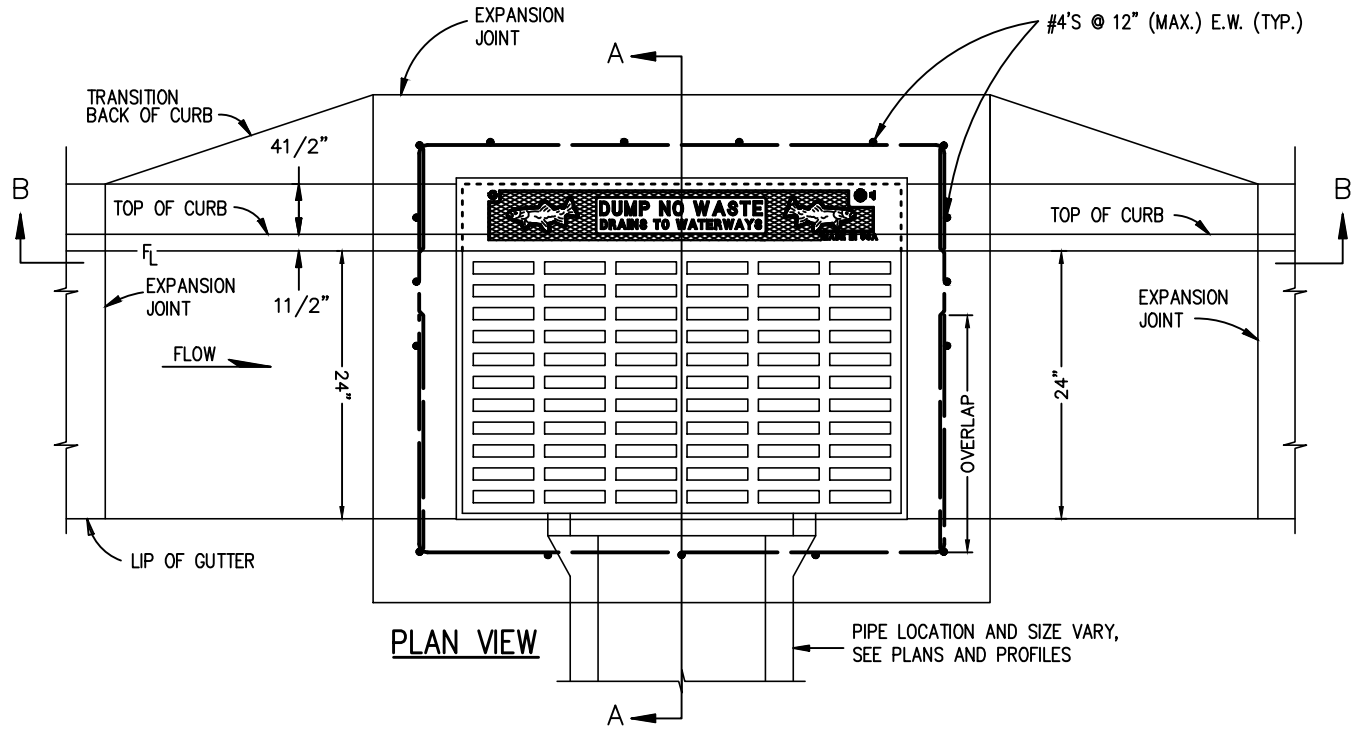


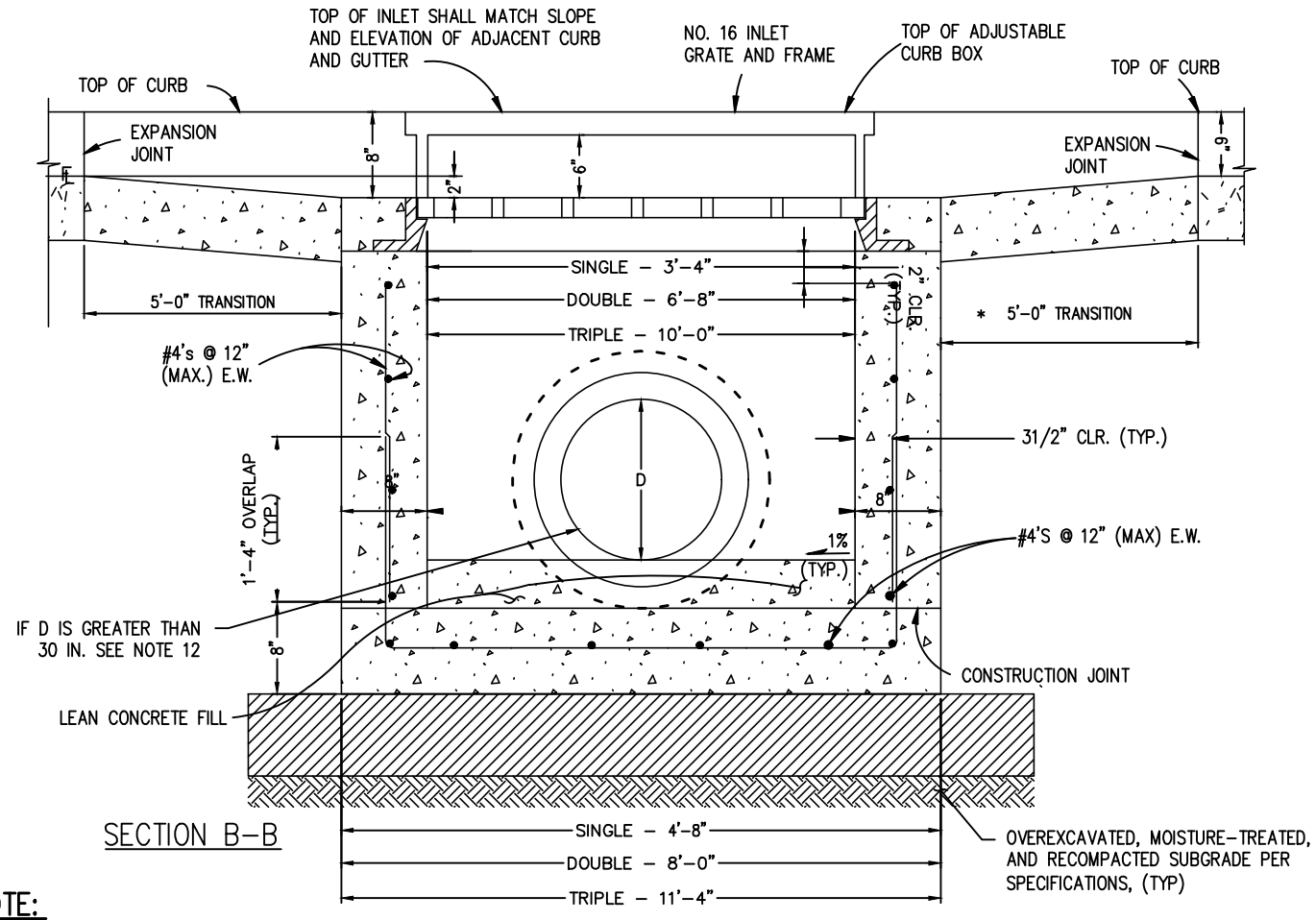
NOTES:

