

Standard Construction Specifications

City of Gillette
Engineering Division
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CITY OF GILLETTE

STANDARD CONSTRUCTION SPECIFICATIONS

(2025)

PREPARED BY:

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ACKNOWLEDGEMENTS

SHAY LUNDVALL, MAYOR

CITY COUNCIL

Heidi Gross	Nathan McLeland
Jim West	Tim Carsrud
Jack Clary	Chis Smith

PUBLIC WORKS AND UTILITIES ADVISORY COMMITTEE

Adrienne Hahn - Chairman	Elizabeth Hunter
Lance Walker – Vice Chair	Terri Shugars
Zane Green	Michael Walter
Michael Oakley	Rolf Arands

CITY STAFF

Michael H. Cole	City Administrator
Ry Muzzarelli, P.E.	Development Services Director
Joe Schoen, P.E.	City Engineer

STANDARD DRAWING CHANGES FROM 2020 EDITION for 2025 EDITION		
Standard Drawing Name	Standard Drawing #	Description of Change
Move all Standard Drawings to Specs		Move all standard drawings (details) from the Design Standards to the Spec Book.
RESIDENTIAL ACCESS CONTROL AND OFFSETS	02530-02	Remove 5' offset from property line
		Added "32' or 50% of lot line dimension per the adjacent street"
COMMERCIAL & INDUSTRIAL ACCESS CONTROL	02530-03	Remove 5' offset from property line
		Change spacing between driveways/street intersections for a local/local through street to 50' and not 100'
SANITARY SEWER SERVICE LINE	02700-06	Changed "Sewer Pipe Wye, Tee Wye combination" to "Sewer pipe factory wye"
		Removed "6"" and "8" (or larger)" and added "factory" to Note 1.
		Added Note 4. "Repair saddles may be only be used when approved by Wastewater Division"
LANDSCAPE DETAILS	02900-01 thru 02900-06	2020 Landscape Details removed and replaced in their entirety.
IRRIGATION DETAILS	02920-1 thru 02920-33	2020 Irrigation Details Remove and Replaced in their entirety.

STANDARD SPEC CHANGES FROM 2020 EDITION for 2025 EDITION			
SECTION	PART	Subsection	Description of Change
Move all Standard Drawings to Specs			Move all standard drawings (details) from the Design Standards to the Spec Book.
Section 02920-IRRIGATION	All	All	Section 02920-IRRIGATION as previously published in 2020 editon is removed and replaced entirely with 2025 edition.

STANDARD DESIGN STANDARDS CHANGES FROM 2020 EDITION for 2025 EDITION			
SECTION	Section	Subsection	Description of Change
101	All		Remove "City of Gillette CAD Standards"
			Delete "ePlans" verbiage or replace with "electronic software permitting"
	101.10	D	Delete "Any water and/or sewer service lines not needed shall be abandoned according to the City of Gillette Design Standards and Standard Construction Specifications prior to the plat being recorded."

STANDARD DESIGN STANDARDS CHANGES FROM 2020 EDITION for 2025 EDITION (CONT'D)			
SECTION	Section	Subsection	Description of Change
102	102.3		Replaced "black line copies" with "electronic copies"
103	103.10.2	A	Deleted "two unbound sets and one bound set of size B (11x17)black line prints"
	103.10.3	1	Added "printable" and deleted "size B"
		3	Replaced with "Shapefiles and CAD files (dwg) are acceptable formats of record drawings."
	103.10.4		Added "in the design standards" and removed "at the City Engineer's Office". Added "electronically"
	103.20.1		Added "prior to final acceptance"
	103.20.2		Added "private development" and added "an electronic set of plans"
			Added "prior to final acceptance or certificate of occupancy can be given for the development."
301 DESIGN OF WATER DISTRIBUTION SYSTEMS	6	6-b-ii	Updated "6-b-ii" to "9-c-iii" per DEQ updates
		6-b-iii	Updated "6-b-iii" to "9-c-iv" per DEQ updates
	14		Updated Section "14" to "16" and "14-b-iii" to 16-e
			Updated "Add new subsection after subsection 16-f-v
			Added subsection "vi"
			Add new section after "subsection 16-d-ii"
		14-b-vi	Updated to "16-d-ii (iii) Dead-end "other flushing device and shall not exceed 1,200 feet in total distance"
			Updated subsection "14-b-vii" to "16-d-viii"
			Updated "(viii)" to "(iv)"
		(viii) Services	Inserted "All commercial building plans shall include a detailed water riser diagram showing valve(s) and water meter(s) sizes and shall include the type and size of all backflow prevention."
			Replaced paragraph two with "There shall be only one tap and water service line from the main to the property line for each lot unless any single structure on the lot allows for more than one occupied space for separate lease or ownership. Unless otherwise approved by the City Engineer, any single structure with a single utility room that allows for more than one occupied space, shall have an individual water meter and shut off valve installed for each occupied space within the utility room. If any occupied space within the structure has a separate or individual utility room, then the occupied space shall have an individual water meter, shut off valve and curb stop installed. "
			Replaced paragraph three with "The City Engineer may approve a single tap from the main to be divided at the property line into multiple service lines with each individual water service line having a meter and a curb stop."
			Added "Add new subsection 16-d-iv"
			Updated "(ix)" to "(v)"
			Added "after subsection 16-d-v"
			Updated "(x)" to "(vi)"
			Added "add subsection after 16-d-vi"
			Updated "(c) Valves" to "(vii) valves"
			Updated "subsection 14-f-I and 14-f-ii" to "subsection "16-h-i, 16-h-ii, 16-h-iii"
			Updated "Add the following language at the end of Subsection 14-f-v" to "(iii) Cover"
			Updated "14-i" to "16-m"

STANDARD DESIGN STANDARDS CHANGES FROM 2020 EDITION for 2025 EDITION (CONT'D)			
401 DESIGN OF SANITARY SEWER SYSTEMS	9	9-C-iii-D	Add to (D) Connections - "All new construction shall require a factory wye connection to any collection line. Flexible couplings shall not be used for any service connections within the right of way or easements of any collection line. Tapping saddles for new construction shall only be allowed if approved by the Wastewater Division."
			Replace 2nd paragraph with "Connections of sewer services less than eight (8) inches in diameter shall connect to collection lines and not manholes."
			Replace third paragraph with "Sewer services will be extended to a point on each lot, which is a minimum of ten (10) feet from the lower property corner based on the sanitary sewer main lowest elevation. For any building with more than one occupied space, for separate lease or ownership, a sewer cleanout shall be installed outside of the building for each individual occupiable space, unless approved by the City Engineer."
		9-d-i	Deleted "Dead end lateral lines shall terminate in a manole."
609 DESIGN OF FLEXIBLE PAVEMENTS	609.2		Updated Alleys asphalt thickness to "6.0 inches" and Local/Local Through asphalt thickness to "5.0"
610 DESIGN OF RIGID PAVEMENTS	610		Replaced "twenty year design life to "30"
	610.2		Updated Alleys concrete thickness to "6 inches", Local/Local Through "6.0" and Collector to "6.5"
611 STREET GEOMETRICS	611.08		Added "H. The maximum length of a cul-de-sac shall not exceed 1,200 feet from any intersecting street

CITY ELECTRIC LINE EXTENSION POLICY CHANGES FROM 2017 EDITION for 2025 EDITION			
SECTION I - GENERAL INFORMATION	ITEM 10 - A	ACCESS & RIGHT OF WAY	THE CUSTOMER SHALL GRANT FREE ACCESS TO THE CUSTOMER'S PREMISES FOR THE UTILITY TO COMPLETE ALL PROJECTS AND TO MAINTAIN CONTINUITY OF SERVICE, AT TIME THIS MAY BE WITHOUT NOTICE.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - A	GENERAL INFORMATION	THE UTILITY WILL PROVIDE ELECTRICAL CAPACITY TO NEW DEVELOPMENTS FOR ALL ELECTRICAL DISTRIBUTION SYSTEM EXTENSIONS. DISTRIBUTION CAPACITY UP TO 1MW WILL BE PROVIDED, CAPACITY OVER 1MW AND ITS SHARED COST WILL BE EVALUATED ON A CASE-BY-CASE BASIS.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - L	GENERAL INFORMATION	AS A UTILITY, WE OPERATE A LOOPED DISTRIBUTION SYSTEM TO MAINTIAN RELIABILITY. THE CUSTOMER SHALL BE REQUIRED TO EXTEND CONDUIT TO ADJACENT PROPERTY(IES) ACCORDING TO UTILITY DESIGN.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - M	GENERAL INFORMATION	NEW RESIDENTIAL DEVELOPMENTS SHALL HAVE ALL EQUIPMENT INSTALLED IN THE FRONT OF LOTS, UNLESS OTHERWISE APPROVED BY ELECTRICAL ENGINEERING.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - N	GENERAL INFORMATION	IT'S THE UTILITY'S RESPONSIBILITY TO DELIVER CLASS A VOLTAGE TO A UTILITY OWNED METER.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - O	GENERAL INFORMATION	IN THE INSTANCE OF A UTILITY OWNED METER BEING BEYOND THE POINT OF SERVICE, IT SHALL BE THE CUSTOMER'S RESPONSIBILITY TO ENSURE THAT CLASS A VOLTAGE IS DELIVERED TO THE UTILITY OWNED METER
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - P	GENERAL INFORMATION	THERE SHALL BE NO DECORATIONS ON UTILITY OWNED ELECTRICAL EQUIPMENT. EXAMPLES INCLUDE PAINTING, DECORATIVE STICKERS, SIGNAGE, ETC.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - Q	GENERAL INFORMATION	THERE SHALL BE NO CUSTOMER BUILDING ON OR OVER UTILITY OWNED EQUIPMENT.
SECTION II - DISTRIBUTION SYSTEMS	ITEM 1 - R	GENERAL INFORMATION	PAYMENT FOR DISTRIBUTION SYSTEM INVOICES SHALL BE PAID IN FULL BEFORE OBTAINING CERTIFICATE OF OCCUPANCY AND/OR POWER BEING DELIVERED.
SECTION III - CUSTOMER SERVICE LINE EXTENSION	ITEM 3 - B	CUSTOMER PROVIDED	ACCESS AND AVAILABILITY FOR RESIDENTIAL 3 PHASE SERVICE IS EXTREMELY LIMITED AND AT THE DISCRETION OF ELECTRICAL ENGINEERING.

REQUEST TO REVISE THE
CITY OF GILLETTE STANDARD CONSTRUCTION SPECIFICATIONS

Please submit this form or a document (electronically or hard copy) with the following information to request a change to the "City of Gillette Standard Construction Specifications". The City of Gillette will consider each request in its annual specification review process. Please be as specific as possible for each request. Proposed wording and supporting documentation for the proposed specification change will increase the chances for approval.

Requester's Name: _____

Address: _____

Telephone Number: _____

E-mail Address: _____

Specification Section Proposed for Change: _____
(Please submit individual forms for each specification section proposed to be changed)

General Description of Proposed Change:

Specific Wording for Proposed Specification Section Change:

Supporting documentation for proposed change such as AWWA Standard, WYDOT Standard, etc…

Does this proposed change impact or require changes to other specifications sections or details?
___Yes____ No

If Yes, which sections are impacted? _____

Submit Request to:
City of Gillette
Attn: City Engineer
Proposed Specification Revision
201 E. 5th St
Gillette, WY 82716

ADVERTISEMENT AND INVITATION FOR BIDS
CITY OF GILLETTE

NOTICE IS HEREBY GIVEN THAT SEPARATE SEALED BIDS FOR THE FURNISHING OF:

(PROJECT)

GENERALLY DESCRIBED AS:

(BRIEF DESCRIPTION OF MAJOR WORK ITEMS AND QUANTITIES TO BE COMPLETED)

(PROJECT NUMBER)

WILL BE RECEIVED BY THE CITY OF GILLETTE, WYOMING, AT THE OFFICE OF THE CITY PURCHASING DIVISION, CITY WAREHOUSE, 800 N. BURMA AVENUE, P.O. BOX 3003, GILLETTE, WYOMING, 82717, UNTIL THE FOLLOWING TIME AND DATE, AND THEN PUBLICLY OPENED AND READ ALOUD:

(TIME AND DATE)

THE CONTRACT DOCUMENTS MAY BE EXAMINED AT THE FOLLOWING LOCATIONS:

CITY OF GILLETTE WEBSITE:

GILLETTEWY.GOV
DEPARTMENTS>FINANCE>
PURCHASING & WAREHOUSE>
ELECTRONIC PLANS and SPECS

PROJECT ENGINEER:
(ENGINEERING FIRM NAME)
(ADDRESS)
(PHONE NUMBER)

COPIES OF THE CONTRACT DOCUMENTS MAY BE OBTAINED THROUGH THE CITY OF GILLETTE WEB PAGE UPON PAYMENT OF A NON-REFUNDABLE FEE OF **$22.00**.

A PRE-BID MEETING IS SCHEDULED FOR **(TIME)** ON **(DATE)** AT **(LOCATION)**. BIDDERS ARE **(REQUIRED)/(ENCOURAGED)** TO ATTEND AND PARTICIPATE IN THE CONFERENCE.

BIDS MUST BE APPROPRIATELY MARKED:

(PROJECT)
(PROJECT NUMBER)

THE CITY OF GILLETTE RESERVES THE RIGHT TO REJECT ANY AND ALL BIDS.

CITY ENGINEER

_____ _____
CITY ENGINEER NAME, PE DATE

CITY ADMINISTRATOR

_____ _____
CITY ADMINISTRATOR NAME DATE

PUBLISH: ***(DATE A WEEK APART)***
(DATE A WEEK APART)
(DATE A WEEK APART)

SECTION 00200

INSTRUCTIONS TO BIDDERS

ARTICLE 1 -- DEFINED TERMS

1.01 Terms used in these Instructions to Bidders, which are defined in the General Conditions of the Construction Contract, have the meanings assigned to them in the General Conditions.

A. Bidder: The term "Bidder" means one who submits a Bid directly to the Owner, as distinct from a sub-bidder, who submits a bid to a Bidder.

B. Successful Bidder: The term "Successful Bidder" means the lowest, qualified, responsible and responsive Bidder to whom the Owner, (on the basis of the Owner's evaluation as hereinafter provided), makes an award.

C. Bidding Documents: The term "Bidding Documents" includes the Advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form, and the proposed Contract Documents, (including all Addenda issued prior to receipt of Bids).

D. Issuing Office: The Purchasing Office from which the Bidding Documents are to be issued prior to receipt of Bids.

ARTICLE 2 -- COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Issuing Office. The deposit will be non-refundable.

2.02 Complete sets of Bidding Documents must be used in preparing Bids. Neither the Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 The Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work, and do not confer a license or grant for any other use.

ARTICLE 3 -- QUALIFICATIONS OF BIDDERS

3.01 To demonstrate qualifications to perform the Work, within five (5) days of the Owner's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments and other such data, as may be called for below.

A. Successful Bidder submits to the Owner evidence of the Bidder's qualifications to do business in the state of Wyoming, prior to Notice of Award.

B. Successful Bidder submits to Owner a list of all Subcontractors, Suppliers and others who must be identified for acceptance by Owner and Engineer prior to Notice of Award.

C. Successful Bidder shall obtain OR possess the appropriate City of Gillette Contractor’s License prior to execution of the Agreement.

ARTICLE 4 -- EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA AND SITE

4.01 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site, which have been utilized by the Engineer in preparation of the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures, at or contiguous to the Site (except Underground Facilities), which have been utilized by the Engineer in preparation of the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by the Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Article 5 of the General Conditions has been identified and established in Paragraph 5.03 of the Supplementary Conditions. Bidder is responsible for any interpretations or conclusions Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents, with respect to existing Underground Facilities at or contiguous to the Site, is based upon information and data furnished to the Owner and Engineer by owners of such Underground Facilities including Owner or others.

4.03 Hazardous Environmental Conditions

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site, which have been utilized by the Engineer in preparation of the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures, at or contiguous to the Site (except Underground Facilities), which have been utilized by the Engineer in preparation of the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by the Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Article 5 of the General Conditions has been identified and established in Paragraph 5.06 of the Supplementary Conditions. Bidder is responsible for any interpretations or conclusions Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents, due to differing or unanticipated conditions appear in Article 5 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and

possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawing or Specifications or identified in the Contract Documents to be within the scope of the Work also appear in Article 5 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests and studies, as Bidder deems necessary, for submission of a Bid. Bidder shall fill and compact all holes, clean up, and restore the site to its former conditions upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.06 Reference is made to Article 8 of the General Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Article 5 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in the Supplementary Conditions as also provided in Article 5 of the General Conditions;

E. obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedure of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional

examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences or procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder and that the Bidding Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 5 -- PREBID CONFERENCE

5.01 A pre-bid conference will be held at [Time] [a.m.][p.m.] on [Day-Date-Month] at [Location].

5.02 Representatives of the Owner and Engineer will be present to discuss the Project. Bidders are [required][encouraged] to attend and participate in the conference. The Engineer will transmit, to all prospective Bidders of record, such Addenda, as the Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 – SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work is to be obtained and paid for by Contractor.

ARTICLE 7 -- INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to the Engineer in writing. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents, as deemed advisable by the Owner or Engineer.

ARTICLE 8 -- BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to the Owner in the amount of five percent of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid Bond, (on form attached) issued by a surety meeting the requirements of Article 6 of the General Conditions. The form of Bid Bond attached complies with the requirements of State Law and is recommended, but is not mandatory. All Bid Bonds submitted to the City shall be conclusively presumed to conform to all the requirements of State law, and shall include the obligations specified under Section 15-1-113(f) of the Wyoming Statutes, even though not expressly written into the Bid Bond. All Bidders shall be liable for compliance with this section if it is not enforceable against their bonding company or surety.

8.02 The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid Security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within fifteen (15) business days after the Notice of Award and the Bid Security of the Bidder will be forfeited.

The Bid Security of other Bidders whom the Owner believes to have a reasonable chance of receiving the award may be retained by the Owner until the earlier of the seven days after the Effective Date of the Agreement, or sixty (60) days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven (7) days after the Bid Opening.

ARTICLE 9 -- CONTRACT TIME

9.01 The numbers of days within which, or the dates by which, the Work is to be completed and ready for final payment, are set forth in the Bid Form and the Agreement.

ARTICLE 10 -- LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 -- SUBSTITUTE OR "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents or those in the substitute or "or-equal" materials and equipment approved by Engineer, and identified by Addendum. The materials and equipment described in the Bidding Documents established a standard of required type, function and quality to be met by any proposed substitute or “or-equal” item. No item of material or equipment will be considered by Engineer as a substitute or “or-equal” unless written request for approval has been submitted by Bidder and has been received by Engineer as a substitute or “or-equal” unless written request for approval has been submitted by Bidder and has been received by Engineer at least fifteen (15) days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraph 7.05 and 7.06 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer’s decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approval made in any other manner.

ARTICLE 12 -- WYOMING PREFERENCE, SUBCONTRACTORS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five (5) days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractor, Supplier, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer make no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner or Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 7.07 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

12.04 In accordance with W.S. 16-6-101 et. seq., a 5% preferential treatment shall be given to all Bids submitted by Wyoming Bidders, except when the funding source for the project does not allow. The Contract shall be let to the responsible Wyoming resident making the lowest Bid; if, after adding 5% to the lowest responsible non-resident's Bid, the Wyoming residents Bid is less. Wyoming Bidders shall attach a copy of their Certificate of Residency to their bid, as provided by the Wyoming Department of Workforce Services, Employment Division.

12.05 A successful resident Bidder shall not subcontract more than thirty Percent (30%) of the work covered by his Contract to non-resident Contractors.

12.06 Preference is hereby given to materials, supplies, equipment, machinery and provisions produced, manufactured, supplied, or grown in Wyoming, quality being equal to articles offered by the competitors outside of the state.

12.07 Resident Wyoming laborers, workmen and mechanics shall be used upon all Work whenever possible, and any Contract let shall so provide, as required by the Wyoming Statutes cited below.

W.S. 16-6-201. Short title. This act may be cited as the "Wyoming Preference Act of 1971".

W.S. 16-6-202. Definitions.

(a) As used in this act:

(i) "Laborer" means a person employed to perform unskilled or skilled manual labor for wages in any capacity and does not include independent contractors;

(ii) "Resident" includes any person who is a citizen of the United States and has resided in the state of Wyoming for at least one (1) year immediately preceding his application for employment;

(iii) "Wages" means a payment of money for labor or services according to a contract or any hourly, daily or piece-work basis;

(iv) “Public work” means as described in W.S. 16-6-101 (a) (ix)
(v) "This act" means W.S. 16-6-201 through 16-6-206.

W.S. 16-6-203. Required resident labor on public works projects; exception.

(a) Every person who is responsible for a public work shall employ only Wyoming laborers on the public work. Every contract for a public work let by any person shall contain a provision requiring that Wyoming labor be used except other laborers may be used when Wyoming laborers are not available for the employment from within the state or are not qualified to perform the work involved. The contract shall contain a provision requiring specific acknowledgement of the requirements of this section. A person required to employ Wyoming laborers may employ other than Wyoming laborers if:

(i) That person informs the nearest state workforce center of his employment needs at least eleven (11) days before work is commenced; and

(ii) The state workforce center certifies that the person's need for laborers cannot be filled from those Wyoming laborers listed with the Wyoming department of workforce services. The department shall respond to a person's request for certification within ten (10) days of the date the information is filed.

(b) Upon request by the workforce center, the general contractor shall provide the most recent construction schedule for the project.

W.S. 16-6-204. Employees not covered by provisions.

All other employees of the contractor or subcontractor, other than laborers as defined by this act, are not covered by this act.

W.S. 16-6-205. Enforcement.

(a) The department of workforce services shall promulgate rules and regulations required to enforce this act and is authorized and directed to enforce this act. For purposes of all investigations, the department shall have the power to issue subpoenas requiring the attendance and testimony of witnesses and the production of any books, papers, documents or records which the department deems relevant or material to the inquiry.

(b) If requested in writing by the department of workforce services or contracting entity, the general contractor shall provide to the department or contracting entity a payroll report for the period requested for all contractors and subcontractors involved in the project in a form that is consistent with federally certified reporting requirements and includes residency status for each laborer.

(c) This act shall not be enforced in a manner which conflicts with any federal statutes or rules and regulations.

W.S. 16-6-206. Failure to employ state laborers; penalty.

(a) A person who willfully or intentionally fails to use Wyoming laborers as required in this act shall be subject to a civil penalty of not more than one thousand dollars ($1,000.00) per nonresident laborer employed per day, not to exceed a total penalty of ten percent (10%) of the amount of the person's contract. Each separate case of failure to employ Wyoming laborers on public works projects constitutes a separate offense.

(b) In the event a second offense occurs, the person shall be barred from bidding on any contract subject to the provisions of this act or submitting any request for proposal on any

project subject to the provisions of this act for one (1) year from the date the violation is corrected.

(c) Before a civil penalty is imposed under this section, the department of workforce services shall notify the person accused of a violation. The notice shall be served in accordance with the Wyoming Rules of Civil Procedure and contain:

(i) A statement of the grounds for imposing the civil penalty, including a citation to the statute involved;

(ii) A statement of the facts in support of the allegations;

(iii) A statement informing the person of the right to a hearing and that failure to timely request a hearing will result in imposition of the civil penalty stated.

(d) A request for hearing on a proposed civil penalty shall be in writing and shall be submitted to the department no later than seven (7) days after receipt of the notice from the department. The hearing shall be conducted as a contested case before a hearing examiner of the office of administrative hearings. The hearing shall be no later than fifteen (15) days after receipt of the request for hearing, unless the person subject to the proposed civil penalty requests an extension of time for good cause shown. The hearing officer shall recommend a decision to the director of the department. After hearing or upon failure of the accused to request a hearing, the director of the department shall determine the amount of the civil penalty to be imposed in accordance with the limitations in this section. Judicial review, if any, shall be from the decision of the director and in accordance with the provisions of the Wyoming Administrative Procedure Act.

(e) A civil penalty may be recovered in an action brought by the attorney general in the name of the state of Wyoming in any court of appropriate jurisdiction.

12.08 Any contract to be awarded shall comply with capital construction projects restrictions, preference requirements, and waivers in accordance with W.S. 16-6-1001.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents: Additional copies may be obtained from the issuing office.

13.02 All blanks on the Bid Form must be completed by printing in ink or by typewriter or electronically, and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each [section, Bid item, alternative, adjustment unit price item, and unit price item] listed therein, or the word "No Bid," "No Change," or "Not Applicable" entered.

13.03 Bids by corporations shall be executed in the corporate name by the president or vice-president, or authorized designee accompanied by evidence of authority to sign. The corporate seal, if available, must be affixed and attested by the Corporate Secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

13.04 Bids by partnerships must be executed in the partnership name, and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 All names must be typed or printed below the signature.

13.08 The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

13.09 The address and telephone number for communications regarding the Bid must be shown.

13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID; COMPARISON OF BIDS

14.01 Lump Sum

A. Bidder shall submit a Bid on a lump sum basis as set forth in the Bid Form.

[or]

14.01 Unit Price

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 13.02 of the General Conditions.

ARTICLE 15 – SUBMITTAL OF BIDS

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid Security.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title, (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If the Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED".

15.03 The BIDDER may, at their option, submit the number compilation portion of the Bid in an "electronic format" using the "electronic form" supplied by the ENGINEER.

When submitting the "electronic format" Bid, the BIDDER will submit the following:

a. A printout of the portion of the Bid contained in the electronic format that has had each page signed and dated by the BIDDER. These pages must be inserted in the Bid Form to replace the Article 5 Basis of Bid section.
b. Pages of the Bid Form provided in the Project Manual with all the required blanks being filled.

ARTICLE 16 -- MODIFICATION AND WITHDRAWAL OF BIDS

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

ARTICLE 17 -- OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 -- BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All bids will remain subject to acceptance for the period of time stated in the Bid Form, but the Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any and all Bids, including without limitations, nonconforming, non-responsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or change in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award. The Owner will consider Bids irregular, and intends to reject them for any of the following substantial reasons:

A. Bid Proposal not received prior to the specified deadline.
B. Unsigned Bid Proposals.
C. Bid Proposals which have items omitted by the Bidder.
D. Post bid refusal to submit to specified bidding requirements, such as: MBE requirements, Subcontractor listing, Contractor licensing, etc.
E. Altering a Bid as to specified time of commencement or completion of Work.
F. Bid Proposal not accompanied by a security of character indicated or of an amount less than indicated.
G. If the Bid Proposal is on a form other than that furnished by the Owner, or if the form is altered.

H. If there are unauthorized additions, conditional, or alternate Bids, or discrepancies of any kind which may tend to make the Bid Proposal incomplete, indefinite, or ambiguous as to its' meaning.
I. If the Bidder adds any provisions, reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award.
J. If the Bid Proposal does not contain a unit price for each pay item listed.
K. If the Bid Proposal contains any erasure of alteration of written words or figures of unit prices not initialed in ink by the Bidder.
L. Submitting more than one Bid.

The Owner will consider Bids informal, but does not intend to reject them for the following minor reasons:

A. Omission of dates when signed, or title and evidence of authority of person signing.
B. Failure to acknowledge an addendum, which does not affect quantity, quality, time, or price.
C. Submission of a Bid in an unsealed envelope.
D. Unit price Bid Proposals that include reconcilable arithmetic errors may be corrected if it does not change the unit price.
E. Lump sum Bid Proposals which include reconcilable arithmetic errors may be corrected, if it does not change the amount on which the award will be based.

19.04 In evaluating Bidders, Owner may consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions. The Owner also may consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers, and other individuals or entities to perform Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award to Bidder whose bid is in the best interests of the Project.

ARTICLE 20 -- CONTRACT SECURITY AND INSURANCE

20.01 Article 6 of the General Conditions as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the successful Bidder delivers the executed Agreement to the Owner, it shall be accompanied by such bonds and insurance.

ARTICLE 21 -- SIGNING OF AGREEMENT

21.01 When the Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with all other Contract Documents. Within fifteen (15) business days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten (10) business days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder and a complete set of the Drawings with appropriate identification.

ARTICLE 22 -- SALES AND USE TAXES

22.01 The Contractor must pay all State Sales and Use Tax on materials and equipment to be incorporated in the Work.

ARTICLE 23 -- RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

SECTION 00300

BID FORM

[Insert Project Identification]
[Insert Contract Identification Number]

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Gillette, City Warehouse
800 N Burma Ave
Gillette, WY 82716

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the price, and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 The Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty (60) days after the day of the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents:

A. The Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents and the following Addenda, receipt of all which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. The Bidder has visited the Site, and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Law and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and test of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in Paragraph 5.03 Supplementary Conditions and (2) reports and drawings of

Hazardous Environmental Conditions that have been identified in Paragraph 5.06 Supplementary Conditions.

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so), all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of the Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, report and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Biddings Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which the Bid is submitted.

K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

A. This bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following prices(s):

[SUGGESTED FORMAT FOR LUMP SUM BID]

*Lump Sum Bid Price*_____ $_____
(words) *(numerals)*

Subcontractors	*Type of Work*
_____	_____
_____	_____
_____	_____

[or]

*Lump Sum Bid Price for Section I only*_____ $_____
(words) *(numerals)*

*Lump Sum Bid Price for Section II only*_____ $_____
(words) *(numerals)*

*Lump Sum Bid Price for Section III only*_____ $_____
(words) *(numerals)*

Subcontractors	*Type of Work*
_____	_____
_____	_____
_____	_____

[or]

*Lump Sum Bid Price for Base Bid*_____ $_____
(words) *(numerals)*

*Alternate A [Add] [Deduct]*_____ $_____
(words) *(numerals)*

*Alternate B [Add] [Deduct]*_____ $_____
(words) *(numerals)*

Subcontractors	*Type of Work*
_____	_____
_____	_____
_____	_____

All specified cash allowances are included in the price(s) set forth above and have Been computed in accordance with Paragraph 13.02 of the General Conditions.

[SUGGESTED FORMATS FOR UNIT PRICE BID]

Item No.	*Description*	*Unit*	*Estimated Quantity*	*Bid Unit Price*	*Bid Price*
				$_____	$_____
				$_____	$_____
				$_____	$_____

Total of all Bid Prices *($_____)*

Subcontractors	*Type of Work*

Unit Price work has been computed in accordance with Paragraph 13.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contact Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be completed within _____ (working) days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions.

Working Day contract times include **no** allowance for adverse weather days. Fixed Completion Date contract times include an allowance for adverse weather days in accordance with Article 4 of Section 00500 – The Agreement between Owner and Contractor.

6.02 The Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this bid:

A. Required Bid Security in the form of _____.

B. As required, a list of Project References

C. As required, the BIDDER'S Qualification Statement with supporting data.

D. State of Wyoming Residency Certificate if claiming residency.

ARTICLE 8 – BID SUBMITTAL

8.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed):_____

By:_____(SEAL-if available)
(*Individual's Signature)*

Doing business as:_____

A Partnership

Partnership Name:_____(SEAL-if available)

By:_____
(*Signature of general partner – attach evidence of authority to sign)*

Name (typed or printed):_____

A Corporation

Corporation Name:_____(SEAL-if available)

State of Incorporation:_____
Type (General Business, Professional, Service, Limited Liability):_____

By:_____
(*Signature – attach evidence of authority to sign)*

Name (typed or printed):_____

Title:_____
(CORPORATE SEAL-if available)

Attest:_____
(*Signature of Corporate Secretary)*

Bidder's Business address:_____

Phone:_____ Facsimile:_____

Submitted on _____, 20___.

Contractor License No. _____.

SECTION 00500

AGREEMENT
BETWEEN THE OWNER AND CONTRACTOR

THIS AGREEMENT is by and between City of Gillette (OWNER) and _____ (CONTRACTOR).

Owner and Contractor, in consideration of the mutual covenants set forth herein agree as follows:

ARTICLE 1 -- WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

(General Description)

ARTICLE 2 -- THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only part is generally described as follows:

(Project Name)
(Project Number)

ARTICLE 3 -- ENGINEER

3.01 The Project has been designed by _____(Engineer), who is to act as the Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to the Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 4 -- CONTRACT TIME

4.01 Time of the Essence

A. All time limits for Milestones, if any, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract. When the contract time is on a working day basis, the contract time will begin on the date determined in the Notice to Proceed and continue at the rate of one Working Day charged for each day of the Normal Working Week, except as described otherwise in the Supplementary Conditions or Project Documents, until the work is complete. Working Day contracts do not include an initial allowance for adverse weather days and do not charge a working day for adverse weather days.

B. Fixed Completion Date contract times include the following allowance for adverse weather days:

For whole or partial months within the contract time, the table "Adverse Weather Days Expected" shows the number of working days included in the anticipation of weather that will preclude work. On the Engineers Weekly Reports, the engineer will show for each month, and for the project to date, the number of actual adverse weather days determined by the engineer and the amount by which this exceeds the number expected and accounted for in the original Completion Date.

The engineer may extend the completion date if the actual number of adverse weather days exceeds the expected number and the contractor has pursued the work diligently during the month.

The Engineer will not count or treat Saturdays, Sundays, or Holidays as adverse weather days.

Adverse Weather Days Expected

Month	Workdays Incorporated in Contract Time in Anticipation of Adverse Weather
January	**8**
February	**8**
March	**7**
April	**6**
May	**4**
June	**3**
July	**2**
August	**2**
September	**2**
October	**4**
November	**5**
December	**7**

4.02 Days to Achieve Milestones and Final Completion.

A. The Work will be complete and ready for final payment within _____ (working) days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions but not later than (insert completion date)., and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions after the date of issuance of the Certificate of Substantial Completion.

4.03 Liquidated Damages

A. The Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph 4.02 above, plus any extensions thereof allowed, in accordance with Article 11 of the General Conditions. The Parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $_____ for each day that expires after the time specified in Paragraph 4.02 for Milestone Work until *(describe the milestone work)* is complete. After the Milestone Work is complete, if Contactor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $_____ for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 -- CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds according to the Bid, which is attached as an Exhibit.

ARTICLE 6 -- PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment, in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by the Engineer as provided in the General Conditions.

6.02 Progress Payments

A. Owner shall make progress payments on account of the Contract Price on the basis of the Contractor's Applications for Payment, as recommended by the Engineer, subsequent to the second Council meeting of each month during construction, as provided below. All such payments will be measured by the schedule of values established in Paragraph 2.03 A of the General Conditions, (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as the Engineer determines or the Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 15.01 of the General Conditions:

a. Ninety-five percent (95%) of the Work completed (with the balance being retainage). ;

b. Ninety-five percent (95%) of the materials and equipment not incorporated in the Work (with the balance being retainage).

2. Upon issuance of a Certificate of Substantial Completion, Owner shall cause notice to be published in a newspaper of general circulation once a week for two consecutive weeks, and posted on the State of Wyoming's procurement website or the Owner's official website. The notice shall set forth in substance that the Owner has accepted the Work, or designated portion thereof, as substantially complete according to this Agreement and associated documents, and that the Contractor is entitled to payment of the retained amount, together with any other amount due under this Agreement, less any amount withheld for the portion of the Work that is incomplete or not completed in accordance with this Agreement and associated documents, upon the 41st day after the notice was first published.

6.03 Final Payment.

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06

ARTICLE 7 -- INTEREST

7.01 All moneys not paid when due, as provided in Article 15 of the General Conditions, shall bear interest at the maximum rate allowed by law at the place of the Project.

ARTICLE 8 -- CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 5.06 of the General Conditions.

E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedure of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedure of construction expressly required by the Bidding Documents, and safety precautions and programs incident hereto.

F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contact Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 -- CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consists of the following:

1. This Agreement (pages 1 to ___, inclusive).

2. Performance bond (by reference).

3. Payment bond (by reference).

4. Notice of Award (by reference).

5. General Conditions (by reference).

6. Supplementary Conditions (by reference).

7. Specifications bearing the title The City of Gillette, 2020 Standard Construction Specifications, as amended.

8. Drawings consisting of ____ sheets with each sheet bearing the following general title:_____

9. Project Manual bearing the title_____

10. Addenda (pages 1 to ___, inclusive).

11. Exhibits to this Agreement (enumerated as follows):

    a. Contractor's Bid (pages 1 to ___, inclusive).

    b. Documentation submitted by Contractor prior to Notice of Award (pages 1 to ___, inclusive).

    c. _____.

12. The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto:

    a. Notice to Proceed (pages 1 to 1, by reference).

    b. Work Change Directives.

    c. Change Order(s)

B. The documents listed in Paragraphs 9.01.A are attached to this Agreement, (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented, as provided in Paragraphs 11.01 of the General Conditions.

ARTICLE 10 -- MISCELLANEOUS

10.01 Terms

A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

A. Owner and the Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect of all covenants, agreements, and obligations contained in the Contract Documents.

10.04 Severability

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provisions.

10.05 Other Provisions

A. **Governmental Immunity.** The Owner does not waive governmental immunity by entering into this Agreement and specifically retains all immunities and defenses available to it pursuant to WYO. STAT. §§ 1-39-101-120 and all other applicable law. Designations of venue, choice of law, enforcement actions, dispute resolution and similar provisions should not be construed as a waiver of governmental immunity. The parties agree that any ambiguity in this Agreement shall not be strictly construed, either against or for either party, except that any ambiguity as to governmental immunity shall be construed in favor of governmental immunity.

B. **Availability of Funds.** Each payment obligation of the Owner is conditioned upon the availability of government funds which are appropriated or allocated for the payment of this obligation. If funds are not allocated and available for the continuance of the services performed by Engineer and/or the Contractor, the Agreement may be terminated by the Owner at the end of the period for which the funds are available. The Owner shall notify Engineer and/or the Contractor at the earliest possible time of the services which will or may be affected by a shortage of funds. No penalty shall accrue to the Owner in the event this provision is exercised, and the Owner shall not be obligated or liable for any future payments due or for any damages as a result of termination under this section. This provision shall not be construed to permit the Owner to terminate this Contract to acquire similar services from another party.

C. **Force Majeure**. Neither party shall be liable for failure to perform under this Agreement if such failure to perform arises out of causes beyond the control and without the fault or negligence of the

nonperforming party. Such causes may include, but are not limited to, acts of God or the public enemy, fires, floods, epidemics, pandemics, quarantine restrictions, freight embargoes, and unusually severe weather. This provision shall become effective only if the party failing to perform immediately notifies the other party of the extent and nature of the problem, limits delay in performance to that required by the event, and takes all reasonable steps to minimize delays. This provision shall not be effective unless the failure to perform is beyond the control and without the fault or negligence of the nonperforming party. The parties intend and agree that the Owner does not waive governmental immunity by entering into this Agreement and specifically retains all immunities and defenses available to it pursuant to WYO. STAT. §§ 1-39-101-120 and all other applicable law.

D. **Indemnification.** Contractor shall indemnify, defend, and hold harmless the Owner, and its officers, agents, employees, successors, and assignees from any and all claims, lawsuits, losses, and liability arising out of Contractor's failure to perform any of Contractor's duties and obligations hereunder or in connection with the negligent performance of Contractor's duties or obligations, including but not limited to any claims, lawsuits, losses, or liability arising out of Contractor's actions.

E. **Applicable Law/Venue.** The construction, interpretation, and enforcement of this Agreement shall be governed by the laws of the State of Wyoming. The Courts of the State of Wyoming shall have jurisdiction over this Agreement and the parties, and the venue shall be the Sixth Judicial District, Campbell County, Wyoming. The parties intend and agree that the Owner does not waive governmental immunity by entering into this Agreement and specifically retains governmental immunity and all defenses available to it pursuant to WYO. STAT. §§ 1-39-101-120 and all other applicable law.

IN WITNESS WHEREOF, Owner and Contactor have signed this Agreement in duplicate. One counterpart each has been delivered to the Owner and the Contractor. All portions of the Contract Documents have been signed or identified by the Owner and Contractor or on their behalf.

This Agreement will be effective on _____, 20__ (which is the Effective Date of the Agreement)

OWNER:

City of Gillette

By: _____

_____
Print Name

Title: Mayor

Attest: _____

Title: City Clerk

Address for giving notices:

City of Gillette
201 E. 5th Street
Gillette, WY 82716

CONTRACTOR:

_____

By: _____

_____
Print Name

Title: _____

[Corporate Seal]
(If Available)

Attest: _____

Title: _____

Address for giving notices:

_____
_____
_____

License No.: _____

Agent for service or process:_____

_____
(If Contractor is a corporation or partnership, attach evidence of authority to sign.)

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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GUIDELINES FOR USE OF EJCDC® C-700, STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), is the foundation document for the EJCDC Construction Series. The General Conditions define the basic rights, responsibilities, risk allocations, and contractual relationship of the Owner and Contractor, and establish how the Contract is to be administered.

2.0 OTHER DOCUMENTS

EJCDC documents are intended to be used as a system and changes in one EJCDC document may require a corresponding change in other documents. Other EJCDC documents may also serve as a reference to provide insight or guidance for the preparation of this document.

These General Conditions have been prepared for use with either EJCDC® C-520, Agreement Between Owner and Contractor for Construction Contract (Stipulated Price), or EJCDC® C-525, Agreement Between Owner and Contractor for Construction Contract (Cost-Plus-Fee) (2018 Editions). The provisions of the General Conditions and the Agreement are interrelated, and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018).

The full EJCDC Construction series of documents is discussed in the EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

3.0 ORGANIZATION OF INFORMATION

All parties involved in a construction project benefit significantly from a standardized approach in the location of subject matter throughout the documents. Experience confirms the danger of addressing the same subject matter in more than one location; doing so frequently leads to confusion and unanticipated legal consequences. Careful attention should be given to the guidance provided in EJCDC® N-122/AIA® A521, Uniform Location of Subject Matter (2012 Edition) when preparing documents. EJCDC® N-122/AIA® A521 is available at no charge from the EJCDC website, www.ejcdc.org, and from the websites of EJCDC's sponsoring organizations.

If CSI MasterFormat™ is used for organizing the Project Manual, consult CSI MasterFormat™ for the appropriate document number (e.g., under 00 11 00, Advertisements and Invitations), and accordingly number the document and its pages.

4.0 EDITING THIS DOCUMENT

Remove these Guidelines for Use. Some users may also prefer to remove the two cover pages.

Although it is permissible to revise the Standard EJCDC Text of C-700 (the content beginning at page 1 and continuing to the end), it is common practice to leave the Standard EJCDC Text of C-700 intact and unaltered, with modifications and supplementation of C-700's provisions set forth in EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018). If the Standard Text itself is revised, the

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user must comply with the terms of the License Agreement, Paragraph 4.0, Document-Specific Provisions, concerning the tracking or highlighting of revisions. The following is a summary of the relevant License Agreement provisions:

1. The term "Standard EJCDC Text" for C-700 refers to all text prepared by EJCDC in the main body of the document. Document covers, logos, footers, instructions, or copyright notices are not Standard EJCDC Text for this purpose.
2. During the drafting or negotiating process for C-700, it is important that the two contracting parties are both aware of any changes that have been made to the Standard EJCDC Text. Thus, if a draft or version of C-700 purports to be or appears to be an EJCDC document, the user must plainly show all changes to the Standard EJCDC Text, using "Track Changes" (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions.
3. If C-700 has been revised or altered and is subsequently presented to third parties (such as potential bidders, grant agencies, lenders, or sureties) as an EJCDC document, then the changes to the Standard EJCDC Text must be shown, or the third parties must receive access to a version that shows the changes.
4. Once the document is ready to be finalized (and if applicable executed by the contracting parties), it is no longer necessary to continue to show changes to the Standard EJCDC Text. The user may produce a final version of the document in a format in which all changes are accepted, and the document at that point does not need to include any "Track Changes," redline/strikeout, highlighting, or other indication of additions and deletions to the Standard EJCDC Text.

5.0 LICENSE AGREEMENT

This document is subject to the terms and conditions of the **License Agreement, 2018 EJCDC® Construction Series Documents**. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcdc.org and the websites of EJCDC's sponsoring organizations.