1. INLET TYPE C IS NOT HS-20 RATED AND SHALL NOT BE PLACED IN PAVED ROADWAYS. THIS INLET SHALL BE USED ONLY OUTSIDE PAVED ROADWAYS.
2. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
3. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A MINIMUM 2 IN. CLEARANCE. CUT OR BEND AROUND PIPES AS REQUIRED
4. CONCRETE SLOPE AND DITCH PAVING SHALL BE IN ACCORDANCE WITH CDOT SECTION 507. REINFORCEMENT FOR CONCRETE SLOPE PAVING SHALL BE 6 X 6 – W1.4 X W1.4 OR 6 X 6 – W2.1 X W2.1.
5. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED, AND SHALL BE IN ACCORDANCE WITH CDOT SUBSECTION 712.06
6. THE STANDARD INLET GRATES SHALL BE USED ON ALL TYPE C INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS
7. CLOSE MESH GRATES ARE RECOMMENDED WHERE FOOT TRAFFIC OR BICYCLE ROUTES ARE IN CLOSE PROXIMITY TO GRATE. THIS GRATE IS NOT ADA COMPLIANT OR BICYCLE FRIENDLY AND SHALL NOT BE PLACED DIRECTLY IN SIDEWALKS, CROSSWALKS OR BIKE PATHS.
8. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT. – 6 IN., AND SHALL CONFORM TO AASHTO M 199.
9. ALL INLETS SHALL HAVE A 4 IN. DIA. METAL MEDALLION WITH A "NO DUMPING DRAINS TO WATERWAYS" MESSAGE ON IT. THE MEDALLION SHALL HAVE A FISH 9. SYMBOL WITH A BLUE BACKGROUND. IT SHALL BE FIRMLY ATTACHED TO THE TOP OF THE INLET WITH A PERMANENT FASTENER.
10. SEE PLANS FOR SIZE AND LOCATION OF PIPE
11. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAIL M-604-10
12. ALL CONNECTED PIPES WITH A DIAMETER (D) GREATER THAN 24" AND/OR ENTERING AT AN ANGLE GREATER THAN 80° A CUSTOM CONC BOX MUST BE CONSTRUCTED. CONTRACTOR TO COORDINATE BOX DIMENSIONS AND SPECS WITH MANUFACTURER.

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.05
	TYPE C INLET	DATE: 12/2020



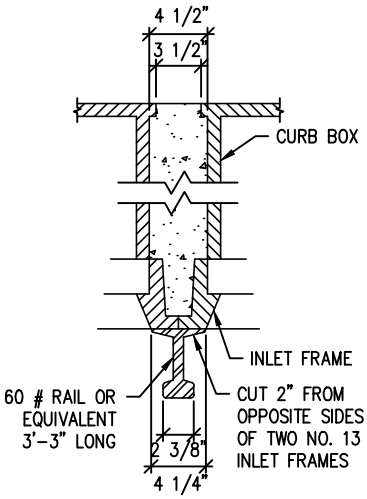


NOTE:

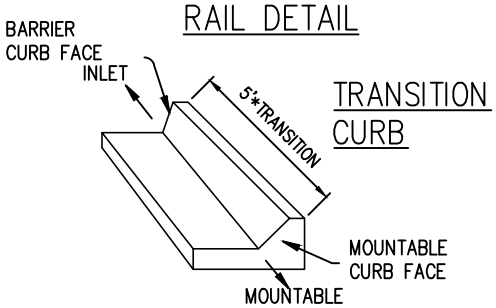
1. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAILS

SCALE: NTS

TOWN OF BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.06A
	COMBINATION INLET (1 OF 2)	DATE: 12/2020



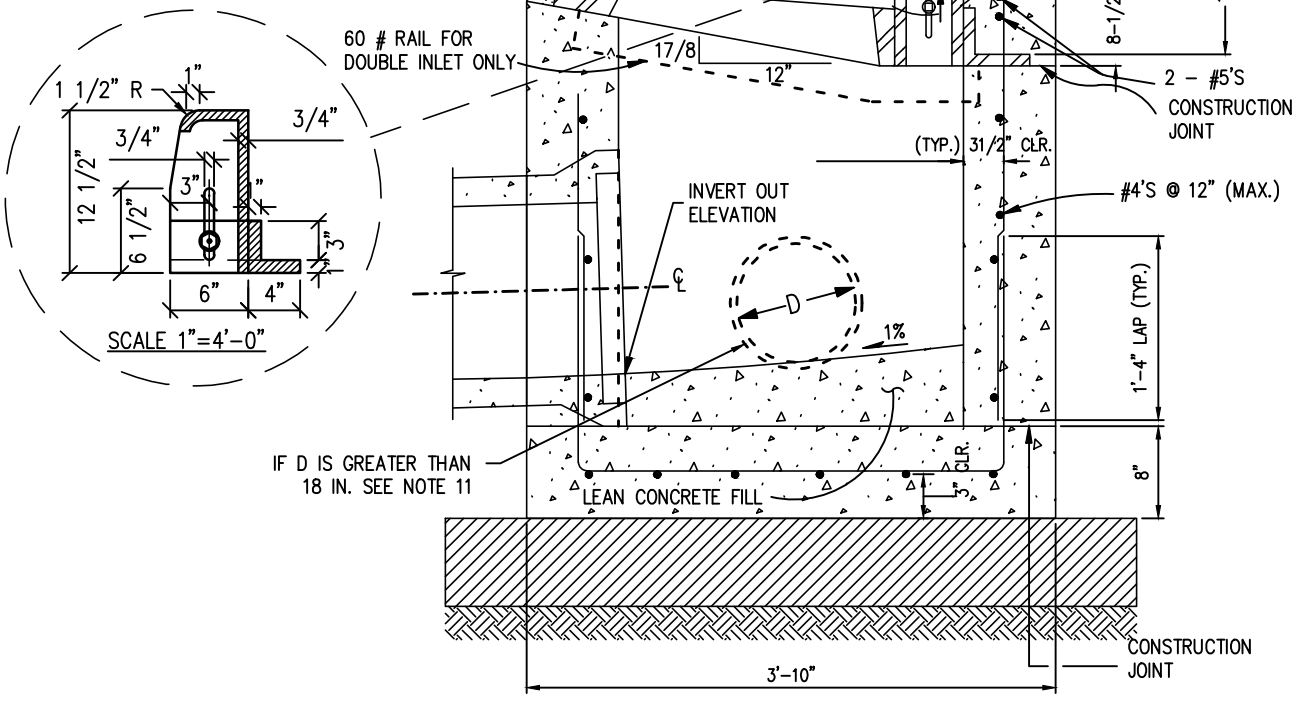
RAIL DETAIL



TRANSITION CURB

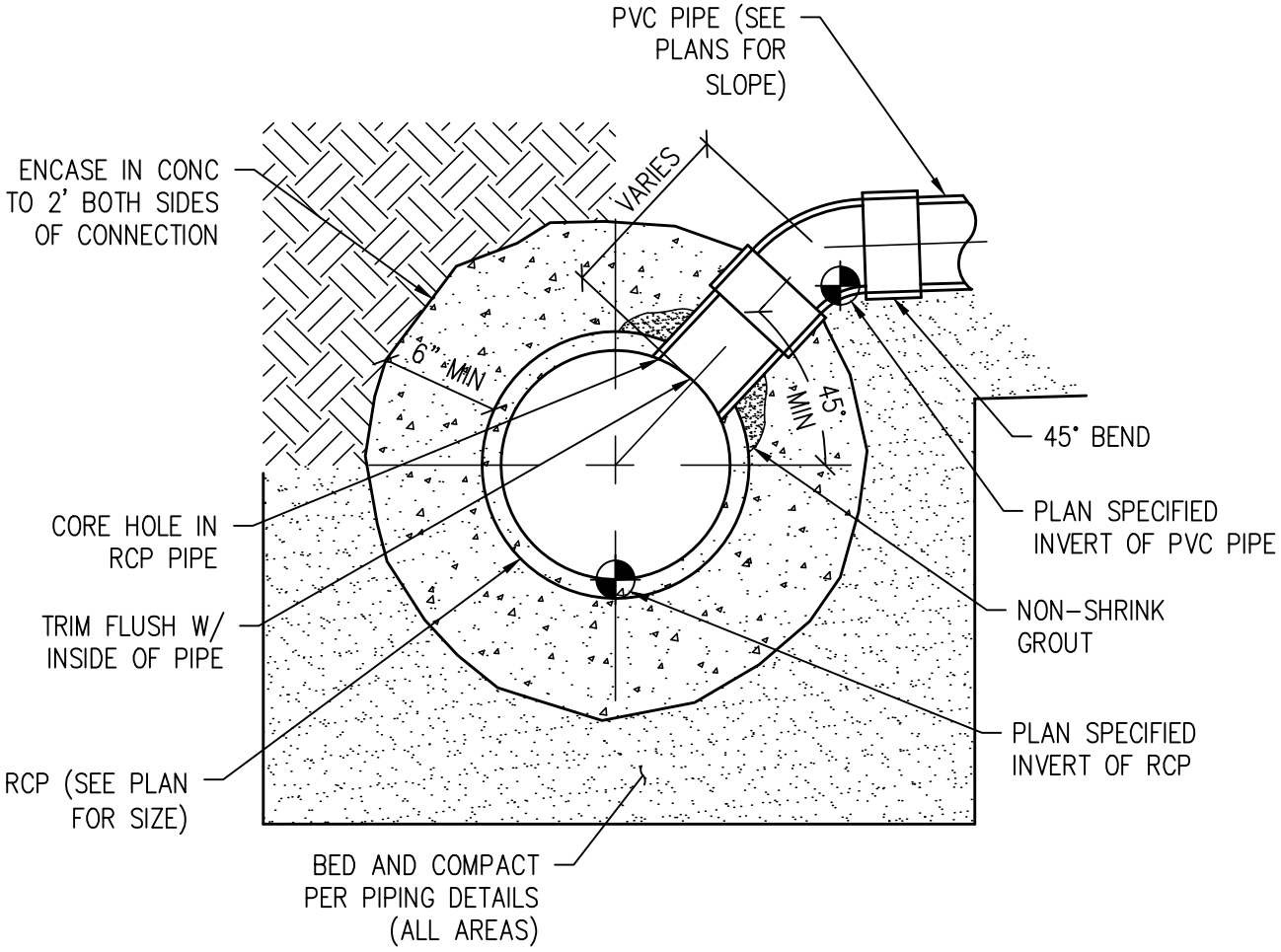
NOTES:

1. ALL CASTING SHALL CONFORM TO ASTM A-48(C1 35b) WITH A MINIMUM STRENGTH OF 35 ksi.
2. ALL CASTINGS SHALL BE HEAVY DUTY, AND CAPABLE OF WITHSTANDING AASHTO H20 LOADING.
3. FLOOR SLOPE MAY BE POURED MONOLITHIC WITH BASE.
4. ALL REINFORCING STEEL SHALL BE ASTM, A-615, GRADE 60 DEFORMED BARS. DIAMETER OF BEND MEASURED ON THE INSIDE OF THE BAR SHALL BE A MINIMUM OF 6 BAR DIAMETER. 5. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT. 6. CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 4000 PSI.
7. SUBGRADE SHALL HAVE A GRADATION EQUAL TO CLASS B BEDDING COMPACTED TO 100% MAXIMUM DRY DENSITY, AASHTO T-99. 8. NO FORM WORK SHALL REMAIN INSIDE STRUCTURE WHEN COMPLETE.
9. INLET WALLS SHALL BE FORMED BOTH INSIDE AND OUTSIDE. CASTING OF SIDEWALLS AGAINST EARTH IS NOT PERMITTED. 10. LEAN CONCRETE FILL TO BE f' = 2000 PSI.
11. ALL CONNECTED PIPES WITH A DIAMETER (D) GREATER THAN 30" FRONT AND 18" SIDE AND/OR ENTERING AT AN ANGLE GREATER THAN 80° A CUSTOM CONC BOX MUST BE CONSTRUCTED. CONTRACTOR TO COORDINATE BOX DIMENSIONS AND SPECS WITH MANUFACTURER.
12. USE RAIL FOR MULTIPLE INLET CONNECTION
13. WHEN THE SPECIAL INLET IS USED WITH MOUNTABLE CURB AND GUTTER, 5 FT. TRANSITION SHALL BE CONSTRUCTED. TRANSITION SHALL B E PAID FOR AS CURB AND GUTTER.
14. FOR FULL DETAIL INCLUDING BAR LIST. DIMENSIONS AND QTY. TABLE SEE CDOT DETAILS