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by

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Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or

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communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

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32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part

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thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

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4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

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2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

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2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

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3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take

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precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

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ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

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C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
2. Abnormal weather conditions;
3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;
2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the

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effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise;

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(b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

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D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement

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to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

    b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

    c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities.

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Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written

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statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

    c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

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2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

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ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the

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required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

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2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

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4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

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D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

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1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at

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Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

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7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

    a. in the exercise of reasonable judgment Engineer determines that the proposed item:

        1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

        3) has a proven record of performance and availability of responsive service; and

        4) is not objectionable to Owner.

    b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

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E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

   c. will identify:

      1) all variations of the proposed substitute item from the item specified; and

      2) available engineering, sales, maintenance, repair, and replacement services.

   d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in

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Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or

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otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any

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license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to

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such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any

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of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

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7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer

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may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two

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resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

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2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity

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directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

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G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be

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set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
2. An itemization of the specific matters to be covered by such authority and responsibility; and
3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

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C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

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B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any

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Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

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3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving

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the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

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c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

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B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

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11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal

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and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe

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benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment,

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machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

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2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

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13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

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b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

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5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved

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by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then

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Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

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3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

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c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

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e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

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C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

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2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents;

b. consent of the surety, if any, to final payment;

c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment

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bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

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15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

   1. correct the defective repairs to the Site or such adjacent areas;

   2. correct such defective Work;

   3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

   4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

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ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as

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to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

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ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be

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as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (C-700, 2018 ed.) and other provisions of the Contract Documents as indicated below. All provisions, which are not so amended or supplemented, remain in full force and effect, including but specifically not limited to Governmental Immunity, Availability of Funds, Force Majeure, Indemnification and Applicable Law/Venus.

The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (C-700, 2018 ed.) have the meanings assigned to them in the General Conditions.

SC-1.01 Defined Terms

Add the following language at the end of the definition entitled "Agreement" of the General Conditions:

> "The definition of the word "Contract" is synonymous with the word "Agreement" and is used interchangeably in the Contract Documents."

And as so amended this definition remains in effect.

Add the following language to the end of the first sentence of the definition entitled "Drawings" of the General Conditions.

> The definition of the word "Plans" is synonymous with the word "drawings" and is used interchangeably in the Contract Documents.

Add the following language to the end of the definition entitled "Owner" of the General Conditions:

> The Owner is a public entity defined in W.S. 16-6-101(a)(viii).

Delete the definition of "Substantial Completion" and replace it with the following language:

> Substantial Completion is defined in W.S. 16-6-101(a)(xi).

Delete Article 1.01 A.19. of the General Conditions in its entirety and insert the following in its place:

> "19. *Effective Date of the Contract*: The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it shall be no later than thirty (30) days after formal award of the bid by the Owner.

Add the following new paragraphs immediately after the last paragraph of Article 1.01 of the General Conditions, which are to read as follows:

> *Adverse Weather Day* – A Day, in the opinion of the Engineer, on which weather prevents construction operations from proceeding for a minimum of five (5) hours with the normal working force engaged in performing Work which would be in progress at that time based on the most recent Progress Schedule with current controlling items identified.
>
> *Adverse Weather Recovery Day* – An adverse weather recovery day will only be considered when continuing construction progress on the Controlling Item is delayed due to the effects of adverse weather. An adverse weather recovery day must meet either one of the following two (2) criteria in conjunction with the third:
>
> 1. Days following Adverse Weather Days that are needed for project conditions to improve to a condition in which the Contractor is able to, and in the opinion of the Engineer, would be expected to, restart work.

OR

2. Days following Adverse Weather Days needed for rework of previously completed work conforming to the specifications. The Engineer will only consider rework necessary through no fault of the Contractor and within the limits of previously completed work. No other work outside the rework area may commence on the project in order to be awarded an Adverse Weather Recovery Day.
   AND the following:
3. Days following Adverse Weather Days in which the project conditions result in a delay to the Contractor for a minimum of five (5) hours from continuing regular construction progress on the Controlling Item as scheduled prior to the adverse weather.

Controlling Item – Those items of Work that would normally be in progress and will control the overall progress and completion of the Contractor's work effort on the Project, as identified on the Contractor's most recent Progress Schedule.

Holidays – Holidays shall be defined as the City's observed Holidays where normal business operations are closed.

Normal Working Week – Monday through Friday, except for Holidays, and Saturdays only as outlined in the Engineer approved Progress Schedule.

Regular Working Hours – 7:00 A.M. to 6:00 P.M. of the Working Day.

Working Day – A Day that the normal working force is or could be engaged in performing Work on the Project during the Normal Working Week and on Saturdays only as outlined in the Engineer approved Progress Schedule. Holidays or Sundays are only allowed as permitted in writing by the Engineer.

SC-2.02 Copies of Documents

Delete Paragraph 2.02 A in its entirety and insert the following in its place:

"A. Owner shall furnish to Contractor up to three copies of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction."

Delete Paragraph 2.02. B in its entirety.

SC-2.03 Before Starting Construction

Delete Paragraph 2.03.A.1 of the General Conditions in its entirety and insert the following in its place:

1. a preliminary Progress Schedule; indicating any proposed Saturdays to be worked, and indicating the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents.

Add a new paragraph immediately after Paragraph 2.03.A.3 of the General Conditions, which is to read as follows:

4. Contractor shall submit a preliminary list of construction equipment with hourly rates, owned or rented by the Contractor and all Subcontractors that will be used in the performance of the Work. The equipment list will include information necessary to confirm the hourly rates per Paragraph 13.01.B.5.c.1 and 13.01.B.5.c.2 of the General Conditions and these Supplementary Conditions including: make, model, and year of manufacture as well as the horsepower, capacity or weight, and accessories.

SC-2.04 Preconstruction Conference; Designation of Authorized Representatives

Delete Paragraph 2.04.B and add two new paragraphs immediately after Paragraph 2.04.A of the General Conditions, which are to read as follows:

"B. A list of supervisory and responsible-in-charge personnel working on the project shall be provided by the Contractor for the Preconstruction Conference.

C. The Contractor shall also submit at least one name that will be the Contractor's representative to respond to emergency conditions. Contractor shall provide the Engineer with the representative's telephone number prior to commencement of construction."

SC-2.05 Acceptance of Schedules

Delete Paragraph 2.05 of the General Conditions in its entirety and insert the following in its place:

"Prior to the first application for payment all submittals identified in Paragraph 2.03 shall be finalized and acceptable to the Engineer and Owner. No progress payment shall be made to Contractor until the schedules are submitted to and acceptable to Engineer and Owner as provided below.

The progress schedule shall show estimated time for each work item, starting and completion dates for each part of the Work, all dependencies and float time, and any proposed Saturday Work. The progress schedule shall be updated and resubmitted to Owner when the project schedule deviates from the previously approved schedule by more than five days. Failure to properly submit required construction schedules will result in a delay in payment of monies due the Contractor until the required schedules are submitted.

The progress schedule will show an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Acceptance by either Engineer or Owner will neither impose on Engineer or Owner responsibility for the sequencing, scheduling or progress of the Work and will not interfere with or relieve Contractor from Contractor's full responsibility therefore.

Contractor's schedule of shop drawings and sample submissions will be acceptable to Engineer as providing a workable arrangement for reviewing and processing the required submittals. Contractor's schedule of values and Contractor's list of construction equipment (as identified in SC 2.03.A.4) will be acceptable to Engineer as to form and substance."

SC-2.07 Mobile Equipment

Add a new paragraph immediately after Paragraph 2.06 of the General Conditions, which is to read as follows:

"2.07 *Mobile Equipment*

"A. Prior to using any mobile machinery on any construction project receiving State of Wyoming funds, the Contractor shall provide certification to the Owner that the mobile machinery has been registered as required by Wyoming State Statutes W.S. 31-18-203 through 31-18-208. Mobile machinery shall be defined as heavy equipment, except shop or hand tools or attachments, which are self-propelled, towed or hauled and used primarily in construction and maintenance of roads, bridges, ditches, buildings or land reclamation. The certification requirement does not apply to any mobile machinery that is exempt under Wyoming State Statutes."

SC-4.01 Determination of Contract Times; Commencement of Contract Times; Notice to Proceed

Delete Article 4.01 of the General Conditions in its entirety and insert the following in its place:

"A. The Contract Time, or number of days allowed for the performance and completion of the Work included in the Contract, will be stated in the bid documents and agreement.

1. Working Day Contracts:

When the contract time is on a working day basis, the contract time will begin on the date determined in the Notice to Proceed and continue at the rate of one Working Day charged for each day of the Normal Working Week, except as described herein, until the work is complete.

Saturdays will not be included in the count of Working Days, except those Saturdays the Contractor has identified in their Progress Schedule for Working, and which the Progress Schedule has been approved by the Engineer, which will then be counted as Working Days.

Holidays and Sundays will not be included in the count of Working Days, except those days the Contractor has made a formal written request and been granted written permission by the Engineer to work, which will then be counted as Working Days.

No Working Day shall be charged when, in the opinion of the Engineer, conditions beyond the control of the Contractor preclude prosecution of the work.

Working Days will not be charged for Adverse Weather Days, but will be charged for any other partially worked day.

A full Working Day will be charged on Normal Working Week days when the Contractor could be performing Work, but elects not to work for either a partial or entire day, or elects to work elsewhere. Allowance will not be made for delay or suspension of the work due to the fault of the Contractor. The Engineer will determine which days are working days.

No working days will be charged in the event delays are encountered as outlined in Article 4.05 of the General Conditions.

The number of days for performance allowed in the contract as awarded is based on the original quantities as outlined in the Bidder's Proposal. If satisfactory fulfillment of the contract requires performance of extra work or work on items with an increase in quantities that will take additional time to complete, the Contractor may submit a Change Proposal in accordance with Section 11.09 requesting additional time. The Change Proposal must show how the increased work delays the overall completion of the entire project. Information shall be submitted as soon as possible after the increased work has been performed. If, in the opinion of the Engineer the information submitted justifies additional time, a Construction Change Order increasing the contract time will be prepared.

If the Contractor finds it impossible, for reasons beyond his control, fault, or negligence, to complete the work within the contract time as specified or as extended in accordance with the provisions of this subsection, he may, at any time, submit a Change Proposal in accordance with Section 11.09 requesting additional time.

The Contractor shall immediately notify the Engineer in writing when it becomes evident that there will be a delay in obtaining critical materials. Delays due to slow delivery of materials from the supplier or fabricator, material delayed for reasons of late ordering, financial considerations, or other causes which could have been prevented will be considered within the Contractor's control. However, delays in delivery of materials to the Contractor due to some unusual market condition caused by an industry wide strike,

national disaster, area-wide shortage, or other reason beyond the control of the Contractor, Subcontractor, or Supplier, will be considered a basis for granting additional time.

The Contractor's plea that insufficient time was specified is not a valid reason for the extension of time.

2. Fixed Completion Date Contracts:

When the contract time is a fixed calendar date, it shall be the date on which all work on the project shall be completed. If work is not completed by the date specified, the Engineer will keep a record of working days charged after that date and furnish the Contractor a bi-weekly statement showing the number of days charged to the contract for the preceding two (2) weeks. The Contractor will be allowed one (1) week in which to file a written protest setting forth in what respect said biweekly statement is incorrect; otherwise, the statement shall be deemed to have been accepted by the Contractor as correct. If the Engineer and Contractor fail to reach an agreement on any statement of working days, the Engineer shall refer the statement in question to the City Engineer for review and final decision.

Allowance will not be made for delay or suspension of the work due to the fault of the Contractor. The Engineer will determine which days are working days.

If Work toward completing the Project commences past the completion date, the charged working day count shall begin as described above. When the Contractor is or could be performing Work, but, in the judgment of the Engineer, weather or job conditions beyond the Contractor's control are such that the Contractor could or does work only approximately one-half day or the Contractor's efficiency is materially reduced, the Engineer may count one-half working day. No working days will be charged in the event delays are encountered as outlined in Article 4.05 of the General Conditions.

If the Engineer finds that the work was delayed because of conditions beyond the Control and without fault of the Contractor, they may extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and affect the same as though it were the original time for completion.

B. The Contract Times will commence to run no later than the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty (30) days after the Effective Date of the Agreement."

SC-4.05 Delays in Contractor's Progress

Delete Paragraph 4.05.A through 4.05.G in their entirety and insert the following in their place:

"A. Where Contractor is prevented from completing any part of the Work within the Contract Time (or Milestones) due to delay beyond the control of the Contractor, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay. The Contractor agrees to make no claim for damages for delay in performance of this contract caused by any act or failure to act of the Owner, Engineer, or designated agents or representatives whether such delays are avoidable or unavoidable. The Contractor agrees that such delays shall solely and fully be compensated for by an extension of Contract Time to complete performance of the Work as provided herein.

B. Provisions for liquidated damages are set forth in the Agreement. The liquidated damages identified therein include, among the other costs to the Owner, an amount for

maintaining the necessary engineering forces engaged beyond the time identified in the Agreement for Substantial Completion.

C. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

D. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;
2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

SC-5.01 Availability of Lands

Delete Paragraph 5.01.B of the General Conditions in its entirety and insert the following in its place:

"B. 1. The Contractor shall confine his construction operations to the immediate vicinity of the location shown on the Drawings, and shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause the least possible damage to property and interference with traffic.

2. If it is necessary or desirable that the Contractor use land outside of the Owner's easement or Right of Way, the Contractor shall obtain consent from the landowner and/or tenant of the land. The Contractor shall not enter for materials delivery or occupy for any other purpose with men, tools, equipment, construction materials, or with materials excavated from the site, any private property outside the designated construction easement boundaries without written permission from the landowner and tenant."

SC-5.03 Add the following new paragraph(s) immediately after Paragraph 5.03D:

E. In the preparation of Drawings and Specifications, Engineer relied upon the following reports of explorations and tests of subsurface conditions at the Site:

(Insert reports information here)

F. In the preparation of Drawings and Specifications, Engineer relied upon the following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the Site:

(Insert reports information here)

G. Copies of reports and drawings itemized in SC-5.03.E and SC-5.03F that are not included with Bidding Documents may be examined at _____(insert location) during regular business hours. These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Contractor may rely as identified and established above are incorporated therein by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer in the preparation of Drawings and Specifications.

(or)

SC-5.03 Delete Paragraph 5.03A – 5.03.D in their entirety and insert the following:

A. No reports of explorations or tests of subsurface conditions at or contiguous to the Site are known to the Owner or Engineer.

SC-5.04 Differing Subsurface or Physical Conditions

Delete 5.04.E.4 and substitute the following:

4. "Failure of the Contractor to notify Owner and Engineer in writing about differing subsurface or physical conditions within fifteen (15) days of discovery or before disturbing such conditions or performing any of the Work in connection therewith will constitute an acceptance by the Contractor of the conditions encountered and shall constitute a waiver of all claims in connection therewith, whether direct or consequential in nature."

SC-5.05 Underground Facilities

Delete Paragraph 5.05 of the General Conditions in its entirety and insert the following Section 5.05 in its place:

A. It is the Owner's intent that the Owner, Engineer and Contractor meet the requirements of Wyoming State Statutes 37-12-301, et seq. and the requirements of the City of Gillette Municipal codes regarding Underground Facilities. The Owner and Engineer have completed an evaluation of the project and project area with all known Underground Facility owners at the time this Contract with Contractor is executed.

B. Shown or Indicated:

The information and data shown or indicated in the contract documents, with respect to existing Underground Facilities at or contiguous to the site, are based on information and data furnished to the Owner or Engineer by the owner of such Underground Facilities or by others. The sources of information and type of information relied upon are listed in the Supplementary Conditions, SC-5.03 or on the Plans. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. The Owner and Engineer are responsible for the accuracy and completeness of any such information or data to the extent that the records or sources used to obtain the information are accurate and complete; and,

2. The Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such

Underground Facilities during construction, for the safety and protection thereof as provided in Paragraph 7.13, and repairing any damage thereto resulting from the Work, the cost of which will be considered having been included in the contract price.

C. Not Shown or Indicated or Inaccurately Indicated.

If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated on the Contract Documents the Contractor shall, promptly, after becoming aware thereof, and before performing any Work affected thereby, (except in an emergency as permitted by Paragraph 7.15) identify the owner of such Underground Facility and give written notice thereof to that owner and the Owner and Engineer. The Engineer will promptly review the Underground Facility to determine the extent to which the Contract Documents will be amended or supplemented. During such time, the Contractor shall be responsible for the safety and protection of such Underground Facilities as provided in Paragraph 7.13.

If the Contractor damages or is delayed by an underground utility belonging to an entity other than the Owner which is not located or inaccurately located, the Owner shall bear no responsibility for the Contractor's costs associated with such damages or delays. Instead, the Contractor shall seek to recover said costs from the entity owning said underground utility.

D. Identified for Field Location by the Contractor.

If an Underground Facility is identified on the Contract Documents for field locating by the Contractor, the Contractor shall complete the field locating as instructed in the Contract documents. The Engineer will promptly review the Underground Facility to determine the extent to which the Contract Documents will be amended or supplemented. During such time, the Contractor shall be responsible for the safety and protection of such underground facilities as provided in Paragraph 7.13."

SC-5.06 Hazardous Environmental Condition at Site

Delete Paragraph 5.06(I.) of the General Conditions in its entirety.

SC-6.03 Contractor's Insurance

Delete Paragraph 6.03.B.3 in its entirety and insert the following:

3. with respect to completed operations insurance, and any insurance coverage written on a claims made basis, remain in effect for at least one year after final acceptance of the project;

Add a new Paragraph 6.03.B.6. which states as follows:

6 All insurance policies required by this Contract, except workers' compensation, shall name the Owner as an additional insured, and shall contain a waiver of subrogation against the Owner, its agents and employees. Contractor shall provide, upon request, a copy of an endorsement providing this coverage.

Delete Section 6.04 in its entirety, and add new Sections 6.03.D. and 6.03.E. which state as follows:

D. Contractor's Property Insurance

Contractor shall purchase and maintain property insurance upon the work at the site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, Engineer, Engineer's consultants, and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have in insurable interest and shall be listed as an insured or additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss and damage to the Work, temporary buildings, falsework, materials and equipment and Work in transit and shall insure against at least the following perils: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and other perils as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to the fees and charges of engineers and architects);

4. cover materials and equipment in transit for incorporation in the Work or stored at the site or at another location prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer; and

5. be endorsed to allow occupancy and partial utilization of the Work by Owner;

6. include testing and start-up; and

7. be maintained in effect throughout the life of the Agreement unless otherwise agreed to in writing by Owner, Contractor, and Engineer, with 45-days written notice to each other additional insured to whom a certificate of insurance has been issued.

E. Contractor's Liability Insurance

1. The limits of liability for the insurance required by Paragraph 6.03.A of the General Conditions shall provide coverage for not less than the following amount or greater where required by law or regulations:

a. Workers' Compensation;

(i).	State	Statutory
(ii).	Applicable Federal (e.g. Longshoreman)	Statutory

b. Contractor's General Liability, which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

(i)	General Aggregate	$4,000,000
(ii)	Products – Completed Operations Aggregate	$4,000,000
(iii)	Personal and Advertising Injury	$2,000,000
(iv)	Each Occurrence (Bodily Injury and Property Damage)	$2,000,000
(v)	Property Damage Liability Insurance will provide explosion, collapse, and under-ground coverage where applicable	
(vi)	Excess or Umbrella Liability	$4,000,000

c. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions.

(i) Bodily Injury:
Each Person $1,000,000
Each Accident $1,000,000

(ii) Property Damage:
Each Accident $1,000,000

(iii) Combined Single Limit of $2,000,000

d. Contractual Liability coverage covering indemnity obligations under Paragraphs 5.02.A.2, 7.18 and 8.03.C. of the General Conditions, providing coverage for not less than the following amounts:

(i) Bodily Injury:
Each Accident $2,000,000
Annual Aggregate $4,000,000

(ii) Property Damage
Each Accident $2,000,000
Annual Aggregate $4,000,000

SC-6.05 Property Losses; Subrogation

Renumber this section as 6.04.

SC-6.06 Receipt and Application of Property Insurance Proceeds

Delete Section 6.06 of the General Conditions in entirety, renumber it as Section 6.05 and insert the following:

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.03 will be adjusted and settled with the named insured that purchased the policy along with the owner. Such named insured shall give notice to such other insureds that adjustment and settlement of a claim is in progress. Coverage shall name the owner as a loss payee as their interests shall appear.

B. Proceeds for such insured losses may be made payable jointly to the loss payee and the named insured. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.03 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

SC-7.03 Labor; Working Hours

Delete Paragraph 7.03.C of the General Conditions in its entirety and insert the following in its place:

"C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, between 7:00 A.M. and 6:00 P.M. Contractor will not permit the performance of Work

on a Saturday unless as outlined on the Progress Schedule as approved by the Engineer. Work on a Sunday or Holiday shall only be allowed as permitted in writing by the Engineer.

In the event that Contractor works on a Saturday, Sunday or Holiday, the Owner reserves the right to charge the Contractor for the cost borne by the Owner to have the Engineer onsite during such days. ”

SC-7.07 Concerning Subcontractors, Supplies, and Others

Delete Paragraph 7.07.D of the General Conditions in its entirety and insert the following in its place:

“D. If the Owner and Engineer require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five (5) days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid. If the apparent Successful Bidder is unable to provide a substitution at equal cost, the Owner may take action to reject the apparent Successful Bid. Inability to provide an equal substitution shall not be reason to withhold the Bidder’s Bid Bond.”

Add the following new Paragraph 7.07.N immediately after Paragraph 7.07.M of the General Conditions, which is to read as follows:

“N. Any subcontractor or material man entitled to protection of a bond or other form of guarantee approved by the Owner under Wyoming State Statute W.S. 16-6-112 shall give notice of his right to that protection to the prime Contractor as required under W.S. 16-6-121. Failure to give notice to a prime Contractor who has complied with W.S. 16-6-121 waives the subcontractor or material man’s protection under the bond or guarantee and waives any right to a lien for material or services provided.

4. This section shall only apply where the prime Contractor’s contract is for One Hundred Fifty thousand dollars ($150,000) or more.

5. The prime Contractor shall post on the construction site a prominent sign citing Wyoming State Statute W.S. 16-6-121 and stating that any subcontractor or material man shall give notice to the prime Contractor of a right to protection under the bond or guarantee and that failure to provide this notice shall waive the subcontractor or material man’s protection under the bond or guarantee and shall waive any right to a lien for materials or services provided.

SC-7.18 Indemnification

Add a new paragraph immediately after Paragraph 7.18.A of the General Conditions which is to read as follows:

“It is expressly understood and agreed that while Owner and Engineer may have the right under this Contract to observe or otherwise review the Work, progress and operations of the Contractor, it is expressly understood and agreed that such observations shall not relieve the Contractor from any of its covenants and obligations hereunder. The Contractor shall be solely responsible and

save the Owner and Engineer and their consultants, agents and employees harmless from all suits, actions or claims of any character brought on account of any injuries or damages sustained by any person or property in consequence of any neglect in safeguarding the work, observing safety standards or regulations, or otherwise. The indemnification would include the use of unsafe or unacceptable materials in the construction or completion of the project, unacceptable materials in the construction or completion of the project, or the Contractor's failure to comply with any law, ordinance, or regulation, even though such act, omission, or work was done under the direct or indirect review of, or was observed by the Owner or Engineer."

Add the following language at the end of Paragraph 7.18.B of the General Conditions:

"Nor shall the Contractor's obligations under Paragraph 7.18.A or 7.18.B in any way be limited by any insurance coverage which the Contractor may have or which may insure to his benefit."

SC-10.03 Resident Project Representative

Delete Paragraph 10.03.A of the General Conditions in its entirety and insert the following in its place:

A. The Engineer will furnish a Resident Project Representative (RPR) for this project and the following is applicable:

A LISTING OF THE DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE.

The Engineer shall furnish a resident project representative (RPR), assistants, and other field staff to assist the Engineer in observing performance of the Work of the Contractor.

Through more extensive on-site observations of the Work in progress, and field checks of materials and equipment by the RPR and assistants, the Engineer shall endeavor to provide further protection for the Owner against defects and deficiencies in the Work; but, the furnishing of such services will not make the Engineer responsible for or give the Engineer control over construction means, methods, techniques, sequences or procedures, or for safety precautions or programs, or responsibility for the Contractor's failure to perform the Work in accordance with the Contract Documents.

The duties and responsibilities of the RPR are limited to those of the Engineer in the Engineer's agreement with the Owner, and in the construction Contract Documents, and are further limited and described as follows:

1. General

RPR is the Engineer's agent at the site and will act as directed by and under the supervision of the Engineer and will confer with the Engineer regarding RPR's Actions. RPR's dealing in matters pertaining to the on-site work shall, in general, be with the Engineer and Contractor, keeping the Owner advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of the Contractor. RPR shall generally communicate with the Owner with the knowledge of and under the direction of the Engineer. As agent for the Engineer, with express and implied supervisory authority, the RPR's authority shall be limited only by the limitations on authority placed upon the Engineer in the Contract Documents. The Contractor shall be entitled to rely upon the representations and instructions provided by the Resident Project Representative as agent for the Engineer,

2. Duties and Responsibilities of RPR

a. Schedules: Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by the Contractor and consult with the Engineer concerning acceptability.

b. Conferences and Meetings: Attend meetings with the Contractor, such as Pre-Construction Conferences, progress meetings, job conferences, and other project-related meetings, and prepare and circulate copies of minutes thereof.

c. Liaison:

   i. Serve as the Engineer's liaison with the Contractor's working principally through the Contractor's superintendent, and assist in understanding the intent of the Contract Documents; and assist the Engineer in serving as the Owner's liaison with the Contractor when the Contractor's operations affect the Owner's on-site operations.

   ii. Assist in obtaining, from the Owner, additional details or information, when required, for proper execution of the Work.

d. Shop Drawings and Samples:

   i. Record date of receipt of Shop Drawings and Samples.

   ii. Receive samples, which are furnished at the site by Contractor, and notify the Engineer of availability of samples for examination.

   iii. Advise the Engineer and Contractor of the commencement of any Work requiring a Shop Drawing or sample, if the submittal has not been approved by the Engineer.

e. Review of Work, Rejection of Defective Work, Inspections and Tests:

   i. Conduct on-site observations of the Work in progress to assist the Engineer in determining if the Work is, in general, proceeding in accordance with the Contract Documents.

   ii. Report to the Engineer whenever the RPR believes that any Work is unsatisfactory, faulty, or defective, or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise the Engineer of Work that the RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection, or approval.

   iii. Verify that tests, equipment and systems start-up and operating and maintenance training are conducted in the presence of appropriate personnel, and that the Contractor maintains adequate records thereof, and observe, record and report to the Engineer appropriate details relative to the test procedures and start-ups.

   iv. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections, and report to the Engineer.

f. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed, and transmit, to the Contractor, clarifications and interpretations as issued by the Engineer.

g. Modifications: Consider and evaluate the Contractor's suggestions for modifications in Drawings or Specifications, and report with RPR's recommendations to the Engineer. Transmit, to the Contractor, decisions, as issued by the Engineer.

h. Records:

i. Maintain orderly files for correspondence, reports of job conferences, Shop Drawings and Samples, re-productions of original Contract Documents, including all work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, the Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

ii. Keep a diary or log book, recording the Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail, as in the case of observing test procedures; and send copies to the Engineer.

iii. Record names, addresses, and telephone numbers of all the Contractor's, subcontractors, and major suppliers of materials and equipment.

i. Reports

i. Furnish the Engineer periodic reports, as required, or progress of the Work and of the Contractor's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.

ii. Consult with the Engineer, in advance of scheduled major tests, inspections or start of important phases of the Work.

iii. Draft proposed Change Orders and Work Directive Changes, obtaining backup material from the Contractor and recommended to the Engineer Change Orders, Work Directive Changes, and Field Orders.

iv. Report immediately to the Engineer and Owner, upon the occurrence of any accident.

j. Payment Requests: Review applications for payment with the Contractor for compliance with the established procedure for their submission, and forward with recommendations to the Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the site, but not incorporated in the Work.

k. Certificates, Maintenance and Operation Manuals: During the course of the Work, verify that certificates, maintenance and operating manuals, and other data required to be assembled and furnished by the Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to the Engineer for review and forwarded to the Owner prior to final payment for the Work.

l. Completion

i. Before the Engineer issues a Certificate of Substantial Completion, submit to the Contractor a list of observed items requiring completion or correction.

ii. Conduct final inspection in the company of the Engineer, Owner, and Contractor, and prepare a final list of items to be completed or corrected.

iii. Observe that all items on a final list have been completed or corrected, and make recommendations to the Engineer concerning acceptance.

3. Limitations of Authority

Resident Project Representative:

a. Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by the Engineer.

b. Shall not exceed limitations of the Engineer's authority, as set forth in the Contract Documents.

c. Shall not undertake any of the responsibilities of the Contractor, Subcontractors, or Contractor's Superintendent.

d. Shall not advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction, unless such advice or directions are specifically required by the Contract Documents.

e. Shall not advise on, issue directions regarding, or assume control over safety precautions and programs in connection with the Work.

f. Shall not accept Shop Drawings or sample submittals from anyone other than the Contractor.

g. Shall not authorize the Owner to occupy the Project in whole or part.

h. Shall not participate in specialized field or laboratory field or laboratory tests or inspections conducted by others, except as specifically authorized by the Engineer.

SC-11.07 Change of Contract Price

Add the following to the end of Paragraph 11.07.A of the General Conditions which is to read as follows:

"The Contractor agrees to make no claim for damages for delay in the performance of this Contract caused by any act or failure act of the Owner, Engineer or designated agents or representative, whether such delays are avoidable or unavoidable; that the Contractor agrees that such delays shall solely and fully be compensated for by an extension of time to complete performance of the work as provided herein.

Any claim for an increase or decrease in the Contract Price originated by a Subcontractor shall be evaluated by the Contractor. The Contractor shall determine the validity of said claim, and if the Contractor determines that said claim is valid, the Contractor shall so state in writing to the Owner in accordance with all the requirements of Article 12."

SC-13.01 Cost of the Work

Add the following to the end of Paragraph 13.01.B.1 of the General Conditions which is to read as follows:

"The Contractor shall receive up to forty-five percent (45%) of direct labor costs for the payroll fringe benefit items listed in Paragraph 13.01.B.1 in lieu of the method of payment provided therein."

Delete Paragraph 13.01.B.5.c.1) and 13.01.B.5.c.2) and insert the following in its place:

1) Contractor shall utilize the list of hourly rates for construction equipment as stated in Paragraph 2.03.A.4 as the basis for construction equipment rental costs.

SC-13.03 Unit Price Work

Delete Paragraph 13.03.E.1. of the General Conditions in its entirety and insert the following in its place:

"1. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment under the following conditions:

a. The total cost of a particular item of Unit Price Work amounts to ten percent (10%) or more of the Contract Price, and the variation in the quantity of that particular item of Unit Price Work performed by the Contractor differs by more than thirty percent (30%) from the estimated quantity of such item indicated in the Agreement; and

b. if there is no corresponding adjustment with respect to any other item or work;

And, either of the following two conditions (c or d) are met:

c. if the Contractor believes that the Contractor has incurred additional expense as a result thereof; or

d. if the Owner believes that the quantity variation entitles it to an adjustment in the unit price.

e. Either the Owner or Contractor may make a claim for an adjustment in the Contract Unit Price in accordance with Articles 11 and 12 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed."

SC-15.01 Progress Payments

Delete Paragraphs 15.01.B.1 and 15.01.B.2 of the General Conditions in their entirety, and insert the following in their place:

"1. At least twenty (20) days before the date established in the Agreement for each progress payment (but not more often than once a month), the Engineer shall submit to the Contractor, for review and approval, an Application for Payment covering the Work completed as of the date of the Application. The Contractor shall supply supporting documentation as is required by the Contract Documents to accompany the Application for Payment as prepared by the Engineer. Upon the Contractor approval of the Application, the Contractor and Engineer shall sign the Application and submit to Owner for payment. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by

a bill of sale, invoice, or other documentation warranting to the Owner that the Contractor has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner."

Delete Paragraph 15.01.C.1 of the General Conditions in its entirety, and insert the following in its place:

"1. The Contractor will, within ten (10) days after receipt of each Application for Payment from Engineer, either concur with the Engineer's prepared Application for Payment, provide accompanying documentation, sign and submit to Owner for payment or return the Application for Payment to the Engineer indicating in writing Contractor's reasons for refusing to approve the Application. In the latter case, Engineer may review Contractor's reasons, make the necessary corrections and resubmit the Application.

Delete paragraph 15.01.D.1 of the General Conditions in its entirety, and insert the following in its place:

"1. Twenty (20) days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to provisions of Paragraph 15.01.E) become due, and when due will be paid by Owner to Contractor."

Add the following language to the end of paragraph 15.06.B of the General Conditions.

"Below are the dates on which pay requests shall be submitted to the Owner for processing. If the pay requests are not received by 5:00 P.M. on the dates listed below, the pay request will be processed on the following processing date. Pay requests will be submitted on proper Owner-approved forms. Minor discrepancies will be corrected on the processing date. Major discrepancies will be corrected and may cause the request to be processed on the following processing date. Pay requests shall include progress through the last day of each month."

(Insert Owner processing dates here)"

Add the following new Paragraph 15.01.F to the General Conditions which is to read as follows:

"F.. Retainage

1. If requested by the Contractor, retainage shall be retained in an interest bearing account in the name of the Contractor. The interest bearing account will be assigned to the Owner until the contract is completed satisfactorily and finally accepted by the Owner.

2. The Owner shall enter into an interest bearing deposit agreement with any depository designated by the Contractor, after notice to the surety, to provide an agent for the custodial care and servicing of any deposits placed with the depository. The requirement for an interest bearing deposit agreement shall apply only to contracts of more than fifty thousand dollars ($50,000). The services shall include the safe keeping of the obligations and rendering of all services required to effectuate the purposes of Wyoming State Statute W.S.16-6-701 through W.S.16-6-706.

4. The Owner or any depository designated by the Contractor to serve as custodian for the retainage monies shall collect all interest and income when due on retainage so deposited and shall pay them, when and as collected, to the Contractor or as otherwise instructed by the Contractor. Any expense incurred for this service shall not be charged to the Owner.

5. The requirements of 15.01.F.1 through 15.01.F.4 above shall not apply in the case of contract made or awarded by the Owner if a part of the contract price is

to be paid with funds from the federal government or from some other source and if the federal government or other funding source has requirements concerning retainage or payment of funds which are applicable to the contract and which are inconsistent with these Articles.

6. The Contractor shall provide the Owner with an interest bearing deposit agreement prior to issuance of the Notice to Proceed."

SC-15.02 Contractor's Warranty of Title

Add the following Paragraph 15.02.B of the General Conditions:

"B. Neither recommendation of any progress payment by Engineer nor payment by the Owner to Contractor, nor any use of occupancy of the Work or any part thereof will release the Contractor from complying with the Contract Documents. Specifically the Contractor shall maintain in accordance with Article 6, property insurance on all Work, materials, and equipment whether incorporated in the project or not and whether included in an application for payment or not, for the full insurable value thereof. Passing title to Owner for materials and equipment included in an application for payment does not relieve the Contractor of the Contractor's obligation to provide insurance (including property insurance), as required in Article 6 of the General Conditions and these Supplementary Conditions. All insurance shall remain in effect as provided in Article 6."

SC-15.03 Substantial Completion

Delete Paragraphs 15.03.C and D, and replace them with the following:

C. If Owner in accordance with Wyoming State Statute 16-6-101(a)(xi), determines that the Work is substantially complete, it shall issue a Certificate of Substantial Completion. Upon issuance of a Certificate of Substantial Completion, the Owner shall cause notice to be published in a newspaper of general circulation, published nearest the point at which the Work is being carried on, once a week for two (2) consecutive weeks, and posted on the State of Wyoming's procurement website or the Owner's official website. The notice shall set forth in substance that the Owner has accepted the Work, or designated portion thereof, as substantially complete according to the Contract and associated documents, and that the Contractor is entitled to payment of any amount retained by the Owner, together with any other amount due under the Contract, less any amount withheld for the portion of the Work that is incomplete or not completed in accordance with the Contract and associated documents. Payment shall be made on the 41st day after the notice was first published. Notwithstanding the previous sentence, no payment shall be made until the Contractor files with the Owner a sworn statement settling forth that all claims for material, supplies and labor performed under the Contract have been and are paid for the entire period of time for which the payment is to be made. If any claim for material, supplies or labor is disputed, the sworn statement shall so state, and the amount claimed to be due the subcontractor or materialmen may be filed by the claimant as a claim against the Contractor's surety bond. Payment to the Contractor shall be paid without regard to any pending claims against the Contractor's surety bond unless the Owner has actual knowledge that the surety bond is deficient to settle known present claims, in which case an amount equal to the disputed claims may be withheld by the Owner.

D. At the time of receipt of the Certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of

the Work, property insurance, maintenance, hear, and utilities upon Owner's issuance of the Certificate of Substantial Completion.

SC15.06. Final Payment,

Delete Section A.3. in its entirety.

SC-15.08 Correction Period

Delete Paragraphs 15.08.A through 15.08.F of the General Conditions in their entirety and insert the following in their place:

"If within one (1) year after the date of Substantial Completion by the Owner or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contact Documents, any work is found to be defective, the Contractor shall promptly, without cost to the Owner and in accordance with the Warranty and the Owner's written instructions, either correct such defective work, or if it has been rejected by the Owner, remove it from the site and replace it with non-defective work. If the Contractor does not promptly comply with the terms of such instructions, or in an actual emergency where delay could cause serious risk of loss or damage, the Owner may have the defective work corrected or the rejected work removed and replaced, and all direct, indirect, and consequential costs of such removal and replacement, (including, but not limited to, fees and charges of engineer, architects, attorneys, and other professionals), will be paid by the Contractor. In special circumstances where a particular item of equipment or specified part of the work is placed in continuous service before Substantial Completion of all the Work, the correction period for that item or part of the Work, may start from the date it is placed in continuous service only if so provided in the specifications, special provisions, written amendment, or by written agreement between the Owner and the Contractor.

Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed."

SC-17 ARTICLE 17 - FINAL RESOLUTION OF DISPUTES

Delete this article in its entirety.

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. Apply for, obtain, and pay for permits required to perform the work.

B. Comply with applicable codes and regulations of authorities having jurisdiction.

C. Field-verify dimensions indicated on drawings before fabricating or ordering materials. Do not scale drawings.

D. Notify OWNER of existing conditions differing from those indicated on the drawings. Verify the existence and location of underground utilities along the route of proposed work. Omission of an existing utility location on the Drawings is not to be considered as its nonexistence. Inclusion of existing utility location on the Drawings is not to be considered as its definite location. Do not remove or alter existing utilities without prior written approval. The CONTRACTOR is required to comply with the terms of the Wyoming Statute W. S. 37-12-301 through W. S. 37-12-305. *"Wyoming Underground Facilities Notification Act"*

E. The Contract Documents are intended to provide the basis for proper completion of the work suitable for the intended use of OWNER. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the project shall be included.

F. Portions of the Contract Documents are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is CONTRACTOR. For example, "Furnish…" means "CONTRACTOR shall furnish…", "Provide…" means "CONTRACTOR shall provide…".

1.02 LIMITS OF CONSTRUCTION

A. The work on this Project shall be limited to the area to be developed, unless specifically shown otherwise on the Drawings, for staging, storage of equipment and materials, construction, and clean-up operations. No waste areas are indicated as it will be the responsibility of the CONTRACTOR to obtain the same.

Access to lands outside the limits as shown on the Drawings will be permitted only upon the submission from the CONTRACTOR to the ENGINEER of a copy of the written agreement between the CONTRACTOR and the landowner(s) permitting the CONTRACTOR access to the private land(s). No additional compensation will be made for repairs or restoration outside the limits shown on the Drawings.

SECTION 01020

CONTRACT PAY ITEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section consists of the various pay items associated with a Project that do not fit into the various construction item Sections.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MOBILIZATION

A. The OWNER will pay for the cost of mobilizing the resources needed to prepare for the start of work. Mobilization includes but is not limited to the following:

1. Moving personnel, equipment, supplies, and incidentals to the site;
2. Establishing offices, buildings, and other facilities at the site; and
3. Other preparatory work and operations.

B. The OWNER will pay for mobilization as a percentage of the lump sum bid based on the percentage of the original Contract Price earned accordance with the following formulas:

Percentage of Original Contract Amount Earned (PCE)	Percentage of Lump Sum Mobilization to be paid (PMP)
0-5	(4)x(PCE)
5-10	20 + (6)x(PCE - 5)
10-25	50 + (2/3)x(PCE – 10)
25-65	60 + (3/4)x(PCE – 25)
65-80	90 + (2/3)x(PCE – 65)
80+	100

(Note: Materials stored on site shall be included when calculating PCE but Change Orders shall not.)

3.02 FORCE ACCOUNT

A. Force Account amount has been set up and is to be used to pay for work done on approved Change Orders. In the event, the total cost of approved Change Orders exceed the Force Account amount, the Change Order will be prepared to cover the additional amount of required Contract Price change. The CONTRACTOR will be paid for only that portion of each Force Account amount that is covered by approved Change Orders.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASURMENT

A. STANDARD ITEMS.

1. 01020.01 MOBILIZATION

This item will be paid as a percentage of the lump sum bid based on the percentage of the original Contract Price earned.

2. 01020.02 CONTRACT BONDS

This item will be paid as a lump sum for the lesser of the amount bid or the cost of the bond based on invoices from the insuring firm indicating the actual initial cost of the bond.

3. 01020.03 FORCE ACCOUNT

This item shall be paid for only that portion of each Force Account amount that is covered by approved Change Orders.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS.

1. 01020.01 MOBILIZATION

Payment for this item includes the costs associated with preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies and incidentals to the Project site; for the establishment of all offices, buildings, and other facilities necessary for the work on the Project and for all other work and operations which must be performed, or costs incurred prior to beginning work on the Project.

2. 01020.02 CONTACT BONDS

Payment for this item includes the costs associated with furnishing the bonds that are required by the General Conditions.

3. 01020.03 FORCE ACCOUNT

A Force Account amount has been set up for each project and is to be used to pay for work done on approved Change Orders. In the event the total cost of approved Change Orders exceeds the Force Account amount, a Change Order will be prepared to cover the additional amount.

SECTION 01041

PROJECT COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Schedule a preconstruction conference to be held within twenty (20) days of the Notice of Award. CONTRACTOR's assigned supervisory personnel shall attend this conference.

B. Conduct all construction activities between the hours of 7:00 A.M. and 6:00 P.M. on Working Days of the Normal Working Week, Monday through Friday except for Holidays, and on Saturdays only as outlined in the Engineer approved Progress Schedule. Exception to these hours shall only be as approved by the Owner's representative.

C. Water for use during construction will be obtained by CONTRACTOR at his expense. If he elects to obtain water from the City of Gillette, he will make all the arrangements, comply with their regulations, and pay all fees and charges. The City does not allow water for construction activities to be obtained through the City's fire hydrant system.

1.02 COORDINATION WITH PUBLIC AND PRIVATE AGENCIES

A. If other utility companies elect to repair or replace their lines in the project area, their crews will be permitted access to the area to accomplish their work.

B. Contact all utility companies for location of their facilities. Call at least 48 hours prior to excavation.

C. CONTRACTOR is responsible for dust and sediment control, including tracking of mud onto a street, as well as maintaining a neat work site, and shall provide all equipment and personnel necessary to meet the requirements of this responsibility. CONTRACTOR shall provide ENGINEER with the name(s) and telephone number(s) of the person(s) designated to maintain the work site and dust and sediment control during evenings and weekends. If this person cannot be contacted, OWNER may correct the problem with its own forces or contract by others. In this case, CONTRACTOR shall pay all costs incurred by OWNER.