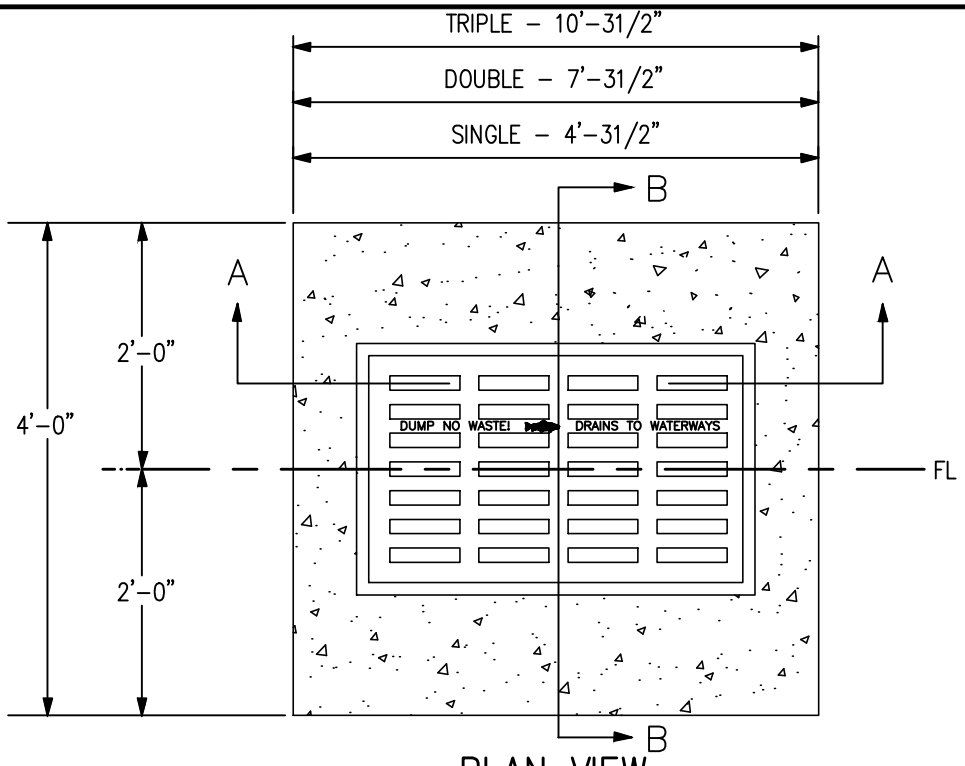
SECTION A-A

SCALE: NTS

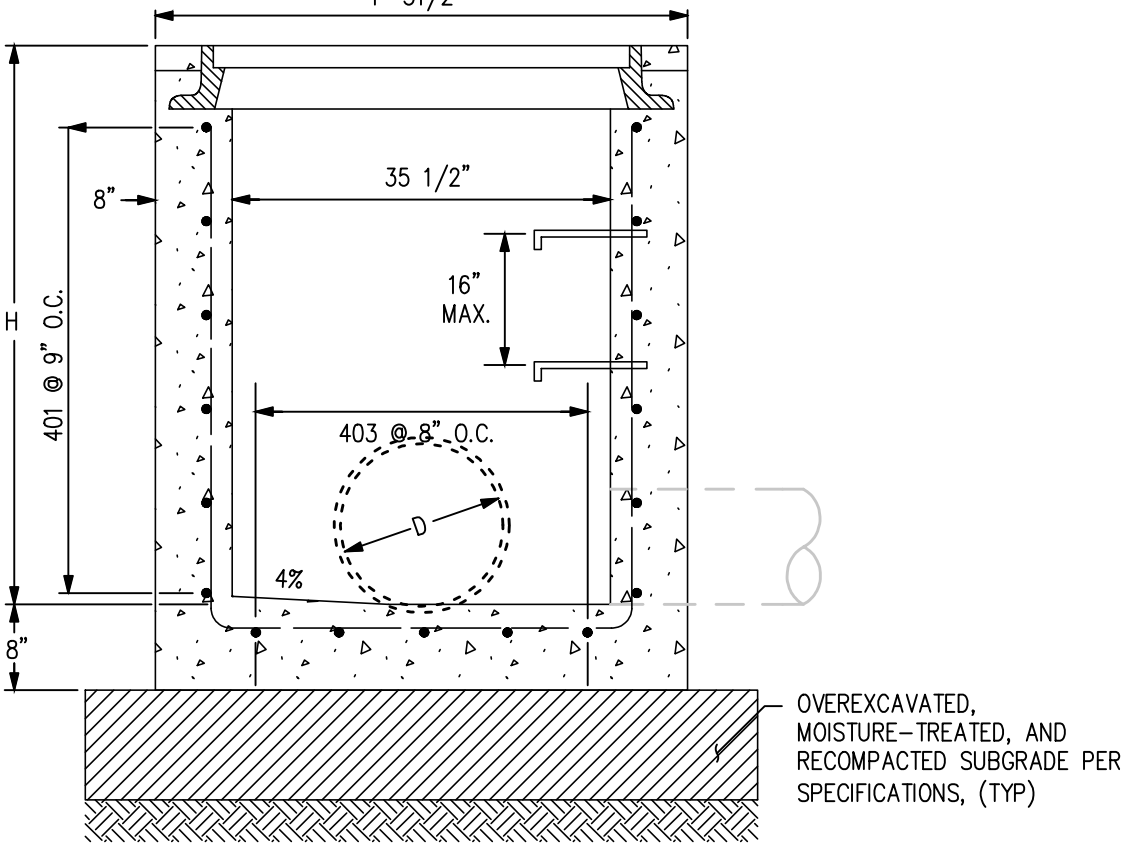


SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.07
	DIRECT CONNECTION RCP TO PVC CONNECTION	DATE: 12/2020



PLAN VIEW



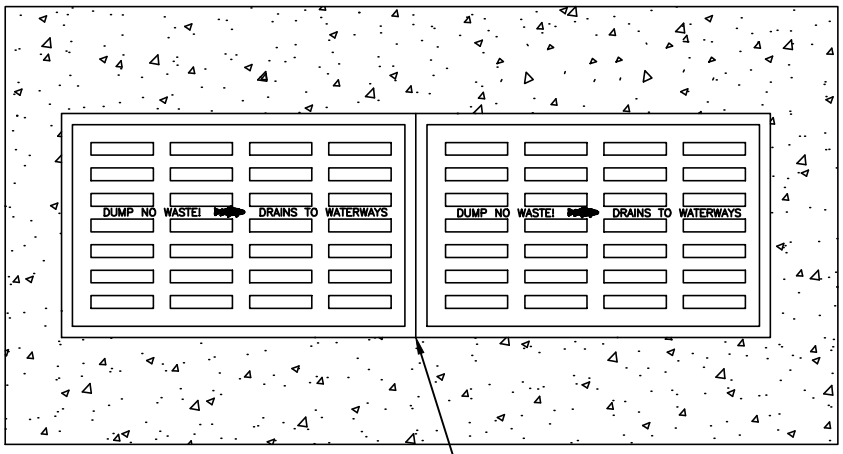
SECTION A–A

NOTES:

1. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAILS

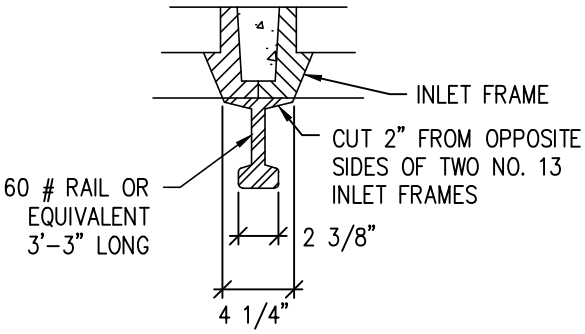
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.08A
	VALLEY INLET (CDOT TYPE 13) (1 OF 2)	DATE: 12/2020

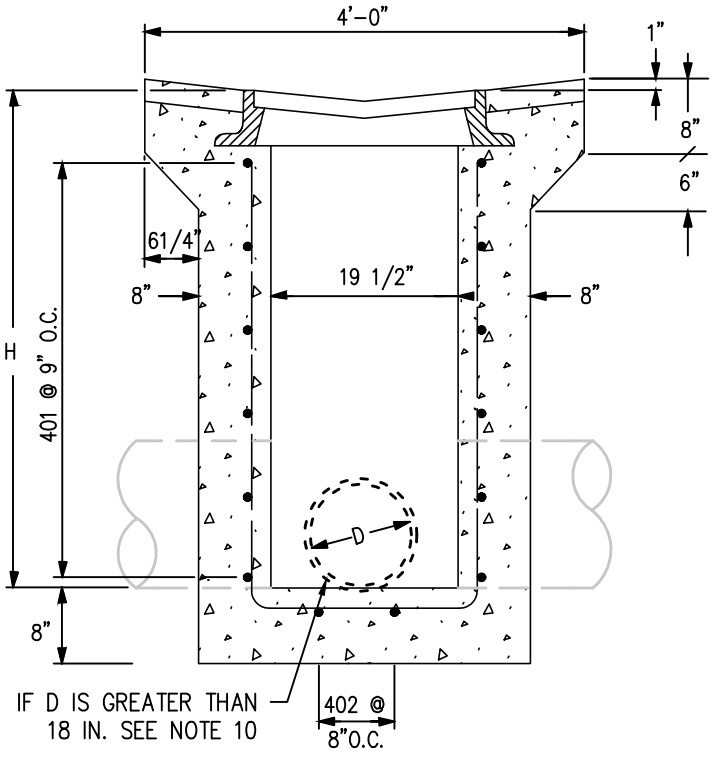


PLAN VIEW

USE RAIL FOR MULTIPLE INLET CONNECTION



RAIL DETAIL



SECTION B-B

NOTES:

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
2. CAST-IN-PLACE CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES.
3. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN.
4. REINFORCING BARS SHALL BE DEFORMED #4 AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.-6 IN. AND SHALL CONFORM TO AASHTO M 199.
6. ALL GRATES AND FRAMES SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06. GRATES AND FRAMES SHALL BE DESIGNED TO WITHSTAND HS 20 LOADING.
7. STATION POINT IS AT THE CENTER OF THE INLET.
8. GRATE SHALL HAVE "DUMP NO WASTE DRAINS TO STREAM" MESSAGE CAST ON SURFACE.
9. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAIL M-604-13
10. ALL CONNECTED PIPES WITH A DIAMETER (D) GREATER THAN 30" FRONT AND 18" SIDE AND/OR ENTERING AT AN ANGLE GREATER THAN 80° A CUSTOM CONC BOX MUST BE CONSTRUCTED. CONTRACTOR TO COORDINATE BOX DIMENSIONS AND SPECS WITH MANUFACTURER.
11. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAILS

SCALE: NTS

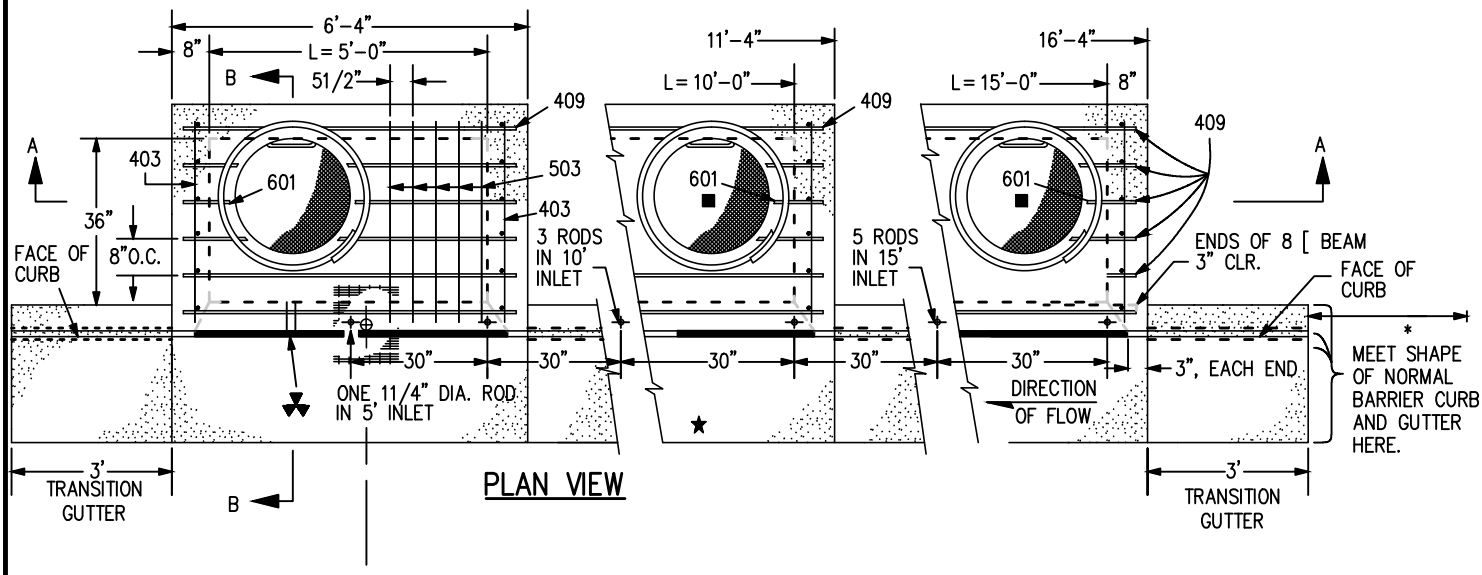
TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
STORM SEWER DETAILS