D. Do not park vehicles or equipment on private property without written permission from the property owner.

E. The CONTRACTOR shall provide the means, all labor, and resources to either give access to the City of Gillette Solid Waste Department on the regular route and schedule, or to move the refuse containers to a location agreed upon with the COG Solid Waste Department for pick up by the solid waste department. The refuse containers shall be returned to the original address after the collection has been completed and prior to the end of the work day. This task will be incidental to the project cost.

1.03 COORDINATION WITH OWNER AND ENGINEER

A. OWNER will provide engineering surveys to establish reference points as necessary. Construct all work in accordance with the lines and grades shown on the Drawings, and as designated by ENGINEER. These lines and grades may be modified by ENGINEER as provided in the General Conditions. Notify ENGINEER a minimum of 24 hours in advance to request surveying. All control survey work shall be done by or under the direct supervision of a licensed Wyoming professional land surveyor.

B. Unless otherwise provided for in the Contract, the OWNER shall employ and pay for the services of an independent testing laboratory to perform all quality assurance, or acceptance tests required by the Contract Documents. The CONTRACTOR shall notify the ENGINEER a minimum of 24 hours in advance to request testing.

C. Unless otherwise provided for in the Contract, the CONTRACTOR shall be responsible for all quality control testing of their Work. Performing quality control testing is at the discretion of the CONTRACTOR for their use, and those tests will not be used for basis of acceptance of the Work. All expenses incurred to perform retesting of failed quality assurance or acceptance test areas shall be the responsibility of the CONTRACTOR. Any failed tests that were the result of faulty tesing methods or equipment will not be charged to the CONTRACTOR.

1.04 CONFINED SPACE ENTRY PROGRAM

A. A confined space is defined as any enclosed space which is large enough and so configured that an employee can bodily enter and perform assigned work, has limited or restricted means for entry or exit, and is not designed for continuous employee occupancy.

A permit required confined space is a confined space that has one or more of the following characteristics: contains or has a known potential to contain a hazardous atmosphere; contains a material with a potential for engulfment of an entrant; has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross section; or, contains any other recognized serious safety or health hazard.

A non-permit confined space is a space that meets the above definition of a confined space and does not contain or, with respect to atmosphere hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Examples of permit required confined spaces are: manholes, digesters, enclosed tanks, vessels, storage bins, silos, pits, or vaults.

All personnel entering a permit required confined space shall have a valid confined space entry permit issued by the contractor responsible for the operation or their designated representative, and shall comply with all testing and monitoring procedures, shall utilize appropriate personal protective equipment, and shall comply with all applicable requirements and work practices and procedures.

Contractors or other personnel who may be required to enter any city facilities confined space will be informed if the area is designated a permit required space and will be required to follow appropriate confined space entry procedures. All manholes in the City's wastewater collection system are designated permit required confined space.

Entry into wastewater system manholes or other designated confined spaces is prohibited unless specific approval is obtained from the related Operational Division or the Engineering Division prior to entry.

Any contractor working on existing city facilities with confined space shall have a written confined space entry program in effect. Any necessary entries shall be made in accordance with the contractors confined space entry program and 29 CFR 1910.146. Failure to comply with the confined space entry program will result in immediate shut down of the segment of work being performed.

1.05 JOB SITE SAFETY AND CONDUCT

A. The City of Gillette is committed to completing all maintenance and construction activities in a safe, conscientious and courteous manner. Contractors, including engineering firms and subcontractors, working on City projects and premises are viewed by the public as representatives of the City. The following guidelines are established to provide minimum expectations for contractors and their employees. Flagrant or continuous failure to meet these expectations could result in removal of the employee from the Project.

1. All Contractors working on City Projects and premises shall have a written substance abuse policy in effect. Copies of the written policy will be available upon request to the City Project Manager and kept on file for reference on future contracts with the City. The contractor shall provide the City with policy updates. In the event that a Contractor does not have a written substance abuse policy, the contractor shall follow the general requirements of the City's policy. A copy of the City's policy will be provided to the Contractor upon necessity.

2. Contractor employees will be properly attired for the work they are doing. At a minimum, employees will have appropriate footwear, long pants, shirts and any Personal Protection Equipment that is required by OSHA, WYOSHA, or the Contractor.

3. Contractor employees shall follow all OSHA, WYOSHA, and Contractor's safety requirements as required by the Work. All employees subject to exposure of sanitary sewage shall be trained and follow all requirements related to blood borne pathogens.

4. Contractor employees are representatives of the Contractor. They should represent their employer by being courteous and polite with the public. They should not misuse private property by loitering, littering or other damaging acts.

5. Contractor employees should refer project-related questions from the public to the Superintendent, Project Engineer or City Project Manager.

1.06 STREET CLOSURE PROCEDURE AND APPLICATION FORM

A. Street closure will not be allowed if prior forty-eight (48) hours written notice is not given to the authorities via e-mail to streetclosure@gillettewy.gov. A street closure shall be defined as any time through traffic is not allowed on a street for a period of two (2) hours or more. Additionally, the CONTRACTOR shall inform the affected homeowners and/or businesses on a house-by-house and/or business-by-business basis as to the situation by making them aware of the time of closure as well as the anticipated reopening. This shall also be done a minimum of forty-eight (48) hours prior to any street closure. The Contractor shall provide to the Owner and/or the Engineer the Street Closure Form for review and approval prior to the Contractor sending out notice of street closure.

B. A minimum of forty-eight (48) hours prior to any street closure, the CONTRACTOR will be responsible for notifying the following authorities via e-mail to **streetclosure@gillettewy.gov**:

Campbell County Hospital/Ambulance Service
Phone Number: 688-1000

Campbell County Fire Department
Phone Number: 682-5319

Campbell County Sheriff's Department
Phone Number: 682-7271

Gillette Police Department
Phone Number: 682-5155

Gillette Department of Engineering
Phone Number: 686-5265

Gillette Department of Utilities
Phone Number: 686-5277

Gillette Department of Public Works
Phone Number: 686-5278

Gillette Public Information Officer
Phone Number: 686-5393

Geographic Information Systems
Phone Number: 686-5364

Black Hills Energy
Phone Number: 682-5881

Wyoming Dept. of Transportation
Phone Number: 682-3550

School District (Bus Garage)
Phone Number: 682-4179

United States Postmaster
Phone Number: 682-3727

The Gillette News-Record
Phone Number: 682-9306

Radio Stations KGWY/KIML/KAML
Phone Number: 686-2242

County 17
Phone Number: 686-5121

The most current Street Closure Form is available on the City of Gillette website at www.gillettewy.gov.

1.07 TEMPORARY WATER SHUT-OFF PROCEDURE AND APPLICATION FORM

A. Water shut-offs of City's water mains will not be allowed if prior forty-eight (48) hours written notice is not given to the authorities via e-mail to streetclosure@gillettewy.gov. For the purposes of this section and for necessity of notice, a water shut-off shall be defined as any time that domestic or fire protection water services are disrupted for construction purposes. Additionally, the CONTRACTOR shall inform the affected homeowners and/or businesses on a house-by-house and/or business-by-business basis as to the situation by making them aware of the time of shut-off as well as the anticipated time of establishment of water service. This shall also be done a minimum of forty-eight (48) hours prior to any shut-off. A temporary water shut-off shall not be planned to last longer than four (4) hours. All practical means shall be used to prevent shut-off times from occurring during peak usage hours. The proposed time of shut-off shall be identified accordingly on the temporary water shut-off form and shall be subject to approval by Owner. The Contractor shall provide to the Owner and/or the Engineer the Temporary Water Shut-Off Form for review and approval prior to the Contractor sending out notice of shut-off.

B. Water shut-offs that impact the service of multiple fire hydrants shall be coordinated with and approved by the Engineer and/or the Owner so that fire protection services are not be compromised. In these cases, Construction methods shall be scheduled to progress accordingly to reduce the number of hydrants out of service to a number that will not compromise the ability to provide fire protection services to the area.

In any instances where the fire hydrant(s) are in place, but are out of service, they shall be bagged and taped or wired to properly indicate that they are restricted from use. The bag(s) shall be maintained for the entire duration of the hydrant(s) being off-line.

C. A minimum of forty-eight (48) hours prior to any water shut-off, the CONTRACTOR will be responsible for notifying the following authorities via e-mail to **streetclosure@gillettewy.gov**:

Campbell County Hospital/Ambulance Service
Phone Number: 688-1000

Campbell County Fire Department
Phone Number: 682-5319

Gillette Police Department
Phone Number: 682-5155

Gillette Department of Engineering
Phone Number: 686-5265

Gillette Department of Utilities
Phone Number: 686-5277

Gillette Department of Public Works
Phone Number: 686-5278

Gillette Public Information Officer
Phone Number: 686-5393

Geographic Information Systems
Phone Number: 686-5364

The Gillette News-Record
Phone Number: 682-9306

Radio Stations KGWY/KIML/KAML
Phone Number: 686-2242

Engineer (if City Project)

The most current Temporary Water Shut-Off Form is available on the City of Gillette website at www.gillettewy.gov.

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 PRESERVATION OF REFERENCE POINTS

A. The CONTRACTOR shall carefully mark and preserve reference points, which include, but are not limited to: bench marks, lot corners, section corners, other monuments, and stakes prior to starting the Work and in case of destruction CONTRACTOR shall be charged for resetting of such points and shall be responsible for any mistakes or deviation from the Contract Documents that may be attributed to the disturbance of reference points by CONTRACTOR.

B. The CONTRACTOR shall promptly report loss or destruction of reference points which include, but are not limited to: bench marks, lot corners, section corners, other monuments, and stakes to the ENGINEER.

1.02 RE-STAKING

A. The ENGINEER shall replace reference points, which include but are not limited to: bench marks, lot corners, section corners, other monuments, and stakes that are destroyed or altered by the CONTRACTOR at the CONTRACTOR'S expense.

B. Construction surveys provided by the ENGINEER will be provided once. Should re-staking or replacing reference points be required for whatever reason, including negligence or lack of preparedness, the OWNER'S cost shall be the responsibility of the CONTRACTOR. These costs shall be withheld from the CONTRACTOR'S subsequent progress payments and be paid to the ENGINEER by the OWNER.

1.03 ENGINEER PROVIDED SURVEYS

A. The ENGINEER will provide the construction surveys listed below. The CONTRACTOR shall provide a minimum of forty-eight (48) hours advance notice for construction staking.

B. The following staking services will be provided by the ENGINEER:

1. Stake construction limits at one hundred foot (100') intervals.
2. Stake horizontal and vertical alignment of new storm sewer at fifty foot (50') intervals, as well as manholes, inlets, junction boxes, and other appurtenances/fittings as required for installation.
3. Stake horizontal and vertical alignment of new sanitary sewer at fifty foot (50') intervals, as well as manholes, and service lines as required for installation.
4. Stake horizontal alignment of new water lines at fifty foot (50') intervals , as well as fittings, hydrants, valves, and other appurtances as required for installation.
5. Stake horizontal and vertical layout of box and pipe culverts.

6. Stake horizontal and vertical alignment of curb and gutter at fifty foot (50') intervals along tangents and twenty-five foot (25') intervals along vertical and horizontal curves.
7. Slope stake subgrade at one hundred foot (100') intervals.
8. Blue top roadway subgrade at fifty foot (50') intervals. Three (3) blue tops will be placed, one (1) on centerline, and one (1) on each edge of the roadway.
9. Blue top aggregate base course at fifty foot (50') intervals. Three (3) blue tops will be placed, one (1) at the centerline, and one (1) on each edge of the roadway.
10. Stake the center of handicap ramps.
11. Stake the pavement markings at two hundred foot (200') intervals along tangents and fifty foot (50') intervals through curves.
12. Stake permanent sign locations.

C. If the CONTRACTOR requests blue top staking and the area requested is greater than four-tenths (0.40) of a foot different than the design grade, the ENGINEER will discontinue staking operations until the subject area is within this tolerance limit. The ENGINEER'S field time shall be withheld from the CONTRACTOR'S subsequent progress payment and be paid to the ENGINEER from OWNER.

1.04 CONTRACTOR PROVIDED SURVEYS

A. If the CONTRACTOR performs additional survey work beyond what is provided by the ENGINEER, the CONTRACTOR shall maintain survey notes in a neat and legible format. Upon request, the CONTRACTOR shall provide a duplicate set of survey notes to the ENGINEER for record purposes. The ENGINEER reserves the right to monitor the work of the CONTRACTOR'S survey to verify conformance with the Contract Documents.

B. The CONTRACTOR may employ a Land Surveyor registered in the State of Wyoming, or a party chief with similar experience for any CONTRACTOR provided surveys. The CONTRACTOR shall provide verification of the individual's credentials to the ENGINEER upon request.

C. Additional surveys required for construction beyond the ENGINEER provided surveys identified herein.

D. The CONTRACTOR'S cost for equipment, materials, and personnel shall be included in the prices bid for the various bid items listed on the bid sheets.

SECTION 01090

REFERENCES

PART 1 GENERAL

1.01 COORDINATION OF CONTRACT DOCUMENTS

A. The various portions of the Contract Documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in any portion or part is as binding as though occurring in all. All portions are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, the following hierarchy shall be observed:

1. Special Provision will govern over
2. Supplementary Specifications, which will govern over
3. Project Drawings, which will govern over
4. These specifications and Standard Drawings.

B. CONTRACTOR shall not take advantage of any apparent error or omission in the Contract Documents. If CONTRACTOR discovers an error or omission, CONTRACTOR shall immediately notify ENGINEER. ENGINEER will pursue such corrections and interpretations as may be necessary for fulfilling the intent of the Contract Documents.

1.02 DEFINITIONS

A. These specification use "Article 1 – Definitions" of the Standard General Conditions of the Construction Contract prepared and issued by the Engineers Joint Contract Documents Committee (EJCDC), as the basis for the definition of terms herein. Changes in these definitions shall be made either by substitution for that article or as Supplementary Conditions.

B. Additional definitions and clarification of terms:

1. Provide: Furnish and install, complete with all necessary ancillary items, ready for intended use. Pay for all related costs.
2. Approved: Acceptance of an item submitted for approval. Not a limitation or release for compliance with the Contract Documents or any regulatory requirements. Refer to limitations of 'Approved' in the EJCDC General Conditions, Paragraph 3. 4 if used.
3. Match Existing: Construct new work to conform to the existing lines and grades of the site and facilities as acceptable to OWNER.
4. Supplementary Specifications: Permanent additions to and revisions of these specifications, covering conditions that are not unique to any one project. Supplementary Specifications will govern over these specifications, including the Standard Drawings when in conflict therewith.
5. Special Provisions: Additions and revisions to these specifications covering special conditions on an individual project. Special Provisions will govern over project Drawings and supplementary documents, Supplementary Specifications, Standard Drawings, and these specifications when in conflict therewith.

SECTION 01340

SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. Wherever submittals are required hereunder, all such submittals by the CONTRACTOR shall be submitted to the ENGINEER.

B. At the preconstruction meeting, the CONTRACTOR shall submit the following items to the ENGINEER for review:

1. A project overview bar chart.
2. A preliminary schedule of values if the project is bid primarily with lump sum bid items.
3. A CONTRACTOR'S schedule of Submittals showing a workable arrangement for reviewing and processing the required submittals.

1.01.01 SHOP DRAWINGS

A. Wherever called for in the Contract Documents, the CONTRACTOR shall furnish to the ENGINEER for review, five (5) copies, of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, lists, graphs, catalog sheets, and similar items.

B. All Shop Drawing submittals shall be accompanied by the ENGINEER's COVER PAGE. A copy of the form is shown at the end of this section. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER.

D. Except as may otherwise be indicated herein, the ENGINEER will return two (2) copies of the submittals to the CONTRACTOR with its comments noted, within ten (10) calendar days following their receipt by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item. The OWNER reserves the right to withhold monies due the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the second submittal. The ENGINEER's maximum review period for each submittal, including all resubmittals, will be ten (10) days per submittal. In other words, for a submittal that requires two resubmittals before it is complete, the maximum review period for that submittal could be thirty (30) days.

E. If copies of a submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN", formal revision and resubmission of said submittal will not be required.

F. If copies of a submittal are returned to the CONTRACTOR marked "MAKE CORRECTION NOTED", formal revision and resubmission of said submittal will not be required.

G. If a submittal is returned to the CONTRACTOR marked "AMEND-RESUBMIT", the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER.

H. If a submittal is returned to the CONTRACTOR marked 'REJECTED-RESUBMIT", the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said submittal to the ENGINEER.

I. Fabrication of an item shall be commenced only after the ENGINEER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

J. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed and certified. No considerations for review by the ENGINEER of any CONTRACTOR submittal will be made for any items that have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

K. The ENGINEER's review of CONTRACTOR shop drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfit due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

L. At the time of each submission, call to the attention of the ENGINEER on the COVER PAGE any deviations from the requirements of the Contract Documents. If changes are made on resubmitted shop drawings, such changes shall be clearly explained on the COVER PAGE accompanying the resubmitted shop drawing.

1.01.02 SAMPLES

A. Whenever in the Specifications samples are required, the CONTRACTOR shall submit not less than three (3) samples of each item or material to the ENGINEER for acceptance at no additional cost to the OWNER.

B. Samples, as required herein, shall be submitted for acceptance a minimum of twenty-one (21) days prior to ordering such material for delivery to the job site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.

C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name for identification and

submitted to the ENGINEER for acceptance. Upon receiving acceptance of the ENGINEER, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, and one set of samples will be retained by the ENGINEER, and one set of samples shall remain at the job site until completion of the WORK.

D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, the CONTRACTOR will clearly indicate same on the transmittal page of the submittal.

1.01.03 OWNER'S MANUAL

A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. The OWNER'S MANUAL shall be written so that it can be used and understood by the OWNER's operation and maintenance staff.

B. The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "part". "Parts shall conform to the following (as applicable):

1. Part 1 – Equipment Summary

   a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

   b. Form: The ENGINEER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

2. Part 2 – Operational Procedures

   a. Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:

      Installation
      Adjustment
      Startup

   Location of controls, special tools or other equipment required or related instruments needed for operation.

      Operation Procedures
      Load Changes
      Calibration
      Shutdown
      Troubleshooting
      Disassembly
      Reassembly
      Testing to determine performance efficiency

Tabulation of proper settings for all pressure relief valves, low and high pressure switches and other protection devices.

List of all electrical relay settings including alarm and contact settings.

3. Part 3 – Preventive Maintenance Procedures

   a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component and by leaving the equipment in place.

   b. Schedule: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

4. Part 4 – Parts List

   a. Part List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list:

5. Part 5 – Wiring Diagrams

   a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Part 6 – Safety

   a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

7. Part 7 – Documentation

   a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

C. The CONTRACTOR shall furnish to the ENGINEER 5 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals shall be prepared.

D. OWNER'S MANUALS shall be submitted in final form to the ENGINEER no later than the seventy-five percent (75%) of construction completion date. All discrepancies found by the ENGINEER in the OWNER'S MANUALS shall be corrected by the CONTRACTOR within thirty (30) days from the date of written notification by the ENGINEER.

1.02 CONTRACT BOND

A. Subsequent to award of the contract and satisfactory compliance with the Contract Bond requirements, the CONTRACTOR shall submit a written request to the ENGINEER requesting payment of the Contract Bond bid item. The CONTRACTOR shall include with this written request copies of the invoices from the insuring firm(s) indicating the actual initial cost of these items. Payment for this bid item shall be the contract bid price or the cost of the bond based on the invoices, whichever is less.

1.03 CONTRACTOR'S LICENSE AND PERMIT

A. Prior to execution of the Agreement, the contractor shall have the appropriate City Contractor's License with the City of Gillette as related to the Work of the project. Applications for the license may be obtained from the City Building Division. City of Gillette, 201 E. 5th Street, Gillette, WY 82717. The contractor shall also obtain all appropriate permits for the project from the City Engineering Division, located at the same address.

B. Before commencing with the project, all subcontractors, shall have the appropriate City Contractor's License with the City of Gillette as related to their Work on the project. Applications for the license may be obtained from the City Building Division. City of Gillette, 201 E. 5th Street, Gillette, WY 82717.

TRANSMITTAL OF SHOP DRAWINGS		DATE:	☐ NEW SUBMITTAL	☐ RESUBMITTAL
TO:		PROJECT:	PROJECT #:	
BID ITEM NO.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number, etc.)	MANUFACTURER OR SUPPLIER	NO. OF COPIES	
LIST ALL VARIANCES FROM CONTRACT DOCUMENT REQUIREMENTS				
I hereby certify that all Contractor's responsibilities under the Contract Documents with respect to review and submission of the above Shop Drawings have been satisfied and that each shop drawing has been stamped and/or marked to indicate Contractor's compliance with the Shop Drawing review requirements.				
CONTRACTOR: _____		SIGNED: _____ (NAME & TITLE)		

SECTION 01500

SEDIMENT AND EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This work consists of temporary and permanent measures necessary to control sediment and erosion during the life of the contract and post-construction. The temporary sediment and erosion control provisions contained herein shall be coordinated with the final sediment and erosion control features to the extent practical to assure economical effective and continuous sediment and erosion control throughout the construction and post-construction period.

PART 2 PRODUCTS

2.01 SEDIMENT AND EROSION CONTROL

A. Materials used in sediment and erosion control work shall conform to the requirements set forth in the contract. When work is ordered for which no provisions are contained in the contract, material requirements shall be set forth in the agreement covering the additional work.

B. Silt Fence shall consist of a temporary vertical barrier of fabric attached to and supported by woven wire (if required) and wood or steel posts and entrenched into the ground. The silt fence fabric shall conform to Section 02895.

C. Erosion Bales shall consist of hay or straw bales free of noxious weeds.

D. Wattles shall consist of straw fibers encased in tubular netting. Wattles shall be as manufactured by American Excelsior Company or approved equal. Wattles shall be installed in accordance with the manufacturer's recommendations and the City of Gillette Standard Details.

E. Erosion Control Blanket, when called for in the plans, shall be used to prevent erosion in ditches and on slopes. The blanket shall be installed in accordance with the plans. Erosion Control Blanket shall conform to Section 02895.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. The Contractor shall submit, at the pre-construction meeting, a copy of the approved City of Gillette Storm Water Permit, State of Wyoming Stormwater Permit Notice of Intent (if applicable), and Stormwater Pollution Prevention Plan.

B. The Contractor shall install all necessary temporary sediment and erosion control devices prior to commencement of construction. Temporary sediment and erosion control devices shall be maintained at the Contractors expense throughout the contract period.

C. All final sediment and erosion control devices, as detailed in the plans, shall be installed prior to the final completion date as specified in the contract.

D. In the event of conflict between these requirements and pollution control laws, rules, or regulation of other Federal or State or local agencies, the more restrictive laws, rules or regulations shall apply.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 01500.11 CONSTRUCTION STORMWATER MANAGEMENT

   This item shall be paid as a percentage of the lump sum bid based on the percentage of the original Contract Price earned.

2. 01500.12 INSTALL SILT FENCE

   This item shall be measured by the lineal footage of silt fence installed.

3. 01500.13 INSTALL EROSION BALES

   This item shall be measured by the lineal footage of erosion bales installed.

4. 01500.14 INSTALL EROSION BLANKETS

   This item shall be measured by the square yardage of completed exposed surface area. Overlap will not be measured.

5. 015000.15 INSTALL WATTLES

   This item shall be measured by the lineal footage of wattles installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 01500.11 CONSTRUCTION STORMWATER MANAGEMENT

   The lump sum payment shall constitute full payment for all materials, equipment, tools, labor, management, maintenance, etc. for the performance of all work and incidentals necessary to implement and perform the preparation, administration, maintenance and transfer of the applicable stormwater permit(s). All costs associated with the performance of the stormwater permit(s), including but not limited to the installation and maintenance of temporary sediment and erosion control devices shall be covered by this item.

2. 01500.12 INSTALL SILT FENCE

   Payment shall include furnishing and installing all materials including posts, woven wire and fabric; excavation and backfill; and all equipment, labor, tools and incidentals to complete this item for final sediment and erosion control purposes.

3. 01500.13 INSTALL EROSION BALES

   Payment shall include furnishing and installing all materials including stakes and straw bales; excavation and backfill; and all equipment, labor, tools and incidentals to complete this item for final sediment and erosion control purposes.

4. 01500.14 INSTALL EROSION BLANKETS

   Payment shall include furnishing and installing all materials including those required for the specified overlaps, equipment, labor, tools and incidentals to complete this item for final sediment and erosion control purposes.

5. 01500.15 INSTALL WATTLES

   Payment shall include furnishing and installing all materials including stakes and straw wattles; excavation and backfill; and all equipment, labor, tools and incidentals to complete this item for final sediment and erosion control purposes

SECTION 01505

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Furnish temporary services and utilities, including use fees and operation costs, e.g.:

1. Potable and non-potable water
2. Lighting and power
3. Materials storage

B. Furnish construction facilities, including utility costs, e.g.:

1. Construction equipment
2. Dewatering and pumping

C. Furnish security and protection requirements, e.g.:

1. Fire extinguishers
2. Site enclosure fence, barricades, warning signs, and lights, if requested
3. Snow and ice removal, if applicable

D. Furnish personnel support facilities, e.g.:

1. Sanitary facilities
2. Drinking water
3. First aid facilities
4. Coordinate emergency medical services
5. Trash removal

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASURMENT

A. No measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 01510

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of the requirements for the furnishing, installation, and maintenance of traffic control devices, both temporary and permanent.

PART 2 PRODUCTS

2.01 CONSTRUCTION TRAFFIC CONTROL AND WARNING DEVICES

A. Construction traffic control and warning devices shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, more specifically Part VI, published by the U.S. Department of Transportation, and the latest edition of the American Traffic Safety Services Association Quality Guidelines for Temporary Traffic Control Devices and Features.

2.02 PROJECT IDENTIFICATION SIGNS

A. Sign Panels.

1. Sign panels shall consist of three-quarter inch (3/4") minimum thickness, sanded, exterior grade Douglas Fir plywood, grade B-B or better. The plywood shall be in good repair and be approved by the OWNER prior to payment. Sign panel fastenings shall be three-eighths inch (3/8") machine bolts, nuts and wrought iron washers.

2. The primer, paint and stain shall meet the following requirements:

Type	Color	Federal Specification (Latest Edition)
Primer, wood, exterior	---	TT-P-25
Primer, metal	Red Base	TT -P-86 or TT-P-615
Paint, exterior	White	TT-P-71
Enamel, Alkyd, gloss	Black	TT-E-489
Stain, oil, wood, semi-transparent, exterior	Cedar	TT-S-708

(Other paints of equal or better quality may be substituted with approval of the OWNER. No lead-based paint shall be used on this Project.)

B. Posts.

1. Posts shall be breakaway type, at least four inch by four inch (4" x 4") nominal dimensions or at least four inch (4") diameter Douglas Fir or Western Larch.

Rough-worn posts or peeled and seasoned timber is acceptable. Posts larger than six inches by six inches (6" x 6") shall not be used.

2. Breakaway holes of the sizes shown below shall be drilled in the posts at the locations between six and eighteen inches (6" – 18") above the ground level. The post size shall be measured at the breakaway hole location.

Post Size	Number of Holes	Hole Diameter (in Inches)
4" Diameter	None	---
5" Diameter	None	---
6" Diameter	2	1/2
4" x 4"	None	---
4" x 6"	None	---
6" x 6"	3	1/2

3. Skids.

Skids shall be constructed of the same material as the posts. They shall be connected to the posts with adequate bracing or brackets at the CONTRACTOR's option. Skids shall be large enough to prevent overturning in the wind either by themselves or with sandbag weights.

2.03 PAVEMENT STRIPING AND MARKINGS

A. Temporary Pavement Striping.

Temporary pavement striping shall be made of self-adhesive thermoplastic material with a minimum thickness of sixty (60) mils. The coloring of the temporary street striping shall be the same as the permanent striping will be and shall be reflective.

B. Permanent Pavement Striping and Markings.

1. Paints used for crosswalks, stop bars, directional arrows and symbols shall be Diamond Vogel TM 1734 (or ENGINEER approved equal), white rubberized traffic paint.

2. All other paint shall be Diamond Vogel TB-1503 and TB-3581 (or ENGINEER approved equal), white or yellow alkyd-slow dry traffic paint.

3. Beads shall meet the current specifications of the Wyoming Department of Transportation (WYDOT).

PART 3 EXECUTION

3.01 CONSTRUCTION TRAFFIC CONTROL AND WARNING DEVICES

A. The CONTRACTOR shall plan and construct the project in such a manner as to minimize the interruption of the use of roads, highways, streets and sidewalks involved, shall provide for emergency access to adjacent property and fire hydrants at

all times, and provide temporary traffic control layouts and devices in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways and the latest edition of the Quality Guidelines for Temporary Traffic Control Devices and Features published by the ATSSA to alert the public, motorists, and pedestrians of hazardous conditions.

B. At the time of initial set up or major stage changes the CONTRACTOR shall furnish one hundred percent (100%) of traffic control devices that meet the "acceptable" category as described in the latest edition of the Quality Guidelines for Temporary Traffic Control Devices and Features published by the ATSSA. Throughout the duration of the project, the number of "acceptable" devices may decrease to seventy-five percent (75%) of the initial quantity, as a result of damage and/or deterioration during the course of work, with the remainder of devices in the "marginal" category. "Unacceptable" devices or situations that are found on the jobsite shall be replaced or the situation corrected within two (2) hours of notification or as specified in the contract documents.

C. The ENGINEER will provide a general traffic control plan or details outlining recommended traffic control practices in the contract documents to provide guidance to the CONTRACTOR. Should the CONTRACTOR elect to modify or change the traffic control plan due to construction sequencing or methods, the CONTRACTOR shall submit his traffic control plan to the ENGINEER and OWNER prior to any construction activity for review and acceptance. This plan shall be updated weekly during construction if changes in the accepted layout are required.

D. The CONTRACTOR shall fence all open trenches in accordance with the latest OSHA regulations. Fences shall be durable woven material with high visibility and a minimum of forty-two inches (42") high. Support posts shall be no more than ten feet (10') apart. Corners shall be braced as required to maintain the vertical integrity of the fence.

E. The CONTRACTOR shall assign a traffic control maintainer who will be responsible for maintenance, including cleaning of all traffic control devices. A daily inspection of the temporary traffic control devices and layout shall be made by the CONTRACTOR. The CONTRACTOR shall replace damaged signs or barricades and shall take all responsible precautions for the protection of the work and the safety of the public. The CONTRACTOR will furnish the ENGINEER and the OWNER the names of the responsible persons of the CONTRACTOR along with telephone numbers as to where they can be reached during the day or night in case of a need to maintain, replace, or install additional signs. The person or persons called upon by the ENGINEER or OWNER shall respond and attend to the requirements of the ENGINEER or OWNER within one (1) hour.

F. Flagging shall be used to control traffic as required by the CONTRACTOR submitted traffic control plans for the Project. Flaggers shall be furnished at each authorized station necessary to safely and efficiently control traffic in and around the work area.

G. When flagging is required, it shall be performed by trained, competent, properly equipped flaggers supplied by the CONTRACTOR. All flaggers shall have completed and passed a Flagger Training Program, such as the flagger training program administered by the Associated General Contractors of Wyoming, prior to performing any flagging on the Project. A one day's grace period will be allowed for this requirement. The approved training and testing may be administered by the CONTRACTOR. Compliance with the MUTCD standards is required, more specifically Part 6, Chapter 6E.

3.02 PROJECT IDENTIFICATION SIGN

A. This item of work shall consist of furnishing, installing, maintaining and removing the Project Identification Sign. The sign is to be installed prior to commencement of the work at the location designated on the Design Drawings.

B. Construction Requirements

1. Construction. The sign shall be constructed to the dimensions shown in Standard Drawing 01510-1. The signs shall be securely bolted to firmly set posts. The top of the signs shall be level and the posts and sign faces shall be vertical. Signs shall be installed as directed by the ENGINEER. Posts shall not extend above the top of the sign panels. The sign panels and posts shall be removed after completion of all Project construction and become the property of the CONTRACTOR. The sign letters shall be clear, sharp, of uniform width, free of cracking, scaling, discoloring, blistering, or pitting and shall conform to the details shown in the Special Provisions.

2. Painting. The primer coat and first coat of white paint may be applied by brushing, rolling, or spraying. The finish coat of white paint shall be brushed or sprayed. Each coat must be completely dry before the following coat is applied. The finish coat shall be semi-gloss finish, free of brush marks, blisters, wrinkles, or blemishes.

3.03 PAVEMENT STRIPING AND MARKINGS

A. Temporary Pavement Striping

The CONTRACTOR shall provide temporary street striping per the direction of the ENGINEER prior to opening any street requiring permanent striping to traffic before the permanent striping has been installed. Spacing of the temporary street striping will be a maximum of seventy-five feet (75') on centers. The stripes shall have a minimum width of four inches (4") and a minimum length of eighteen inches (18").

B. Permanent Pavement Striping and Markings.

The CONTRACTOR shall provide permanent street striping and markings as per the Design Drawings and as stated herein. All markings shall conform to the requirements of the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD).

1. Striping and Marking Sizes

All pavement-striping dimensions shall be as stated in the following paragraphs. Deviation from the dimensions stated shall be permitted only with the prior written approval of the ENGINEER.

a. Center stripes shall be a solid double yellow line, each line being four inches (4") in width with a four inch (4") separation between lines.

b. Edge lines shall be a solid single white line being four inches (4") in width.

c. Lane stripes shall be a broken single white line being four inches (4") in width. The paint lines shall be nine feet (9') in length with fifteen feet (15') unpainted between lines.

d. Stacking lane stripes shall be single white lines being six inches (6") in width.

e. Stop bars shall be white and shall be installed as shown on the Design Drawings. The marking shall have a minimum width of twenty-four inches (24").

f. Separation stripes shall be single white lines being eight inches (8") in width.

g. Turn lane arrows shall be white and have a minimum overall length along road centerline of eight feet (8'). The marking shall have a minimum width of twelve inches (12").

h. Cross walk bars shall be white and have a minimum overall length along road centerline of ten feet (10'). The marking shall have a minimum width of twenty-four inches (24").

i. Turn lane stripes shall be a solid yellow line being four inches (4") in width and a dashed yellow line being four inches (4") in width. The two (2) lines shall have a four inch (4") separation between lines. The dashed paint lines shall be nine feet (9') in length with fifteen feet (15') unpainted between lines.

j. Curb paint shall be yellow and shall cover the face and top portions of the curb.

k. "Words" shall be white and have a minimum overall length along the road centerline of eight feet (8')

l. The bicycle lane symbol marking, if used, shall be placed immediately after an intersection and at other location as needed. The bicycle lane symbol marking shall be white and have a minimum overall length along the road centerline of six feet (6'). If the bicycle lane symbol marking is used in conjunction with other word or symbol messages, it shall precede them.

2. Cleaning and Layout

Street sweeping prior to striping shall be the responsibility of the CONTRACTOR. The ENGINEER will provide layout for all permanent striping and markings, but will require a minimum of forty-eight (48) hours advance notice.

3. Reflectorization

All on-street striping and markings relative to traffic control shall be reflectorized.

4. Equipment

The CONTRACTOR shall use equipment designed for the placement of traffic pavement marking paint to the thickness and width as shown on the Design Drawings.

5. Application

Paint shall be applied evenly to the pavement surface to be coated at a thickness of sixteen (16) mils wet thickness per coat. A minimum of two (2) coats of paint shall be installed per acceptable Pay Item. Beads shall be applied at the rate of three pounds per gallon (3 lbs./gal) of paint and shall be included with each application coat.

The CONTRACTOR shall provide guidelines and templates as necessary to control paint application. All edges of markings shall be sharply outlined. The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen and pickup, displacement, or discoloration by tires. If there is a deficiency in drying of the markings, painting operations shall be discontinued until the cause of the slow drying is determined and corrected.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 01510.01 CONSTRUCTION SIGNING AND TRAFFIC CONTROL

This item will be paid as a lump sum basis for the furnishing, installation, and maintenance of all signing, traffic control devices, barricades, barriers, and flagging necessary to safely and efficiently control traffic in and around the work area.

2. 01510.02 FLAGGING

This item shall be measured by the one-quarter (1/4) hour for flaggers and all equipment for flagging necessary to safely and efficiently control traffic in and around the work area.

3. 01510.03 PROJECT IDENTIFICATION SIGN

This item shall be measured by the number of project identification signs installed.

4. 01510.04 SOLID DOUBLE YELLOW CENTER STRIPE

This item shall be measured by the lineal foot of solid double yellow center stripe installed along the centerline of the painted double stripe.

5. 01510.05 SOLID WHITE EDGE LINE

This item shall be measured by the lineal foot of solid single white edge line installed along the centerline of the painted line.

6. 01510.06 BROKEN WHITE LANE STRIPE

This item shall be measured by the lineal foot of broken single white edge line installed along the centerline of the painted broken line, including the unpainted length between lines.

7. 01510.07 SOLID WHITE STACKING LANE STRIPE

This item shall be measured by the lineal foot of solid single white stacking lane stripe installed along the centerline of the painted stripe.

8. 01510.08 YELLOW TWO-WAY TURN LANE STRIPE

This item shall be measured by the lineal foot of yellow turn lane stripe which includes the solid yellow and dashed yellow line installed along the centerline of the painted stripe.

9. 01510.09 SOLID WHITE SEPARATION STRIPE

This item shall be measured by the lineal foot of solid single white separation stripe installed along the centerline of the painted stripe.

10. 01510.10 DASHED WHITE ACCEL/DECEL STRIPE

This item shall be measured by the lineal foot of dashed white accel/decel stripe installed along the centerline of the painted stripe, including the unpainted length between lines.

11. 01510.11 REMOVE EXISTING STRIPE

This item shall be measure by the lineal foot of existing stripe removed along the centerline of the existing stripe.

12. 01510.12 STOP BARS

This item shall be measured by the lineal footage of white stop bars installed.

13. 01510.13 TURN ARROW

This item shall be measured by the numerical count of white turn arrows installed.

14. 01510.14 PEDESTRIAN CROSSING STRIPES

This item shall be measured by the numerical count of white pedestrian crossing stripes installed.

15. 01510.15 SOLID WHITE CHEVRONS

This item shall be measured by the numerical count of white chevrons installed.

16. 01510.16 INSTALL RUMBLE STRIP

This item shall be measured by the lineal foot of rumble strip installed.

17. 01510.17 CURB PAINT

This item shall be measured by the lineal foot of curb painted along the face of the curb.

18. 01510.18 “WORDS”

This item shall be measured by the numerical count of each word installed.

19. 01510.19 BICYCLE LANE SYMBOL

This item shall be measured by the numerical count of each bicycle Lane symbol installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 01510.01 CONSTRUCTION SIGNING AND TRAFFIC CONTROL

Payment will be based on a percentage equal to the percentage of the original Contract Price earned excluding the amount paid for Materials Stored on Site.

2. 01510.02 FLAGGING

Payment shall include full compensation for furnishing flaggers at each authorized station, providing equipment, any required nighttime lighting, supervision, relief, overtime, training, transportation and general overhead costs to maintain the flaggers at each authorized station.

3. 01510.03 PROJECT IDENTIFICATION SIGN

Payment shall include all materials including the sign, lettering, posts and skids; excavation; moving from location to location; cleaning as required; and equipment, labor, tools and incidentals to complete this item.

4. 01510.04 SOLID DOUBLE YELLOW CENTER STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

5. 01510.05 SOLID WHITE EDGE LINE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

6. 01510.06 BROKEN WHITE LANE STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

7. 01510.07 SOLID WHITE STACKING LANE STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

8. 01510.08 YELLOW TWO-WAY TURN LANE STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

9. 01510.09 SOLID WHITE SEPARATION STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

10. 01510.10 DASHED WHITE ACCEL/DECEL STRIPE

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, tools and labor necessary for the completion of this item.

11. 01510.11 REMOVE EXISTING STRIPE

Payment shall include grinding the existing painted surface; and all other items, equipment, tools and labor necessary for the completion of this item.

12. 01510.12 STOP BARS

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

13. 01510.13 TURN ARROW

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

14. 01510.14 PEDESTRIAN CROSSING STRIPES

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

15. 01510.15 SOLID WHITE CHEVRONS

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

16. 01510.16 INSTALL RUMBLE STRIP

Payment shall include saw cutting the pavement; hauling and disposal of the waste material; and all other items, equipment, tools and labor necessary for the completion of this item.

17. 01510.17 CURB PAINT

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

18. 01510.18 “WORDS”

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

19. 01510.19 BICYCLE LANE SYMBOL

Payment shall include furnishing and installing the paint and reflective beads; and all other items, equipment, templates, tools and labor necessary for the completion of this item.

SECTION 02050

REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 GENERAL

1.01 SUMMARY

A. The work involved in this category shall consist of removing and satisfactorily disposing of existing fences, trees, bushes, abandoned pipe lines, buildings and any other structure or obstruction designated for removal on the plans.

B. Removed items shall be properly disposed of as required by Federal, State, and Local Government regulations. The Engineer shall receive written notification of disposal procedures and may require the Contractor to certify that proper disposal methods were used.

C. It shall also include the salvaging of designated material, as shown on the plans, and backfilling the resulting trenches, holes, and pits. Items designated for salvage and damaged during removal shall be repaired or replaced at the CONTRACTOR's expense.

D. Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the CONTRACTOR.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Demolition of asphalt and Portland cement concrete. Section 02075

B. Clearing and grubbing. Section 02110

C. Selective clearing. Section 02115

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. Demolition and disposal.

1. All existing fences, abandoned pipe lines, buildings or any other structure or obstruction specified for removal on the plans or as directed by the ENGINEER, shall be removed and disposed of by the CONTRACTOR.

2. Care shall be exercised in such removal to assure that adjacent facilities or structures, which are to remain, shall not be disturbed.

3. Any damage to such existing facilities or structures resulting from carelessness or negligence on the CONTRACTOR's part shall be satisfactorily restored to its original condition at the CONTRACTOR's expense.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS:

1. 02050.01 REMOVE END OF LINE PLUG

   This item shall be measured by the numerical count of end of line plugs removed.

2. 02050.02 REMOVE EXISTING WATER MAIN

   This item shall be measured by the lineal feet of existing water main removed along the centerline of pipe from start of removal to end of removal.

3. 02050.03 REMOVE AIR VACUUM AND AIR RELEASE VALVE

   This item shall be measured by the numerical count of air vacuum and air release valves removed.

4. 02050.04 REMOVE EXISTING WATERLINE TEST STATION

   This item shall be measured by numerical count of Water Line Electrical Test Stations removed.

5. 02050.05 REMOVE EXISTING FITTING

   This item shall be measured by the numerical count of existing fittings removed.

6. 02050.06 REMOVE WATER VALVE BOX

   This item shall be measured by the numerical count of existing water valve boxes removed.

7. 02050.07 REMOVE FIRE HYDRANT

   This item shall be measured by the numerical count of fire hydrants removed.

8. 02050.08 REMOVE VALVE

   This item shall be measured by the numerical count of valves removed.

9. 02050.09 REMOVE WATER METER PIT

   This item shall be measured by the numerical count of water meter pits removed.

10. 02050.10 REMOVE CURB STOP

    This item shall be measured by the numerical count of curb stops removed.

11. 02050.11 REMOVE SANITARY SEWER MAIN

    This item shall be measured by the lineal feet of existing sanitary sewer main removed along the centerline of pipe from start of removal to end of removal.

12. 02050.12 REMOVE SANITARY SEWER MANHOLE

    This item shall be measured by numerical count of sanitary sewer manholes removed.

13. 02050.13 REMOVE FORCE MAIN

    This item shall be measured by the lineal feet of existing force sanitary sewer main removed along the centerline of pipe from start of removal to end of removal.

14. 02050.14 ABANDON SANITARY SEWER MAIN IN PLACE

    This item shall be measured by lineal foot of existing sanitary sewer mains abandoned in place.

15. 02050.15 REMOVE SANITARY SEWER MANHOLE CONE SECTION

    This item will be measured by numerical count of manhole cone sections removed.

16. 02050.16 ABANDON SANITARY SEWER MANHOLE IN PLACE

    This item shall be measured by numerical count of sanitary sewer manholes abandoned in place.

17. 02050.17 ABANDON SEPTIC TANK IN PLACE

    This item shall be measured by numerical count of septic tanks abandoned in place.

18. 02050.18 REMOVE EXISTING STORM DRAIN

    This item shall be measured by the lineal feet of existing storm drain removed.

19. 02050.19 REMOVE EXISTING FLARED END SECTION

    This item shall be measured by the numerical count of flared end sections removed.

20. 02050.20 REMOVE EXISTING STORM INLET

    This item shall be measured by numerical count of storm inlets removed.

21. 02050.21 INSTALL CONCRETE PLUG

This item shall be measured by numerical count of concrete plugs installed, regardless of the size of pipe being plugged.

22. 02050.22 REMOVE TREE

This item shall be paid by numerical count for all trees removed through out the project.

23. 02050.23 REMOVE BUSH

This item shall be paid by numerical count for all bushes removed through out the project.

24. 02050.24 REMOVAL OF EXISTING FENCE

This item shall be measured by the lineal foot of permanent fences removed as called for on the Drawings.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02050.01 REMOVE END OF LINE PLUG

Payment shall include all excavation and backfill; removing the end of line plug and thrust block; either disposing of the end of line plug or delivering to the City of Gillette as specified; all labor and all other work necessary or incidental for completion of the item.

2. 02050.02 REMOVE EXISTING WATER MAIN

Payment shall include the removal of the pipe; any additional trench excavation and backfill needed to remove the pipe; and the hauling and satisfactory disposal of the existing pipe.

3. 02050.03 REMOVE AIR VACUUM AND AIR RELEASE VALVE

Payment shall include all excavation and backfill; removing the valve, manhole and standpipe assembly; either disposing of the valve or delivering it to the City of Gillette as specified; all labor and all other work necessary or incidental for completion of the item.

4. 02050.04 REMOVE EXISTING WATERLINE TEST STATION

Payment shall include removing the water valve box top, electrical conduit and test board; delivering the removed components to the City of Gillette; all tools and labor; and all other work necessary or incidental for completion of the item.

5. 02050.05 REMOVE EXISTING FITTING

   Payment shall include all excavation and backfill; removing the fitting, which shall include but not be limited to tees, crosses and reducers; removing any thrust blocking; either disposing of the fitting or delivering to the City of Gillette as specified; all labor and all other work necessary or incidental for completion of the item.

6. 02050.06 REMOVE WATER VALVE BOX

   Payment shall include all excavation and backfill; removing the water valve box; all labor and all other work necessary or incidental for completion of the item.

7. 02050.07 REMOVE FIRE HYDRANT

   Payment shall include all excavation and backfill; removing the fire hydrant, thrust block and anchor blocking; delivering the fire hydrant to the City of Gillette as specified; all labor and all other work necessary or incidental for completion of the item.

8. 02050.08 REMOVE VALVE

   Payment shall include all excavation and backfill; removing the valve, valve box and thrust block; either disposing of the valve or delivering to the City of Gillette as specified; all labor; and all other work necessary or incidental for completion of the item.

9. 02050.09 REMOVE WATER METER PIT

   Payment shall include the removal of the water meter pit; any additional excavation and backfill needed to remove the meter pit; and the hauling and satisfactory disposal of the existing water meter pit; and salvage to the OWNER of the meter, yoke and pit cover.

10. 02050.10 REMOVE CURB STOP

    Payment shall include the removal of the curb stop and box; any additional excavation and backfill needed to remove the curb stop; and the hauling and satisfactory disposal of the existing curb stop and box.

11. 02050.11 REMOVE SANITARY SEWER MAIN

    Payment shall include the removal of the pipe; any additional trench excavation and backfill needed to remove the pipe; and the hauling and satisfactory disposal of the existing pipe.

12. 02050.12 REMOVE SANITARY SEWER MANHOLE

    Payment shall include the removal of the manhole; any additional trench excavation and backfill needed to remove the manhole; and the hauling and satisfactory disposal of the existing manhole.

13. 02050.13 REMOVE FORCE MAIN

    Payment shall include the removal of the pipe; any additional trench excavation and backfill needed to remove the pipe; and the hauling and satisfactory disposal of the existing pipe.

14. 02050.14 ABANDON SANITARY SEWER MAIN IN PLACE

    Payment shall include, filling the sewer mains with slurry; providing water tight sealing of all openings; all excavation and backfill needed to abandon the main; and all labor, tools, and other work necessary or incidental for completion of the item.

15. 02050.15 REMOVE SANITARY SEWER MANHOLE CONE SECTION

    Payment shall include the removal of the cone section; any additional excavation and backfill needed to remove the cone section; the hauling and satisfactory disposal of the existing cone section; and all other incidentals required to complete the item.

16. 02050.16 ABANDON SANITARY SEWER MANHOLE IN PLACE

    Payment shall include proper disposal of any waste material; removal and disposal of the top section of the manhole, breaking up of the concrete floor, filling the manhole with slurry; providing water tight sealing of all openings; any additional excavation and backfill needed to abandon the manhole; and all labor, tools, and other work necessary or incidental for completion of the item.

17. 02050.17 ABANDON SEPTIC TANK IN PLACE

    Payment shall include pumping the tank empty; proper disposal of the pumped waste material; filling the tank with slurry; providing water tight sealing of all openings; any additional excavation and backfill needed to abandon the tank; and all labor, tools, and other work necessary or incidental for completion of the item.

18. 02050.18 REMOVE EXISTING STORM DRAIN

    Payment shall include the removal of the storm drain; excavation and backfill; and satisfactory disposal of the storm drain.

19. 02050.19 REMOVE EXISTING FLARED END SECTION

    Payment shall include the removal of the flared end section; and additional excavation and backfill needed to remove the flared end section; and satisfactory disposal of the flared end section.

20. 02050.20 REMOVE EXISTING STORM INLET

    Payment shall include the removal of the storm inlet; any additional excavation and backfill needed to remove the storm inlet; and satisfactory disposal of the existing storm inlet.

21. 2050.21 INSTALL CONCRETE PLUG

Payment shall include all excavation; backfill; furnishing and installing concrete plug on abandoned utility line; all tools and labor; and all other work necessary or incidental for completion of this item.

22. 02050.22 REMOVE TREE

Payment shall include all materials, excavation, backfill, equipment, labor, tools and incidentals to complete this item.

23. 02050.23 REMOVE BUSH

Payment shall include all materials, excavation, backfill, equipment, labor, tools and incidentals to complete this item.

24. 02050.24 REMOVAL OF EXISTING FENCE

Payment shall include all materials, excavation, backfill, equipment, labor, tools, and incidentals to remove the existing fence to complete this item.

SECTION 02075

DEMOLITION OF ASPHALT AND PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. The work involved in this category shall consist of removing and the satisfactory disposal of existing asphalt pavement, concrete pavement, concrete curb, combined curb and gutter, sidewalk, private driveways, cross pans, cement treated base (CTB), retaining walls, or concrete trickle channels designated for removal on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Clearing and grubbing. Section 02110

B. Selective clearing. Section 02115

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PAVEMENT REMOVAL

A. Where trench excavation or structure excavation requires the removal of curb and gutter, concrete sidewalks, or asphaltic or concrete pavement, the pavement or concrete shall be cut in a straight line parallel to the edge of the excavation by use of a concrete saw, or similar approved equipment to obtain a straight, square clean break. Pavement cuts shall be two (2) feet (610 mm) wider than the actual trench opening and centered over such trench.

B. Demolition and disposal.

1. All existing pavement, curb, gutter, sidewalks, driveways, cross pans, specified for removal on the plans or as directed by the ENGINEER, shall be removed and disposed of by the CONTRACTOR.

2. Existing pavement cross pans and/or curb and gutter shall be cut and removed to the lines indicated on the plans, or as directed by the ENGINEER;

3. Existing private concrete driveways or sidewalks which interfere with construction of street improvements or which do not match for grade shall be removed as shown on the plans or as directed by the ENGINEER. Removal shall be on a neat line produced by a concrete saw cut.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02075.01 REMOVAL OF EXISTING ASPHALT PAVEMENT

   This item shall be measured by the square yard of asphalt pavement that is entirely removed.

2. 02075.02 REMOVAL OF PORTLAND CEMENT CONCRETE PAVEMENT

   This item shall be measured by the square yard of concrete pavement that is entirely removed.

3. 02075.03 REMOVAL OF EXISTING CTB

   This item shall be measured by the square yard of cement treated base (CTB) that remains solid when entirely removed.

4. 02075.04 REMOVAL OF SIDEWALK

   This item shall be measured by the square foot of existing sidewalk removed.

5. 02075.05 REMOVAL OF DRIVEWAY

   This item shall be measured by the square foot of existing driveway removed.

6. 02075.06 REMOVE CURB & GUTTER

   This item shall be measured by the lineal feet of curb and gutter removed, as measured along the flow line of the curb and gutter.

7. 02075.07 REMOVE CONCRETE CURB RAMP

   This item shall be measured by the lineal feet of concrete curb ramp removed along the flowline of the curb.

8. 02075.08 REMOVAL OF MONOLITHIC CURB & GUTTER WITH SIDEWALK

   This item shall be measured by the lineal feet of curb and gutter with sidewalk remove along the flow line of the street tangent sections or radial sections.

9. 02075.09 REMOVAL OF CONCRETE FILLET

   This item shall be measured by the square foot of fillet removed, including the radius curb that is part of the fillet.

10. 02075.10 REMOVAL OF CONCRETE VALLEY GUTTER

This item shall be measured by the square foot of valley gutter removed.

11. 02075.11 REMOVAL OF RETAINING WALL

This item shall be measured by the lineal feet of retaining wall removed along the centerline of the wall.

12. 02075.12 REMOVAL OF CONCRETE TRICKLE CHANNEL

This item shall be measured by the lineal feet of concrete trickle channel removed along the flow line of the trickle channel.

13. 02075.13 REMOVAL OF MISCELLANEOUS CONCRETE

This item shall be measured by the square foot of concrete removed not covered by other removal items.

14. 02075.14 REMOVAL OF SUB-DRAIN SYSTEM

This item shall be measured by the lineal feet of subdrain system removed along the centerline of the subdrain.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02075.01 REMOVAL OF EXISTING ASPHALT PAVEMENT

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and the satisfactory disposal of existing asphalt pavement.

2. 02075.02 REMOVAL OF PORTLAND CEMENT CONCRETE PAVEMENT

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and the satisfactory disposal of existing concrete pavement.

3. 02075.03 REMOVAL OF EXISTING CTB

Payment shall include any required saw cutting to produce a neat line and the removing and satisfactory disposal of the existing CTB.

4. 02075.04 REMOVAL OF SIDEWALK

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and satisfactory disposal of sidewalk.

5. 02075.05 REMOVAL OF DRIVEWAY

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and satisfactory disposal of driveway.

6. 02075.06 REMOVE CURB & GUTTER

Payment shall include any required saw cutting to produce a neat line and subsequent removal, hauling and the satisfactory disposal of existing curb and gutter.

7. 02075.07 REMOVE CONCRETE CURB RAMP

Payment shall include any required sawcutting, and the removing, hauling and satisfactory disposal of the existing concrete curb ramp.

8. 02075.08 REMOVAL OF MONOLITHIC CURB & GUTTER WITH SIDEWALK

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and satisfactory disposal of existing curb and gutter with sidewalk.

9. 02075.09 REMOVAL OF CONCRETE FILLET

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and the satisfactory disposal of existing concrete fillet and curb included in the fillet section.

10. 02075.10 REMOVAL OF CONCRETE VALLEY GUTTER

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and the satisfactory disposal of existing concrete valley gutter.

11. 02075.11 REMOVAL OF RETAINING WALL

Payment shall include any required saw cutting to produce a neat line, removing, hauling, and the satisfactory disposal of the existing retaining wall.

12. 02075.12 REMOVAL OF CONCRETE TRICKLE CHANNEL

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and the satisfactory disposal of existing trickle channel.

13. 02075.13 REMOVAL OF MISCELLANEOUS CONCRETE

Payment shall include any required saw cutting to produce a neat line and the removing, hauling and satisfactory disposal of existing concrete.

14. 02075.14 REMOVAL OF SUB-DRAIN SYSTEM

Payment shall include the removal of the subdrain; any additional trench excavation and backfill needed to remove the subdrain; and the hauling and satisfactory disposal of the existing subdrain.

SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of the construction area. Vegetation and objects designated to remain shall be preserved from injury or defacement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Unless otherwise established by the ENGINEER, all areas between lines two feet (2.0') (600 mm) outside the back of sidewalk, curb and/or curb and gutter, or within the neat lines of cut or fill areas shall constitute the clearing and grubbing limits. Where sidewalk, curb and/or curb and gutter is not required, the clearing limits shall be two feet (2.0') (600 mm) outside the edge of pavement or within the neat lines of cut or fill areas.

B. All stumps, roots, logs or other timber more than three inches (3") (75 mm) in diameter, and all brush, matted roots and other debris within the grubbing limits not suitable for street foundation shall be pulled or otherwise removed to a depth of not less than six inches (6") (150 mm) below the original ground in fill sections or twelve inches (12") (300 mm) below street subgrade in cut sections.

C. The refuse resulting from the clearing and grubbing operation may be hauled to an available waste site approved by the OWNER and shall be disposed of in such a manner as to meet all requirements of State, county and municipal regulations regarding health, safety, and public welfare.

D. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried in embankments or trenches on the project.

E. The CONTRACTOR shall avoid, as far as practicable, injury to shrubbery, vines, plants, grasses and other vegetation growing on areas outside of the grading area, or on parking strips or adjacent lots.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02110.01 CLEARING AND GRUBBING

This item shall be measured by the number of acres and fraction thereof acceptably cleared and grubbed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02110.01 CLEARING AND GRUBBING

Pay shall include clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of the construction area as identified on the Drawings; and all labor, equipment, tools and incidentals necessary to complete this item.

SECTION 02150

SHORING AND UNDERPINNING

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of all necessary bracing, shoring and protection, required for open excavations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION

A. All excavation, trenching and shoring, and the like, under this contract shall be performed in a manner that meets with the latest edition of the OSHA Department of Labor, Safety and Health Regulations for Construction.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 02190

AGGREGATES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes the preparation and stockpiling of aggregates for Portland Cement concrete, bases, bituminous pavements and surface treatments, cover coats, bed courses, drains, pervious backfill and riprap.

B. This section is a material specification only and is subsidiary to other sections which address placement of the materials prepared under same.

1.02 RELATED WORK

A. Section 02231, Aggregate Sub-base Base Courses.

B. Section 02273, Riprap.

C. Section 03304, Portland Cement Concrete.

D. Section 02512, Plant Mix Pavements

E. Section 02550, Prime Coat.

F. Section 02552, Seal Coat.

G. Section 02553, Bituminous Surface Treatment.

1.03 QUALITY ASSURANCE

A. AASHTO M 6: Fine Aggregate for Portland Cement Concrete.

B. AASHTO M 80: Coarse Aggregate for Portland Cement Concrete.

C. AASHTO M 92: Wire-cloth Sieve for Testing Purposes.

D. AASHTO T 2: Sampling Aggregates.

E. AASHTO T 27(Wyoming Modified): Sieve Analysis of Fine and Coarse Aggregates.

F. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

G. AASHTO T 104: Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.

H. ASTM C 33: Concrete Aggregates.

I. ASTM C 127: Specific Gravity and Moisture Absorption of Coarse Aggregate.

J. ASTM C 131: Resistance to Degradation of Small-size Coarse Aggregate.

K. ASTM C 136: Sieve or Screen Analysis of Fine and Coarse Aggregate.

L. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.04 SUBMITTAL

A. Sampling and testing of aggregates for flexible pavements shall be in accordance with the following standard methods of the American Association of State Highway Transportation Officials (AASHTO) and American Society for Testing and Materials (ASTM)

1.	Sampling	T 2
2.	Percentage of Wear	T 96
3.	Soundness	T 104
4.	Sieve Analysis	T 27, Wyoming Modified

B. Sampling and testing of aggregates for Portland cement concrete shall be in accordance with the following standard methods of the American Association of State Highway Transportation Officials (AASHTO):

1.	Fine Aggregate	M 6
2.	Coarse Aggregate	M 80
3.	Sieve Analysis	T 27, Wyoming Modified
4.	Percentage of Wear	T 96
5.	Soundness	T 104

C. Sampling and testing of aggregates shall be performed by an independent laboratory. Each pit or stock-piled source for aggregate material shall be tested and qualified to meet the applicable specifications at minimum on an annual basis. The ENGINEER may require random sampling and testing of source material at their discretion.

1.05 DEFINITIONS

A. Coarse aggregate shall mean materials retained on a #4 (4.75 mm) sieve.

B. Fine aggregate shall mean materials passing a #4 (4.75 mm) sieve.

C. Sub-base shall be crushed sub-base unless otherwise specified.

D. Base shall be crushed base unless otherwise specified.

E. Gradation requirements, as listed herein, shall be the percentage of material by weight passing laboratory sieves having square openings. Sieve sizes or designations will be in accordance with AASHTO M 92 and ASTM C 33.

PART 2 PRODUCTS

2.01 MATERIALS

A. When crushed aggregate for sub-base, bases, surfacing or bituminous pavements is specified, all boulders in the pit up to eighteen inches (18") in diameter shall be crushed to meet the required specifications and shall be uniformly distributed in the remainder of the material, unless otherwise specified.

B. Before production of any of the following materials, all vegetation and stripping material shall be removed from the pit. Only designated portions of the pit will be used. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of flat and elongated pieces.

2.02 AGGREGATE FOR PORTLAND CEMENT CONCRETE

A. FINE AGGREGATE

1. Fine aggregate for concrete shall conform to the requirements of AASHTO M 6 with the following exceptions:

	Max. % by Weight
Clay Lumps	0.5
Coal, Lignite or Shale	1.0
Material Passing No. 200 (0.075mm) Sieve	4.0

The sum of the above materials and other deleterious substances such as shale, alkali, mica, coated grains, or soft and flat particles shall not exceed four percent (4%) by weight.

2. Fine Aggregate shall be well graded from coarse to fine in accordance with ASTM C 33 and shall conform to the following gradation requirements:

TABLE No. 02910-2.02A

MASTER GRADING BAND LIMITS FOR FINE AGGREGATION			
		FINE AGGREGATE Percent passing by Weight	
Sieve Sizes			
in	Mm	MIN	MAX
3/8"	9.5	100	-
#4	4.75	95	100
#16	1.18	45	80
#50	300µm	10	30
#100	150µm	2	10
#200	75µm	0	4

B. COARSE AGGREGATE

1. Coarse aggregates shall consist of crushed stone, gravel, crushed concrete, or other approved inert materials of similar characteristics, or combinations thereof, having strong and durable pieces. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter that would prevent thorough bonding in accordance with Paragraph 2.

2. Coarse aggregate shall conform to the requirements of AASHTO M 80 with the following exceptions:

a. The amount of deleterious substances shall not exceed the following limits:

	Max. % by Weight
Clay Lumps	0.5
Coal, Lignite, or Shale	1.0
Material Passing #200 (0.075 mm) Sieve	4.0
Other deleterious substances such as friable, thin, elongated or laminated pieces	2.0

The sum of the above material and other deleterious substances shall not exceed 5% by weight.
Flat and elongated particles shall be determined using ASTM D4791, using a 1:5 ratio.

b. Coarse aggregates shall have a percentage of wear of no more than forty (40) when tested in accordance with AASHTO T 96 (LA Abrasion) or show a sodium sulfate loss not to exceed twelve percent (12%) when tested in accordance with AASHTO T104 (Soundness). The wear and soundness requirements may be waived, or modified, by the ENGINEER provided that the coarse aggregate has a proven service record for similar conditions.

c. Coarse aggregate shall meet the following gradation limits for the concrete class specified. Other sizes or combinations of sizes may be used when otherwise specified. If not specified, Grade No. 57 shall be the gradation used.

TABLE 02190-2.02B

MASTER GRADING BAND LIMITS FOR COARSE AGGREGATION					
		COARSE AGGREGATE Percent Passing by Weight			
Sieve Sizes		Grade 57		Grade 67	
in	mm	Min	Max	Min	Max
1-1/2”	38.1	100	-	-	-
1”	25.4	95	100	100	-
3/4”	19.1	-	-	90	100
1/2”	12.7	25	60	-	-
3/8”	9.5	-	-	20	55
#4	4.75	0	10	0	10
#8	2.36	0	5	0	5

2.03 AGGREGATE FOR UNTREATED SUB-BASE AND BASE

A. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of flat and elongated pieces.

B. Crushed sub-base and crushed base shall be crushed stone, crushed gravel, crushed concrete or recycled asphaltic concrete and an approved soil binder or natural filler, where required, conforming to the following requirements, unless otherwise designated in the Contract Documents.

1. Coarse aggregate shall consist of hard, durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. Unless otherwise specified, the coarse

aggregate shall have a percentage of wear of not more than fifty (50) when tested in accordance with ASTM C 131.

2. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand.

3. The CONTRACTOR shall provide a job design mix from an independent testing laboratory. The grading requirements shall adhere to the following unless modified in the special provision or specified otherwise by the ENGINEER. Crushed base and crushed sub-base shall meet one of the following gradation requirements as specified in the Contract Documents:

Sieve Designation	Grading D	Grading G	Grading H	Grading J	Grading L*	Grading K	Grading W**
2”	100	100		100			
1 ½”	95-100	95-100		90-100	100	100	100
1”			100		90-100	90-100	90-100
¾”			95-100				
½”					60-85		60-85
#4	50-85		45-65	35-75	35-55	40-65	45-65
#8	40-70		33-53		25-50	30-55	33-53
#30					10-30		
#200	2-5	0-15	3-12	0 -15	3-15	3-15	3-12

* Crushed Limestone
** Stone other than Limestone, including recycled materials

C. Base course material shall be Grading L, crushed limestone aggregate with no natural filler, or Grading W.

D. Crusher run sub-base and crusher run base shall be crusher run material of the maximum size as called for in the Contract Documents, not to exceed three inches (3”) (75 mm)

E. Pit run or screened sub-base and base shall be pit run or screened material of the maximum size called for in the Contract Documents, not to exceed three inches (3”) (75 MM).

F. Placement of sub-base materials with aggregates greater than three inches (3”) (75 mm) shall not be allowed unless otherwise specified by ENGINEER in the Special Provisions.

2.04 AGGREGATE FOR PLANT MIX BITUMINOUS BASE

A. GENERAL – Aggregate shall be composed of coarse and fine aggregates combined in the proper proportions to meet the grading requirements for Grading W of Subsection 2.03 herein, AGGREGATE FOR UNTREATED SUB-BASE AND BASE, unless otherwise noted in the Contract Documents. Aggregates shall be composed of clean, tough, durable fragments free from an excess of flat, elongated, soft or disintegrated pieces and free from fragments coated with dirt or other objectionable matter.

B. COARSE AGGREGATE – Coarse aggregate shall be crushed stone, crushed gravel, or natural gravel. Unless otherwise shown noted in the Contract Documents, the material shall have a percentage of wear of not more than forty (40) when tested in accordance with AASHTO T 96 (LA Abrasion). The sodium sulfate soundness loss shall not exceed twelve percent (12%) in accordance with AASHTO T 104 (Soundness). The angularity shall have the minimum value of seventy-five percent (75%) in accordance with ASTM D 5821.

C. FINE AGGREGATE – Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the #200 (0.075 mm) sieve shall not be greater than two thirds (2/3) of the fraction passing the #40 (0.425 mm) sieve. The fraction passing the #40 (0.425 mm) sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than 3, except that when the plasticity index is non-plastic (NP), the liquid limit shall be not more than thirty (30).

2.05 AGGREGATE FOR HOT PLANT MIX BITUMINOUS PAVEMENT

A. Type I Pavement aggregate shall be composed of coarse and fine aggregates combined as shown and in conformance with Subsection 2.04 herein, AGGREGATE FOR PLANT MIX BITUMINOUS BASE.

B. TYPE II Pavement aggregate material, prior to crushing, shall be of such size that not less than ninety-five percent (95%) shall be retained on a sieve with square openings one fourth inch (¼") (6.3 mm) larger than the maximum size mineral aggregate being produced, unless otherwise specified by ENGINEER in the Special Provisions.

C. Type III Pavement aggregate shall have not less than fifty percent (50%) of the materials by weight retained on the #4 (4.75 mm) sieve with at least one fractured face, unless a different percentage of fractured faces is otherwise specified in the Contract Documents.

D. The several aggregate fractions for the mixture shall be sized, graded, and combined in such proportions that the resulting composite blend meets one of the grading requirements in the following table as specified in the Contract Documents. If not specified, CONTRACTOR shall use the three fourths inch (¾") (19.0 mm) maximum material grading specification.

Sieve Designation		% by Weight Passing	
Inches	Millimeters	¾" Max. (19 mm)	½" Max. (12.5 mm)
1"	25 mm	100	
¾"	19 mm	90-100	100
½"	12.5 mm	55-90	90-100
3/8"	9.5 mm	45-85	55-90
#4	4.75 mm	30-65	35-70
#8	2.36 mm	20-50	20-55
#30	0.600 mm	5-30	5-35
#200	0.075 mm	2-7	2-7

E. Flat and Elongated particles (1:5 ratio) maximum percentage shall be 10%.

2.06 AGGREGATE FOR PLANT MIX WEARING COURSE

A. The aggregate for plant mix wearing course shall be crushed stone or gravel composed of hard, durable pebbles or fragments and a filler of finely crushed stone, gravel, or sand, where required, to provide a composition of aggregates meeting the following requirements for the type specified.

Sieve Designation		% by Weight Passing	
Inches	Millimeters	Type A	Type B
½"	12.5 mm	100	100
3/8"	9.5 mm	97-100	97-100
#4	4.75 mm	25-45	20-40
#8	2.36 mm	10-25	10-20
#200	0.075 mm	2-7	2-7

B. The aggregate shall be free from vegetable matter, lumps or balls of clay adherent films of clay, or other matter that would prevent thorough coating with bituminous material. Unless otherwise shown on the plans, at least seventy-five (75%) of the material by weight retained on the #4 (4.75 mm) sieve shall be particles having a least one fractured face and shall have a percentage of wear of not more than thirty-five (35).

C. When either Type A or Type B wearing course is specified, the aggregate material, prior to crushing, shall be of such size that not less than ninety-five percent (95%) shall be retained on a sieve with square openings of three eighths inch (3/8") (9.5 mm).

2.07 AGGREGATE FOR ROAD MIX BITUMINOUS PAVEMENT

A. Aggregates shall be composed of clean, tough durable fragments of crushed stone, or crushed or natural gravel free from an excess of flat, elongated, soft, or disintegrated pieces. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films or other matter that would prevent thorough coating with bituminous material.

B. Unless otherwise specified, the coarse aggregate shall have a percentage of wear of not more than forty (40). The sodium sulfate soundness loss shall not exceed twelve percent (12%) and the plasticity index shall not exceed three (3). The combined coarse and fine aggregate shall meet the following gradation requirements:

Sieve Designation		% by Weight Passing
1"	25 mm	100
¾"	19 mm	95-100
#4	4.75 mm	45-60
#8	2.36 mm	33–53
#200	0.075 mm	3-12

2.08 AGGREGATE FOR COVER COAT

A. Only one type of aggregate shall be used on the project unless alternate types are approved.

B. Cover aggregate for seal coats shall be crushed stone, crushed ledge rock, crushed or natural gravel, or sand.

C. Cover aggregate material for bituminous surface treatment shall consist of clean, tough, durable fragments free from an excess of flat, elongated, soft or disintegrated pieces and free from coatings of dirt or other objectionable matter. The aggregate shall have neither a percentage of wear of more than forty (40) nor a plasticity index in excess of three (3). The aggregate material shall be well graded from coarse to fine within the following limits:

Sieve Designation		% by Weight Passing
1”	25 mm	100
¾”	19 mm	95-100
#4	4.75 mm	50-70
#8	2.36 mm	33–63
#200	0.075 mm	3-10

D. Type A, B, C, D, E and S aggregate material produced shall be well graded from coarse to fine within the following limits:

Sieve Designation		% by Weight Passing					
Inches	Millimeters	Type A	Type B	Type C	Type D	Type E	Type S
1”	25 mm	100					
¾”	19 mm	95-100	100		100	100	
½”	12.5 mm	30-60	95-100	100	95-100	95-100	100
3/8”	9.5 mm			95-100			95-100
#4	4.75 mm	0-15	0-15	0-20	0-15	35-70	85-100
#8	2.36 mm	0-7	0-7	0-12	0-7		
#200	0.075 mm	0-2	0-2	0-2	0-2	0-10	0-5

E. Material used for the production of Type A, B, or C cover aggregate shall be stone, ledge rock, or boulders of such size that prior to crushing not more than five percent (5%) will pass a one fourth inch (¾”) (19 mm) screen for Type A or a one half inch (½”) (12.5 mm) screen for Type B and Type C.

F. Type D cover aggregate shall be crushed stone, crushed gravel, or clean pea gravel.

G. Types A, B, C, or D shall have a percentage of wear of not more than thirty-five (35), unless a different percentage of wear is specified by ENGINEER in the Special Provisions.

H. Type E cover aggregate shall be crushed sand-gravel. Type S cover aggregate shall be screened or pit-run sand. The plasticity index of either Type E or Type S shall not exceed three (3).

2.09 AGGREGATE FOR BLOTTER

A. Blotter material shall be either sand or screenings, free from vegetable matter, or other deleterious matter. The material shall be of such size that one hundred percent (100%) of the material will pass through a three eighths inch (3/8”) (9.5 mm) sieve, the fraction passing the #4 (4.75 mm) sieve shall be from eighty-five percent (85%) to one hundred percent (100%) and the fraction passing the #200 (0.075 mm) sieve shall not be greater than twenty percent (20%). The plastic index shall not exceed three (3).

2.10 AGGREGATE FOR FILLER

A. Filler shall consist of clean, hard, durable grains of naturally occurring granular material taken either from locations shown on the Drawings or from approved sources as otherwise specified in the Contract Documents.

2.11 AGGREGATE FOR BED COURSE MATERIAL

A. Bed course material for sidewalks and curbing shall consist of graded gravel, crushed stone, or other approved material such that all particles will pass through a sieve having one half inch (½") (12.5 mm) square openings.

2.12 AGGREGATE FOR DRAINS

A. Gravel for drains shall be crushed or natural sand and gravel or other approved free-draining material. The material shall be uniformly graded from coarse to fine within the following gradation requirements for the material type indicated in the Contract Documents. When the grading is not indicated in the Contract Documents, Grading B shall be used.

Sieve Designation		% by Weight Passing		
Inches	Millimeters	Grading A	Grading B	Grading C
2"	50 mm	100		
1 ½"	37.5 mm	95-100	100	
1"	25 mm		95–100	
¾"	19 mm	35–70		100
3/8"	9.5 mm	10–30		95–100
#4	4.75 mm	0–5	0–10	
#8	2.36 mm			65–95
#16	1.18 mm			5–30
#100	0.150 mm			0-10

2.13 AGGREGATE FOR MAINTENANCE STOCKPILES

A. Type A aggregate shall consist of clean, hard, durable particles of crushed gravel or stone free from soft, thin, elongated, or laminated pieces or organic material, and shall show a percentage of wear of not more than fifty (50). The fraction passing the #40 (0.425mm) sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than three (3), except that, when the plasticity index is non-plastic (NP), the liquid limit shall not be more than thirty (30). The material placed in the stockpile shall meet the following gradation requirements for the maximum size specified:

Sieve Designation		% by Weight Passing	
Inches	Millimeters	½" max. (12.5 mm)	3/8" Max (9.5 mm)
¾"	19 mm	100	
½"	12.5 mm	90-100	100
3/8"	9.5 mm	60-90	90-100
#4	4.75 mm	45–65	50–80
#8	2.36 mm	30-50	33–63
#200	.075 mm	3–12	3–12

B. Type B aggregate shall consist of clean, hard, durable particles of crusher-run gravel or stone free from soft, thin, elongated, laminated pieces or organic material. Material shall be obtained from designated portion of the pit. The plasticity index shall not be greater than three (3). The material placed in the stockpile shall meet the following gradation requirements for the maximum size specified:

Sieve designation		% by Weight Passing
Maximum designated		95–100
#4	4.75 mm	0–75
#200	0.075 mm	0-15

C. Type C aggregate shall consist of crusher-run scoria. Not less than ninety-five percent (95%) of the material placed in the stockpile shall pass a one half inch (½") (12.5 mm) sieve.

D. Type D aggregate shall consist of clean, hard, durable particles of screened sand free from soft, thin, elongated or laminated pieces, or organic material. The plasticity index shall not be greater than six (6). The material placed in the stockpile shall meet the following gradation requirements:

E.

Sieve designation		% by Weight Passing
½"	12.5 mm	100
3/8"	9.5 mm	95–100
#4	4.75 mm	85–100
#200	0.075 mm	3-12

2.14 AGGREGATE FOR PERVIOUS BACKFILL MATERIAL

A. Pervious Backfill Material shall consist of gravel, crushed rock, natural sands, manufactured sands, or combinations thereof, and shall meet the following gradation requirements:

Sieve designation		% by Weight Passing
2"	50 mm	100
#4	4.75 mm	0–30
#100	0.150 mm	0-10
#200	0.075 mm	0-4

B. In addition, the fraction passing the #40 (0.425 mm) sieve shall be nonplastic (NP) and shall have a liquid limit not greater than thirty (30).

2.15 AGGREGATE FOR RIPRAP

A. Aggregate for riprap shall be hard, durable, crushed, quarried, or natural stone, or broken concrete having an apparent specific gravity of two and four tenths (2.4) or greater. The absorption shall not exceed four percent (4%) unless otherwise approved by ENGINEER in the Special Provisions. The stone shall be free of weak laminations and cleavages, and shall be of a quality that will not disintegrate on exposure to water or weathering. The aggregate for the various types of riprap shall meet the following additional requirements:

1. Class 1 Riprap aggregate shall consist of two sizes of stone.

   a. Primary stones shall be not less than three inches (3") (75 mm) thick and shall weigh not less than fifty (50) pounds (22.7 kilograms). At least sixty percent (60%) of the stones shall weigh more than eighty (80) pounds (36.3 kilograms) each.

   b. Choke stones shall be fragments or spalls of the proper size to satisfactorily wedge between the primary stones as placed.

2. Class 2 Riprap aggregate shall be graded with a sufficient amount of smaller stones uniformly distributed throughout. At least sixty percent (60%) of the stones shall weight more than eighty (80) pounds (36.3 kilograms) each.

3. Grouted Riprap aggregate shall conform to the specifications for Class I or Class 2 Riprap. If not specified, Class I Riprap shall be used.

4. Wire Enclosed Riprap aggregate shall be round or angular stones. Not less than ninety-five percent (95%) of the stone shall be retained on a screen or wire having two inches (2") (50 mm) square openings.

5. Sacked Concrete Riprap aggregate shall consist of either a sandy or gravelly pit-run material. This material shall be clean and free from roots, vegetable matter, or other deleterious substances. The aggregate shall meet the following gradation requirements:

Sieve designation		% by Weight Passing
2"	50 mm	80-100
#200	0.075 mm	0-4

2.16 AGGREGATE FOR RIPRAP FILTER

A. Filter aggregates for riprap shall be hard, durable particles or fragments of crushed stone or natural gravel screened or crushed to meet the following gradation requirements:

Sieve designation		% by Weight Passing
3"	75 mm	100
#4	4.75 mm	20–50
#200	0.075 mm	0-10

PART 3 EXECUTION

3.01 STOCKPILED AGGREGATE

A. This work shall consist of storing aggregate material which will be used in construction projects in accordance with these specifications at locations shown on the Drawings, noted in the Contract Documents, or as otherwise designated by ENGINEER.

B. The aggregates shall meet applicable parts of this section for the type of material required.

C. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the site shall be firm and smooth and well drained. A bed of aggregate suitable to avoid the inclusion of soil or foreign material shall be maintained.

D. The stockpiles shall be built in layers not exceeding four feet (4') (1200 mm) in height, and each layer shall be completely in place before the next layer is started so as to prevent segregation. The material shall be deposited in such a manner as to prevent coning, except in the case of fine aggregate composed of material approximately ninety percent (90%) finer than a #4 (4.75 mm) sieve.

E. Dumping, casting, or pushing over sides of stockpiles is prohibited except in the case of fine aggregate materials.

F. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart or separated by suitable walls or partitions to prevent the mixing of the aggregates.

G. Any stockpiling of materials derived by wet pit or dredging operations, other than those stockpiles previously mentioned, are subject to prior approval of ENGINEER and must be specified and submitted in the CONTRACTOR's plan of operations.

H. When it is necessary to operate trucks or other equipment on the stockpile in the process of building that stockpile, it should be done in a manner approved by ENGINEER. Any method of stockpiling aggregate, which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate, will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated. Failure of such samples to meet all grading requirements for the aggregate shall be considered cause for discontinuance of such stockpiling procedures.

I. The aggregate shall be transferred from the stockpiles in such a way as to obtain a material having a uniform grading.

3.02 STOCKPILED AGGREGATE

A. The equipment and methods utilized in the production, storage, transportation and final placement of aggregate materials shall be such as to provide in-place materials meeting all requirements as specified.

PART 4 METHOD OF MEASURMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02190.01 DRAIN GRAVEL GRADING A

   This item shall be measured by the number of tons of Drain Gravel Grading A installed and shall be verified with the weigh tickets provided by the CONTRACTOR.

2. 02190.02 DRAIN GRAVEL GRADING B

This item shall be measured by the number of tons of Drain Gravel Grading B installed and shall be verified with the weigh tickets provided by the CONTRACTOR.

3. 02190.03 DRAIN GRAVEL GRADING C

This item shall be measured by the number of tons of Drain Gravel Grading C installed and shall be verified with the weigh tickets provided by the CONTRACTOR.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02190.01 DRAIN GRAVEL GRADING A

Payment shall include furnishing, hauling, laying, spreading and compacting the required aggregate to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any materials; and all labor, equipment, tools and incidentals necessary to complete this item.

2. 02190.02 DRAIN GRAVEL GRADING B

Payment shall include furnishing, hauling, laying, spreading and compacting the required aggregate to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any materials; and all labor, equipment, tools and incidentals necessary to complete this item.

3. 02190.03 DRAIN GRAVEL GRADING C

Payment shall include furnishing, hauling, laying, spreading and compacting the required aggregate to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any materials; and all labor, equipment, tools and incidentals necessary to complete this item.

SECTION 02210

EXCAVATION AND EMBANKMENT

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of excavation, disposal, or compaction of all materials not being removed under some other item, which is encountered within the limits of the work necessary for the construction of the project in accordance with the specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown in the plans. All excavation will be denoted as borrow special excavation, muck excavation, or unclassified excavation as hereafter described.

PART 2 PRODUCTS

2.01 BORROW EXCAVATION

A. Borrow excavation shall consist of excavation made from borrow areas within the project limits and outside the normal grading limits for the completion of embankments. Borrow areas or areas within the project limits from which borrow may be obtained will be designated on the plans.

B. Borrow excavation shall be made only at those designated locations and within the horizontal and vertical limits as stated or directed. On completion of borrow operations, the borrow area will be adequately drained and finished to a neat and uniform grade acceptable to the ENGINEER. Borrow excavation, if required, shall be paid for at the contract unit price bid for "Unclassified Excavation."

2.02 IMPORTED BORROW EXCAVATION

A. Imported borrow excavation shall consist of excavation made from areas outside the project limits and outside the normal grading limits for the completion of the embankments. Borrow areas or areas outside the project pits from which the imported borrow may be obtained will be designated. However, any source chosen by the CONTRACTOR will be subject to the approval of the ENGINEER.

B. Imported borrow excavation, if required, shall be paid for at the contract unit price bid for "Imported Borrow."

2.03 MUCK EXCAVATION

A. Muck excavation shall consist of the removal and disposal of saturated organic mixtures of soils or organic matter from within the project, not associated with culvert installations, which requires additional work or equipment which would not normally be required for unclassified excavation. When it is necessary that the muck excavation be stockpiled prior to final placement, classification of the material for the second handling shall be determined by the ENGINEER.

2.04 UNCLASSIFIED EXCAVATION

A. Unclassified excavation shall consist of the excavation and/or the on-site hauling, stock piling, or placement of the material encountered in the Work, including excavation obtained from borrow sources, not classified under other items of the contract.

2.05 SURPLUS MATERIAL

A. Surplus material shall be the quantity of excess suitable material not classified under any other items of the contract, as determined by the ENGINEER, that may be in part the balance between any cut and fill operations, minus any associated shrinkage, that is to be disposed of from the Project.

2.06 REJECTED MATERIAL

A. Rejected material shall be the quantity of unsuitable, deleterious, or overly saturated excavated material not classified under any other items of the contract, as determined by the ENGINEER, which is to be disposed of from the Project.

B. For a material to be automatically rejected by the Engineer due to saturation, the moisture content as determined by the nuclear density gauge prior to or during the initial excavation, must be at least twelve (12) percent above optimum moisture. If the material is unsuitable due to moisture content within the range of greater than six (6) percent and less than twelve (12) percent above optimum, the Contractor shall either dry or blend the material to bring it within the specified range for both moisture and density standards, unless it is otherwise in the opinion of the Engineer to be rejected. Import and rejected material associated with blending shall be as quantified, documented, and approved by the Engineer. Material six (6) percent or less above optimum shall be worked, dried or otherwise made compliant with the specified moisture and density.

2.07 UTILITY LOCATES IN SUBGRADE PROCESSING FOR ALLEYS

A. The Standard Bid Items of Section 02220 for Utility Locates and Crossings for Trenching operations may be applied to the Subgrade Processing Work, as determined necessary by the Engineer.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. All excavation and embankment work shall be constructed to neat lines and elevations staked by the ENGINEER or shown on the plans. No materials shall be wasted without permission from the ENGINEER. All grading and related operations shall be conducted so that the terrain outside of the limits of construction will not be disturbed. Prior to the commencement of grading operations, all necessary clearing and grubbing in the areas shall have been performed in accordance with Section 02110, CLEARING AND GRUBBING.

B. When embankments are to be placed on a hillside, or where new fill is placed against existing embankment, the slope of the original hillside, or old fill respectively, shall be benched or stepped by cutting into it horizontally, for a

minimum distance of thirty-six inches (36") to provide for secure bonding of the embankment while it is being brought up in layers. Each bench shall be cut as close to the one below as the slope of the ground will permit. Materials thus cut out of the benches shall be incorporated into the new fill at the CONTRACTOR's expense.

C. If it should become necessary, because of weather or other conditions, to suspend grading operations, the entire area worked upon shall be bladed until smooth, free of depressions and ruts, and graded so that no water can collect or be impounded.

D. Embankment placed adjacent to structures shall be brought up in equal layers on all sides to prevent distortion of any of these parts. If it is necessary to deposit embankment on only one side of abutments, wing walls, piers, or culvert headwalls, compaction shall be accomplished without causing overturning of or excessive pressure against the structure. Areas inaccessible to tamping rollers or power rollers shall be compacted by hand or mechanical tampers or other means until the density conforms to adjacent embankment, compacted in accordance with these specifications.

E. Embankment material shall be placed in uniform approximate horizontal layers not exceeding eight inches (8") in loose thickness, for the entire width of the embankment. Each layer of embankment shall be completed, leveled and compacted before the succeeding layer is placed.

F. Embankment which has been subjected to freezing shall be refinished to grade, cross-section and compaction requirements after the frost is out of the ground and the embankment is in suitable condition to work.

G. If, before acceptance of the work, softening of the subgrade surface takes place under construction traffic to a degree unsatisfactory to the ENGINEER, the soft area shall be dug out and backfilled with the same classification of material, and compacted in layers at the required water content to obtain a satisfactory embankment. All cost of such work shall be borne by the CONTRACTOR.