VALLEY INLET (CDOT TYPE 13) (2 OF 2)

D6.08B

DATE: 12/2020

★ FOR LENGTH (L) 10 FT. OR MORE, PROVIDE MAINTENANCE ACCESS AT BOTH ENDS WITH AN ADDITIONAL MANHOLE RING AND COVER. CUT REINFORCEMENT BAR ACCORDINGLY.

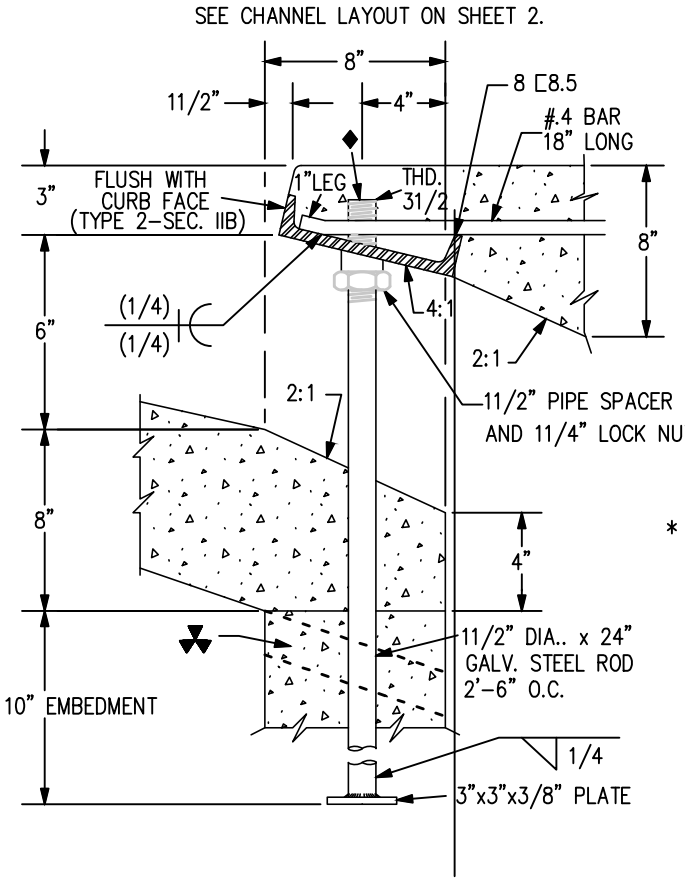


NOTES:

1. USE OF A TYPE R INLET MUST BE APPROVED BY THE TOWN.
2. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
3. CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 IN. THICK.
4. INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
5. CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING. 5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
6. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
7. DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
8. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
9. SINCE PIPE ENTRIES INTO THE INLET ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK. QUANTITIES INCLUDE VOLUMES OCCUPIED BY PIPES.
10. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
11. ALL MANHOLE COVERS SHALL BE CAST WITH A "NO DUMPING DRAINS TO STREAM" MESSAGE AND A FISH SYMBOL. THE SURFACE OF THE MANHOLE COVER SHALL HAVE A NON-SLIP PATTERN.
12. FOR FULL DETAIL INCLUDING BAR LIST AND DIMENSION TABLE, SEE CDOT DETAIL M-604-12 SHEETS 1 AND 2

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.09A
	TYPE R CURB INLET (1 OF 3)	DATE: 12/2020

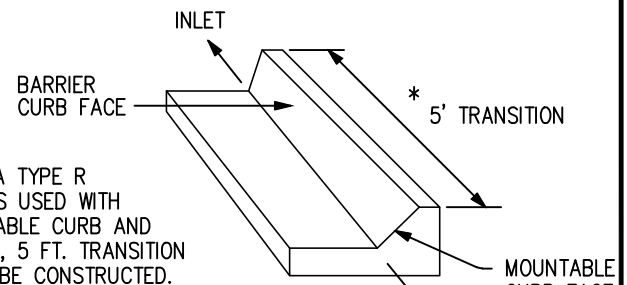


CURB FACE ASSEMBLY

◆PLACE ENTIRE ASSEMBLY BEFORE POURING CONCRETE.

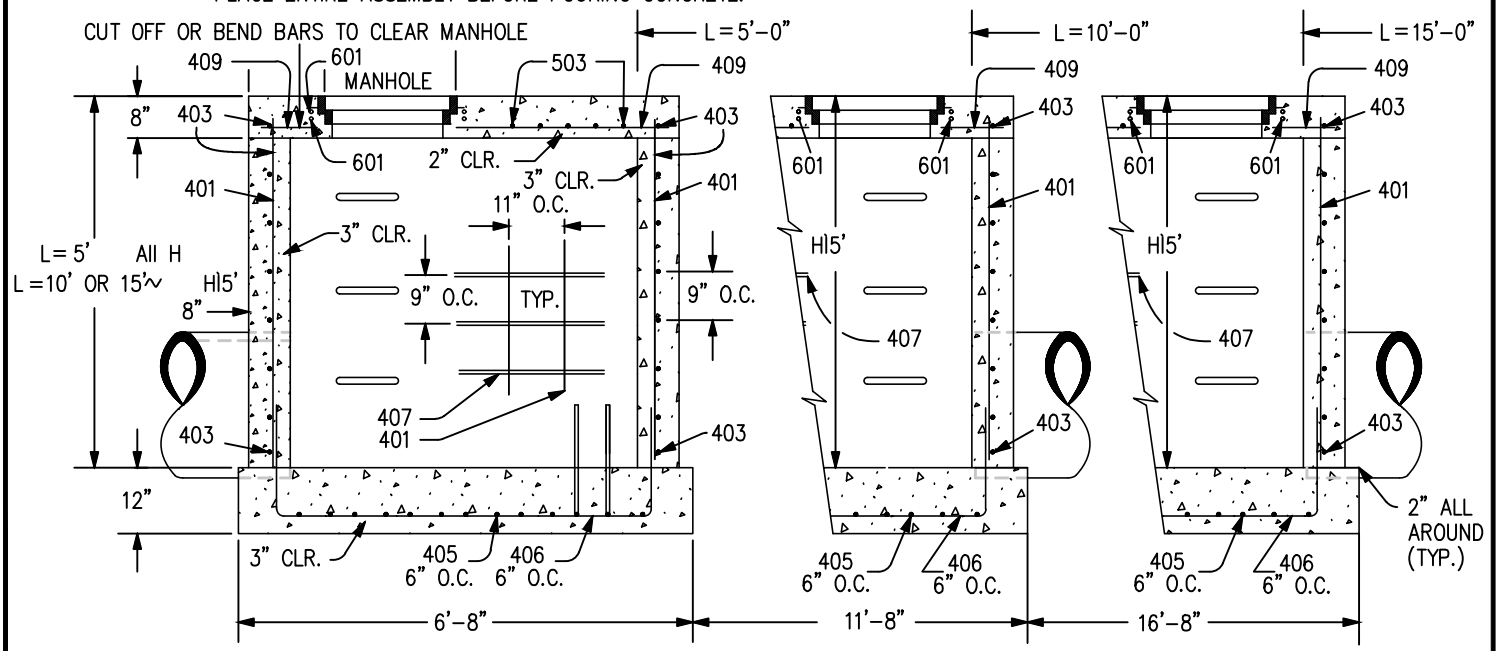
NOTE:

1. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAILS



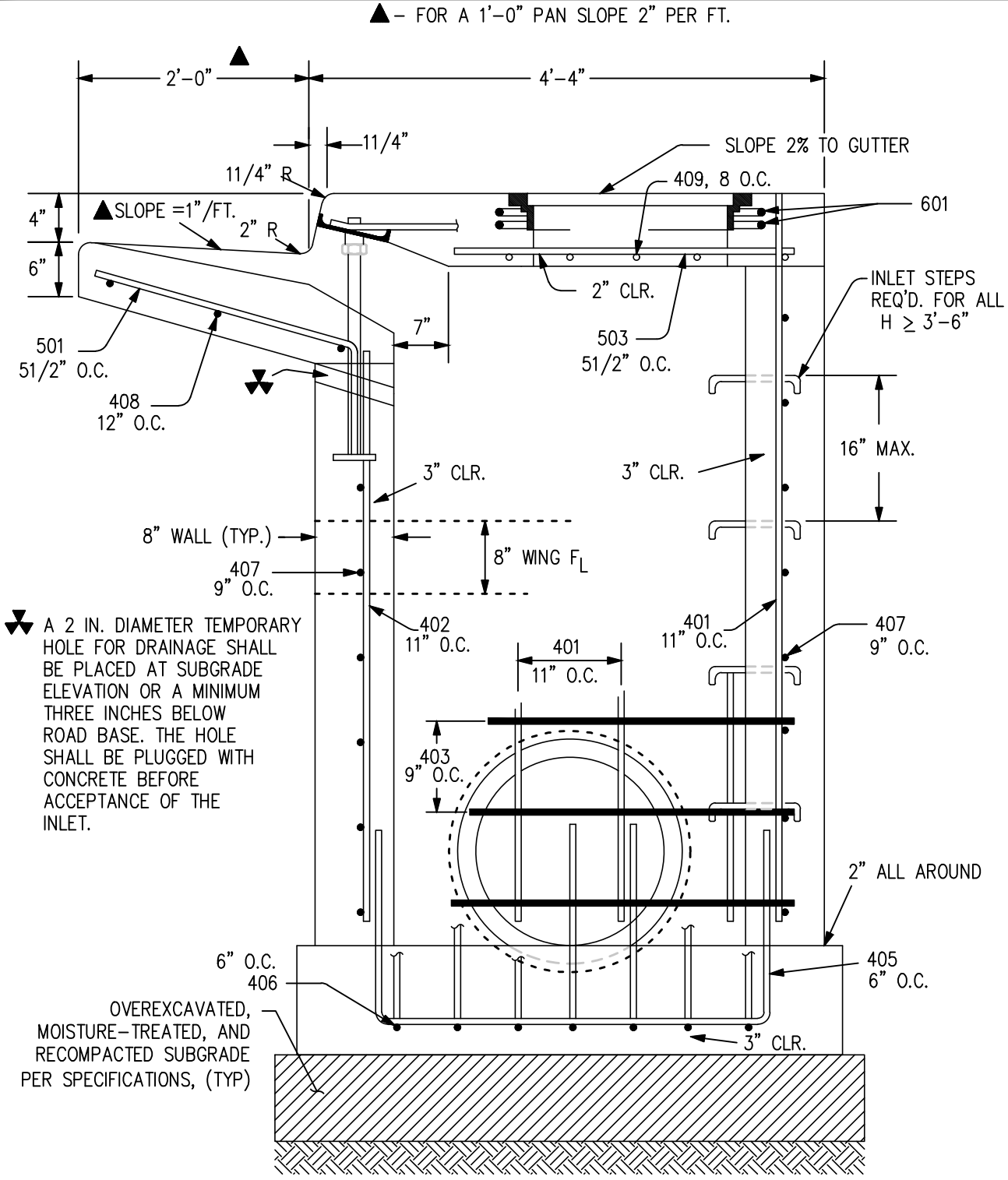
* WHEN A TYPE R INLET IS USED WITH MOUNTABLE CURB AND GUTTER, 5 FT. TRANSITION SHALL BE CONSTRUCTED. TRANSITION SHALL BE PAID FOR AS CURB AND GUTTER.

TRANSITION CURB



SECTION A-A

SCALE: NTS



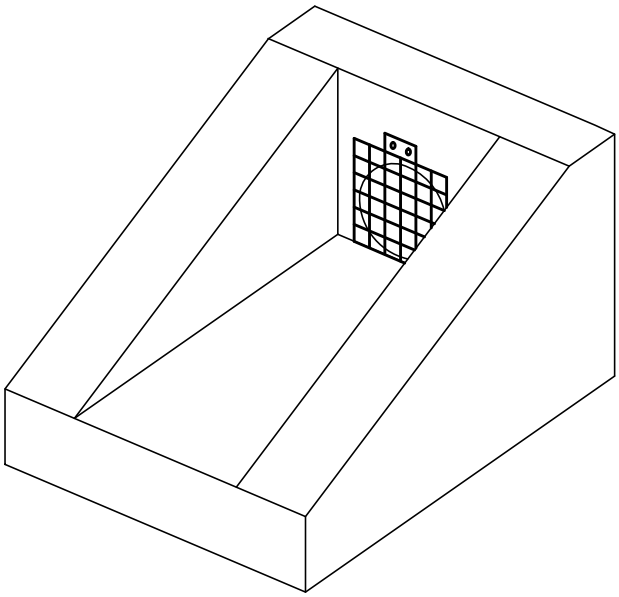
SECTION B–B – END VIEW

NOTES:

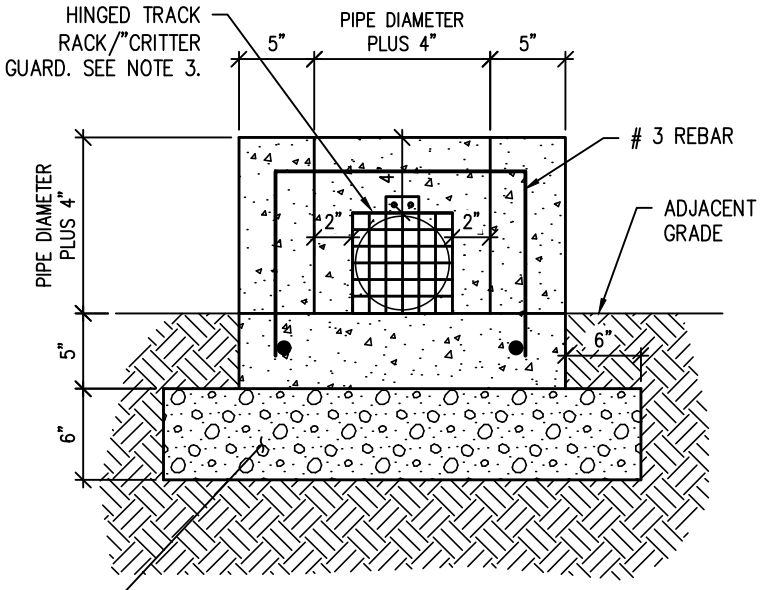
1. FOR FULL DETAIL INCLUDING BAR LIST, DIMENSIONS AND QTY. TABLE, SEE CDOT DETAILS
2. MANHOLE RING AND COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET

SCALE: NTS

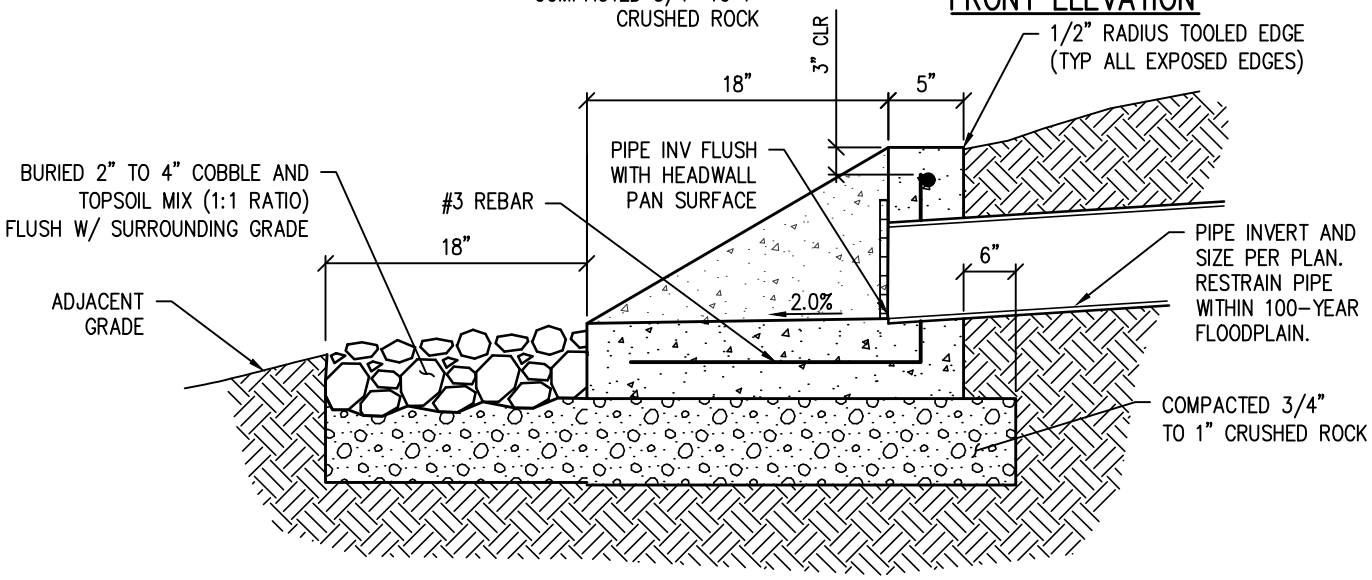
TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.09C
	TYPE R CURB INLET (3 OF 3)	DATE: 12/2020



ISOMETRIC VIEW



FRONT ELEVATION

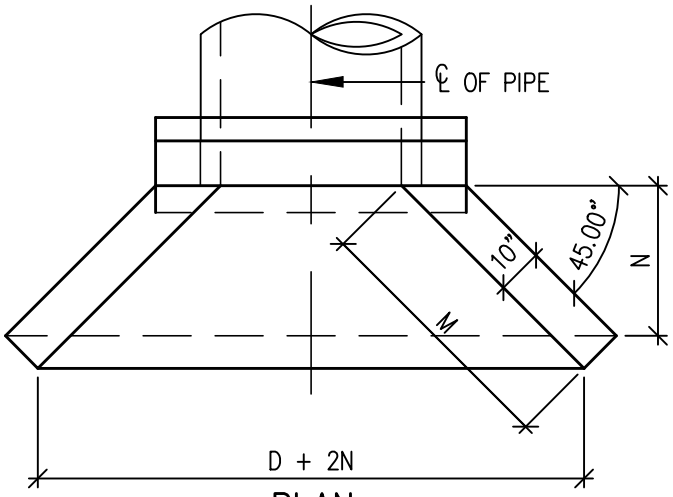


NOTES:

1. ALL CONCRETE AND BEDDING PER SPECIFICATIONS
2. INSTALL REMOVABLE, GALVANIZED STEEL, HINGED TRASH RACK WITH 2" MAX OPENINGS.
3. TRASH GUARD TO BE APPROVED BY TOWN

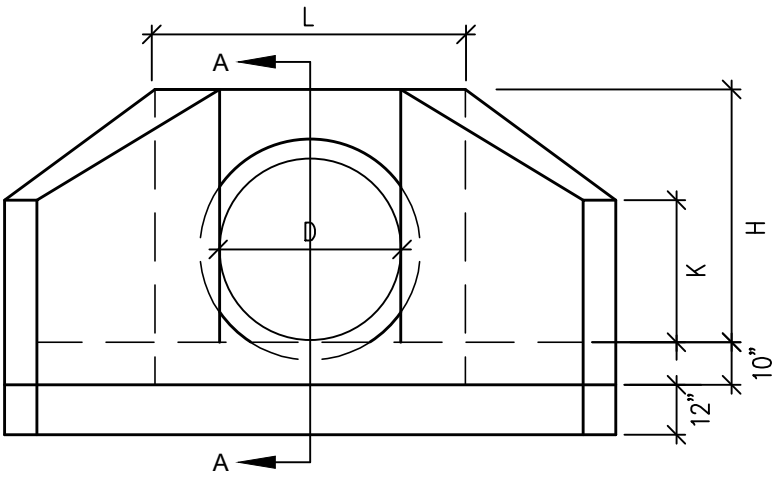
SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.10
	SMALL PIPE HEADWALL	DATE: 12/2020

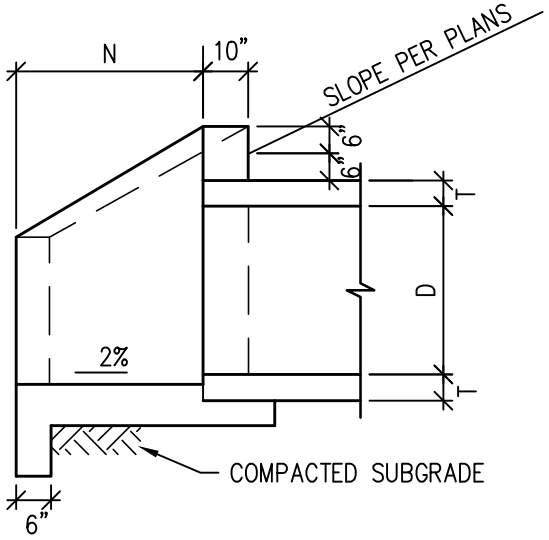


PLAN

DIMENSIONS							
D	AREA SQ FT	T	H	K	L	M	N
15"	1.23	2 1/4"	2'-5 1/4"	1'-5"	3'-7"	1'-9"	1'-3"
18"	1.77	2 1/2"	2'-8 1/2"	1'-7"	3'-10"	2'-1 1/2"	1'-6"
24"	3.14	3"	3'-3"	1'-10 1/2"	4'-4"	2'-10"	2'-0"
30"	4.91	3 1/2"	3'-9 1/2"	2'-2"	4'-10"	3'-6 1/2"	2'-6"
36"	7.07	4"	4'-4"	2'-5 1/2"	5'-4"	4'-3"	3'-0"
42"	9.62	4 1/2"	4'-10 1/2"	2'-9"	5'-10"	4'-1 1/2"	3'-6"



ELEVATION



SECTION A–A

NOTES:

1. CONCRETE SHALL BE CLASS B. CAST–IN–PLACE CONCRETE SHALL CONFORM TO ASTM C478
2. CAST–IN–PLACE CONCRETE WALL EDGES SHALL BE CHAMFERED 3/4"
3. ALL WALLS AND BASE SHALL BE REINFORCED WITH #4'S @ 12" DC EACH WAY. REINFORCING BARS SHALL BE DEFORMED AN SHALL HAVE 3" MINIMUM CLEARANCE FROM FACE OF CONCRETE.
4. DIMENSIONS AND MATERIAL REQUIREMENTS VARY DEPENDING ON APPLICATION. FOR COMPLETE DETAILS, MEASUREMENTS, MATERIALS LIST, AND OTHER FACTORS REFER TO CURRENT CDOT M7S STANDARDS