3.02 MOISTURE AND DENSITY CONTROL

A. Soil layers shall be processed to satisfy the following moisture and compaction requirements as determined by AASHTO T-180, Modified Proctor Density, unless otherwise specified by the ENGINEER.

For Non-structural fill–Any areas outside of right of way or under non-paved areas
Degree of compaction: minimum of 90%

For structural fill – Area within the right of way or any material as shown in the proposed typical section, or under paved areas
Degree of compaction: minimum of 92%

For clay soils or soils with clay in it – moisture content shall be optimum or above the upper moisture limit as determined from Modified Proctor curve of the specific soil.
For all other material – moisture content shall be a workable moisture content to meet densities as stated above.

B. Within the areas indicated on the plans, or as directed by the ENGINEER, earth shall be removed to the designated depth of Subgrade Processing, or to the designated depth of Excavation Below Subgrade. At this depth, it is the

CONTRACTOR's responsibility to assure that the exposed soil is inspected for saturated or yielding conditions prior to the spreading, relaying, and compaction of the subgrade material or the excavation below subgrade material. These areas shall then be reestablished to the specified optimum moisture and density controls for the material type.

C. For Subgrade Processing or for Excavation Below Subgrade, the lower six inches (6") of the specified depth may be left in place and then made uniform by scarifying and thoroughly blending with the moisture content increased or reduced as necessary. Payment for any subsequent necessity to remove this lower six inches shall be incidental to the associated Subgrade Processing or Excavation Below Subgrade bid item.

3.03 FREQUENCY OF COMPACTION TESTS

A. For concrete curbs, combined curbs and gutters, and trickle channels a minimum of one test for every one hundred fifty (150) lineal feet, or one per placement if less than one hundred fifty (150) lineal feet, or as otherwise determined necessary by the ENGINEER.

B. For concrete sidewalks, driveway approaches, curb return fillets, valley gutters, and miscellaneous new concrete construction, a minimum of one test for every five hundred (500) square feet, or one per placement if less than five hundred (500) square feet, or as otherwise determined necessary by the ENGINEER.

C. For street, alley, or parking lot paving, a minimum of one test for every five hundred (500) square yards of subgrade surface.

D. For embankment there shall be at least one (1) compliance compaction test for each one-thousand (1000) cubic yards of compacted soil.

E. Additional testing may be required by the OWNER or ENGINEER.

Any failed tests shall be retested after the area has been reworked by scarifying, moisture conditioning, compaction, or other means to obtain desired density requirements.

Testing technician shall have a copy of the proctor curve from which the maximum density and optimum moisture content is derived available on site for review at the time of the test, or otherwise upon request of the ENGINEER.

All expenses incurred to perform retests of failed test areas shall be at the CONTRACTOR'S expense.

The OWNER or ENGINEER may require confirmation tests by an independent testing lab. Acceptance of the compacted soil can be delayed and re-work of the material may be required based on discrepancies between primary tests and confirmation tests.

3.04 HAUL

A. When constructing embankments as specified, or wasting, as the case may be, no haul will be allowed on excavated material as a haul item but shall be included in the contract unit price bid for earthwork item or items listed on the Proposal.

3.05 FINE GRADING

A. After the earthwork has been substantially completed and after all underground utilities, manholes, catch basins, valve boxes, etc., have been installed or adjusted to grade, the subgrade shall be brought to the lines, grades, and cross-sections shown on the plans, and compacted to the required density.

B. All soft and unstable material and other portions of the subgrade, which, in the opinion of the ENGINEER, cannot be compacted satisfactorily, shall be removed to lines and grades as directed by the ENGINEER.

C. All boulders appearing in the earth excavation shall be removed or broken off to a depth of not less than four inches (4") below subgrade. All rock sections shall be brought to grade by depositing a satisfactory cushion material to a depth authorized by the ENGINEER.

D. If the surface of an old stone or gravel roadbed conforms approximately to the surface of the finished subgrade, such sections shall be scarified and mixed for the full width of the subgrade to a minimum depth of 1.0 foot (1') to provide uniform moisture and density for the full width.

E. At all times, ditches and drains along the subgrade shall be so maintained as to drain effectively. When ruts of two inches (2") or more in depth are formed, the subgrade shall be brought to grade and if necessary be reshaped and re-rolled. In no case shall any surface course or pavement be placed on a frozen or muddy subgrade. Not less than the top twelve inches (12") of the subgrade shall have a minimum compacted density as specified for embankment.

F. In addition, the finish grade shall not deviate more than one-tenth of a foot (1/10') at any point from the staked elevation. Until the subgrade has been checked and approved, no surface course or pavement shall be laid thereon. Under the square yard method of measurement and payment the CONTRACTOR has the option of deviating from the above tolerances as long as the specified base coarse section and profile is maintained.

3.06 PROOF ROLLING

A. The existing soil under areas where the subgrade preparation material has been removed may be specified to be "proof rolled" on the Design Drawings or by the ENGINEER prior to placing or compacting the subgrade material. Proof rolling may also be required at the surface of the subgrade preparation prior to placing base material or paving. This operation will be done in order to determine if there are any soft spots that will require additional work or excavation below subgrade.

B. "Proof rolling" shall be accomplished with a pneumatic tire roller with a minimum weight of twenty-seven tons (27 tons), or a different piece of equipment that exerts approximately the same tire contact pressure on the soil. The roller speed shall not exceed three miles per hour (3 MPH) so that the ENGINEER or his representative may observe any movement in the existing subgrade. A minimum of three (3) passes over the entire surface area will be required for observation, or as otherwise directed by the ENGINEER.

C. Proof rolling is incidental to the associated Subgrade Processing and Excavation Below Subgrade standard items of this section. In the event that soft spots are found on existing soil below subgrade preparation, their repair will be paid for under the associated or relevant pay items.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02210.01 UNCLASSIFIED EXCAVATION ABOVE SUBGRADE

This item shall be measured by the cubic yards of material excavated above the top of subgrade by means of average end areas, or by other applicable means as determined by the ENGINEER.

2. 02210.02 EXCAVATION BELOW SUBGRADE

This item shall be measured by the cubic yards of excavated, processed, or scarified material below the bottom of SUBGRADE PROCESSING by means of average end areas, or by other applicable means as determined by the ENGINEER.

3. 02210.03 REJECTED MATERIAL DISPOSAL

This item shall be measured by the cubic yards of rejected material disposed of at the direction of the ENGINEER by means of average end areas, or by other applicable means as determined by the ENGINEER.

4. 02210.04 SURPLUS MATERIAL DISPOSAL

This item shall be measured by the cubic yards of surplus material loaded, hauled, and disposed of from the Project site, or by other applicable means as determined by the ENGINEER.

5. 02210.05 IMPORTED BORROW (CLAY)

This item shall be measured by the cubic yards of imported borrow (clay) placed and accepted in final position by means of average end areas, or by other applicable means as determined by the ENGINEER.

6. 02210.06 IMPORTED BORROW (SAND)

This item shall be measured by the cubic yards of imported borrow (sand) placed and accepted in final position by means of average end areas, or by other applicable means as determined by the ENGINEER.

7. 02210.07X X" PAVED ROAD SUBGRADE PROCESSING

This item shall be measured by the square yard of subgrade acceptably processed to a _____ inch (__") depth and shall apply to all areas that are eleven feet (11') or greater in width and larger than one hundred square yards (100 SY) in size.

8. 02210.08X X" SUBGRADE PROCESSING FOR PATCH

This item shall be measured by the square yard of subgrade acceptably processed to a _____ inch (__") depth and shall apply to all areas that

are less than eleven feet (11') in width or less than one hundred square yards (100 SY) in size.

9. 02210.09 CONSTRUCT TEMPORARY HAUL ROAD
This item shall be measured as a lump sum.

10. 02210.10 FINISH GRADING

This item shall be paid as a lump sum for all work associated with the finish grading plans.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02210.01 UNCLASSIFIED EXCAVATION ABOVE SUBGRADE

Payment shall include all tools, labor, equipment and incidentals necessary to complete all clearing, grubbing, street and drainage excavation, including excavation for sidewalk, curb and/or combined curb and gutter as shown on the Drawings; to construct, shape and slope embankments, cuts, subgrades, shoulders, gutters, ditches, street and alley intersections, approaches and private driveway entrances in the locations, to the elevations according to details shown on the Drawings; to backfill ditches, depressions and behind sidewalk, curb and/or combined curb and gutters; to remove and to place, compact, moisture condition and fine grade embankment, backfill, and compact areas where unsuitable or surplus material has been removed within the limits of the Work and above the top of subgrade; and all other incidental items and operations to complete this item.

2. 02210.02 EXCAVATION BELOW SUBGRADE

Payment shall include all tools, labor, equipment and incidentals necessary to complete the excavation, inspection of exposed soil for saturated or yielding conditions, proof rolling, scarifying, moisture conditioning, placement, and compaction of the existing soil or imported borrow material below the bottom of SUBGRADE PROCESSING.

3. 02210.03 REJECTED MATERIAL DISPOSAL

Payment shall include all tools, labor, equipment and incidentals necessary for the loading, hauling, and disposal of the rejected material.

4. 02210.04 SURPLUS MATERIAL DISPOSAL

Payment shall include all tools, labor, equipment and incidentals necessary for the loading, hauling, and disposal of the surplus material.

5. 02210.05 IMPORTED BORROW (CLAY)

Payment shall include loading and hauling imported material; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

6. 02210. 06 IMPORTED BORROW (SAND)

Payment shall include loading and hauling imported material; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

7. 02210.07X X" PAVED ROAD SUBGRADE PROCESSING

Payment shall include all labor, equipment, tools, and incidentals necessary to remove, scarify, moisture condition, relay and spread materials as necessary; inspect exposed soil or proof roll for saturated or yielding conditions; place and compact existing materials or imported borrow to the specified moisture and density; trim and finish grade the subgrade; proof rolling of subgrade; and any other incidentals necessary to complete this item.

8. 02210.08X X" SUBGRADE PROCESSING FOR PATCH

Payment shall include all labor, equipment, tools, and incidentals necessary to remove, scarify, moisture condition, relay and spread materials as necessary; inspect exposed soil or proof roll for saturated or yielding conditions; place and compact existing materials or imported borrow to the specified moisture and density; trim and finish grade the subgrade; proof rolling of subgrade; and any other incidentals necessary to complete this item.

9. 02210.09 CONSTRUCT TEMPORARY HAUL ROAD

Payment shall include all tolls, labor, materials, equipment and incidentals required to construct and maintain the haul road.

10. 02210.10 FINISH GRADING

Payment shall include all items and incidentals necessary to complete finish grading procedures for minor grading to blend and match from the limits of UNCLASSIFIED EXCAVATION and beyond to the construction limits.

SECTION 02220

TRENCH EXCAVATION AND UTILITY LOCATES

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of excavation and trenching for pipelines and all associated handling and storage of materials, pumping and dewatering as necessary, and subgrade preparation and surface restoration of the trench. The Facility Crossing and Locate standard items of this section may also be applied to the Subgrade Processing Work, as determined necessary by the Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION

A. During excavation, materials suitable for backfilling shall be piled in an orderly manner and a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated material shall be piled on one side of the trench only, to permit ready access to existing fire hydrants, valves, manholes and other appurtenances. Surface drainage of adjoining areas shall be unobstructed.

B. All excavated materials not required or suitable for backfill shall be removed from the site and disposed of in a manner and/or by methods acceptable to OWNER. The Engineer may require certification of proper disposal procedures.

C. Grading shall be done as necessary to prevent surface water from flowing into excavations, and any other water accumulating therein shall be promptly removed. Under no circumstances shall water be permitted to rise in un-backfilled trenches until after the pipe has been placed, tested and covered to final grade with backfill. Any pipe having its alignment or grade changed as a result of a flooded trench shall be re-laid at no additional cost to the OWNER.

D. Adequate provisions shall be made for maintaining the flow of sewers, drains and water courses encountered during construction. Culverts, ditches, fences, crosspans and structures that are disturbed by this construction, shall be satisfactorily restored to their original condition upon completion of the work.

3.02 SITE CONDITIONS

A. CONTRACTOR'S SAFETY RESPONSIBILITIES

1. The CONTRACTOR shall be responsible for enforcing safety and maintaining safe working conditions in all trenching and shoring to conform to OSHA regulations.
2. The CONTRACTOR shall employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches, and other operations involving safety procedures, as prescribed by OSHA.

3.03 STRUCTURES

A. The CONTRACTOR shall exercise every precaution to prevent damage to existing buildings or structures in the vicinity of his work. In the event of such damages, he shall repair them to the satisfaction of the owner of the damaged structure at no cost to the OWNER.

3.04 OVERHEAD UTLITITES

A. The CONTRACTOR shall use extreme caution to avoid a conflict, contact, or damage to overhead utilities such as power lines, streetlights, telephone lines, television lines, poles or other appurtenances during the course of construction of the Project.

3.05 SURVEY MARKERS AND MONUMENTS

A. The CONTRACTOR shall use every care and precaution to protect and not disturb any survey markers or monuments, such as those that might be located at lot or block corners, property pins, intersection of street monuments or addition line demarcation. Such protection shall include marking with flagged high lath and close supervision. No monument shall be disturbed without prior approval of the OWNER and ENGINEER. Any survey marker or monument that is disturbed or destroyed by the CONTRACTOR without approval during construction of the Project shall be replaced at no cost to the OWNER by a licensed land surveyor.

3.06 CLEANUP

A. As work progresses, that portion of the work completed shall be cleared of debris and brought to the finished grade. Upon completion of the work, the entire site shall be cleared of all debris and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. All rocks brought to the ground surface by excavation or backfilling operations shall be removed.

B. At all times during construction, the CONTRACTOR shall be responsible for dust control as directed by the ENGINEER.

3.07 TRENCH EXCAVATION

A. Trench excavation shall be performed in accordance with the requirements of Wyoming State OSHA Regulations. It is the CONTRACTOR'S responsibility to assure that all trench excavation safety precautions are met.

3.08 PREPARATION

A. PROTECTION OF EXISTING PROPERTIES

1. Prior to beginning construction, the CONTRACTOR must fulfill and meet the requirements of Wyoming Statures 37-12-304 relating to public utilities; providing definitions; providing that notice of intended excavation be given to the public utilities with underground facilities located in the area of proposed excavation; and providing for exceptions.

2. The CONTRACTOR will relocate existing public utilities which will interfere with the new pipelines.

3. Existing water or sewer services from the mains to private property which interfere with trenching operations may be cut and replaced at the CONTRACTOR's expense. The use of such services shall in no case be interrupted for more than two (2) hours, unless temporary service is provided.

4. Existing water mains and water services shall be protected at all times during construction operations.

3.09 PRIVATELY OWNED UTILITIES

A. Gas mains, underground electrical and telephone cables, telephone poles, light poles, cable television, etc., required to be moved to make way for new construction will be moved by others. The CONTRACTOR shall assure that all necessary arrangements are made with the appropriate owner(s) prior to beginning work in the affected area, and shall assure that all required work is coordinated with the appropriate utility owner(s) as work progresses.

3.10 EXPLORATORY EXCAVATION

A. Exposure of buried utilities that might interfere with alignment or grade shall be accomplished by Exploratory Excavation prior to construction. If any existing utility interferes with the proposed work in either alignment or grade and has to be moved, such work shall be done by or arranged for by the CONTRACTOR.

B. Exploratory Excavation may be required either prior to or during construction to verify location(s) of the utilities or underground facilities when there are discrepancies with surface "locates" or discrepancies with how the utilities are identified on the Plans in relation to their true underground location.

C. The CONTRACTOR shall communicate to the ENGINEER and they shall agree on the appropriateness to proceed with Exploratory Excavation prior to commencing with the work.

3.11 SHORING, SHEETING AND BRACING

A. The CONTRACTOR shall do all shoring, bracing and tight sheeting required to prevent caving and to protect his workmen, in accordance with Occupational Safety and Health Regulation Requirements, and to protect adjacent property and structures.

3.12 DEWATERING

A. Where ground water is encountered in excavation, it shall be removed to avoid interfering with pipe laying and other construction operations.

B. Discharge from dewatering operations shall be directed to approved natural drainages or storm sewers as appropriate.

C. Discharge form dewatering operations shall be in accordance with rules and regulations established by the Wyoming Department of Environmental Quality (DEQ). These activities require coverage under a NPDES permit. The DEQ has issued a general permit for temporary discharges. The general permit for temporary discharges currently authorizes the discharge of wastewaters to surface waters of the state

associated with; hydrostatic testing of pipes, tanks or other similar vessels, disinfection of potable water lines, pump tests of water wells, or construction dewatering.

D. In order to request coverage under the general permit for temporary discharges, the CONTRACTOR must complete and submit a "Notice of Intent" (NOI) to the DEQ. The DEQ will review the NOI and determine if the proposed activity is eligible for coverage under this permit or if the activity must be covered under an individual permit. If the proposed activity is eligible for coverage under the general permit, the DEQ will send the CONTRACTOR notification, through a written facility certification form, that coverage has been granted. The facility certification form will also establish effluent limitations and monitoring requirements.

E. Effluent associated with construction dewatering. Refer to table below.

PARAMETER	EFFLUENT LIMITATION	FREQUENCY	SAMPLE TYPE
Flow, gpm	N/A	Daily	Instantaneous or Continuous
Total Suspended Solids, mg/L	The concentration shall not exceed a monthly average of 30 mg/l, a weekly average of 45 mg/l or a daily maximum of 90 mg/l	Weekly	Grab
pH,s.u.	The pH shall not be less than 6.5 nor more than 9.0 standard units.	Daily	Grab
Oil and Grease	The concentration shall not exceed 10 mg/l	Daily	Visual
Turbidity	A discharge to Class 1 water shall not result in a turbidity increase of 10 nephelometric turbidity units (NTUs). A discharge to Class 2 waters or Class 3 waters shall not result in a turbidity increase of 15 NTUs.	Daily	Grab

3.13 GENERAL EXCAVATION OPERATIONS

A. The CONTRACTOR shall excavate as necessary at the locations shown on the drawings, staked in the field or otherwise specified for the installation of pipelines.

B. The CONTRACTOR shall take precautions and protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, trees, and fences. Any disturbed or damaged facilities will be suitably restored or replaced by the CONTRACTOR.

C. Crossing under sidewalks or curbs may be made by tunneling only if approved by the ENGINEER. If the CONTRACTOR elects to remove a portion of the sidewalk or curb, he must use a concrete saw for making neat joints corresponding to existing joints, compact the backfill as specified, and install a new concrete sidewalk or curb section.

D. Excavations for manholes, hydrants, structures, and other appurtenances shall be sufficient to leave clearance adequate for proper compactive efforts on all sides. The depth, provisions for removing water, and other applicable portions of these specifications shall apply to excavation for appurtenances.

3.14 TRENCH DIMENSIONS

A. Trench dimensions shall be as specified below:

1. Trench width from the trench bottom to a point one foot (305 mm) above the top of the pipe shall be no less than the outside diameter of the pipe plus

twenty-four (24) inches. The width of the trench from the bottom of the trench to the existing ground surface shall be adequate to allow proper compactive effort along both sides of the pipe.

a. Depth of Trench. Trench depth shall be as required for the invert grade or pipe bury depth shown on the plans. Care shall be taken not to excavate below the required depth.

b. When soft or unstable material or rock is encountered at the subgrade, which will not uniformly support the pipe, such material shall be excavated to an additional depth as necessary and backfilled with Type 2 Bedding Material.

2. TRENCH BOTTOM

a. The bottom of the trenches shall be accurately graded to the line and grade show on the drawings. Bedding material shall provide uniform bearing and support for each section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench bedding has been graded, and shall be only of such length, depth and width as required for properly making the particular joint type. Unauthorized over depths shall be backfilled with bedding material at the CONTRACTOR's expense.

3.15 TIME OF OPEN TRENCHES

A. The CONTRACTOR will be required to conduct his work so that trenches will remain open a minimum possible time.

B. No trench excavating shall begin until approved compaction equipment is at the site where the excavating is to take place. All backfill and compacting shall be completed in all trenching and structural excavations within a maximum distance of two hundred (200) feet behind the end of the newly installed pipe and the maximum distance between the newly installed pipe and the excavator shall be two hundred (200) feet. For each work group consisting of trench excavator, a pipe laying crew, and a backfilling and compacting crew, the maximum allowable open ditch at any time will be four hundred (400) feet.

C. Certain conditions may necessitate the closing of certain sections of trench, such as prior to daily, weekend, or holiday shutdown.

3.16 EQUIPMENT

A. The use of trench digging machinery will be permitted except in places where its operation will cause damage to existing structures or features, in which case hand methods shall be employed.

B. Any equipment on tracks, or that have outriggers which is to be used on pavement, shall be equipped with suitable pads to prevent damage to the pavement. All pavement damaged during construction by the CONTRACTOR's equipment shall be replaced to its original condition by the CONTRACTOR.

3.17 ONE-CALL OF WYOMING

A. Obtaining and preserving utility "locates" as per the One-Call of Wyoming regulations are the responsibility of the CONTRACTOR. Full compensation for this responsibility shall be considered as included in the prices paid for the various other contract items and no additional compensation will be made.

B. As per the One-Call of Wyoming regulations, the Contractor shall call-in "locates" of all Underground Facilities ahead of any planned excavation activities. This call must be made within the required advanced notice to allow for the "locates" to be completed prior to trenching.

3.18 UNDERGROUND FACILITIES

A. The CONTRACTOR shall have full responsibility for the following items concerning Underground Facilities (Utilities):

1. Reviewing and checking all information and data regarding any Underground Facility.

2. Arranging "locates" of the existing Underground Facilities by contacting the local One-Call of Wyoming Center.

3. Coordinating the Work with the owners of the Underground Facilities during construction.

4. Safety and protection thereof and repairing any damage thereto resulting from the Work, the cost of which shall be considered as included in the unit contract pricing for the Work.

5. Recording and preserving the information obtained during the "locates". Additional costs charged by the utility owners for additional and/or excessive "locate" requests shall be at the expense of the CONTRACTOR.

B. CONTRACTOR shall, after One-Call "locates" have been obtained, physically locate all Underground Facilities in the area of the Work in advance of excavating or trenching. Upon physically locating the facility or appurtenance, the CONTRACTOR shall notify the ENGINEER of its location. The CONTRACTOR shall assist the ENGINEER in recording the size, location, and depth (elevation) of the facility for the compilation of the "Drawings of Construction Record".

C. The following are restrictions on Compensation for Underground Facility Locates or Crossings and Exploratory Excavation:

1. No payment shall be made for Facilities that are overhead or on the ground surface.

2. No payment shall be made for Underground Facilities that are installed temporarily by the OWNER, CONTRACTOR, or Underground Facility owner as a result of this Project.

3. No payment shall be made for Underground Facilities installed or owned by the CONTRACTOR, including any work as part of the Project.

4. No payment shall be made for the discovery of known abandoned Underground Facilities, whether abandoned as a result of this Project or known to be abandoned prior to the start of the Project. Any slowdown in production or Trenching Excavation procedures due to planned abandonments or known-to-be abandoned Underground Facilities shall be

considered as included in the prices paid for the various other contract items and no additional compensation will be made.

5. No payment shall be made for paralleling adjacent Underground Facilities. Any slowdown in production or Trenching Excavation procedures due to paralleling adjacent Underground Facilities shall be considered as included in the prices paid for the various other contract items and no additional compensation will be made unless as otherwise called out by the ENGINEER in the Special Provisions.

6. No payment will be made under this Section for restraint or support of utility poles during construction.

7. No payment for "Underground Facility Crossing" will be made for crossing over the top of an Underground Facility. Payment may be applicable as "Underground Facility Locates" if verification is necessary that the new construction will be above the said Underground Facility.

8. No payment under the pay items of this Section shall be made for crossing lawn sprinkler or irrigation lines, or other private residential or commercial equipment that is not associated with the operations of a public or private utility that serves the general public.

9. No distinction or difference for payment shall be made as to the size or type of a certain Underground Facility that is to be located or crossed.

10. Any or all Underground Facilities identified as adjacent to each other in the same vertical plane, or within 18 inches horizontal offset of that plane, will be paid as one crossing or locate as per the applicable pay item.

11. No duplicate payments shall be made for the location, uncovering, or exposing of any Underground Facility that is paid for under another pay item.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02220.01 EXPLORATORY EXCAVATION

   This item shall be measured by the quantity of hours spent during exploratory excavation and backfill and be paid by the hour in quarter (1/4) hour increments.

2. 02220.02 UNDERGROUND FACILITY LOCATES

   This item shall be measured by the numerical count of field located Underground Facilities. Measurement will not be made for those utilities that are located and paid for under any other bid item of this Section, such as the potholing or exposure of a utility paid for under the Underground Facility Crossing bid item.

3. 02220.03 UNDERGROUND FACILITY CROSSING

This item shall be measured by the numerical count of underground facility crossings encountered during Trenching and Subgrade Preparation Excavation procedures. Any or all utilities identified as adjacent to each other in the same vertical plane, or within 18 inches horizontal offset of that plane, will be paid as one crossing.

4. 02220.04 DEWATERING

This item will be paid as a lump sum for the necessary dewatering of surface water and groundwater as determined by the Contractor to install the improvements for this Project.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02220.01 EXPLORATORY EXCAVATION

Payment shall include all tools, labor, equipment and incidentals necessary to complete the excavation, exposure of existing utilities or structures not within 24" of a Utility Locate, moisture conditioning, and compaction up to the bottom of the normal subgrade preparation, or temporary backfilling as necessary, prior to or during construction of the Project. If the Owner's decision is to complete any work associated with the utility, such work shall be done by, or arranged for by the CONTRACTOR and any necessary adjustment in payment will be made at a price agreed upon before the work is started.

2. 02220.02 UNDERGROUND FACILITY LOCATES

Payment shall include any costs for potholing, excavating, uncovering and identifying, or any other means to field verify the underground location of utilities as necessary and not included under other bid items. Payment shall also be for any necessary hand work, protection, preservation, backfill (temporary or permanent), or re-establishment of the physical locate, and all other work necessary or incidental for completion of the item. This item is not applicable for utilities that are located and paid for as an Underground Facility Crossing.

3. 02220.03 UNDERGROUND FACILITY CROSSING

Payment shall include costs associated with production slowdown for Trenching and Subgrade Preparation Excavation procedures for locating and crossing beneath an underground facility. This includes; potholing, excavating, uncovering and identifying, or any other means to field verify the underground location of the crossed utilities, as necessary. Payment shall also be for any necessary hand work, protection, preservation, backfill (temporary or permanent), or re-establishment of the physical locate, and all other work necessary or incidental for completion of the item. Any utility exposure work paid for as incidental to an Underground Facility Crossing shall not be paid for as Underground Facility Locates.

4. 02220.04 DEWATERING

Payment shall include all materials, equipment, tools, labor and other incidentals necessary to complete this item.

SECTION 02222

ROCK EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of requirements for rock removal and the use of explosives to assist in rock removal.

PART 2 PRODUCTS

2.01 ROCK EXCAVATION

A. Rock excavation shall consist of the removal and disposal of igneous, metamorphic, and sedimentary rock, which cannot be excavated without blasting or using rippers, and all boulders or other detached stones each having a volume or one-half (1/2) cubic yard or more.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Blasting for excavation will be permitted only after securing the approval of the OWNER and ENGINEER, and the hours of blasting will be fixed by the ENGINEER. The CONTRACTOR shall use utmost care to protect life and property. All explosives shall be safely and securely stored in compliance with local laws and ordinances and all such storage places shall be clearly marked "Dangerous Explosives". No explosives shall be left unprotected where they could endanger persons or property.

B. When blasting rock in trenches, the CONTRACTOR shall cover the area to be shot with earth backfill or approved blasting mats that will prevent the scattering of rock fragments outside the excavation. Prior to blasting, the CONTRACTOR shall station men and provide signals of danger in suitable places to warn people and stop vehicles. The CONTRACTOR will be responsible for all damage to property and injury to persons resulting from blasting or accidental explosions that may occur in connection with his use of explosions.

C. The CONTRACTOR shall furnish in writing the following information to the OWNER and ENGINEER prior to commencing blasting operations: Name of his powder man's experience, type of shot, type of explosives and detonators being used, proof of insurance covering liability for such operation, traffic control plans and planned procedures for protecting the public.

D. The CONTRACTOR's blasting procedures shall conform to Federal, State and local ordinances. The CONTRACTOR shall acquire all required permits prior to the start of blasting.

PART 4 METHOD OF MESUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section.

4.02 BASIS OF PAYMENT

A. There will be no differentiation between common and rock trench excavation, except when listed as separate items on the bid proposal or bid form. Excavation shall include the removal and subsequent handling of all earth, gravel, rock or other material encountered regardless of the type, character, composition or condition of the material. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 02225

TRENCH BACKFILL

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of handling and storage of materials to be used for fill, backfill, and final grading.

1.02 RELATED WORK

A. Section 02210, Excavation and Embankment
B. Section 02665, Water Distribution and Transmission Systems
C. Section 02700, Sanitary Sewer Systems

PART 2 PRODUCTS

2.01 MATERIALS

A. PIPE BEDDING MATERIAL

1. In general, pipe bedding material shall meet all pipe manufacturer recommendations. When there is discrepancy between the following directives and the manufacturer's recommendations for pipe bedding material, the more conservative engineering grade quality of materials shall be used as directed by the ENGINEER.

2. Pipe bedding material around the pipe from six (6) inches under the pipe to six (6) inches over the pipe shall consist of native clay and/or sand. This native pipe bedding material shall be incidental to the associated pipe installation. This material shall be free from clods, frozen material, or stones larger than three-quarters (3/4) inch in their maximum dimension. Where wet or otherwise unstable conditions exist, the material in this zone shall be free draining, non-plastic material. Where suitable material is available in the material excavated from the trench, the CONTRACTOR may procure the select material by screening, sifting or manually sorting the material removed from the trench in a manner approved by the ENGINEER.

3. Type 1 Pipe Bedding, material around the pipe from six (6) inches under the pipe to six (6) inches over the pipe, shall be used when on-site native soil is unsuitable or as directed by the ENGINEER. This material shall be silt, clay, silty sand, silty gravels, or clayey sand or gravel (ASTM D-2487 classification ML, CL, ML-CL, SM, SC, GM, GC, SW, SP) free of stones larger than ¾ inch in their maximum dimension.

4. Trench Foundation material is required for foundation in over-excavated trenches and shall consist of the bedding material from six (6) inches under the pipe and below. The bedding material shall consist of clean gravel or sand having a maximum size of one and one-half (1½) inches, with zero to five percent (0 to 5%) passing the #200 sieve.

B. CEMENT TREATED FILL

Cement treated fill, when specified, shall meet the following criteria:

INGREDIENT	LBS/CY
Cement (0.45 Sack)	42 lbs (19 kg)
Water (39 Gallons)	325 lbs (147.4 kg)
Coarse Aggregate (size No. 57)	1700 lbs (771.1 kg)
Sand (ASTM C 33)	1845 lbs (837 kg)

PART 3 EXECUTION

3.01 CONSTRUCTION

A. COMMON AND SELECT BACKFILL

1. All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and approved. Leakage tests, pressure tests or tests for alignment and grade shall be performed after backfill. If any tests fail, the CONTRACTOR shall be responsible for work required to correct the defects.

2. After the select pipe bedding material has been placed and compacted as specified above, the remainder of the trench backfilling shall be done. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other materials that are unsuitable. From one (1) foot above the top of pipe to six (6) inches below the ground surface, or to the subgrade elevation for streets or paved surfaces, material containing stones up to four (4) inches in the greatest dimension may be used.

3. Where shown on the plans, the CONTRACTOR shall provide embankment over the pipe above the original ground surface to a height, which will satisfy the minimum depth of cover requirements. Such embankment shall be constructed to the cross section shown on the plans.

B. TRENCH BACKFILL

1. Materials used for bedding and backfill shall be carefully deposited in layers with a depth suitable to the equipment used for compaction. The moisture and compaction shall be per the requirements of Section 02210 Excavation and Embankment, Paragraph 3.02. All backfill material requiring the addition of water shall be wetted and mixed to a uniform consistency prior to placing in the trench.

2. Compaction by flooding will not be permitted.

3. If the backfilled trench has not been tested at required intervals during backfilling, the CONTRACTOR shall provide excavation equipment to dig compaction test holes through each layer of backfill. Compaction tests shall be as required in paragraph 3.03 of this Section. Should tests fail, the CONTRACTOR shall remove all trench backfill above the failed lift and rework to passing moisture and compaction in the area of deficiency. ENGINEER shall determine the area of deficiency. All work required to bring the failed test area into specification shall be at the CONTRACTOR expense. Passing backfill tests only assures the OWNER that the minimum acceptable

level of testing was achieved. The passing tests do no relieve the CONTRACTOR of his responsibility to compact the entire trench and does not relieve his guarantee of the trench as identified in this specification.

4. For graveled streets and alleys the backfill shall be completed by blading the stripped gravel back over the trench and re-compact.

5. Each service line shall be backfilled and compacted to the same requirements as the main line trench. Each service must have at least one passing compaction test.

C. CEMENT TREATED FILL PIPE SADDLE

1. Where vertical or horizontal clearance between a water and a sewer line identified in Section 02665 Water Distribution and Transmission Systems and 02700 Sanitary Sewer Systems can not be maintained, the water or sewer line shall be encased in a cement treated fill pipe saddle as shown Standard Detail 02225-01.

3.02 COMPACTION

A. Bedding material under and around the pipe to six (6) inches above the top of the pipe shall be distributed by hand in maximum layers of six (6) inches and thoroughly compacted. Special care shall be taken to assure complete compaction under the haunches of the pipe.

B. Backfill material shall be placed in the trench for its full width on each side simultaneously. Compaction of pipe bedding shall be in accordance with this specification.

C. Cement treated fill may be used at the option of the CONTRACTOR provided it meets the requirements of the ENGINEER. ENGINEER may require certification of mix design and batching ingredients.

3.03 TESTING

A. The minimum frequency for taking compaction tests shall be three (3) compliance tests for every one hundred fifty (150) lineal feet of Trench Backfill. The three (3) compliance tests on backfill shall be taken at different elevations in the trench. The recommended elevation where the three (3) tests should be taken are one (1) test four (4) feet or more below grade and two tests in the top four (4) feet at approximately two-foot (2) intervals for trenches eight (8) feet in depth or less. For trenches greater than eight (8) feet in depth, at a minimum, an additional test shall be taken for every two (2) feet of additional trench depth. The ENGINEER shall use discretion to access trenches for testing purposes as related to the trench safety precautions that are in place by the CONTRACTOR. It is the CONTRACTOR'S responsibility to provide proper trench safety to allow for access to the testing depth of the trench.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02225.01 INSTALL TYPE 1 PIPE BEDDING

This item shall be measured by the number of cubic yards of Type 1 Pipe Bedding placed, moisture conditioned, and compacted.

2. 02225.02 INSTALL TRENCH FOUNDATION

This item shall be measured by the number of tons of Trench Foundation material placed, moisture conditioned, and compacted.

3. 02225.03 INSTALL CEMENT TREATED FILL

This item shall be measured by the cubic yard of cement treated fill placed.

4. 02225.04 INSTALL CEMENT TREATED FILL PIPE SADDLE

This item shall be measured by the numerical count of cement treated fill pipe saddles installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02225.01 INSTALL TYPE1 PIPE BEDDING

Payment shall include furnishing and installing the bedding; compacting the bedding; and all labor, equipment, tools and incidentals necessary to complete the item.

2. 02225.02 INSTALL TRENCH FOUNDATION

Payment shall include furnishing and installing the foundation material; compacting the foundation material; and all labor, equipment, tools and incidentals necessary to complete the item.

3. 02225.03 INSTALL CEMENT TREATED FILL

Payment shall include furnishing and installing the cement treated fill; and all labor, equipment, tools and incidentals necessary to complete the item.

4. 02225.04 INSTALL CEMENT TREATED FILL PIPE SADDLE

Payment will be for all materials, including cement treated fill; curing of cement treated fill; excavation and backfill; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

SECTION 02231

AGGREGATE SUB-BASE AND BASE COURSES

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of furnishing and placing one or more courses of aggregate and additives, if required, on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by ENGINEER.

1.02 RELATED WORK

A. Section 02190, Aggregates
B. Section 02210, Excavation and Embankment
C. Section 02895, Engineering Fabric

1.03 REFERENCES

A. ASHTO 180: Modified Proctor Moisture Density Relations of Soils using a ten pound (10 lb) Rammer and an eighteen inch (18") drop
B. AASHTO T 191: Wyoming Modified. Density of Soil in Place (Sand Cone Method).
C. AASHTO T 99: Standard Proctor Moisture Density Relations of soils using a 5.5 lb (2.5 kg) Rammer and a twelve inch (12") drop.
D. ASTM D 2922: Density of soil and soil-aggregate in place by nuclear method.

1.04 SUBMITTALS

A. When the stationary plant method is used, the aggregate will be accepted immediately before mixing and prior to the addition of water based on periodic samples taken from the pugmill feed belt.

PART 2 MATERIALS

2.01 MATERIALS

A. The aggregates shall meet the requirements of Section 02190, AGGREGATES.

B. Unless otherwise permitted by ENGINEER, the product of only one (1) mill for any one (1) brand and type of Portland cement shall be used on the project.

C. CONTRACTOR shall provide suitable means for storing and protecting the additives against dampness and other forms of damage. Cement additives which, for any reason, have become partially set or which contain lumps of caked cement shall be rejected. Cement additives may not be salvaged from discarded or used bags.

D. Other additives, when specified, shall meet the requirements set forth in the Special Provisions.

PART 3 EXECUTION

3.01 PREPARATION

A. CONTRACTOR shall mix the aggregate, water, and commercial additive by the Stationary Plant Method unless otherwise specified by ENGINEER in the Special Provisions.

B. The Stationary Plant Method shall meet the following requirements:

1. The aggregate and water shall be mixed in an approved pugmill mixer. Water shall be added during the mixing operation in the amount necessary to maintain the required moisture content for compacting.

2. The mixer shall be capable of uniformly distributing the aggregate, additives, and water throughout the mixture without evidence of ever-wet or dry pockets of material when the equipment is operated at CONTRACTOR's desired capacity.

3.02 APPLICATION

A. Stationary Plant Method – Material mixed by the stationary plant method shall be transported to the job site while it contains the proper moisture content, and shall be placed on the roadbed by means of an approved method. The spreader shall be capable of spreading the material for a minimum width of ten feet (10') when used to full capacity to a uniform thickness.

B. Travel Plant Method – After the material for each layer has been placed through an aggregate spreader, windrow sizing device, or aggregate hopper, the material shall be uniformly mixed by a traveling mixing plant. During mixing, water shall be added in an amount sufficient to maintain the required moisture content for compacting.

C. Road Mix Method – After material for each layer of the course has been placed, the materials shall be mixed while in the range of plus two percent (2%) or minus four percent (4%) of optimum moisture content, by means of motor graders or other approved equipment until the mixture is uniform throughout.

D. Stockpile Method – Commercial additives, if required, will be introduced into the aggregate during stockpiling operations. Water will be introduced by prewetting the stockpile of aggregate and additive. Additional water may have to be introduced during the placing of the aggregate courses.

3.03 SHAPING AND COMPACTION

A. The moisture content of the material at the time of compaction shall be within plus two percent or minus four percent of optimum.

B. If the required compacted depth of base or sub-base course exceeds six inches (6"), the course shall be constructed in two (2) or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed six inches (6"). When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by ENGINEER.

C. Each layer shall be compacted to a density of not less than ninety-five percent (95%) of maximum dry density as determined in accordance with AASHTO T

180, unless otherwise noted in the Special Provisions. Compactions or in place field densities will be determined by AASHTO T 191 (Wyoming Modified) sand cone method or AASHTO T 310/ASTM 02922 nuclear method. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials during compaction in the amount necessary for proper consolidation.

D. For frequency of compaction tests for Aggregate Sub-Base and Base Course materials, reference Section 02210 of these Construction Specifications.

3.04 PROOF ROLLING

A. The base or sub-base areas may be specified to be "proof rolled" on the Design Drawings or by the ENGINEER prior to paving. This operation will be done in order to determine if there are any soft spots that will require additional work or excavation to correct any yielding base or sub-base conditions.

B. "Proof rolling" shall be accomplished with a pneumatic tire roller with a minimum weight of twenty-seven tons (27 tons), or a different piece of equipment that exerts approximately the same tire contact pressure on the soil. The roller speed shall not exceed three miles per hour (3 MPH) so that the ENGINEER or his representative may observe any movement in the existing base. A minimum of three (3) passes over the entire surface area will be required for observation, or as otherwise directed by the ENGINEER.

C. Proof rolling is incidental to the associated Aggregate Base and Sub-Base standard items of this section.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02231-01X X" AGGREGATE BASE

   This item shall be measured by the square yards of ___ inch (_") thick compacted aggregate base accepted in place.

2. 02231-02X X" AGGREGATE SUB-BASE

   This item shall be measured by the square yards of ___ inch (_") thick compacted aggregate sub-base accepted in place.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02231-01X X" AGGREGATE BASE

   Payment shall include furnishing, hauling, laying, spreading, finishing and compacting the aggregate; proof rolling; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

2. 02231-02X X" AGGREGATE SUB-BASE

Payment shall include furnishing, hauling, laying, spreading, finishing and compacting the aggregate; proof rolling; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

SECTION 02273

RIPRAP

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of the storm sewer discharge outlet, bank or watercourse protection in accordance with these specifications and in reasonable close conformity with the lines, grades, and thickness shown on the plans or established by ENGINEER.

1.02 RELATED WORK

A. Section 02190, Aggregates.
B. Section 02210, Excavation and Embankment.
C. Section 02895, Engineering Fabric.
D. Section 03600, Grout.

1.03 REFERENCES

A. ASTM A 116: Zinc coated (Galvanized) Steel Woven Wire Fence Fabric.
B. ASTM A 777: Specification for Galvanized Round Steel Tying Wire.
C. ASTM C 881: Epoxy-Resin-Base Bonding System for Concrete.

1.04 SUBMITTALS

A. Wire and wire hardware shall be accepted upon the Manufacturer's Certificate of Compliance.

1.05 DEFINITIONS

A. Class 1 Riprap – hand placed stones on earth or gravel bedding.
B. Class 2 Riprap – machine placed stones on earth or gravel bedding.
C. Grouted Riprap – Class 1 or 2 Riprap as described above with voids filled with sand-cement grout.
D. Wire Enclosed Riprap – stones placed in wire fabric enclosures.
E. Sacked Concrete Riprap – hand-placed sacked concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregates used for riprap shall meet the requirements of Section 02190, AGGREGATES.

B. Wire for enclosed riprap shall meet the following requirements unless otherwise noted in the Special Provisions:

1. Woven wire shall be two-inch (2") by four-inch (4") V-mesh fabric having twelve and one-half (12½) gage horizontal wires of two (2-)-strand, twisted construction and twelve and one-half (12½) gage cross wires. All wire shall meet the requirements of ASTM A 116, Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Fencing, and shall be Class 1 or better.

2. Lacing and tie wire shall be galvanized, twelve and one-half (12½) gage smooth steel wire. In lieu of lacing, nine (9) gage galvanized hog rings at four inch (4") spacing may be used for fastening ends, sides, and top panels.

C. Anchorage for Wire Enclosed Riprap shall meet the following requirements unless otherwise noted in the Special Provisions:

1. Steel stakes may be crane rails, three inch (3") nominal standard pipe, or four inch (4") by four inch (4") by three eighths inch (3/8") angles or other approved materials as shown on the Drawings or otherwise noted in the Contract Documents. Stakes shall not be less than five foot (5') in length.

2. Used materials are acceptable provided that the material is not rusted or damaged to an extent that would affect the strength of the stake.