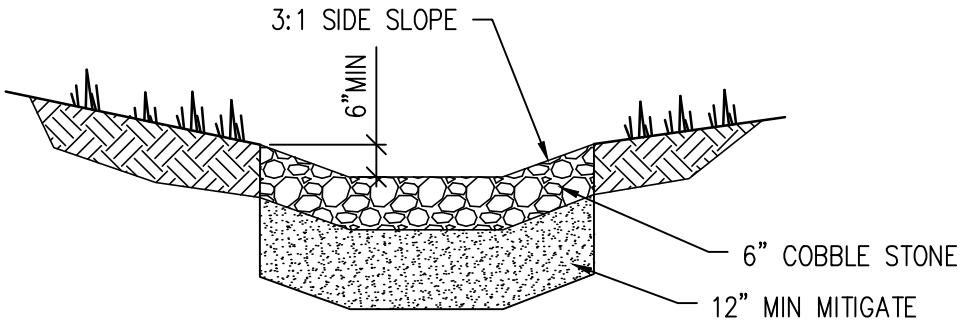
SCALE: NTS

TOWN OF BERTHOUD STANDARD DESIGN CRITERIA
STORM SEWER DETAILS

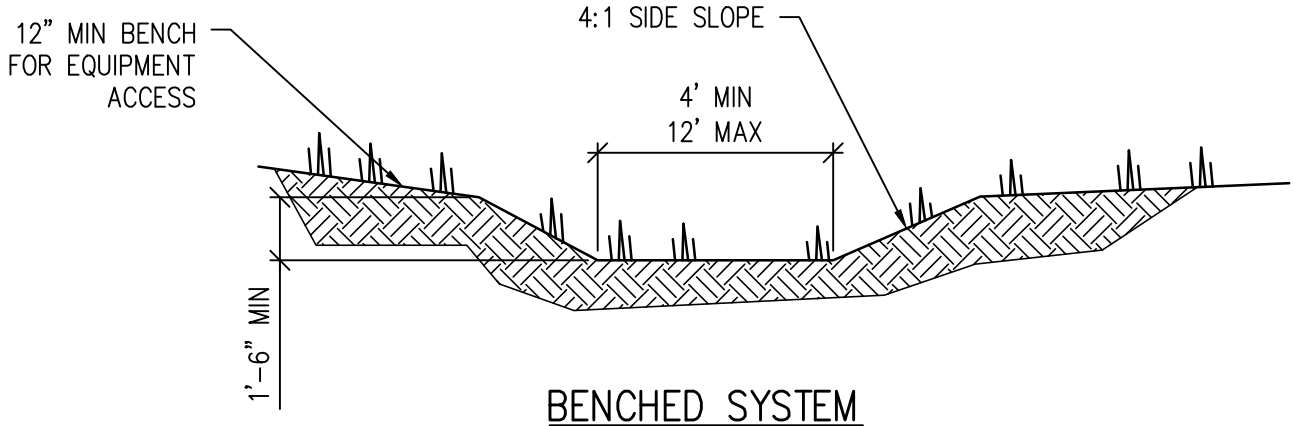
D6.11

HEADWALL WITH CIRCULAR PIPE

DATE: 12/2020



COBBLE SYSTEM



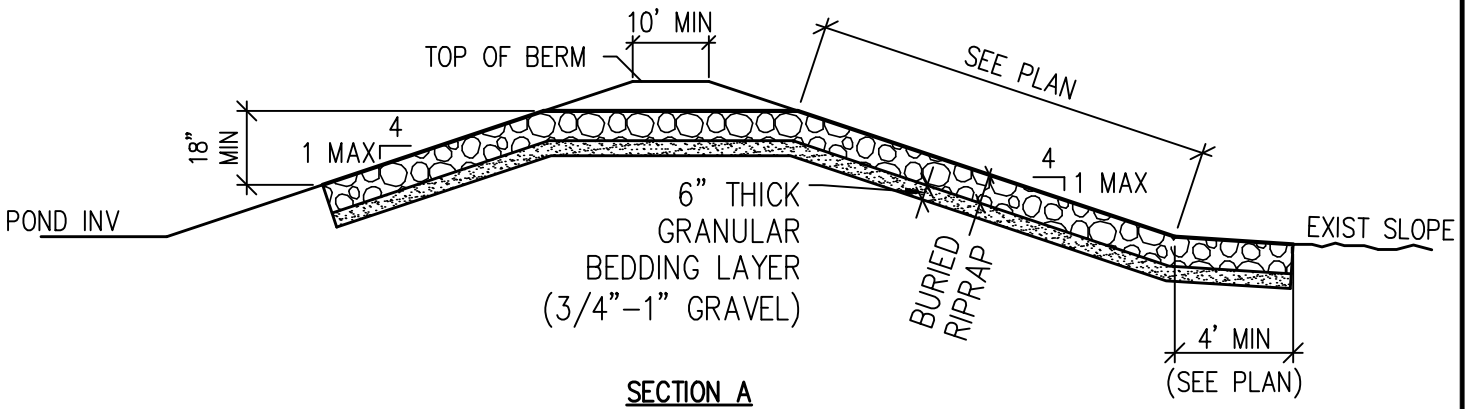
BENCHED SYSTEM

NOTES:

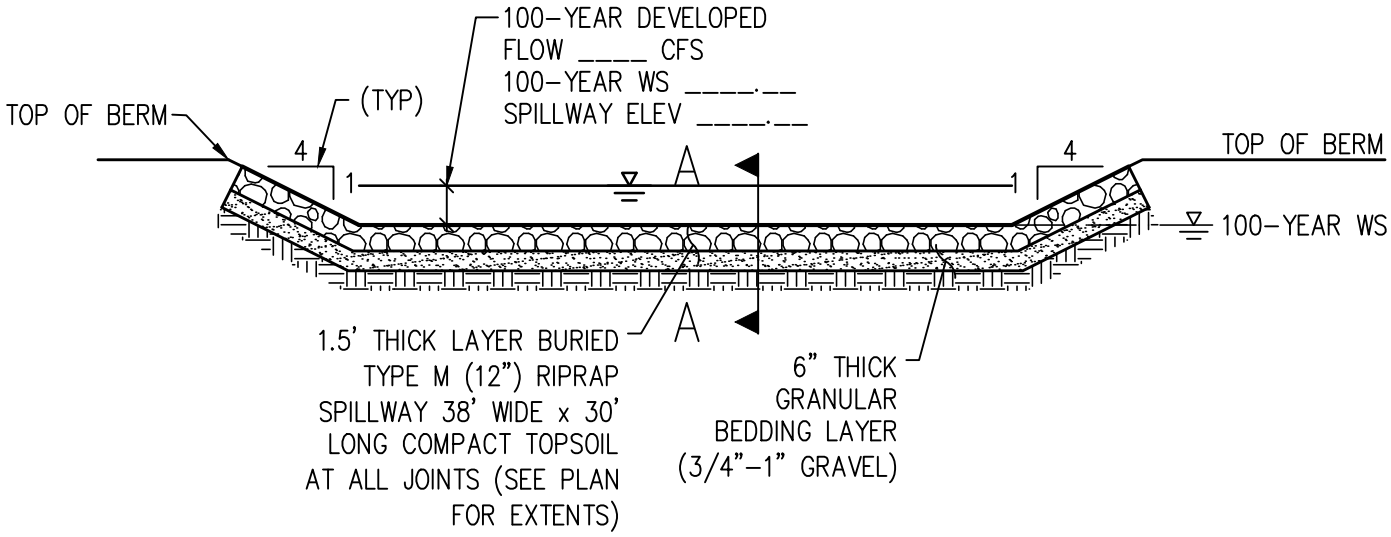
1. MITIGATED SOIL AND COBBLE AREA SHALL BE DESIGNED BY ENGINEER BASED ON ACTUAL HYDRAULIC CONDITIONS

SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.12
	LOW FLOW CHANNEL	DATE: 12/2020



SECTION A



SCALE: NTS

TOWN of BERTHOUD Est. 1888	TOWN OF BERTHOUD STANDARD DESIGN CRITERIA STORM SEWER DETAILS	D6.13
	EMERGENCY OVERFLOW	DATE: 12/2020