D. Grout for grouted riprap shall consist of one (1) part Portland Cement and three (3) parts of sand, thoroughly mixed with water to produce a workable mix or as otherwise specified in the Contract Documents.

E. Sacks for sacked concrete riprap shall be made of at least ten-ounce (10 oz) burlap or other approved materials as shown on the Drawings or otherwise noted in the Contract Documents. Sacks shall be approximately nineteen and one-half inches (19½") by thirty-six inches (36") measured inside the seams when the sack is laid flat, with an approximate capacity of one and one-quarter (1.25) cubic feet. Sound, reclaimed sacks may be used.

F. Concrete for sacked concrete riprap shall consist of mixture of not less than four (4) sacks (376 pounds total weight) of Portland Cement per cubic yard and sufficient water to obtain a slump of three inches (3") to five inches (5") or as otherwise specified in the Contract Documents.

PART 3 EXECUTION

3.01 PREPARATION

A. Slopes on which the riprap is to be placed shall be shaped to allow the full thickness of the specified riprap and any bedding or filter gravel, where required. The slopes shall not be steeper than the natural angle of repose of the slope as shown on the plans or directed. Whenever possible, the excavation shall be undisturbed material or, where this is not possible, the underlying material shall be compacted to at least ninety percent (90%) of maximum at optimum moisture content in accordance with the applicable provisions of Section 02225.

3.02 APPLICATION

A. When called for on the Drawings or otherwise specified in the Contract Documents, a layer of filter gravel shall be placed on the slope immediately prior to placement of the riprap stone. The layer shall be shaped to provide the minimum thickness specified. The surface should generally fit the bottom surface of the riprap.

B. At the completion of slope protection work, the footing trench shall be filled with excavated material and compaction will not be required.

C. Class 1 riprap shall meet the following requirements:

1. The larger stones shall be placed first with close joints.

2. The largest stones shall be placed in the footing trench.

3. Stones shall be placed with their longitudinal axis normal to the embankment face and arranged so that each rock above the foundation course has a three (3)-point bearing on the underlying stones. The foundation course is the course placed on the slope in contact with the ground surface. Bearing on small stones, which may be used for chinking voids will not be acceptable. Placing of stones by dumping will not be permitted. Interstices shall be as nearly filled as practicable with smaller stones and spalls.

D. Class 2 riprap shall meet the following requirements:

1. Stones shall be so placed as to provide a minimum of voids, and the larger stones shall be placed in the toe course and on the outside surface of the slope protection.

2. The stones may be placed by dumping and may be spread in layers by bulldozers or other suitable equipment.

E. Wire enclosed riprap

1. Wire enclosed segments shall be hand or machine formed to the dimensions shown on the plans. Enclosure segments shall be placed, laced, and filled in a workmanlike manner to provide a uniform, dense, protective coat over the area specified.

F. Grouted riprap

1. Clean stone shall be placed on the slope in accordance with the class specified. After the stone has been placed, it shall be drenched or sprinkled with water until the stone is thoroughly moistened. The mixed grout shall be applied while the stone is still moist. During application, the grout shall be worked into the interstices to completely fill the voids with grout.

2. Where the depth specified for grouting is in excess of twelve inches (12”), such as in cut-off walls, the riprap stone shall be placed in twelve inch (12”) lifts, or as otherwise specified in the Contract Documents. Each stone shall be grouted prior to placement of the next lift. The succeeding lifts shall be constructed and grouted before the grout in the previous lift has set.

3. Grout shall be placed only when the weather for such work is favorable and shall be protected from freezing for at least four (4) days if frost is imminent. The surface of grouted riprap shall be covered with moist earth, wet burlap or curing compound for not less than three (3) days after placing to allow the grout to properly cure.

3.03 ACCEPTANCE

A. Sampling of materials shall be in accordance with standard material sampling practices unless otherwise specified in the Contract Documents.

B. At the direction of ENGINEER, wire and wire products used on the project which do not meet the specification requirements for the type of material specified may:

1. Be rejected and CONTRACTOR required to remove and replace all of the out-of-specification material at his expense;

2. Be accepted and left in place and the CONTRACTOR’s cost of the wire product deducted; or

3. Be accepted at a reduced unit price.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02273.01 INSTALL CLASS 1 RIPRAP

   This item shall be measured by the number of cubic yards of riprap installed.

2. 02273.02 INSTALL GROUTED CLASS 1 RIPRAP

   This item shall be measured by the number of cubic yards of grouted riprap installed.

3. 02273.03 INSTALL CLASS 2 RIP RAP

   This item shall be measured by the number of cubic yards of riprap installed.

4. 02273.03 INSTALL GROUTED CLASS 2 RIP RAP

   This item shall be measured by the number of cubic yards of grouted riprap installed.

5. 02273.05 WIRE ENCLOSED RIPRAP

   This item shall be measured by the number of cubic yards of riprap installed.

6. 02273.06X X" FILTER GRAVEL

   This item shall be measured by the square yards of ___ inch (_") thick compacted filter gravel accepted in place.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02273.01 INSTALL CLASS 1 RIPRAP

   Payment shall include furnishing, hauling and laying the riprap to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

2. 02273.02 INSTALL GROUTED CLASS 1 RIPRAP

   Payment shall include furnishing, hauling, laying, and grouting the riprap to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item

3. 02273.03 INSTALL CLASS 2 RIPRAP

   Payment shall include furnishing, hauling and laying the riprap to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to

the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

4. 02273.04 INSTALL GROUTED CLASS 2 RIPRAP

Payment shall include furnishing, hauling, laying, and grouting the riprap to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

5. 02273.05 WIRE ENCLOSED RIPRAP

Payment shall include furnishing, hauling and laying the riprap to the thickness called for on the Drawings; all royalties, costs and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

6. 02273.06X X" FILTER GRAVEL

Payment shall include furnishing, hauling, laying, spreading, finishing and compacting the aggregate; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

SECTION 02280

TOPSOIL

PART 1 GENERAL

1.01 SUMMARY

A. This section shall consist of stripping and depositing topsoil in accordance with the specifications and in reasonably close conformity with the lines, thickness shown on the plans or established.

B. The item "Topsoil Borrow" will apply only to borrow material obtained from borrow areas and placed directly in its final location.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil shall consist of any soil suitable for the growth of grass or other crops reasonably free from roots, branches, clumps of grass, weeds, sticks, hard dirt, clay, rocks, or other foreign materials, which would inhibit the germination of seeds or the growth of the cover top. Classification of soils suitable for topsoil will be at the discretion of the ENGINEER.

PART 3 EXECUTION

3.01 STRIPPING AND STORING TOPSOIL

A. Brush, grass, agricultural crops, or other suitable material can be conserved as mulch and incorporated into the topsoil. If used with any project, the material shall be chopped through a brush chopper, shredded by means of commercial-sized rotary blade mower, or reduced by other approved methods.

B. Unless it can be placed directly on the prepared slopes, topsoil shall be stockpiled for later incorporation into the work. Stockpiles shall be placed at the location and to the dimensions designated by the ENGINEER.

3.02 PREPARATION OF AREAS

A. The embankment or cut slope areas to be covered with topsoil shall be completed to the designated lines and grades. Areas that have become crusted or hard packed shall be scarified to a depth of approximately three inches (3"), prior to placement of the topsoil.

3.03 PLACING TOPSOIL

A. Topsoil shall be placed in a uniform manner to a depth commensurate with the quantity of topsoil available and the area to be covered.

B. If the underlying area has become crusted or hard packed the topsoil shall be keyed to the underlying material by scarifying to a depth of approximately three inches (3").

After the topsoil has been spread, large stiff clods, stones, or other foreign material that would seriously affect the effectiveness or appearance of the topsoil, shall be raked up and removed from the area.

C. Water shall be applied to the topsoil at the locations and in the amounts designated. Water shall be applied in a fine spray by nozzles or spray bars in such a manner that it will not wash or erode the topsoil areas.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02280.01 PLACE TOPSOIL

   This item shall be measured by the cubic yardage of topsoil placed.

2. 02280.02 PLACE TOPSOIL BORROW

   This item shall be measured by the cubic yardage of topsoil placed from a previously stockpiled source.

3. 02280.03 STOCKPILE TOPSOIL

   This item shall be measured by the cubic yardage of topsoil stripped and stockpiled in a location as directed by the ENGINEER.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02280.01 PLACE TOPSOIL

   Payment shall include preparing area for topsoil; loading, hauling, placing and grading of the topsoil; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

2. 02280.02 PLACE TOPSOIL BORROW

   Payment shall include preparing area for topsoil; royalty cost when not obtained from a contractor-furnished source, hauling, laying, and spreading topsoil; and incidentals necessary to complete this item.

3. 02280.03 STOCKPILE TOPSOIL

   Payment shall include removal, loading, hauling and stockpiling of the topsoil; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

SECTION 02290

WATERING

PART 1 GENERAL

1.01 SUMMARY

A. This item shall consist of furnishing and applying water required in the compaction of embankments, subgrades, base courses and surface course, or for the control of dust for the safety and convenience of the public, for the reduction of the dust nuisance with adjacent property, or for other purpose as directed by the ENGINEER, in accordance with the requirements of these specifications.

PART 2 PRODUCTS

2.01 WATER SOURCE

A. Water required for compaction, dust control or other purposes shall be the responsibility of the CONTRACTOR to obtain. Construction water obtained from the City of Gillette, private wells, or Improvement and Service Districts shall require payment for the appropriate fees required by the source owner. The City of Gillette may provide construction water for development projects provided a permanent water service connection that is installed as part of the development project will be used to obtain construction water. A temporary meter pit and backflow device shall be provided, Plant Investment Fees shall be paid in full, and a temporary water service account shall be created for the project.

PART 3 EXECUTION

3.01 WATER ADDED

A. Deficiencies in moisture content of embankment materials, aggregate sub-base, base, or surfacing courses shall be corrected by the addition of water by approved water distribution equipment. Water for dust control, finishing operations, and seeding shall be applied by approved distributor equipment.

1. Grading Operations – Pre-wetting does not guarantee that additional water will not be required. Water added to embankment material during grading operations shall be distributed in a manner that will avoid ponding or over wetting materials for the full width of each layer of material placed.

2. Aggregate Courses – Water added to aggregate courses shall be applied to material immediately prior to mixing and placing the material.

3. Finishing Operations – Water added during finishing operations shall be uniformly applied in a fine spray across the full width of the course by means of controllable pressures and spray bars or nozzles.

4. Seeding – Water added to seeded areas shall be applied in a spray that will not wash or erode the seeded area.

5. Dust Control – Water ordered for dust control measures for the protection and safety of traffic, for abatement of air pollution, or for other purposes, shall be applied in a manner that will best accomplish the elimination of dust.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS *(Watering not incidental to the work)*

1. 02290.01 WATERING

This item shall be measured by the one thousand (1000) gallons, using tank volumes, distributor volumes, or water meters. Water wasted or used contrary to the contract will not be measured.

B. No method of measurement is required except that agreed upon by the CONTRACTOR and the entity from which he receives water.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS *(Watering not incidental to the work*)

1. 02290.01 WATERING

Payment shall include loading, hauling, and distributing the water; and for all tools, equipment, labor and incidentals necessary to complete this item of work.

B. This item shall be considered subsidiary to other work with no additional pay necessary.

SECTION 02511

PAVEMENT REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

A. The work involved in this category shall consist of preparatory work for the rehabilitation of existing paved streets.

PART 2 PRODUCTS

2.01 CRACK REPAIR MEMBRANE

A. The membrane shall be a flexible high-density asphaltic membrane laminated between a non-woven geotextile and a woven polyester geotextile, as provided by "Pave Prep" or an ENGINEER approved equal. Roll width shall be a minimum of twenty inches (20").

2.02 ASPHALT CRACK SEALANT

A. The crack sealer for asphalt pavement shall be composed of a mixture of materials that will form a resilient and adhesive compound that conforms to ASTM D6690.

2.03 CONCRETE CRACK SEALANT

A. The crack sealer and filler for concrete pavement shall meet the requirements of Section 02520, Subsection 2.01.

PART 3 EXECUTION

3.01 ROTOMILLING

A. The bituminous pavement called out for rotomilling shall be removed by a cold milling machine with capabilities of removing in a single pass, a layer of material a minimum of five feet (5') in width and three inches (3") in depth. The cold milling equipment shall be capable of accurately establishing profile grades by referencing from the existing gutter lip, and from independent grade control and shall have a positive means of controlling cross slope elevations. The cold milling equipment shall be self-propelled and shall have sufficient power, traction and stability to maintain an accurate depth of cut. The equipment shall also have an effective means of preventing any dust from the operation from escaping into the air. The CMI RotoMill Pavement Profiler and the Dynapac Pavement Profiler meet these requirements. Other manufacturers of cold milling equipment demonstrating the capability of producing equivalent results, as determined by the ENGINEER, will be permitted.

B. The existing pavement shall be removed to the depth and width and grade shown on

the Design Drawings or established by the ENGINEER. The removed pavement shall be hauled and stockpiled to a location identified by the City of Gillette per direction of the ENGINEER. The rotomilled surface shall be power broomed after the cold milling process, or cleaned thoroughly by the use of oil free compressed air as directed by the ENGINEER.

C. The taper (tie-end) created by lowering and raising the cold milling equipment to the depth shown on the Design Drawings shall be removed by the CONTRACTOR. Removal shall consist of running the cold milling equipment transversely to the roadway pavement so as to produce a vertical edge for the pavement overlay to butt up against. Alternative methods may be used if approved by the ENGINEER.

D. In cases where the rotomilling operation will precede the installation of bituminous pavement by more than four (4) hours, the CONTRACTOR shall provide temporary ramps to reduce the affects of bumps created. They shall be constructed of bituminous material with a maximum slope of one inch per foot (1"/ft) and be accompanied by proper signing. No additional compensation shall be allowed for this Work and it shall be included in the unit prices as shown in the Bid Form. In no case will rotomilling precede the installation of the new bituminous pavement by more than fourteen (14) consecutive calendar days without prior written approval of both the ENGINEER and the OWNER.

3.02 ASPHALT PAVEMENT CRACK REPAIR

A. This item includes all of the material, labor, equipment and other incidentals necessary to complete the repair of existing longitudinal and transverse pavement cracks as stated on the Drawings, or as may be directed by the ENGINEER. This pay item includes, but is not limited to, the following items:

1. Asphalt removal directly above the existing crack, a minimum of twenty-four inches (24") wide to a minimum depth of two inches (2").
2. Surface preparation.
3. Placement of stress relief membrane and tack coat (if specified).
4. Supplying, placement and compaction of asphaltic concrete within the removal area up to the level of the surrounding undisturbed pavement.

B. Asphalt removal shall be completed such that a uniform surface is obtained and vertical edges are created at the limits of the removal.

C. Surface preparation shall produce a surface free of any moisture, dirt or vegetation. Surface cracks one and one-fourth inch (1.25") wide or less need not be cleaned or filled. Those cracks greater than one and one-fourth inch (1.25") in width shall be cleaned and filled with an approved crack filler or graded asphalt mix.

D. The tack coat for these applications shall be applied at a rate of one-quarter gallon per square yard (0.25 gal/SY). In warm weather conditions a lighter application may be sufficient. In no case shall the tack coat exceed the one-quarter gallon per square yard (0.25 gal/SY). The width of the tack coat application shall be the material width plus two to three inches (2"-3") and shall be applied no further in advance of material placement than can be accomplished without losing adhesion abilities of the tack. Weather conditions will be the determining factor. The tack coat shall be of the type recommended by the manufacturer of the stress relief membrane and installed per their recommendations. Stress relief membrane incorporating a self-adhesive backing will not be required to have a tack coat installed prior to its installation.

E. The membrane shall be stored so as to protect it from moisture or damage prior to installation. The membrane shall be placed prior to the time that the tack coat has cooled and lost its tackiness. The woven polyester side of the material should be placed up. Where transverse and longitudinal joints meet, the membrane may be butted or overlapped. The overlap shall be made in the direction of the traffic flow and paving operation. The overlap area will require additional tack coat.

F. Patching operations shall begin immediately after the membrane has adequately bonded to the underlying pavement. Patching shall consist of cleaning and applying tack coat to all vertical surfaces and horizontal surfaces not covered by membrane, and supplying and installing asphaltic concrete to meet the density requirements set forth in Section 02511, ROAD MIX BITUMINOUS PAVEMENTS.

3.03 ASPHALT PAVEMENT CRACK SEALING

A. All cracks in existing asphalt paving that are one-quarter inch (1/4") in width and larger should be sealed. Cracks less than three-eighths inch (3/8") in width shall be routed to one-half inch (1/2") in width and a minimum of three-quarters inch (3/4") in depth. Cracks wider than three-eighths inch (3/8") will not require routing. However, all cracks shall be cleaned with compressed air immediately ahead of placing the hot poured elastic type sealant. Cracks shall be free of dust, dirt, moisture or other materials that might prevent bonding of the hot poured elastic type sealant.

B. Crack sealing shall be accomplished only when the weather conditions are dry. The ambient air and pavement temperature shall be at least fifty degrees Fahrenheit (50° F).

C. The equipment used to apply the sealant shall be capable of heating the elastic type sealant to three-hundred degrees Fahrenheit (300° F) minimum and three-hundred ninety degrees Fahrenheit (390° F) maximum and shall have a positive means to keep the elastic type sealant agitated and thoroughly mixed during sealing activities. The equipment shall also have a minimum melting capacity of one hundred gallons per hour (100 gal/hr). Additional sealant may be added to the mixing tank as long as the manufacturer's recommended minimum temperature is maintained.

D. The cracks shall be sealed from the bottom up and shall be filled completely. The sealant shall be applied until it is slightly above the surface for asphalt pavement and the sealant shall then be smoothed tightly against the surface with a "U" shaped metal or rubber squeegee. The width of the sealant band on the pavement surface over the crack shall not exceed approximately two inches (2") after it has been squeegeed. Traffic shall be kept off the freshly sealed cracks until the sealant has cured or has been sanded with blotter material to prevent tracking.

E. A seven (7) day waiting period will be required, unless approved otherwise by the ENGINEER, between completion of crack sealing of a street and the installation of the bituminous paving overlay or wear course to allow the sealant ample time to set up.

3.04 RESEALING OF JOINTS AND CRACKS IN EXISTING CONCRETE PAVEMENT

A. All transverse and longitudinal construction joints including lip of curb as well as all random cracks shall be resealed. Joints and cracks in existing pavement shall be saw cut to remove old sealant and provide a joint wide enough to accommodate the sealant and the bond breaker. Joint requirements will conform to the details shown on the Design Drawings.

B. After saw cutting is complete, sand-blasting will be required to effectively remove residual cement slurry from joint walls. Sandblasting should be performed in two (2) passes, one (1) pass for each joint face. The nozzle should be held at an angle directed toward the face and no more than two inches (2") from it. A high pressure air blast will then be used to blow out the joint. Its force should be focused along the joint in a single direction only. The air must be oil and water free.

C. After the joints and cracks have been properly cleaned, expanded closed-cell polyethylene foam backer rod will be installed. Proper size and placement will conform to the details on the Drawings. Resealing shall be accomplished only when the weather conditions are dry. The ambient air and pavement temperature shall be at least forty degrees Fahrenheit (40° F). Dow Corning 888 Silicone Joint Sealant or an ENGINEER approved equal, will be used for the resealing.

D. The sealant will be applied by hand or by power equipment in a continuous operation to properly fill and seal the joint gap. After sealant is applied it shall be tooled with a blunt instrument so that is slightly concave and between three-sixteenths and five-sixteenths inch (3/16" - 5/16") below the road surface. Tooling should be done within ten (10) minutes of application. Excess material should be removed from the road surface.

E. The CONTRACTOR shall determine the joint width needed from the existing joint condition.

3.05 CRACK AND SEAT CONCRETE PAVEMENT

A. The Portland Cement Concrete (PCC) pavement called out to be "cracked and seated" is to be cracked at a spacing of thirty inches (30"), with these cracks being limited to the transverse direction. The guillotine type pavement breaker will be the preferred type of equipment used for the cracking. A test section will be run until an acceptable cracking pattern is achieved. The CONTRACTOR will supply a source of water to be used during the running of the test section to verify that the pavement breaker is producing the desired results.

B. After cracking operations are complete, a thirty-five to fifty ton (35-50 TN) roller will proof roll the pavement to locate any rocking panels or soft spots. The CONTRACTOR and the ENGINEER will mark any rocking panels at the point of rotation and this panel will be re-cracked at that rotation point. Any soft spots found will be excavated and repaired under the applicable pavement repair item(s), and payment will be made under these items. After completion of the proof rolling, the CONTRACTOR will make an additional seven (7) passes with the roller.

C. All cracks larger than one-quarter inch (1/4") in width in the existing PCC pavement shall be cleaned with compressed air of all dust, dirt and moisture immediately prior to placing the asphaltic pavement. Any areas that become spalled in any manner during construction will be cleaned of all loosened material.

3.06 PROOF ROLL EXISTING SUBGRADE

A. The existing subgrade under areas where the existing pavement has been removed may be specified to be "proof rolled" on the Design Drawings. This operation will be done in order to determine if there are any soft spots that will require additional work.

B. "Proof rolling" shall be accomplished with a pneumatic tire roller with a minimum weight of twenty-seven tons (27 tons), or a different piece of equipment that exerts approximately the same tire contact pressure on the soil. The roller speed shall not exceed three miles per hour (3 MPH) so that the ENGINEER or his representative may observe any movement in the existing subgrade. A minimum of three (3) passes over the entire surface area will be required for observation.

C. In the event that soft spots are found, their repair will be paid for under separate pay items.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02511.01 ROTOMILLING SURFACE OF ASPHALT PAVEMENT

   This item will be measured by the square yard of asphalt pavement surface rotomilled to the lines and grades shown on the Design Drawings.

2. 02511.02 ROTOMILLING SURFACE OF CONCRETE PAVEMENT

   This item shall be measured by the square yard of concrete pavement surface rotomilled to the lines and grades shown on the Design Drawings.

3. 02511.03 ROTOMILLING EDGE OF ASPHALT PAVEMENT

   This item shall be measured by the square yard of asphalt pavement surface rotomilled adjacent to and within six and one-half feet (6½') of the lip of curb and not included in the end of pavement rotomill length.

4. 02511.04 ROTOMILLING EDGE OF CONCRETE PAVEMENT

   This item shall be measured by the square yard of concrete pavement surface rotomilled adjacent to and within six and one-half feet (6½') of the lip of curb and not included in the end of pavement rotomill length

5. 02511.05 ROTOMILLING END OF ASPHALT PAVEMENT

   This item shall be measured by the square yard of asphalt pavement surface rotomilled in the end of pavement rotomill length.

6. 02511.06 ROTOMILLING END OF CONCRETE PAVEMENT

This item shall be measured by the square yard of concrete pavement surface rotomilled in the end of pavement rotomill length.

7. 02511.07 PAVEMENT CRACK REPAIR (W/O MEMBRANE)

   This item shall be measured by the lineal feet of pavement cracks repaired in existing asphalt pavement.

8. 02511.08 PAVEMENT CRACK REPAIR (W/MEMBRANE)

   This item shall be measured by the lineal feet of pavement cracks repaired in existing asphalt pavement.

9. 02511.09 ASPHALT CRACK SEALING

   This item shall be measured by the lineal feet of cracks routed and sealed in existing asphalt pavement.

10. 02511.10 CONCRETE JOINT AND CRACK RESEALING

    This item shall be measured by lineal footage of joints and cracks resealed in existing concrete pavement, regardless of joint width.

11. 02511.11 CRACK AND SEAT CONCRETE PAVEMENT

    This item shall be measure by the square yards of existing concrete pavement cracked and seated.

12. 02511.12 PROOF ROLL EXISTING SUBGRADE

    This item shall be measured by the total square yardage of paved road or pavement patch subgrade that is proof rolled.

13. 02511.13 INSTALL TEMPORARY SURFACING

    This item shall be measured by the square yards of four-inch (4") thick temporary surfacing accepted in place.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02511.01 ROTOMILLING SURFACE OF ASPHALT PAVEMENT

   Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the asphalt surface, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

2. 02511.02 ROTOMILLING SURFACE OF CONCRETE PAVING

Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the concrete surface, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

3. 02511.03 ROTOMILLING EDGE OF ASPHALT PAVEMENT

Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the asphalt surface, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

4. 02511.04 ROTOMILLING EDGE OF CONCRETE PAVEMENT

Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the concrete surface, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

5. 02511.05 ROTOMILLING END OF ASPHALT PAVEMENT

Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the asphalt surface, remove the taper (tie-end) created by lowering and raising the rotomill equipment, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

6. 02511.06 ROTOMILLING END OF CONCRETE PAVEMENT

Payment shall include all labor, equipment, tools and incidentals necessary to rotomill the concrete surface, remove the taper (tie-end) created by lowering and raising the rotomill equipment, clean the rotomilled surface, haul the material generated to the City of Gillette, and to install temporary ramps with proper signing if the rotomilling operation precedes the installation of new paving by more than four (4) hours.

7. 02511.07 PAVEMENT CRACK REPAIR (W/O MEMBRANE)

Payment will include removal of a portion of the existing asphalt pavement; preparing the surface where the pavement was removed; furnishing and installing the tack coat; and supplying, placement and compaction of the asphaltic concrete within the removal area up to the level of the surrounding undisturbed pavement.

8. 02511.08 PAVEMENT CRACK REPAIR (W/MEMBRANE)

Payment will include removal of a portion of the existing asphalt pavement; preparing the surface where the pavement was removed; furnishing and installing the stress relief membrane and tack coat; and supplying, placement

and compaction of the asphaltic concrete within the removal area up to the level of the surrounding undisturbed pavement.

9. 02511.09 ASPHALT CRACK SEALING

Payment will be for routing, cleaning and sealing the cracks, furnishing the elastic type sealant, labor and equipment necessary to seal the cracks and all other incidentals necessary to complete the work. Any blotter material that is required to sand the cracks will not be measured for payment but will be considered incidental to the bid item.

10. 02511.10 CONCRETE JOINT AND CRACK RESEALING

Payment shall be for routing and cleaning of the joints, furnishing the silicone sealant and backer rod, labor and equipment necessary to do the resealing, and all other incidentals necessary to complete the work.

11. 02511.11 CRACK AND SEAT CONCRETE PAVEMENT

Payment shall include conducting a test section; initial cracking of the pavement and re-cracking of rotating panels; proof rolling the surface to locate soft spots; rolling the surfaces to seat the cracked pavement; cleaning the seated surface; hauling and satisfactorily disposing of any loosened material; and equipment, tools, and labor necessary to complete this item.

12. 02511.12 PROOF ROLL EXISTING SUBGRADE

Payment shall include all labor, equipment, tools and incidentals necessary to complete this item.

13. 02511.13 INSTALL TEMPORARY SURFACING

Payment shall include furnishing, hauling, laying, spreading, finishing and compacting the material; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

SECTION 02512

PLANT MIX PAVEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. These specifications include general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind, and amount of bituminous material or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.

B. This work shall consist of one or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specific requirements of the type under contract, and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by ENGINEER.

1.02 RELATED WORK

A. Section 02190, Aggregates.
B. Section 02545, Bituminous Materials.
C. Section 02550, Prime Coat.
D. Section 02551, Tack Coat.
E. Section 02552, Seal Coat.

1.03 REFERENCES

A. ASTM C 150: Portland Cement
B. ASTM C 911: Quicklime, Hydrated Lime, and Limestone for chemical uses
C. ASTM D 2041: Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
D. ASTM D 2172: Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
E. ASTM D 4125: Asphalt Content of Bituminous Mixtures by the Nuclear Method
F. ASTM D 6307: Asphalt Content of Hot-Mix Asphalt by Ignition Method
G. AASHTO M 303: Hydrated Lime for Asphalt Mixtures.
H. AASHTO M 230: Density of Bituminous Aggregate Mixtures

1.04 SUBMITTALS

A. CONTRACTOR shall submit for ENGINEER's approval a job mix formula for each mixture to be supplied for the project. The job-mix formula with the allowable tolerances shall be within the master range specified. The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single mixing temperature. Should a change in sources of material be made, a new job-mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, ENGINEER may establish a new job-mix formula.

B. Mixing plant scales shall be checked as often as deemed necessary to assure their continued accuracy. CONTRACTOR shall have on hand not less than ten (10) fifty-pound (50 lb) weights for checking of the scales.

1.05 DEFINITIONS

A. Plant mix pavement is considered a surface course in all cases.

B. Plant mix bituminous base is considered a sub-surface course.

PART 2 PRODUCTS

2.01 MATERIALS

A. BITUMINOUS MATERIALS

1. The percentage of bituminous material to be added to the job-mix formula will be designated by ENGINEER and specified in the Contract Documents.

2. The type and grade of bituminous material will be specified in the Contract Documents. The grade may be changed one step by ENGINEER during construction at an agreed upon change in unit price.

3. The bituminous material shall meet the applicable requirements of Section 02545, BITUMINOUS MATERIALS.

B. AGGREGATE MATERIALS

1. Aggregates shall meet the applicable requirements of Section 02190, AGGREGATES.

2. During crushing operations, the course and fine aggregates shall be stockpiled in separate piles in such manner that they can later be combined to meet the required specifications.

3. Stockpiled material shall meet the requirements of Section 02190, AGGREGATES, and Subsection 3.01.

4. Natural filler, when required, shall be stockpiled separately. The plans may limit or prohibit the use of crusher rejects or material from the same source as the aggregate material.

C. COMMERCIAL ADDITIVES

1. The type of commercial additive to be used will either be designated on the plans, or when no specific type is designated, any of the Commercial Additives conforming to either of the following requirements may be used:

a. PORTLAND CEMENT – Portland cement shall conform to the requirements of ASTM C 150.

1. Unless otherwise permitted by ENGINEER, the product of only one mill of any one brand and type of Portland cement shall be used on the project.

2. CONTRACTOR shall provide suitable means for storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

b. HYDRATED LIME – Hydrated lime shall conform to the requirements of ASTM C 911 or AASHTO M 303, except that not less than ninety-three percent (93%) of the hydrated lime shall consist of calcium and magnesium oxides.

D. COMPOSITION OF MIXTURES

1. The bituminous plant mix shall be composed of a mixture of aggregate, natural filler or commercial additive, if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resultant composite blend meets the job-mix formula.

2. The mix design must be performed by an independent testing laboratory and reviewed and signed by an engineer licensed to practice in the State of Wyoming.

3. The Marshall design criteria for surfacing and bases are as follows:

	Streets
	$10^4 <$ Design EAL $< 10^6$
Compaction, number of blows each end of specimen	50
Stability (lbs. Minimum)	2000
Flow (0.01 in.)	8-16
Percent Air Voids ASTM D 3203	4-5
Tensile Strength Ratio AASHTO T 283	>=75

Voids in Mineral Aggregate (VMA) (%)		
Maximum Nominal Size		
¾ in	½ in	3/8 in
12.0 – 15.0	13.0 – 16.0	13.0– 16.0

4. After the job-mix formula is established, all mixtures furnished for the project shall conform thereto within the following ranges of tolerances:

Passing #4 and Larger Sieves	-7 to +7 percent
Passing #8 to #100 Sieves	-5 to +5 percent
Passing #200 Sieve	-3 to +3 percent
Bituminous Material	-0.5 to +0.5 percent
Mixing Temperature	-20 to +20 degrees F
Percent Air Voids	2.5 to 5.0 percent
Percent Voids in Mineral Aggregate (VMA)	
3/4"	11.0 to 15.0 percent
1/2"	12.0 to 16.0 percent
3/8"	12.0 to 16.0 percent
Stability (lbs. Minimum)	2000
Flow (0.01 in.)	8 to 16

5. In general, the point of acceptance for aggregate will be after the material has passed through the gradation unit and prior to the addition of bituminous material. If this point of acceptance proves unsatisfactory, an alternate point of acceptance may be selected by ENGINEER. The bituminous material will be conditionally accepted at the source. The plant-mixed material will be accepted after blending and mixing at the plant.

E. RECYCLED ASPHALT PAVEMENT (RAP)

1. Recycled Asphalt Pavement (RAP) is allowed in AC Paving up to a maximum virgin aggregate replacement of 15%. Recycled Asphalt Shingles (RAS) may be included as part of the RAP replacement material.

2. All specifications for AC Paving herein shall be met in the approved Mix Design for an AC Pavement that includes Recycled Asphalt Products.

3. The gradation determinations for a RAP Paving Mix shall be based on the Mix Verification rather than cold feed gradations.

PART 3 EXECUTION

3.01 PREPARATION

A. CONDITIONING OF EXISTING SURFACE

1. Irregular surfaces of existing pavements or bases shall be brought to uniform grade and cross section as directed.

2. When specified in the Contract Documents, all longitudinal and transverse joints and all cracks shall be sealed by the application of an approved joint sealing compound before the mixture is spread upon a pavement surface. All excessive bituminous material shall be removed from joints and cracks prior to placement of the mixture.

3. All streets will be cleaned thoroughly upon completion of the miscellaneous concrete repairs and prior to any overlay. The CONTRACTOR may use any method he deems necessary as long as an acceptable final product is achieved. The ENGINEER may direct the CONTRACTOR to re-clean a street if it was not cleaned adequately. The work described above is considered incidental to other Bid Items and no additional compensation will be given.

B. PREPARATION OF BITUMINOUS MATERIAL

1. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at the uniform temperature at all times. Charts showing specified temperature range for each source of supply are available from the Central Headquarters Laboratory of the Wyoming Department of Transportation.

C. PREPARATION OF AGGREGATE

1. The aggregates for the mixture shall be dried and heated to the required temperature. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate or coating the aggregate with soot, oil, or other contaminants. Burner fuels may be specified by ENGINEER in the Special Provisions.

2. The aggregates, immediately after heating and drying, shall be screened into two (2) or more fractions and conveyed into separate compartments ready for batching and mixing with bituminous materials. Screening shall be at such rate and in such manner that the course aggregate bin or bins shall contain less than ten percent (10%) of minus #4 sieve material and the fine bin shall contain less than ten percent (10%) of plus #4 sieve material.

D. MIXING

1. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job-mix formula.

2. After the required amounts of aggregate and bituminous material have been introduced into the mixer, unless otherwise specified, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is secured.

3. For hot mix bituminous pavement, the mixture shall be produced at the lowest possible temperature that will produce a workable mix within the application temperatures specified under Section 02545, BITUMINOUS MATERIALS, Subsection 3.02. The bituminous material and aggregate shall be introduced into the mixer within the specified temperature range and shall be within twenty-five degrees Fahrenheit (25ºF) of each other.

E. BITUMINOUS MIXING PLANT – GENERAL

1. Sufficient storage space shall be provided for each size of aggregate, and the different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier.

2. Plants used for preparations of bituminous mixtures shall conform to all requirements under Subsection 3.01 (F) below, except that scale requirements shall apply only where weight proportioning is used. In addition, batch-mixing plants shall conform to the requirements under Subsection 3.01 (G) herein, continuous mixing plants shall conform to the requirements under Subsection 3.01 (H) herein, and dryer-drum mixers shall conform to the requirements under Subsection 3.01 (I) herein.

3. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.

F. REQUIREMENTS FOR ALL PLANTS

1. Plant Scales – Scales shall be accurate to one-half of one percent (0.5%) of the maximum load that may be required. CONTRACTOR may provide an approved automatic printer system, which will print the weight of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by weigh ticket for each load.

2. Equipment for Preparation of Bituminous Material – Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank. The circulating system for the bituminous material shall be designed to assure proper and continuous circulation during the operating period. Provision shall be made for measuring and sampling storage tanks.

3. Feeder for Drier – The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained.

4. Drier – The plants shall include a drier or driers, which continuously agitate the aggregate during the heating and drying process. For cold-type bituminous mix, equipment for mechanical cooling of the dried aggregate to the temperature prescribed for cold mixtures shall be provided and shall be capable of supplying prepared material for the mixer to operate at full capacity.

5. Screens – Plant screens capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer shall be provided.

6. Bins – The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. Separate dry storage shall be provided for commercial additives when used, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location as to prevent backing up of material into other compartments or bins. Each compartment shall be provided with its individual outlet gate, constructed so that when closed, there shall be no leakage. The gates shall cut off quickly and completely. Bins shall be so constructed that samples can be readily obtained. Bins shall be equipped with adequate telltale devices to indicate the position of the aggregates in the bins at the lower quarter points.

7. Sampling Facilities – The plant shall be equipped with suitable sampling devices or facilities to insure representative samples. If ENGINEER is unable to obtain samples, which represent the materials being accepted for incorporation into the project, CONTRACTOR shall make necessary adjustments or revisions to the plant before any further mixing is done.

8. Bituminous Control Unit – Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix. The accuracy of bituminous content measured either by weighing or metering may be checked by computing the daily yield of total material being processed.

9. Thermometric Equipment

    a. An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at a suitable location near the charging valve at the mixer unit.

    b. The plant shall also be equipped with an approved temperature-recording device so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregates. The printed temperature recordings shall be furnished to ENGINEER after each day's run.

10. Dust Collector – The plant shall be equipped with a dust collector constructed to waste or return uniformly to the hot elevator all or any part of the material collected as directed.

11. Truck Scales – The bituminous mixture shall be weighed on approved scales. Such scales shall be inspected as often as ENGINEER deems necessary to assure their accuracy.

G. REQUIREMENTS FOR BATCHING PLANTS

1. Weigh Box or Hopper – The equipment shall include a means for accurately weighing each size of aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch without running over. The gate shall close tightly so that no material is allowed to leak into the mixer while a batch is being weighed.

2. Bituminous Control

   a. The equipment used to measure the bituminous material shall be accurate to plus or minus one half of one percent (0.5%).

   b. The bituminous material bucket shall be nontilting type of loose sheet metal cover. The capacity of the bituminous material bucket shall be at least fifteen percent (15%) in excess of the weight of bituminous material required in any batch. The length of the discharge opening or spray bar shall be not less than three-quarters (3/4) of the length of the mixer, and it shall discharge directly into the mixer. The size and spacing of the spray bar opening shall provide a uniform application of bituminous material the full length of the mixer.

   c. The bituminous material bucket, its discharge valve or valves, and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The plant shall have an adequately heated quick-acting, nondrip, charging valve located directly over the bituminous material bucket.

   d. The indicator dial shall have a capacity of at least fifteen percent (15%) in excess of the quantity of bituminous material used in a batch. The controls shall be constructed so that they may be secured at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over and all of the bituminous material required for one batch will be discharged in not more than fifteen (15) seconds after the flow has started.

3. Mixer

   a. The batch mixer shall be an approved twin pugmill type capable of producing a uniform mixture within the job-mix tolerances. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.

   b. The clearance of blades from all fixed and moving parts shall not exceed one inch (1”).

   c. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material. The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixing gate.

d. The control of the timing shall be flexible and capable of being set at intervals of five (5) seconds or less throughout a total cycle of up to three (3) minutes.

H. REQUIREMENTS FOR CONTINUOUS MIXING PLANTS

1. Aggregate Proportioning

a. The plant shall include means for accurately proportioning each size of aggregate

b. The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled, individual gate to form an orifice for volumetrically measuring the material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and secured against inadvertent movement.

c. Indicators shall be provided for each gate to show the respective opening in inches (millimeters).

2. Weight Calibration of Aggregate Feed – The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples weighing not less than two hundred pounds (200 lbs), and accurate scales shall be provided by CONTRACTOR to weigh such test samples.

3. Synchronization of Aggregate Feed and Bituminous Material Feed – Satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be accomplished by interlocking mechanical means or by other positive, satisfactory method.

4. Mixer

a. The plant shall include a continuous mixer of an approved twin pugmill type, adequately heated and capable of producing a uniform mixture within the job-mix tolerances.

b. It shall be equipped with a discharge hopper with dump gates, which will permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed of aggregate per minute for the aggregate being used.

c. The clearance of blades from all fixed and moving parts shall not exceed one inch (1").

I. REQUIREMENTS FOR DRYER-DRUM MIXER

1. The plant shall be equipped to control aggregate gradation as described for cold feed control. The total cold aggregate feed shall be weighed continuously

by an approved belt scale. When tested for accuracy, the weighing system shall register within plus and minus one half of one percent (0.5%). Provisions shall be made for determining the moisture content of the cold feed and correcting the aggregate weight to a dry weight.

2. An automatic digital record of the dry aggregate and the asphalt shall be displayed, recorded and totaled in appropriate units of weight and time. A positive interlock shall be provided between the dry weight of the aggregate and the bituminous material. The flow of the bituminous material shall be adjusted to compensate for the changes in the dry weight of the aggregate.

3. The dryer-drum mixer shall be capable of drying and heating the aggregate to the moisture and temperature requirements. A uniform mixture of aggregates and bituminous material shall be produced. The plant shall have a temperature-recording device at the discharge chute of the dryer.

J. Sampling

1. Sampling: Sampling of the blended asphalt shall be performed in accordance with the ASTM D 979 test method for sampling bituminous mixtures.

2. Testing: Samples shall be taken for Marshall Control, Gradation, and Asphalt Content each day at the start of production and for every one thousand (1,000) tons of pavement placed per day. The Marshall Test shall be performed in accordance with the ASTM D 6927 test method. The gradation tests shall be performed on either plant samples or extracted samples. The gradation tests shall be performed in accordance with the test methods described in the AASHTO T-30 or the ASTM C 117 and C 136 test methods. Plant samples for gradation tests may be taken every two (2) hours during production. Asphalt content shall be determined by either of the test methods ASTM D 2172, ASTM D 4125, or ASTM D 6307. The Special Provisions may modify testing frequency and type.

K. Failing tests

1. When any Marshall Test result is not in compliance with the Specifications in Section 2.01 D as amended herein or if any Gradation or Asphalt Content Tests fail, then the Material Testing Lab or their field technician shall immediately notify the Engineer. The Engineer shall notify the Contractor of the non-compliance at which time the plant shall take the necessary steps to correct the asphalt mix. At the discretion of the ENGINEER, the Contractor shall remove any pavement placed that did not meet the specifications.

2. Two (2) additional samples for both Marshall Tests and Gradation and Asphalt Content Tests shall be taken at the next asphalt placement to determine if the asphalt mix is in compliance. If any one (1) or more of the additional Marshall, Gradation or Asphalt Content Tests fail, the Contractor shall terminate production until the mix is corrected.

3. If the asphalt fails to meet its Marshall Test, Gradation or Asphalt Content requirements, or if there are indications of deficient placement procedures, the City Engineer, before final acceptance of the project, may request additional tests on the asphalt pavement. In the event that the additional tests indicate that the asphalt is unsatisfactory, the contractor shall remove any pavement placed during that batch that did not meet the specifications.

3.02 APPLICATION

A. The temperature of the mixture prior to lay down shall not be more than twenty-five degrees Fahrenheit (25ºF) less than the mixing temperature from temperature/viscosity chart provided by the asphalt supplier.

C. Plant mix wearing course shall be placed between the dates of May 1st and October 15th. In writing, the OWNER and/or ENGINEER may extend paving start or finish dates.

D. Bituminous plant mix shall not be placed on any wet surface; when the atmospheric temperatures are less than those specified in the following table; or, when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures:

Air Temperature Limitations	
Compacted Thickness of Surface Course Being Placed	Air Temperature °F (°C)
Less than 1”	60 (16)
1” to and including 2”	50 (10)
More than 2”	40 (4)

E. Spot leveling or the bottom lift of a leveling course may be placed at fifty degrees Fahrenheit (50ºF) if additional courses are placed on the same contract.

F. HAULING EQUIPMENT

4. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth, metal beds, which have been thinly coated with a minimum amount of paraffin oil or other approved material to prevent the mixture from adhering to the beds. This material shall not be used in amounts, which will contaminate the mixture. When required, each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

F. SPREADING AND FINISHING

1. The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

2. When the total compacted thickness of the mat is to be in excess of four inches (4”), it shall be placed in two or more lifts. The compacted thickness of any one (1) lift in multiple-lift construction shall not exceed four inches (4”) and the compacted thickness of any surface lift shall not exceed two inches (2”) unless approved by ENGINEER.

3. Except on tapers, narrow median areas, shoulders, and other such areas of irregular shape, limited length or restrictive width, or such other areas as directed, the paver screed shall be controlled by the automatic screed control described under Subsection 3.02 (G) herein.

4. ENGINEER will perform such engineering as may be required to establish controls for the work and will set references for line and grade controls at reasonable intervals along the work.

5. CONTRACTOR shall furnish, place, and maintain such materials, devices, and equipment as may be required to provide specified independent line and grade control references and other controls, which may be required for proper execution of the work.

6. Line and grade control for use with automatic paver control systems shall be an independent control reference consisting of:

   a. A tightly stretched wire or string line offset and paralleling true line for pavement edge and established grade for pavement surface; or

   b. A floating beam of not less than twenty feet (20') in length attached to the paver and riding on previously placed base or pavement material. The beam shall be equipped with a floating string or other device that will actuate the automatic screed control in reference to the base on which it is riding. Unless otherwise permitted by ENGINEER, the first ribbon of the first course of pavement material shall be controlled by the beam reference system.

7. The longitudinal joint in one layer shall offset that in the layer immediately below by at least six inches (6"). Longitudinal joint locations may be otherwise specified in the Contract Documents.

8. Defects caused by trucks bumping into the laydown machine or by unnecessary stopping due to lack of coordination between mixing, hauling, and laydown shall be removed and replaced in accordance with Subsection 3.04.

9. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked and luted by hand tools. For such areas the mixture shall be dumped, spread, and screeded to give the required compacted thickness.

10. Plant mix surfacing ribbons shall be brought up approximately even at the end of each shift on those projects being constructed under traffic.

G. BITUMINOUS PAVERS

1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the plans.

2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

3. The screed or strike off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

4. Pavers shall be equipped with an electronic paver control system, which will automatically control the laying of the mixture to specified transverse slope and established longitudinal grade. The paver control system shall be automatically actuated from an independent line and grade control reference and through a system of mechanical sensors and sensor directed devices which shall maintain the paver screed at the proper transverse slope and at proper height to establish the top surface of the finished compacted mixture at specified slope and grade. In case of failure of the control system, the paver shall be operated by mechanical control only until the material under production at the time of breakdown is laid.

5. The paver shall be capable of being operated, when laying mixtures, at forward speeds consistent with satisfactory laying of the mixture.

6. A paving leveler shall be used when specified and shall be described in the Special Provisions.

H. ROLLERS

1. All rollers shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment, which results in excessive crushing of the aggregate, will not be permitted.

2. Steel wheel vibratory rollers shall have a compactive effort of not less than a dynamic force of twenty-one thousand (21,000) pounds.

3. The pneumatic-tired roller shall be self-propelled with a total weight, including ballast, not greater than thirty (30) tons. The roller shall be constructed so contact pressure may be varied between forty (40) psi and ninety (90) psi.

4. Wobble wheel rollers are not permitted. Each roller shall be equipped with not less than seven (7) wheels with tires of equal size and ply and having a smooth tread design. The wheels shall be staggered on the front and rear axles to provide complete coverage, have a system for uniformly moistening each wheel without an excess of water, and have close-fitting scrapers for each wheel. The tire pressures shall not vary by more than five (5) psi between individual tires from the designated pressure.

I. COMPACTION

1. Immediately after the bituminous mixture has been spread and struck off and the surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be continued while the mixture is in a workable condition until all roller marks are eliminated and, unless otherwise designated on the plans, until a minimum of ninety-two percent (92%) of the maximum density as determined by Rice Test ASTM D 2041, has been obtained. The OWNER will pay for passing tests and the CONTRACTOR will pay for failing tests. Samples will be taken in accordance with AASHTO T 230, or density will be determined by the use of properly calibrated Nuclear Density Gauge.

2. The number, weight, and type of roller furnished shall be sufficient to obtain the required compaction without undue displacement, cracking, or shoving. Pneumatic tires shall be inflated to obtain the contact area pressures designated by ENGINEER.

3. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping one-half (1/2) of the roller width. Roller shall move at a slow, uniform speed with the drive wheels or rolls nearest the paver except on steep grades.

4. When the pavement is placed by machines in echelon or abutted against a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On super-elevated curves, the rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the centerline.

5. Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care should be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.

6. To prevent adhesion of the mixture to the steel drum rollers the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent of other approved material. Excess liquid will not be permitted.

7. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used, or cleated compression strips may be used under the roller to transmit compression to the depressed area.

8. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced.

J. JOINTS

1. Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of the freshly laid mixture unless authorized by ENGINEER. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. When directed by ENGINEER, a brush of bituminous material (tack coat) shall be used on contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

K. ASPHALTIC CONCRETE LEVELING COURSE

1. Asphaltic Concrete Leveling Course is to be used by the CONTRACTOR to fill in any minor low spots, such as rutting, in any of the existing paving surfaces and should be placed on the ground with a normal asphaltic concrete lay down machine. Use of the Asphaltic Concrete Leveling Course should allow for a more uniform surface to be created that will benefit the installation of the subsequent surface courses.

2. Asphaltic Concrete Leveling Course is also to be used on various streets throughout the Project Area to build a crown into the existing pavement surface prior to the installation of the subsequent surface courses. This action is to allow for better drainage of the pavement surfaces by increasing the cross slopes to that indicated on the Drawings.

3. The CONTRACTOR shall be responsible for selecting and using adequate procedures and equipment to obtain desired compaction results in ruts and other low areas.

4. The CONTRACTOR shall use this Asphaltic Concrete Leveling Course on a case by case basis, and then only upon the prior approval of the ENGINEER or his representative (RPR) in the field.

L. THREE QUARTER INCH PLANT MIX

1. When indicated on the plans, all Asphaltic Concrete Paving bid items with a depth over three inches (3") shall be required to use two different mixes. A three-quarter inch (3/4") Plant Mix shall be used in the initial lift up to one and one-half inch (1-1/2") of the final surface elevation. A half-inch (1/2") Plant Mix shall be used for the surface course, or top lift.

2. All Asphaltic Concrete Patch bid items with a depth over three inches (3") shall require a three-quarter inch (3/4") Plant Mix on the initial lift up to one and one-half inch (1-1/2") of the final surface elevation. A second lift of half-inch (1/2") Plant Mix shall be used for the surface course. Upon approval by the Owner, the Asphalt Concrete Patch areas may be paved with one uniform Plant Mix. This will vary depending on the size of the patch, availability of the Plant Mix sizing, and critical timeline to restore the surface of the patch area, all pending Owner's review and approval.

3. The gradation will correspond to the City of Gillette Standard Specification 02190, 2.03. Payment will be by the square yard under the pay item for the total thickness.

3.03 PROTECTION

A. During any delays or suspensions of work as outlined in the Contract Documents, CONTRACTOR shall be responsible for maintaining the quality of all leveling courses until the placement of additional courses. Maintenance of leveling courses because of delays or suspension of work will be done at CONTRACTOR's expense unless otherwise specified in the Contract Documents.

3.04 ACCEPTANCE

A. The surface will be tested by ENGINEER using a ten foot (10') straightedge at selected locations. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed three-sixteenths inch (3/16"). All humps or depressions exceeding specified tolerance shall be corrected by removing defective work and replacing it with new material, or as directed.

C. TOLERANCE IN PAVEMENT THICKNESS

1. Subgrade and pavement cross sections will be taken by the ENGINEER for the purposes of establishing any adjustment to unit prices based on variations in thickness of the pavement. The CONTRACTOR shall notify the ENGINEER 24 hours prior to completion of preparation of the subgrade. After final preparation of the subgrade, the ENGINEER shall obtain cross

sections at fifty foot (50') intervals. Copies of the field notes will be provided to the CONTRACTOR upon request. Sufficient time shall be provided by the ENGINEER to complete and review the cross sections prior to the CONTRACTOR starting paving operations. If the CONTRACTOR is required to change the subgrade after cross sections have been taken, additional cross sections will be obtained by the ENGINEER at the CONTRACTOR's expense.

2. After paving operations have been completed, the ENGINEER will obtain additional cross sections of the pavement surface at the same locations that subgrade cross sections were taken. If the ENGINEER determines that any areas may be deficient with respect to thickness, the pavement will be investigated and better defined by obtaining cores to identify deficiencies.

3. At such points as the ENGINEER may select, in each section of six hundred square yards (600 SY) of pavement, one (1) or more cores shall be taken and measured by the ENGINEER. Two (2) or more cores will be taken in all sections where the pavement thickness is deficient by more than one-eighth inch (1/8") of the Plan thickness. These additional cores shall be averaged to determine adequate or deficient depth of pavement per section. A section shall be the product of the width of the lane paved in one pass and the length required to provide for six hundred square yards (600 SY) of pavement. Fractional sections of less than three hundred square yards (300 SY) shall be considered as part of an adjacent full section and fractional sections of more than three hundred square yards (300 SY) shall be considered a full section. Independent fractional sections will be cored at the discretion of the ENGINEER.

D. PAVEMENT THICKNESS

1. The thickness of the asphaltic pavement core shall be the average of four (4) measurements made at four (4) equally spaced locations on the perimeter of the sample.

E. COMPACTION ACCEPTANCE SAMPLING AND TESTING

1. Asphaltic concrete will be accepted for density on a lot basis. A lot will consist of two hundred (200) tons or as specified in the Special Provisions. One (1) or more tests shall be made for each lot or fraction thereof, produced for each type of asphaltic concrete for each day, or partial day's production. A test shall consist of determining the in-place density of a core sample, in accordance with ASTM D-1188 or ASTM D 2726, or density will be determined by the use of a properly calibrated Nuclear Density Gauge.

2. Samples for determining thickness and density of completed pavements shall be obtained by the CONTRACTOR at no extra cost to the OWNER. The size, number, and locations of the samples will be as directed by the ENGINEER. Samples shall be neatly cut with saw, core drill, or other approved equipment. The CONTRACTOR shall furnish all tools, labor, and materials for cutting samples and replacing pavement. In general, the required samples will be cut on the day following the placement of the asphaltic concrete materials, unless otherwise approved by the ENGINEER.

3. When the nominal layer thickness is either less than one inch or less than 1 ½ times the nominal maximum size of aggregate contained in the asphaltic concrete mixture, the sampling and testing of density for this layer shall be determined in accordance with the ASTM test method D-1188 or D-2726.

4. When the nominal thickness of a layer is greater than one inch and also equal to or greater than 1 ½ times the nominal maximum size of aggregate contained in the asphaltic concrete mixture, the thickness of the density sample, or samples, shall also equal or exceed these thickness requirements. One (1), or if necessary, two (2) additional samples shall be taken at random in a lot in the event the first density sample does not meet the minimum thickness requirement. Compaction requirements shall be waived for any lots in which none of three (3) density samples taken at random meet this minimum thickness requirement.

F. ASPHALTIC CONCRETE PAVEMENT DEFICIENCY FOR THICKNESS

1. Where the average thickness of pavement is deficient by more than one-quarter inch (1/4"), the payment of the paving bid item will be reduced by twice the percentage of the deficient thickness as compared to the specified thickness.

   The CONTRACTOR may propose a method to correct the thickness deficiency. The OWNER reserves the right to accept the reduced payment or the proposed corrective method. The area of adjustment shall be determined by either a street by street basis or by an area identified by the ENGINEER that is deficient in thickness.

   When thickness of pavement is deficient by more than one (1) inch the ENGINEER shall recommend acceptance with payment not to exceed fifty percent (50%) of the contract price, or complete removal. If removal is selected by the OWNER, the CONTRACTOR shall remove and replace the pavement at his cost. The replacement pavement shall meet all applicable specifications.

2. The CONTRACTOR shall pay for all additional costs incurred determining and/or correcting asphalt deficiencies. This includes but is not limited to: all costs of coring; any additional engineering costs associated with the determination and correction of the deficiency (including, but not limited to the time of the RPR and Engineer); additional surveying required; testing of additional lifts of asphalt; and any other incidentals associated with the deficiency of the asphaltic concrete.

G. ASPHALTIC CONCRETE PAVEMENT DEFICIENCY FOR COMPACTION

1. The contract price for compacted asphalt that does not meet the required density shall be adjusted as follows:

Average Density	Percent of Contract Price
91.5	95
91.0	90
90.5	85
90.0	80

If compacted density is less than ninety percent (90%), the Engineer shall recommend acceptance with payment of fifty percent (50%) of contract price or complete removal. If removal is selected, the CONTRACTOR shall remove and replace the pavement at his cost. The replacement pavement shall meet all applicable specifications.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02512.01X X" ASPHALTIC CONCRETE PAVING

This item shall be measured by the square yard of _____ inch (_") thick compacted asphalt paving and shall apply to all areas that are eleven feet (11') or greater in width and larger than one hundred square yards (100 SY) in size.

2. 02512.02X X" ASPHALTIC CONCRETE PATCH

This item shall be measured by the square yard of ___ inch (_") thick compacted asphalt patch and shall apply to all areas that are less than eleven feet (11') in width or less than one hundred square yards (100 SY) in size.

3. 02512.03 ASPHALTIC CONCRETE LEVELING COURSE

This item shall be measured by the number of tons of asphaltic concrete leveling course installed and shall be verified with weigh tickets provided by the CONTRACTOR.

4. 02512.04 INSTALL FABRIC (OVERLAY)

This item shall be by the number of square yardage of horizontal surface area covered by overlay fabric.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02512.01X X" ASPHALTIC CONCRETE PAVING

Payment shall include preparing and cleaning the existing surface; furnishing, hauling, laying and spreading the tack coat(s); furnishing and drying aggregates; heating, proportioning, mixing, and otherwise processing the aggregates and furnishing asphalt cement; hauling, laying, spreading, finishing and compacting the asphaltic concrete; complying with any option requirements shown on the Drawings; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

2. 02512.02X X" ASPHALTIC CONCRETE PATCH

Payment shall include preparing the existing surface; furnishing, hauling, laying and spreading the tack coat(s); furnishing and drying aggregates; heating, proportioning, mixing, and otherwise processing the aggregates and furnishing asphalt cement; hauling, laying, spreading, finishing and compacting the asphaltic concrete; complying with any option requirements shown on the Drawings; all royalties, costs, and expenses that are incidental to the use of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

3. 02512.03 ASPHALTIC CONCRETE LEVELING COURSE

Payment shall include preparing the existing surface; furnishing and drying aggregates; heating, proportioning, mixing and otherwise processing the aggregates and furnishing asphalt cement; furnishing, hauling, laying and spreading the required tack coat between lifts; hauling, laying, spreading,

finishing and compacting the asphaltic concrete; complying with any option requirements shown on the Drawings; all royalties, costs and expenses that are incidental to the sue of any of the materials; and all labor, equipment, tools and incidentals necessary to complete this item.

4. 02512.04 INSTALL FABRIC (OVERLAY)

Payment shall include furnishing and installing all materials including those required for the specified overlaps and the additional tack coat required above the application rate specified for overlays without fabric; and its application, equipment, labor, tools and incidentals to complete this item.

SECTION 02520

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of constructing a pavement composed of Air-Entrained Portland Cement Concrete. Portland Cement Concrete shall be constructed on a prepared subgrade or base course in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or designated by the ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. CONCRETE

1. Section 03304, Subsection 2.01, Cement
2. Section 03304, Subsection 2.07, Admixtures
3. Section 03304, Subsection 2.02, Water
4. Section 03304, Subsection 2.05, Fine Aggregate
5. Section 03304, Subsection 2.04, Course Aggregate
6. Section 03200, Subsection 2.01, Concrete Reinforcement Materials

B. JOINT FILLERS

1. The filler for each joint shall be furnished in a single piece for the full depth required for the joint unless otherwise authorized by the ENGINEER. When the use of more than one (1) piece is authorized for a joint, the abutting ends shall be fasted securely, and held accurately to shape by stapling or other positive fastening satisfactory to the ENGINEER.

2. Preformed joint filler shall conform to the requirements of AASHTO M-213, ASTM D 944, ASTM D 1751 or ASTM D 1752 unless otherwise shown on the plans, and shall be punched to admit the dowels where called for on the plans.

C. JOINT SEALERS

1. Hot poured sealer for joints shall conform to the requirements of ASTM D 3405 unless otherwise shown on the plans.

2. Elastic joint sealer, where called for on the plans, shall be two (2) component polyurethane sealant meeting ASTM C 920, Type M, Grade P, Class 25, Use TMO. Sealant for horizontal joints may be either Class A (self-leveling) or Class B (nonsag). Sealant for sloped or vertical joints shall be Class B.

3. Preformed compression joints shall be manufactured to the size and shape shown on the plans, from materials conforming to the requirements of ASTM D 2628. The CONTRACTOR shall furnish a certification for each shipment indicating that the material has been sampled, tested, and inspected in accordance with the provisions of ASTM D 2628. Each certification so furnished shall be signed by

an authorized agent of the manufacturer or independent testing agency. If recommended by the manufacturer, an approved lubricant-adhesive may be used to provide lubrication and bond the joint. The lubricant shall be manufactured of material that is compatible with the sealer.

4. Silicone Rubber Base joint sealant shall conform to ASTM D 5893.

5. All asphalt-to-concrete joints that require sealing shall use Dow Corning 890-SL Silicone Joint Sealant, or approved equal.

D. CURING MATERIALS

1. Burlap Cloth made from Jute or Kenaf AASHTO M-182 (Class 3)

2. Waterproof Paper for Curing Concrete AASHTO M-171 (ASTM C-171)

3. Liquid Membrane-Forming Compounds for Curing shall be Dayton Superior J-9-A or an approved equal conforming to ASTM C 309 or AAASHTO M-148, Type 2, Class A.

E. STOCKPILED AGGREGATES

1. Stockpiled materials shall meet the requirements of Section 02190, Subsection 3.01, STOCKPILED AGGREGATES.

PART 3 EXECUTION

3.01 PROPORTIONING CONCRETE MIX

A. The concrete shall be Class B or higher and meet the requirements of Section 03304, Paragraph 2.07 ACI Mix Design.

B. The mix proportions will be based upon trial mixes conducted by an Independent Testing Laboratory in accordance with ACI 211. The proportions will be stated in terms of aggregates in a saturated, surface-dry condition, and the batch weights will have to be adjusted periodically to take into account the actual moisture content of the aggregates at time of use.

C. The designated proportions shall govern during the progress of the work, except as provided below in paragraphs (1) through (3), inclusive.

1. If it is found impossible to obtain concrete of the desired plasticity and workability with the proportions originally approved by the ENGINEER, he may approve changes in aggregate weights, provided that in no case shall the cement content designated be changed except as provided below.

2. If it is found impossible to produce concrete having the required consistency without exceeding the maximum allowable water-cement ratio specified, the cement content shall be increased or admixtures added as approved by the ENGINEER so that the maximum water-cement ratio will not be exceeded.

3. No change in the sources or character of the materials shall be made without due notice to the ENGINEER, and no new materials shall be used until approved by the ENGINEER and he has approved new proportions based upon Independent Laboratory tests and trial mixes.

3.02 EQUIPMENT

A. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of course aggregate. If cement is used in bulk, a bin, hopper, and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation.

1. Bins and Hoppers – Bins with adequate separate compartments for fine aggregate and for each size of course aggregate shall be provided in the batching plant.

2. Scales – The scales for weighing aggregates and cement shall be of either the beam type or the springless-dial type. They shall be accurate within 0.5 percent throughout the range of use. When beam-type scales are used, provision, such as "telltale" dial, shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on weighing beams shall indicate critical position clearly. Poises shall be designed to be secured in any position and to prevent inadvertent change. The weigh beam and "telltale" device shall be in full view of the operator while the hopper is charged, and he shall have convenient access to all controls. Weighing may be accomplished using electronic load cells and computer controls.
Scales shall be tested as often as the ENGINEER may deem necessary to assure their continued accuracy. The CONTRACTOR shall have on hand not less than ten 50-pound (22.6 kilogram) weights for frequent testing of all scales.

B. Concrete may be mixed at the site of construction or at a central point, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

1. Central plant mixers shall be capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging and distributing the mixture without segregation. The mixer shall be equipped with an approved timing device, which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period.

   The mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down one inch (1") or more. The CONTRACTOR shall: (1) have available at the job site a copy of the manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth; or (2) provide permanent marks on blade to show points of one inch (1") wear from new condition. Drilled holes of one-quarter inch (1/4") diameter near each end and at the midpoint of each blade are recommended.

2. Truck Mixers and Truck Agitators – Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central mixed concrete shall conform to the requirements of ASTM C 94.

3. Non-agitator Trucks – Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight, metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation. The concrete shall be discharged from the bottom of the container. If discharge of concrete is accomplished by tilting the body, the surface of the load shall be retarded by a suitable baffle. Covers shall be provided when needed for protection.

C. The finishing machine shall be of an approved type. The finishing machine shall be of ample weight and power for proper finishing of the concrete. The finishing machine shall

be designed and operated to strike off, screed and consolidate the concrete. Screed and float adjustments of these machines shall be checked at the start of each day's paving. Machines that cause displacement of side forms or frequent delays due to mechanical failure shall be replaced. When the finishing machines ride the edge of previously constructed slabs, provisions shall be made to protect the surface of these slabs.

D. Vibrators, for full width vibration of concrete paving slabs, may be either the surface pan type or the internal type with either immersed tube or multiple spuds.

1. Vibrators may be attached to the spreader or the finishing machine, or may be mounted on a separate carriage.

2. Vibrators shall not come in contact with the joint, load transfer devices, subgrade, or side forms.

3. The frequency of the surface vibrators shall not be less than three thousand five hundred (3,500) impulses per minute, and the frequency of the internal type shall not be less than five thousand (5,000) impulses per minute for tube vibrators and not less than seven thousand (7,000) impulses per minute for spud vibrators. When spud-type internal vibrators, either hand-operated or attached to spreaders or finishing machines, are used adjacent to forms, they shall have a frequency of not less than three thousand five hundred (3,500) impulses per minutes.

E. The CONTRACTOR shall provide sawing equipment adequate in number of units and power to complete the sawing with a water-cooled diamond edge saw blade, abrasive wheel at the required rate or an early entry dry cut saw. The CONTRACTOR shall provide adequate artificial lighting for night sawing. All of this equipment shall be on the job before and continuously during concrete placement. A backup saw shall be available.

3.03 PREPARATION OF GRADE

A. After the base has been graded and compacted, in accordance with the provisions for the material specified, the grade shall be trimmed to an acceptable elevation.

3.04 SETTING FORMS

A. The foundations under the forms shall be hard and true to grade so that the form, when set, will be firmly in contact for its whole length and at the specified grade. Any grade which at the form line is found below established grade shall be filled to grade and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or by cutting, as necessary.

B. Forms shall be set sufficiently in advance of the point where concrete is being placed.

1. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms.

2. Forms shall be staked into place with not less than three (3) pins for each ten-foot (10') section. A pin shall be placed at each side of every joint.

3. Forms sections shall be tightly locked, free from play or movement in any direction. No excessive settlement or springing of forms under the finishing machine will be tolerated.

4. Forms shall be cleaned and oiled prior to the placing of the concrete.

C. The forms shall not deviate from true line by more than one-quarter inch (1/4") at any point. The alignment and grade elevation of the forms shall be checked and corrections shall be made by the CONTRACTOR immediately before the concrete is placed. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

D. In lieu of setting forms, the edge of a previously placed concrete gutter section may be used as a form.

3.05 CONDITIONING OF SUBGRADE OR BASE COURSE

A. When side forms have been securely set to grade, the subgrade or base course shall be brought to proper cross section. Low areas may be filled with subgrade or base course material and compacted to the specified density, or filled with concrete integral with the pavement. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.

B. The subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.

C. No concrete shall be placed on frozen ground.

3.06 HANDLING, MEASURING, AND BATCHING MATERIALS

A. The batch plant site, layout, equipment, and provisions for transporting material shall be such as to assure a continuous supply of material to the work. Aggregates from different sources and of different gradings shall not be stockpiled together.

B. Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner as to secure a uniform grading of the material. Aggregates that have become segregated or mixed with earth of foreign material shall not be used.

C. Cement shall be measured by the sack or by weight. Separate scales and hoppers shall be used for weighing the cement, with a device to indicate positively the complete discharge of the batch of cement into the mixer. Ninety-four pounds (94 lbs) of bulk cement shall be considered one sack. Batches involving fractional sacks shall not be allowed, except when bulk cement is used.

D. Flyash shall be stored in a separate silo. If both cement and flyash are used, they may be batched cumulatively provided Portland Cement is batched first.

E. Methods of equipment for adding air-entraining agent or other admixtures into the batch, where required, shall be approved by the ENGINEER. All admixtures shall be measured into the mixer with an accuracy of $\pm$ three percent (3%).

3.07 MIXING CONCRETE

A. The concrete may be mixed at the site of the work, in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity.

B. Ready-mix concrete shall be mixed and delivered in accordance with requirements of AASHTO M-157.

C. When concrete is mixed in a central mixing plant, the mixing time shall not be less than recommended by the manufacturer unless tests show the mix can be thoroughly mixed in

less time. Mixing time shall be measured from the time all materials, are in the drum. Transfer time in multiple drum mixers is included in mixing time.

1. The contents of an individual mixer drum shall be completely removed before a succeeding batch is emptied therein.

2. The mixer shall be operated at a drum speed as shown on the manufacturer's nameplate on the approved mixer.

3. The batch shall be so charged into the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

D. Any concrete mixed less than the specified time shall be discarded and disposed of by the CONTRACTOR at his expense.

E. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet, as shown on the manufacture's standard rating plate on the mixer, except that an overload up to ten percent (10%) above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

F. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the site of the work shall not exceed:

1. Forty-five (45) minutes when the concrete is hauled in non-agitating trucks

2. Ninety (90) minutes when hauled in truck mixers or truck agitators.

G. Retempering concrete by adding water or by other means will not be permitted, except when concrete is delivered in transit mixers or agitators, and when approved by the ENGINEER. When additional water is added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, the following conditions must be met:

1. Water must be measured through a water meter.

2. Maximum allowable water-cement ratio is not exceeded.

3. Maximum allowable slump is not exceeded.

4. Maximum allowable mixing and agitating time (or drum revolutions) are not exceeded.

5. Concrete is remixed for at least half the minimum required mixing time or number of revolutions.

6. Concrete that does not meet the above provisions shall be rejected.

H. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

I. Unless otherwise authorized, the temperature of the mixed concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat

reaches forty degrees Fahrenheit (40ºF) and not resumed until an ascending air temperature in the shade away from artificial heat reaches thirty-five degrees Fahrenheit (35ºF).

J. The temperature of the mixed concrete shall be not less than 50ºF (10ºC) and not more than ninety degrees Fahrenheit (90ºF) at the time of placing it.

1. The mixing water may be heated to no more than one hundred fifty degrees Fahrenheit (150ºF).

2. Aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might injure the materials.

3.08 PLACING CONCRETE

A. The concrete shall be deposited on the grade in such manner as to require as little rehandling as possible. Unless truck mixers, truck agitators, or non-agitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substance.

B. Where concrete is to be placed adjoining a previously constructed lane of pavement and mechanical equipment will be operated upon the existing lane of pavement, that lane shall have attained a minimum of eighty percent (80%) of design strength. If only finishing equipment is carried on the existing lane, paving adjoining lanes may be permitted after three (3) days.

C. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one location.

D. Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

3.09 TESTING

A. The CONTRACTOR shall furnish the concrete necessary for testing and shall cooperate fully with the ENGINEER in obtaining the material for testing purposes.

B. The concrete shall be sampled, specimens made, and compliance determined in accordance with the following:

1.	Slump	AASTHO T-119/ASTM C 143
2.	Air Content	AASHTO T-152/ASTM C 231
3.	Unit Weight	AASHTO T-121/ASTM C 138
4.	Strength (compressive)	AASHTO T-22/ASTM C 39

(flexural, third point)	AASHTO T-97/ASTM C 78
5. Making and Curing Test Specimens in the field	AASHTO T-23/ASTM C 31

C. Tests will be performed on pours over five (5) cubic yards (15 m^3). Slump, Air Content and Unit Weight tests will be performed within every twenty-five (25) cubic yards. For strength testing, one group of four (4) test specimens will be made within every fifty (50) cubic yards. Test ages will be one (1) at seven (7) days, two (2) at twenty-eight (28) days and one (1) hold.

D. All testing will be performed by an ACI certified technician.

3.10 STRIKEOFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

A. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be at the elevation shown on the plans or established by the ENGINEER.

B. When reinforced concrete is placed in one (1) layer, the reinforcement may be positioned in advance of concrete placement or it may be placed by mechanical or vibratory means in plastic concrete, after the concrete is spread.

C. Reinforcing steel for new construction or for substantially rehabilitated roadways and bridges shall be epoxy coated, free from dirt, oil, paint, grease, mill scale, and loose or thick rust which would impair bond of the steel with the concrete.

3.11 JOINTS

A. Joints shall be constructed of the type and dimension, and at the locations required by the plans or special provisions.

B. Bars shall be placed by approved mechanical equipment or rigidly secured by chairs or other approved supports to prevent displacement. Epoxy coated bars shall be required for all new or substantially rehabilitated roadways and bridges.

C. Epoxy coated tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves.

D. Dowels, when used as load transfer devices, shall be held in position parallel to the surface and centerline of the slab by a metal device that is left in the pavement.

1. One half (1/2) of each dowel shall be coated with grease to prevent concrete from binding to that portion of the dowel.

2. An approved metal dowel cap or sleeve shall be furnished for each dowel bar used with the expansion joints. The caps or sleeves shall fit the dowel bar tightly.

3. In lieu of using dowel assemblies at contraction joints, epoxy coated dowel bars may be placed in the full thickness of pavement by a mechanical device approved by the ENGINEER.

E. Sawed joints shall be cut by means of concrete saws with diamond blades, early entry dry cut saw or other approved equipment to the depth, width, and line shown on the plans.

1. Sawing of the joints with a diamond blade shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually four (4) to twenty-four (24) hours. Sawing of the joints with an early entry dry cut saw shall commence per manufacturers recommendation, which is usually one (1) to four (4) hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both during the day and night, regardless of weather conditions. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing, and sawing shall be discontinued when a crack develops ahead of the saw. In general, all joints should be sawed in sequence. Where the saw cut was discontinued because of interference of the form the saw cut must be completed when the form is stripped.

2. Suitable guidelines or devices shall be used to assure cutting the joints as shown on the plans.

3. The saw cut shall not vary from the planned line by more than one-quarter inch (1/4") in ten feet (10').

4. When shown on the plans, a second shallower cut must be made to the concrete to allow space for joint sealer. This sawing may commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing.

F. When approved by the ENGINEER joints may be cut into the fresh concrete with a finishing tool. This tool must be capable of cutting to the depth specified.

G. LONGITUDINAL JOINTS. Deformed steel tie bars of specified length, size, spacing, and material shall be placed perpendicular to the longitudinal joints when shown on the plans.

1. When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint or dowels shall be installed at the spacing and size shown on the drawings. Tie bars or load transfer bars may be installed through holes in the forms or approved two-piece connectors may be used.

2. Longitudinal contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies.

H. TRANSVERSE EXPANSION JOINTS – The expansion joint filler shall be continuous from form to form, shaped to the subgrade. Damaged or repaired joint filler shall not be used unless approved by the ENGINEER.

1. The expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete.
2. Finished joints shall not deviate more than one-quarter inch (1/4") in the horizontal alignment from a straight line.

3. If joint fillers are assembled in section, there shall be no offsets between adjacent units.

4. No plugs of concrete shall be permitted anywhere within the expansion space.

I. TRANSVERSE CONTRACTION JOINTS – Transverse contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies.

J. When directed by the ENGINEER, random cracks shall be routed or sawed and filled with joint sealer. Care shall be taken so that the depth of cut is uniform.

K. TRANSVERSE FORMED CONTRACTION JOINTS – These joints shall comply with the requirements of Subsection 3.11 (G) for the longitudinal formed joint.

L. TRANSVERSE CONSTRUCTION JOINT – Transverse construction joints shall be constructed when there is an interruption of more than thirty (30) minutes in the concreting operations. No transverse joint shall be constructed within five feet (5') of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least five (5) feet (1520 mm) long, the excess concrete back to the last preceding joint shall be removed and disposed of as directed.

3.12 FINAL STRIKEOFF, CONSOLIDATION, AND FINISHING

A. The sequence of operations shall be the strikeoff and consolidation, floating and removal of laitance, straight-edging, and final surface finish.

B. First, the concrete shall be consolidated and struck off.

1. Unless otherwise permitted for small areas or for short periods of time due to equipment failure, all pavement concrete shall be consolidated using vibrators for full width of paving slabs.

2. Concrete adjacent to joints shall be mechanically vibrated, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement.

3. After the concrete has been placed and vibrated adjacent to the joints as required, the finishing machine shall be brought forward, operating in a manner to avoid damage to or misalignment of joint devices.

C. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated, by means of a longitudinal float, by the use of one of the following methods as specified or permitted:

1. Mechanical Method – The mechanical longitudinal float shall be of a design approved by the ENGINEER and shall be in good working condition. The tracks from which the float operates shall be securely adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustments of the transverse finishing machine so that the small amount of mortar is carried ahead of the float at all times. The forward speed shall be adjusted so that the float will lap the distance specified by the ENGINEER on each transverse trip. The float shall pass over each area of pavement at least two (2) times, but excessive operation over a given area will not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.

2. Alternative Mechanical Method – As an alternative of Item C-1 above, the CONTRACTOR may use a machine composed of a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. This frame shall be carried by four (4) or more visible wheels riding on, and constantly in contact with, the side forms.

3. If necessary, following one (1) of the preceding methods of floating, long handled floats having blades not less than five feet (5') in length and six inches (6") in width may be used to smooth and fill in open-textured areas in the pavement. Long handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strikeoff and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a straightedge ten feet (10') or more in length. Successive drags shall be lapped one-half (1/2) of the length of the blade.

D. After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a ten-foot straightedge. For this purpose the CONTRACTOR shall furnish and use an accurate ten foot (10') straightedge swung from handles three feet (3') longer than one-half (1/2) the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the road centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancement along the road shall be in successive stages of not more than one-half (1/2) the length of the straightedge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and the slab conforms to the required grade and cross section.

E. Before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to a radius of one-quarter inch (1/4").

1. A well-defined and continuous radius shall be produced, and a smooth, dense mortar finish shall be obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

2. At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by texturing the surface. The rounding of the corner of the slab shall not be disturbed when the surface is textured. All concrete on top of the joint filler shall be completely removed.

3. All joints shall be tested with a straightedge before the concrete has set, and correction shall be made if one side of the joint is higher or lower than the adjacent slabs.

F. The final finish will be specified on the plans as to the type of surface texture. The following types of surface textures may be specified:

1. Type I – Transverse Tining – The mainline finish shall be produced by mechanical equipment described as follows: The transverse grooving machine shall be either a vibrating roller or a comb equipped with steel tines. The machine shall be self-propelled and shall automatically lift the roller or tine comb at the end of the pavement. Hand grooving methods will be permitted in a manner approved by the ENGINEER in those areas where the mechanical equipment cannot be used.

This equipment shall have rectangular or circular shaped spring steel tines, which are randomly spaced at one-half to one inch (1/2 to 1") intervals from center to center. The grooves shall be made perpendicular to the centerline of the pavement and the resulting transverse grooves shall be .090 to .125 inches wide and shall be one-eighth to three-sixteenths inch (1/8 to 3/16") deep.

Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical provided they produce a similar type of transverse groove.

2. Type II – Longitudinal Tining – The mainline finish shall be produced by mechanical equipment described as follows: The longitudinal grooving machine shall be either a vibrating roller or a comb equipped with steel tines. The machine shall be self-propelled and shall automatically lift the roller or tine comb at the end of the pavement. Hand grooving methods will be permitted in a manner approved by the ENGINEER in those areas where the mechanical equipment cannot be used.

   This equipment shall have rectangular or circular shaped spring steel tines, which are randomly spaced at one-half to one inch (1/2 to 1") intervals from center to center. The grooves shall be made parallel to the centerline of the pavement and the resulting longitudinal grooves shall be .090 to .125 inches wide and shall be one-eighth to three-sixteenth inches (1/8 to 3/16") deep. The mechanical equipment shall be operated from a bridge when the pavement is sixteen feet (16') or more in width.

   Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical, provided they produce a similar type of longitudinal groove.

3. Type III – Artificial Grass Drag – The pavement finish shall be produced by a nylon or artificial grass drag as approved by the ENGINEER. A uniform surface of gritty texture shall be produced by pulling the drag longitudinally. For a pavement width of sixteen feet (16') or more in width, the drag shall be mounted on a bridge, which travels on the forms. The drag shall be at least three feet (3') wide and in full contact with the full width of pavement. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new ones substituted.

4. Type IV – Bristle Broom – The surface texture produced by a broom shall be applied when the water sheen has practically disappeared. The broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping. The brooming operation shall be so executed that the corrugations produced in the surface shall be uniform in appearance and shall have a minimum depth of approximately one-sixteenth inch (1/16") and a maximum depth of approximately one-eighth inch (1/8"). Brooming shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operation. The finished surface shall be free from rough and porous areas, irregularities and depressions resulting from improper handling of the broom. Mechanical brooming, in lieu of the manual brooming, will be permitted if satisfactory results can be obtained.

5. Type V – Belt Finish (Paving with Rigid Forms) – When straight edging is complete and the water sheen has practically disappeared and just before the concrete becomes nonplastic the surface shall be belted with a two-ply (2-ply) canvas belt not less than eight inches (8") wide and at least three feet (3') longer than the pavement width. Hand belts shall have suitable handles to permit

controlled, uniform manipulation. The belts shall be operated with short strokes transverse to the road centerline and with a rapid advance parallel to the centerline.

6. Type VI – Burlap Drag – The drag shall be a seamless strip of damp burlap or cotton fabric which shall produce a uniform surface of a gritty nature after dragging it along the full width of pavement. For pavement sixteen feet (16') or more in width, the drag shall be mounted on a bridge, which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric, at least three feet (3') wide, is in contact with the full width of pavement surface while the drag is used. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags shall be substituted.

G. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.

H. Unless otherwise specified, hand finishing methods will not be permitted except under the following conditions:

1. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade when the breakdown occurs.

2. Narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical, may be finished by hand methods.

3. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. In operation the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.

4. The screed for the surface shall be at least two feet (2') longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or other suitable material shod with metal.

5. Consolidation shall be attained by the use of a suitable vibrator or other approved equipment.

3.13 SURFACE TEST

A. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a ten foot (10') straightedge or other specified devices.

1. Areas showing high spots of more than one-quarter inch (1/4"), but not exceeding one-half inch in ten feet (1/2" in 10'), shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of one-quarter inch (1/4") when tested with a ten-foot (10') straightedge. Grinders shall be of the stacked head, vertical blade type that will not polish or smooth the surface but will provide a coefficient of friction approximately equal to that of the unground pavement. Grinding grooves shall be kept parallel with the direction of travel.

2. Where the departure from correct cross section exceeds one-half inch (1/2"), the pavement shall be removed and replaced by and at the expense of the

CONTRACTOR. Any area or section so removed shall be no less than five feet (5') in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than five feet (5') in length shall also be removed and replaced.

3.14 CURING

A. Immediately after the finishing operation have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be covered and cured in accordance with Section 03370, CONCRETE CURING.

B. Failure to provide sufficient cover material of whatever kind the CONTRACTOR may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than one-half (1/2) hour between stages of curing or during the curing period.

3.15 REMOVING FORMS

A. Forms shall not be removed from freshly placed concrete until it has set for at least twelve (12) hours, except auxiliary forms used temporarily in widened areas.

B. Forms shall be removed carefully so as to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated above.

C. Major honeycombed areas will be considered as defective work and shall be removed and replaced. Any area or section so removed shall not be less than five feet (5') in length nor less than full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than five feet (5') in length shall also be removed and replaced.

3.16 SEALING JOINTS

A. When joints are specified to be sealed on the plans, they shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible.

B. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and the joint faces shall be clean and surface dry when the seal is applied.

C. Material for seal shall be installed in accordance with the manufacturer's recommendations. A copy of the instructions shall be submitted to the ENGINEER for information.

D. The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the ENGINEER.

E. The placement shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed, and the pavement surface shall be cleaned. The use of sand or similar material as a cover for the seal will not be permitted.

F. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than fifty degrees Fahrenheit (50ºF), unless approved by the ENGINEER.

3.17 PROTECTION OF PAVEMENT

A. The CONTRACTOR shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs and lights. He will indicate the location and type of device or facility required to protect the work and provide adequately for traffic.

B. The CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the side of the pavement and covering the surface of the unhardened concrete with the protective covering.

C. Any damage to the pavement occurring prior to final acceptance or opening to traffic shall be repaired or the pavement shall be replaced, at the CONTRACTOR's expense.

D. Cold weather placement measures of Section 03310 shall apply. Concrete that is prematurely exposed to freezing temperatures or that is damaged by freezing shall be removed and replaced at the CONTRACTOR's expense.

3.18 OPENING TO TRAFFIC

A. The pavement shall not be opened to the traffic until the concrete has met at least eighty percent (80%) of its design strength.

B. Prior to being opened to traffic, the pavement shall be cleaned and all temporary or permanent pavement markings shall be in place.

3.19 CONCRETE PAVEMENT – SLIPFORM METHOD

A. GRADE – After the grade or base has been placed and compacted to the required density, the grade and areas, which are to support the paving machine shall be cut to the proper elevation.

1. If the density of the base is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed.

2. The grade shall be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of the placing of the concrete.

B. PLACING CONCRETE – The concrete shall be placed with an approved slipform paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine in such manner that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with the plans and specifications.

1. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibrations shall be accomplished with vibrating tubes or arms working in the concrete, or with a vibrating screed or pan operating on the surface of the concrete.

2. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur.

3. The concrete shall be held at a uniform consistency, having a slump of not more than two inches (2").

4. The slipform shall be operated with as nearly a continuous forward movement as possible, and all operation of mixing, delivering, and spreading concrete shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

C. The surface smoothness and texture shall meet the requirements of Section 02520, Subsection 3.12, FINAL STRIKEOFF, CONSOLIDATION, AND FINISHING, Part E and Section 02520, subsection 3.13, SURFACE TEST.

D. Curing shall be done in accordance with one of the methods included in Section 02520, Subsection 3.14, CURING. The curing material shall be applied at the appropriate time and shall be applied uniformly and completely at all surfaces and edges of the pavement.

E. All joints shall be constructed in accordance with Section 02520, Subsection 3.11, JOINTS.

3.20 TOLERANCE IN PAVEMENT THICKNESS

A. Subgrade and pavement cross sections will be taken by the ENGINEER for the purpose of establishing any adjustments to unit prices based on variations in thickness of the pavement. The CONTRACTOR shall notify the ENGINEER twenty-four (24) hours prior to completion of preparation of subgrade. After final preparation of the subgrade, the ENGINEER shall obtain cross sections at Fifty (50) foot intervals. Copies of the field notes will be provided to the CONTRACTOR upon request. Sufficient time shall be provided by the ENGINEER to complete and review the cross section prior to the CONTRACTOR starting paving operations. If the CONTRACTOR is required to change the subgrade after cross sections have been taken, additional cross sections will be obtained by the ENGINEER at the CONTRACTOR's expense.

B. After paving operations have been completed, the ENGINEER will obtain additional cross sections of the pavement surface at the same locations that subgrade cross sections were taken. The ENGINEER will determine any areas, which may be deficient with respect to thickness. In addition, pavement will be investigated and better defined by obtaining cores.

C. At such points as the ENGINEER may select, in each section of six hundred (600) square yards of pavement, one or more cores will be taken and measured by the ENGINEER. Two (2) or more cores will be taken in all sections where the slab thickness is deficient by more than one-eighth inch (1/8") of the Plan thickness. A section shall be the product of the width of the lane paved in one pass and the length required to provide for six hundred (600) square yards of pavement. Fractional sections of less than three hundred (300) square yards shall be considered as part of an adjacent full section and fractional sections of more than three hundred (300) square yards shall be considered a full section. Independent fractional sections will be cored at the discretion of the ENGINEER.

D. The CONTRACTOR shall be responsible for the cost of drilling all cores deficient more than one-half inch (1/2") in thickness. The CONTRACTOR shall also repair, at his expense, all core holes with concrete specified for the pavement slab from which the cores

are taken. The ENGINEER will determine the core length at no expense to the CONTRACTOR.

E. The thickness of the pavement shall be determined by measuring the lengths of drilled concrete cores according to the ASTM C 174 (Method of Measuring Length of Drilled Concrete Cores).

3.21 REPAIR OF DEFECTIVE PAVEMENT SLABS

A. Spalls along joints shall be replaced by saw cutting at least one-half inch (1/2") outside the spalled area and to a minimum of two inches (2") deep. The area shall be chipped out at least three inches (3") to solid concrete and then cleaned with compressed air sandblasting. First, the surface of the cavity shall be coated with an approved epoxy-resin binder. Then the cavity shall be filled with an approved nonshrink grout.

B. Random cracks which occur away from joints and, in the judgment of the ENGINEER, will not cause future maintenance problems may be routed and sealed. If not accepted, the slab shall be replaced at the CONTRACTOR's expense.

3.22 CONCRETE PAVEMENT DEFICIENCY FOR THICKNESS

A. Where the average thickness of pavement is deficient in thickness by more than one-eighth inch (1/8"), but not more than one inch (1"), payment will be made at an adjusted price as specified in the following table:

Deficiency in Thickness (in)	Proportional Part of Contract Price Percentage Allowed
0.0 to < 0.13	100%
0.13 to < 0.38	95%
0.38 to < 0.51	90%
0.51 to < 0.75	85%
0.75 to 1.00	80%

When thickness of pavement is deficient by more than one inch (1") the ENGINEER shall recommend acceptance with payment of fifty percent (50%) of the contract price or complete removal. If removal is selected, the CONTRACTOR shall remove and replace the pavement at his cost. The replacement pavement shall meet all applicable specifications.

B. The CONTRACTOR shall pay for all additional costs incurred determining and/or correcting deficiencies. This includes but is not limited to: all costs of coring; any additional engineering costs associated with the determination and correction of the deficiency (including, but not limited to the time of the RPR and Engineer); additional surveying required; testing; and any other incidentals associated with the deficiency of the concrete.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

2. 02520.01X X" PORTLAND CEMENT CONCRETE PAVING

This item shall be measured by the square yard of _____ inch (_") thick concrete paving and shall apply to all areas that are equal to or greater than one hundred square yards (100 SY) in size.

3. 02520.02X X" PORTLAND CEMENT CONCRETE PATCH

This item shall be measured by the square yard of _____ inch (_") thick concrete patch and shall apply to all areas that are less than one hundred square yards (100 SY) in size.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02520.01X X" PORTLAND CEMENT CONCRETE PAVING

Payment shall include furnishing and preparation of all materials, including concrete, joints, joint filler, dowels, and reinforcing if required in the Drawings or Special Provisions; sealing all construction joints including all perimeter joints between existing and new pavement; placing, finishing and curing of the Portland Cement Concrete; and all labor, equipment, tools and incidentals necessary to complete these items.

2. 02520.02X X" PORTLAND CEMENT CONCRETE PATCH

Payment shall include furnishing and preparation of all materials, including concrete, joints, joint filler, dowels, and reinforcing if required in the Drawings or Special Provisions; sealing all construction joints including all perimeter joints between existing and new pavement; placing, finishing and curing of the Portland Cement Concrete; and all labor, equipment, tools and incidentals necessary to complete these items.

SECTION 02528

CONCRETE CURB, COMBINED CURBS AND GUTTERS

PART 1 GENERAL

1.01 SUMMARY

A. Curbs or combined curbs and gutters shall consist of air-entrained Portland Cement Concrete constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the ENGINEER. See Standard Drawing 02528-01

B. Concrete curbs and combined curbs and gutters shall be constructed to meet requirements of Americans with Disabilities Act, Title II, when applicable.

PART 2 PRODUCTS

2.01 MATERIALS

A. PORTLAND CEMENT CONCRETE – Air-entrained Portland Cement Concrete shall conform to the requirements of Section 03304, Class B

B. REINFORCING STEEL – Reinforcing steel shall conform to the requirements of Section 03200, CONCRETE REINFORCEMENT.

C. PREFORMED EXPANSION JOINT MATERIAL – Joint material shall comply with the requirements of AASTHO M-213, ASTM D 994, ASTM D 1751, or ASTM D 1752.

PART 3 EXECUTION

3.01 GENERAL

A. Curbs and curbs and gutter shall be constructed at the locations shown on the plans and where directed by the ENGINEER and shall be in accordance with these specifications and plans.

3.02 SUBGRADE AND BASE COURSE PREPARATION

A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.

B. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Subgrade shall be compacted a minimum of one foot (1') outside the form lines.

C. The subgrade shall be compacted in accordance with Section 02210 EXCAVATION AND EMBANKMENT, Paragraph 3.02.

D. If the roadway is designed as a composite section to include a base course layer, base course shall also be designed for placement underneath the curb and gutter

section to promote positive subsurface drainage away from the pavement section and installed to the required grade in accordance with Section 02231, Subsection 3.03.

E. New Curb and Gutter base course shall be compacted a minimum of one foot (1') outside the form lines and shall be a minimum of 4" thick, or match the depth to the top of the paved road subgrade preparation of the composite pavement section, whichever is greater, up to 6" maximum required depth.

F. Replacement Curb and Gutter for patch-work or rehabilitation shall match existing conditions for base course thickness, unless otherwise directed by the ENGINEER.

3.03 CONCRETE PLACEMENT

A. The concrete shall be placed either by an approved slipform/extrusion machine, by the formed method, or by a combination of these methods.

B. The slipform/extrusion machine approved shall be so designed as to place, spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section.

1. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed.

2. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.

C. The formed method shall consist of setting forms, placing concrete and finishing.

1. Form material shall be straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Flexible or rigid forms of proper curvature may be used for curves having a radius of one hundred feet (100') or less. Division plates shall be metal.

2. The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal.

3. Forms shall be cleaned and coated with an approved form-release agent before concrete is placed against them.

4. The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation.

5. Low roll or mountable curbs may be formed without the use of a face form by using a straightedge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing

6. Front and back forms may be removed at such time as the concrete is sufficiently set that removal will not chip, spall or otherwise damage the concrete. When forms are removed before the expiration of the curing

period, the exposed edges of the concrete shall be protected with curing compound.

3.04 FINISHING

A. The surface of the concrete shall be finished true to the lines and grades shown on the plans.

B. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated with a wooden float to a smooth and uniform surface.

C. When the concrete has hardened sufficiently the surface shall be given a broom finish. The strokes shall be square across the concrete from edge to edge with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth inch (1/8") in depth.

D. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the plans.

E. All new water and sewer services shall be stamped in the curb section with four inch (4") "W" or "S" letters.

3.05 JOINTS

A. CONTRACTION JOINTS – Transverse weakened – plane contraction joints shall be constructed at right angles to the curb line and at intervals not exceeding ten feet (10') where adjacent to asphaltic concrete and coinciding with adjacent Portland Cement Concrete pavement joints where concrete paving is used. Curbs or combined curbs and gutters constructed adjacent to existing concrete shall have the same type of joints as in the existing concrete, with similar spacing; however, contraction joint spacing shall not exceed fifteen feet (15'). Joint depth shall average at least one-third (1/3) of the cross section of the concrete.

1. Contraction joints may be sawed, hand-formed, or made by 1/8 – inch thick division plates in the formwork.

2. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking.

3. The joints may be hand-formed either by using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete temporarily. Steel strips shall be withdrawn before final finishing of the concrete.

4. Where division plates are used to make contraction joints, the plates shall be removed after the concrete has set and while the forms are still in place.

B. EXPANSION JOINTS – Expansion joints shall be placed where old curb and gutter meets new curb and gutter; where curb and gutter meets driveway and/or driveway apron; where curb and gutter had a point of curvature; where a curb and gutter abuts curb returns; and a maximum of one hundred fifty feet (150') or as determined by the ENGINEER. All expansion joints shall be sealed.

1. Filler material for expansion joints shall be furnished in a single three-quarter-inch (3/4") thick piece for the full depth and width of the joint.

2. Expansion joints in a slip-formed curb and curb and gutter shall be constructed with an appropriate hand tool by raking or sawing through partially set concrete for the full depth and width of the section. The cut shall be only wide enough to permit a snug fit for the joint filler. After the filler is placed, open areas adjacent to the filler shall be filled with concrete and then toweled and edged.

3. Alternately, an expansion joint may be installed by removing a short section of freshly extruded curb and gutter immediately, installing temporary holding forms, placing the expansion joint filler, and replacing and reconsolidating the concrete that was removed. Contaminated concrete shall be discarded.

C. CONSTRUCTION JOINTS - Construction joints may be either butt or expansion type joints. All longitudinal joints of replacement curb and gutter shall provide a waterproof seal against the asphalt pavement by means of an ENGINEER approved asphalt-to-concrete joint sealant.

1. All replacement curb and gutter shall be tied to the abutting end of the existing curb and gutter. This shall be performed with a minimum of two (2) number four (#4) deformed tie bars epoxy glued into the existing gutter pan. As necessary to meet expansion-joint spacing, or as otherwise determined by the ENGINEER, the bars shall be smooth dowels with applicable dowel expansion cap properly installed along with the appropriate expansion joint material as described above.

3.06 PROTECTION

A. The CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slip-form construction, materials such as wood planks or forms to protect the edges shall also be required.

B. Cold weather placement measures of Section 03310 shall apply. Concrete that is prematurely exposed to freezing temperatures or that is damaged by freezing shall be removed and replaced at the CONTRACTOR's expense.

3.07 CURING

A. Curing shall be in accordance with Section 03370, CONCRETE CURING.

3.08 BACKFILLING

A. After the concrete has set sufficiently, the spaces in front and back of curbs shall be backfilled. Backfill shall be original material, or other material as shown on the drawings or as determined by the ENGINEER. Backfilling shall be completed to the required elevations.

B. The backfill material shall be thoroughly compacted to a density equal to that of adjacent materials. It shall be leveled off to a neat and free draining surface.

C. In areas where lawns exist, the topsoil thickness as called out on the plans shall be backfilled to the level of the top of the concrete curb with good topsoil which is suitable for the growth of lawns.

1. It shall be placed out from the curb a sufficient distance and amount to replace turf or lawn removed during installation.

2. Backfill shall be completed by grading to match the existing lawn.

3.09 TOLERANCES

A. The work shall be performed in a manner which results in a curb and gutter constructed to specified line and grade, uniform in appearance and structurally sound.

B. Curb and gutter found with unsightly bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the CONTRACTOR's expense if the ENGINEER considers them to be irreparable.

C. When checked with a ten foot (10') straightedge, grade shall not deviate more than one-quarter (¼) inch and alignment shall not vary more than one-half (½) inch.

D. Final elevation shall not depart from plan elevation by more than one-half (½) inch, unless approved by the ENGINEER.

E. Random cracks which occur away from joints and, in the judgment of the ENGINEER, will not cause future maintenance problems may be routed and sealed. If not accepted, the cracked slab or curb section shall be removed and replaced at the CONTRACTOR's expense.

3.10 CURB GRINDING

A. Grinding shall be completed using a uni-loader mounted rotomill. The rotomill shall have a minimum of sixty-eight (68) teeth per twenty-four inch (24") wide mill surface. The milling equipment shall be capable of accurately milling the back of curb to the proper depths and tapers as required. The finished surface shall be smooth and uniform, with no raveling of the surface or edges. Other methods of cold milling equipment demonstrating the capacity of producing equivalent results, as determined by the ENGINEER may be permitted.

3.11 TESTING

A. Testing requirement shall be in accordance with Section 03305.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02528.01X INSTALL NEW X" CURB & GUTTER

This item shall be measured by the lineal foot along the flow line of the new _____ inch (__") wide curb on street tangent sections and curves.

2. 02528.02X INSTALL REPLACEMENT X" CURB & GUTTER

This item shall be measured by the lineal foot along the flow line of the replacement _____ inch (__") wide curb on street tangent sections and curves with radii equal to or greater than forty feet (40') installed.

3. 02528.05 CURB GRINDING

This item shall be measured by the lineal foot of existing back of curb grinding completed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02528.01X INSTALL NEW X" CURB & GUTTER

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; placing topsoil behind the curb; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

2. 02528.02X INSTALL REPLACEMENT X" CURB & GUTTER

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of twelve inches (12") of subgrade preparation under the curb, or base course if present, and to a point twelve inches (12") behind the back of curb; placing topsoil behind the curb; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

3. 02528.05 CURB GRINDING

Payment shall include all labor, equipment, tools, and incidentals necessary to rotomill the surface, clean the rotomilled surface, haul the material generated, and incidentals necessary to complete the item.

SECTION 02530

CONCRETE SIDEWALKS, DRIVEWAY APPROACHES, CURB RETURN FILLETS, VALLEY GUTTERS AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of construction of concrete sidewalk and driveway approaches, curb return fillets, valley gutters, new monument boxes and other miscellaneous new concrete construction of air-entrained Portland Cement Concrete constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the ENGINEER. See Standard Drawing No. 02776-01.

PART 2 PRODUCTS

2.01 MATERIALS

A. PORTLAND CEMENT CONCRETE – Air-entrained Portland Cement Concrete shall conform to the requirements of Section 03304, PORTLAND CEMENT CONCRETE. All concrete shall be class B.

B. REINFORCING STEEL – Reinforcing steel shall conform to the requirements of Section 03200, CONCRETE REINFORCEMENT.

C. PREFORMED EXPANSION JOINT MATERIAL – Joint material shall comply with the requirements of AASHTO M-213, ASTM D-994, ASTM D-1751, or ASTM D-1752.

D. COLORED DETECTABLE WARNING PANELS – Colored detectable warning panels shall be Arcis Corporation – ADA Arcis Tactile Detectable Warning Panels, East Jordon Iron Works, Inc. – Truncated Dome Detectable Warning Plates, MetaDome, LLC – Metal Panel (Stainless Steel), Advantage Tactile Systems – Stainless Steel detectable/tactile warning surfaces, ADA Solutions, Inc. – ADA Replaceable (Wet-Set) Stainless Steel Tactile Unit, or Neenah Foundry Company – Detectable Warning Plate (With Lugs), or as approved equal by the OWNER. Provide a brick red, or other approved contrasting color, when contrasting against grey concrete or as otherwise specified in the contract documents. Ensure detectable warnings provide a seventy percent (70%) light contrast (light against dark or dark against light) against surrounding concrete surfaces.

PART 3 EXECUTION

3.01 GENERAL

A. Sidewalks and driveway approaches, either new or replacement, valley gutters and curb return fillets shall be constructed at the locations shown on the plans and where directed by the ENGINEER, and shall be in accordance with these specifications and plans.

B. The quantity of driveway approaches, concrete driveway replacement and concrete sidewalk replacement shown in the Proposal is an estimate and may be increased or decreased without an adjustment in unit prices, as these items shall be considered “minor items”.

3.02 SUBGRADE AND BASE COURSE PREPARATION

A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.

B. All soft, yielding and otherwise unsuitable material shall be removed and replaced with suitable material. Subgrade shall be compacted a minimum of one (1) foot outside the form lines.

C. The subgrade shall be compacted per Section 02210, Excavation and Embankment, using consistent and uniform means and methods that produce a uniformly compacted surface.

D. When required on the plans, base course will be installed to the required grade in accordance with Section 02231 Aggregate Sub-Base and Base Courses.

E. Base course for replacement sections of curb return fillets and valley gutters shall, at minimum, match the adjacent street base course depths. For new construction, they shall also match the adjacent street base course depths, and have a minimum of six inches (6") of base course.

3.03 ERECTING FORMS

A. Forms shall be staked securely in place, true to line and grade.

B. Sufficient support shall be given to the form to prevent movement in any direction, resulting from the weight of the concrete or the concrete placement.

C. Forms shall be clean and well oiled prior to setting in place.

D. When set, the top of the form shall not depart from grade more than one-quarter (1/4) inch when checked with a ten (10) foot straightedge. The alignment shall not vary more than one-half (1/2) inch in ten (10) feet.

E. Immediately prior to placing the concrete, forms shall be inspected by the CONTRACTOR for proper grading, alignment and rigid construction. Adjustments and repairs as needed shall be completed before placing concrete.

3.04 PLACING AND FINISHING

A. The subgrade or base course shall be properly compacted and brought to specified grade before placing concrete.

B. The subgrade or base course shall be thoroughly dampened immediately prior to the placement of the concrete.

C. Concrete shall be spaded, tamped, or vibrated thoroughly into the forms to provide a dense, compacted concrete free of voids.

D. The exposed surfaces shall be floated, finished and broomed.

1. The surface of concrete shall be finished true to the lines and grades shown on the plans.

2. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated with a wooden or magnesium float to a smooth and uniform surface.

3. When the concrete has hardened sufficiently, the surface shall be given a broom finish. The broom shall be of an approved type. The strokes shall be square across the concrete transverse to the direction of travel where applicable from edge to edge with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth (1/8) inch in depth.

4. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the plans.

F. The rate of concrete placement shall not exceed the rate at which the various placing and finishing operations can be performed in accordance with these specifications.

3.05 INSTALLATION OF COLORED DETECTABLE WARNING PANELS

A. Install colored detectable warning devices in conformance to the manufacturer's recommendations. Provide two (2) copies of the manufacturer's recommendations to the Engineer prior to installation. Ensure the manufacturer's recommendations detail surface cleaning, installation requirements, and permissible weather and other environmental conditions for installation.

B. Construct detectable warning devices to neat lines and grades. Avoid crossing concrete joints. Where crossing of joints cannot be avoided, custom cut detectable warning material across the joint line so the joint can work without tearing the detectable warning material. Make the valleys of the detectable warning material flush with the adjacent pavement. Replace any treatments which fail to fully bond to adjacent surfaces.

3.06 STRIPPING FORMS

A. Forms may be removed at such times as the concrete is sufficiently set that removal will be without danger of chipping or spalling.

1. When forms are removed before the expiration of the curing period, the exposed edges of the concrete shall be protected with a curing compound.

2. All forms shall be cleaned, oiled, and be examined for defects before they are used again.

3.07 PROTECTION

A. The CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting.

B. Cold weather placement measures of Section 03310 shall apply. Concrete that is prematurely exposed to freezing temperatures, or that is damaged by freezing shall be removed and replaced at the CONTRACTOR's expense.

3.08 CURING

A. Curing shall be in accordance with Section 03370, CONCRETE CURING.

3.09 JOINTS

A. Preformed Expansion Joints shall be installed at intervals of one hundred and fifty (150) feet and at the locations shown in the standard details.

B. Contraction joints shall be provided between expansion joints at the same intervals as the width of the sidewalk or as noted in the standard detail. Joints in new construction shall coincide with joints in adjacent existing concrete.

C. All joints of replacement fillets and valley gutters shall provide a waterproof seal against the asphalt pavement by means of an ENGINEER approved asphalt-to-concrete joint sealant.

3.10 BACKFILL

A. In areas where lawns exist, the topsoil thickness as called out on the plans shall be backfilled to the level of the top of the sidewalk or driveway with good topsoil which is suitable for the growth of lawns.

1. It shall be placed out from the sidewalk or driveway a sufficient distance and in amount to replace turf or lawn removed during installation.

2. Backfill shall be completed by grading to match the existing lawn.

B. Backfill shall be compacted to a density equal to the adjacent materials. It shall be leveled off to a neat and free draining surface.

3.11 TOLERANCES

A. The work shall be performed in a manner which results in the item being constructed true to line and grade, uniform in appearance, and structurally sound.

B. Items found with unsightly bulges, ridges, low spots or other defects shall be removed and replaced at the CONTRACTOR's expense if the ENGINEER considers them to be irrepairable.

C. When checked with a ten (10) foot straightedge, grade shall not deviate by more than one-quarter (1/4) inch and alignment shall not vary by more than one-half (1/2) inch.

D. Final elevation shall not depart from plan elevation by more than one-half (1/2) inch, unless approved by the ENGINEER.

E. Random cracks which occur away from joints and, in the judgment of the ENGINEER, will not cause future maintenance problems may be routed and sealed. If not accepted, the cracked slab or section shall be removed and replaced at the CONTRACTOR's expense.

3.12 TESTING

A. Testing requirement shall be in accordance with Section 03305.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02530.01X INSTALL CONCRETE SIDEWALK (X")

This item shall be measured by the square foot of ____ inch (_") thick sidewalk.

2. 02530.02X INSTALL COLORED CONCRETE SIDEWALK (X")

This item shall be measured by the square foot of ____ inch (_") thick colored sidewalk.

3. 02530.03X INSTALL STAMPED CONCRETE SIDEWALK (X")

This item shall be measured by the square foot of ____ inch (_") thick stamped sidewalk.

4. 02530.04X INSTALL CONCRETE DRIVEWAY (X")

This item shall be measured by the square foot of _____ inch (__") thick driveway behind the back of sidewalk line installed.

5. 02530.06X INSTALL NEW CONCRETE VALLEY GUTTER (X")

This item shall be measured by the square foot of _____ inch (_") thick new valley gutter installed.

6. 02530.07X INSTALL REPLACEMENT CONCRETE VALLEY GUTTER (X")

This item shall be measured by the square foot of _____ inch (__") thick replacement valley gutter installed.

7. 02530.08X INSTALL NEW CURB RETURN FILLET (X")

This item shall be measured by the square foot of _____ inch (_") thick new fillet installed.

8. 02530.09X INSTALL REPLACEMENT CURB RETURN FILLET (X")

This item shall be measured by the square foot of _____ inch (__") thick replacement fillet installed.

9. 02530.10 INSTALL SPLASH PAN FOR FIRE HYDRANT

This item shall be measured by the square foot of four-inch (4") thick splash pan installed.

10. 02530.11 INSTALL SIDEWALK CHASE ASSEMBLY

This item shall be measured by the number of sidewalk chase assemblies installed, regardless of size.

11. 02530.12X INSTALL HANDICAP RAMP AND LANDING (X")

This item shall be measured by the square foot of _____ inch (_") thick handicap ramp installed. The limits to be measured for payment shall include the entire area of the installed ramp, any associated side flares, and the landing surface at the top of the ramp (or landing at the bottom of ramp for parallel ramps).

12. 02530.13X INSTALL MISCELLANEOUS CONCRETE (X")

This item shall be measured by the square foot of _____ inch (_") thick concrete installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02530.01X INSTALL CONCRETE SIDEWALK (X")

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of six inches (6") of subgrade preparation under the sidewalk and topsoil along the edges of the sidewalk; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

2. 02530.02X INSTALL COLORED CONCRETE SIDEWALK (X")

Payment will be for all materials, including concrete, coloring pigment or dye, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of six inches (6") of subgrade preparation under the sidewalk and topsoil along the edges of the sidewalk; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

3. 02530.03X INSTALL STAMPED CONCRETE SIDEWALK (X")

Payment will be for all materials, including concrete, pre-molded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; stamping of concrete; excavation, placing and compaction of six inches (6") of subgrade preparation under the sidewalk and topsoil along the edges of the sidewalk; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

4. 02530.04X INSTALL CONCRETE DRIVEWAY (X")

Payment will be for all materials for the full extent of the driveway section, to include the driveway apron, as identified on the plans, including; concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of twelve inches (12") of subgrade preparation under the driveway, and topsoil along the edges of the driveway; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

5. 02530.06X INSTALL NEW CONCRETE VALLEY GUTTER (X")

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

6. 02530.07X INSTALL REPLACEMENT CONCRETE VALLEY GUTTER (X")

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints, curing of concrete; any required saw cutting to produce a neat line and the subsequent removal and

satisfactory disposal of existing concrete pavement; excavation, placing and compaction of twelve inches (12”) of subgrade preparation under the valley gutter, or base course if present; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

7. 02530.08X INSTALL NEW CURB RETURN FILLET (X")

   Payment will be for all materials for the fillet limits, including the radius curb. Materials include concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

8. 02530.09X INSTALL REPLACEMENT CURB RETURN FILLET (X”)

   Payment will be for all materials for the fillet limits, including the radius curb. Materials include concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints, curing of concrete; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of existing concrete pavement; excavation, placing and compaction of twelve inch (12”) of subgrade preparation under the fillet, or base course if present; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

9. 02530.10 INSTALL SPLASH PAN FOR FIRE HYDRANT

   Payment will be for all materials, including concrete; contraction joints; curing of concrete; excavation, placing and compaction of six inches (6”) of subgrade preparation under the splash pan and topsoil along the edges of the splash pan; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

10. 02530.11 INSTALL SIDEWALK CHASE ASSEMBLY

    Payment shall include all materials for the trench metal chase; excavation, placing and compaction of six inches (6”) of subgrade preparation under the sidewalk plate assembly; supplying, forming and curing of concrete; and all equipment, labor, tools and incidentals to complete this item.

11. 02530.12X INSTALL HANDICAP RAMP AND LANDING (X”)

    Payment will be for all materials, including concrete, rear curb, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints, colored detectable warning panels, curing of concrete, excavation, placing and compaction six inches (6”) of subgrade preparation under the handicap ramp and landing, placing and compaction of topsoil along the edges of the handicap ramp and landing; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

12. 02530.13X INSTALL MISCELLANEOUS CONCRETE (X")

    Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of twelve inches (12") of subgrade preparation under the miscellaneous concrete item and topsoil along the edges of the sidewalk; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

SECTION 02545

BITUMINOUS MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. These specifications include general requirements applicable to all types of bases or pavements that require the application of bituminous materials by spray or mix. Deviations from these general requirements will be indicated in the specific requirements for each type.

1.02 RELATED WORK

A. Section 02512, Plant Mix Pavements.
B. Section 02550, Prime Coat.
C. Section 02551, Tack Coat.

1.03 REFERENCES

A. AASTHO M 81: Cut-Back Asphalt (Rapid Curing Type).
B. AASHTO M 82: Cut-Back Asphalt (Medium Curing Type).
C. AASHTO M 140: Emulsified Asphalt.
D. AASHTO M 141: -70 Slow Curing Liquid Road Material.
E. AASHTO M 208: Cationic Emulsified Asphalt.
F. AASHTO MP 1: High and Low Temperature Graded Asphalt Cement.
G. AASTHO T 40: Sampling Bituminous Materials.

1.04 SUBMITTALS

A. Bituminous material may be conditionally accepted at the source based on test reports furnished by CONTRACTOR for each forty (40) tons or ten thousand (10,000) gallons loaded.

B. Certificate of Compliance shall be provided to the ENGINEER with each load of Asphaltic Materials. The ENGINEER may obtain a sample of each load of Asphaltic Material and that sampling shall be accomplished using methods described and outlined in AASHTO T 40.

C. Tank trucks delivering bituminous material to the project shall be equipped with a sampling cock on the discharge pipe.

D. Bituminous materials used on the project, which do not meet the specification requirements for the type and grade specified may, at the direction of ENGINEER:

1. Be rejected and CONTRACTOR required to remove and replace all materials affected by the out-of-specification material at his expense;

2. Be accepted and left in place and the contract price of the bituminous material deducted, or be accepted at a reduced unit price as directed by ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bituminous materials shall meet all applicable requirements. No materials or products other than those designated in this Section will be added to bituminous material without the express permission of ENGINEER.

2.02 ASPHALTIC CEMENTS

The grades shown on the plans shall conform to the specifications of AASHTO MP 1

Performance Grade	PG 46		PG 52						PG 58					PG 64				
	34	40	10	16	22	28	34	40	16	22	28	34	40	10	16	22	28	34
Average 7-day Maximum Design Temperature, °C[a] (°F)	< 46 (115)		< 52 (125)						< 58 (136)					< 64 (147)				
Minimum Pavement Design Temperature, °C[a] (°F)	-34 (-29)	-40 (-40)	-10 (14)	-16 (3)	-22 (-8)	-28 (-18)	-34 (-29)	-40 (-40)	-16 (3)	-22 (-8)	-28 (-18)	-34 (-29)	-40 (-40)	-10 (14)	-16 (3)	-22 (-8)	-28 (-18)	-34 (-29)

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, or by following the procedures as outlined in MP 2 and PP 28.

A. The spot test shall be negative for all grades when tested with naphtha xylene solvent using fifteen percent (15%) xylene.

2.03 LIQUID CUTBACK ASPHALTS

A. Liquid cutback asphalts shall conform to the requirements of AASHTO M 81, AASHTO M 82, and AASHTO M 141. The spot test shall be negative for all grades when tested with naphtha xylene solvent using fifteen percent (15%) xylene. The Saybolt Furol viscosity alternate will not apply.

2.04 EMULSIFIED ASPHALTS

A. Emulsified asphalts shall conform to the following requirements:

1. Emulsified Asphalt (Anionic) AASHTO M 140 and ASTM D 977
2. Emulsified Asphalt (Cationic) AASHTO M 208 and ASTM D 2397

B. The designation “h” added to any grade of Emulsified Asphalt requires the residue from distillation to have a penetration from forty (40) to ninety (90).

C. The following exceptions apply to grade CMS-2P only:

1. Viscosity: Seconds Saybolt-Furol at 122ºF 50 Min-400 Max
2. Distillation: % Residue 65 Min
3. Distillation: Oil Distillate, by volume of emulsion – to be determined by independent laboratory from produced materials, not to exceed 20%.

D. The letter "F" following the bituminous material type designation shall require a satisfactory antistripping agent be added to the material at the refinery.

E. The presence of antistripping agents will be determined in accordance with the Wyoming Quick Bottle Test or other approved means.

PART 3 EXECUTION

3.01 PREPARATION

A. The water used for the dilution shall be free of sediment and other deleterious matter.

3.02 APPLICATION

A. The rate of emulsified asphalt used for fog seal or tack shown in the Contract Documents is the rate of Emulsified Asphalt as received from the refinery.

B. The emulsified asphalt used for tack may be diluted in the field at a rate of 50% emulsified asphalt and fifty percent (50%) additional water.

C. The emulsified asphalt used for fog seal may be diluted in the field at a rate of thirty-three percent (33%) emulsified asphalt and sixty-seven percent (67%) additional water.

D. Both the dilution water and the emulsion shall be heated to approximately one hundred ten degrees Fahrenheit (110ºF) prior to mixing, and this approximate temperature shall be maintained during the application. Dilution shall be made by introducing the water into the emulsified asphalt.

Bituminous materials for the various types of applications shall be loaded and applied within the temperatures indicated by the manufacturer

E. The maximum loading temperature for asphalt cements shall be three hundred fifty degrees Fahrenheit (350ºF).

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. No measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 02550

PRIME COAT

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of preparing and treating an existing surface with bituminous material and blotter material, if required, in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the ENGINEER.

1.02 RELATED WORK

A. Section 02190, Aggregates
B. Section 02511, Road Mix Bituminous Pavements.
C. Section 02512, Plant Mix Pavements.
D. Section 02545, Bituminous Material
E. Section 02553, Bituminous Surface Treatment

1.03 REFERENCES

A. AASHTO M 140: Emulsified Asphalt.
B. AASHTO M 141: -70 Slow Curing Liquid Road Material.
C. AASHTO M 208: Cationic Emulsified Asphalt.
D. AASHTO MP 1: High and Low Temperature Graded Asphalt Cement.
E. AASTHO M 81: Cut-Back Asphalt (Rapid Curing Type).
F. AASHTO M 82: Cut-Back Asphalt (Medium Curing Type).
G. AASTHO T 40: Sampling Bituminous Materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bituminous materials – The type of bituminous material will be specified in the contract, and the grade will be designated by ENGINEER. The bituminous material shall meet the applicable requirements of Section 02545, BITUMINOUS MATERIAL.

B. Blotter Material – Blotter material shall meet the requirements of Section 02190, AGGREGATES, Subsection 2.11. The material will be accepted based on periodic samples taken at the latest practicable point prior to incorporation into the work.

PART 3 EXECUTION

3.01 PREPARATION

A. The surface to be primed shall be shaped to required grade and section, shall be free from all ruts, corrugations segregated material, or other irregularities, and shall be uniformly compacted.

B. Delays in priming shall require reprocessing or reshaping to provide a smooth, compacted surface.

3.02 APPLICATION

A Weather Limitation – Prime coat shall be applied only when the surface on which the material is to be applied is dry and when the atmospheric temperature is above fifty degrees Fahrenheit (50ºF).

B. Equipment – CONTRACTOR shall provide equipment for heating and applying the bituminous material and for applying blotter material.

C. The quantities, rate of application, and areas to be treated shall be approved before application of the prime coat.

D. Excess bituminous material shall be squeegeed from the surface. Skipped areas or deficiencies shall be corrected.

E. After the application of the prime coat, if the bituminous material fails to penetrate and the roadway must be used by traffic, blotter material shall be spread in the amounts required to absorb any excess bituminous material.

F. Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. When traffic is maintained through construction, not more than one-half of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount.

3.03 PROTECTION

A. Traffic control shall be in accordance with US DOT FHWA Manual on Uniform Traffic Control Devices unless otherwise specified by ENGINEER in the Special Provisions.

B. When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02550.01 PRIME COAT

This item shall be measured by square yard of area that prime coat was applied.

2. 02550.02 BLOTTER MATERIAL

This item shall be measured by square yard of prime coated area that required having blotter material applied.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02550.01 PRIME COAT

Payment shall include all labor, equipment, tools, and incidentals necessary for preparing and coating an existing surface with prime coat.

2. 02250.02 BLOTTER MATERIAL

Payment shall include all labor, equipment, tools, and incidentals necessary for applying blotter material to an area prime coated.

SECTION 02551

TACK COAT

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the ENGINEER.

1.02 RELATED WORK

A. Section 02545, Bituminous Material
B. Section 02512, Plant Mix Pavements.

1.03 REFERENCES

A. AASHTO M 140: Emulsified Asphalt.
B. AASHTO M 141: -70 Slow Curing Liquid Road Material.
C. AASHTO M 208: Cationic Emulsified Asphalt.
D. AASHTO MP 1: High and Low Temperature Graded Asphalt Cement.
E. AASTHO M 81: Cut-Back Asphalt (Rapid Curing Type).
F. AASHTO M 82: Cut-Back Asphalt (Medium Curing Type).
G. AASTHO T 40: Sampling Bituminous Materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. The Tack Coat emulsion shall be SS-1, CSS-1, SS-1h, or CSS-1h.

B. The bituminous material shall meet the applicable requirements of Section 02545, BITUMINOUS MATERIALS.

PART 3 EXECUTION

3.01 PREPARATION

A. The existing surface shall be cleaned and shall be free of irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Unstable corrugated areas shall be removed and replaced with suitable patching materials. The edges of existing pavements, and face of the curb and gutter which are to be adjacent to new pavement, shall be cleaned to permit the adhesion of bituminous materials.

3.02 APPLICATION

A. APPLICATION OF BITUMINOUS MATERIAL

1. The tack coat shall be applied between all lifts of asphalt and to all abutting pavement edges.

2. Emulsified asphalt used for tack coat may be diluted in the field at a ratio of one (1) part emulsified asphalt to one (1) part water (1:1). Before mixing, heat the dilution water and emulsified asphalt to a minimum temperature specified by the supplier. Dilute by introducing the water into the emulsified asphalt.

3. The bituminous material shall be uniformly applied with a pressure distributor.

4. The tack coat shall be applied in such manner as to offer the least inconvenience to traffic without pickup or tracking of the bituminous material.

5. Tack coat shall not be applied during wet or cold weather, after sunset, or to a wet surface. The application rate shall be one-tenth gallon per square yard (0.10 gallon/sy). Maintain pressure so that the application rate varies no more that two-hundredth of a gallon per square yard (0.02gallons/sy). Apply the emulsified asphalt so that there is uniform, complete coverage at the rate specified. Correct deficiencies and areas not covered.

B. EQUIPMENT

1. The CONTRACTOR shall provide equipment for heating and applying the bituminous material.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. No measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore. CONTRACTOR may make request to the ENGINEER to omit the application of tack coat. If conditions warrant, and omission is approved, payment for the associated bid items shall be reduced to an agreed upon price between the CONTRACTOR and ENGINEER for the omission of the tack coat material.

SECTION 02570

ADJUSTING STREET FIXTURES

PART 1 GENERAL

1.01 SUMMARY

A. This item shall consist of locating and adjusting to grade manholes, cleanouts, inlets, water valve boxes, curb stop risers, and fire hydrants as shown on the plans and as required in the Special Provisions.

PART 2 PRODUCTS

2.01 MATERIALS

A. All material such as concrete and mortar shall meet specifications as required in the section on the particular material involved, or if the material is not covered in these specifications, the material used for adjusting shall be equal, and comparable to that in the existing structure. If extensions for water valve boxes or curb stop risers and fire hydrants are required beyond the length found to exist, they shall be comparable to that in the existing structure.

PART 3 EXECUTION

3.01 METHOD OF CONSTRUCTION

A. All manholes, inlets, cleanouts, water valve boxes or curb stop risers shall be brought to grade by either lowering or raising as required in accordance with the details shown on the plans. Where lowering of manholes, cleanouts or inlets is required, care shall be used in removing the top portion of the masonry or pipe. Before the ring and cover is replaced, the top of the masonry on the manhole, cleanout, or inlet must be true to line and grade.

B. Water valve boxes and curb stop risers shall be excavated and exposed so as to readily determine whether height adjustment can be made without substituting a longer section. Water valve boxes and curb stop risers shall be adjusted laterally so the valve stem can be operated by the extension. Curb stop risers shall be adjusted by raising or lowering the curb key stop or extension box as specified in the Special Provisions or as shown in the plans.

C. Manholes, cleanouts, and water valve boxes shall be adjusted to final grade after the top pavement lift is applied. Preliminary adjustment may be required to allow placing of base courses and paving over the manholes, cleanouts or water valves.

D. Backfill shall be in conformance with Section 02210. There may be adjustments required in the horizontal location of some existing fire hydrants. At the time of construction staking, any hydrants which require horizontal adjustment will be located by the ENGINEER and the adjusted location will be staked by the ENGINEER as shown on the plans.

E. There may be minor adjustment required as dimensioned on the plans in the height of some fire hydrants to insure that they are at a reasonable height behind the back of curb. At the time of construction staking, any hydrants which require vertical adjustment will be located by the ENGINEER and the adjusted height will be staked by the ENGINEER.

F. Before final acceptance, all manholes, cleanouts, inlets, water valve boxes, curb stop risers shall be cleaned and water valve boxes, services, and fire hydrants shall be operational.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02570.01 ADJUST MANHOLE

This item shall be measured by the number of manholes adjusted to grade. Included with this item shall be the pavement removal and concrete collar to adjust the manhole.

2. 02570.02 REPLACE MANHOLE ADJUSTING RINGS

This item shall be measured by the vertical feet of sanitary sewer adjusting rings (HDPE) replaced to the nearest tenth foot (0.1').

3. 02570.03 ADJUST SANITARY SEWER CLEANOUT

This item shall be measured by the number of cleanout adjusted to grade. Included with this item shall be the pavement removal, and concrete collar to adjust the cleanout.

4. 02570.04 ADJUST STORM DRAIN INLET

This item shall be measured by the number of storm drain inlets adjusted to grade. Included with this item shall be the pavement removal and replacement to adjust the inlet.

5. 02570.05 ADJUST WATER VALVE BOX

This item shall be measured by the number of water valve boxes adjusted to grade and replacement of the top section if required. Included with this item shall be the pavement removal, concrete collar, and to adjust the valve box.

6. 02570.06 ADJUST WATER SERVICE CURB STOP

This item shall be measured by the number of water service curb stops adjusted to grade.

7. 02570.07 ADJUST WATER METER PIT

This item shall be measured by the number of water meter pits adjusted to grade.

8. 02570.08 ADJUST FIRE HYDRANT

This item shall be measured by the vertical feet of fire hydrants adjusted to the nearest tenth foot (0.1').

9. 02570.09 ROTATE FIRE HYDRANT

This item shall be measured by the numerical count of fire hydrants rotated.

10. 02570.10 RELOCATE FIRE HYDRANT

This item shall be measured by the numerical count of fire hydrants relocated.

11. 02570.11 ADJUST PIEZOMETER

This item shall be measured by the number of piezometers adjusted to grade.

12. 02570.12 ADJUST ELECTRICAL VAULT

This item shall be measured by the number of electrical vaults adjusted to grade. Included with this item shall be the pavement removal and replacement to adjust the electrical vault.

13. 02570.13 ADJUST ELECTRICAL PULL BOX

This item shall be measured by the number of electrical pull boxes adjusted to grade. Included with this item shall be the pavement removal and replacement that is determined by the CONTRACTOR to be necessary to adjust the pull box.

14. 02570.14 REPLACE SEWER MANHOLE RING AND COVER

This item shall be measured by the numerical count of sewer manhole ring and covers removed and replaced with new.

15. 02570.15 ADJUST SUBDRAIN CLEANOUT

This item shall be measured by the number of subdrain cleanouts adjusted to grade.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02570.01 ADJUST MANHOLE

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of existing pavement; excavation, backfill and compaction; cleaning of the pavement; installation of a concrete collar around the manhole; and all labor, tools and incidentals to complete this item.

2. 02570.02 REPLACE MANHOLE ADJUSTING RINGS

Payment shall include furnishing and installing HDPE manhole rings, joint sealer and mortar; removing and disposing of the existing adjusting rings; and all other incidentals to complete this item.

3. 02570.03 ADJUST SANITARY SEWER CLEANOUT

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; installation of a concrete collar around the cleanout; and all labor, tools and incidentals to complete this item.

4. 02570.04 ADJUST STORM DRAIN INLET

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; pavement material for the patch with a thickness equal to the surrounding pavement; and all labor, tools and incidentals to complete this item.

5. 02570.05 ADJUST WATER VALVE BOX

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; replacement of the top section, if required; cleaning of the pavement; installation of a concrete collar around the valve box; and all labor, tools and incidentals to complete this item.

6. 02570.06 ADJUST WATER SERVICE CURB STOP

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; pavement material for the patch with a thickness equal to the surrounding pavement; and all labor, tools and incidentals to complete this item.

7. 02570.07 ADJUST WATER METER PIT

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; pavement material for the patch with a thickness equal to the surrounding pavement; and all labor, tools and incidentals to complete this item.

8. 02570.08 ADJUST FIRE HYDRANT

Payment shall include all materials (including any additional stem length), excavation, backfill, compaction, concrete, labor, tools and incidentals necessary to complete the item.

9. 02570.09 ROTATE FIRE HYDRANT

Payment shall include removing the fire hydrant from its existing base; rotating the fire hydrant; reinstalling the fire hydrant on its base; all materials; and all other necessary or incidental or completion of the item.

10. 02570.10 RELOCATE FIRE HYDRANT

Payment shall include removing the fire hydrant from its existing location; installing the fire hydrant, thrust blocking, anchor blocking and drain gravel; all excavation, backfill and special compaction as required; and all other work necessary or incidental for completion of the item.

11. 02570.11 ADJUST PIEZOMETER

Payment shall include all materials; excavation, backfill and compaction; and all labor, tools and incidentals to complete this item.

12. 02570.12 ADJUST ELECTRICAL VAULT

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement;

excavation, backfill and compaction; cleaning of the pavement; pavement material for the patch with a thickness equal to the surrounding pavement; and all labor, tools and incidentals to complete this item.

13. 02570.13 ADJUST ELECTRICAL PULL BOX

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; pavement material for the patch with a thickness equal to the surrounding pavement; and all labor, tools and incidentals to complete this item.

14. 02570.14 REPLACE SEWER MANHOLE RING AND COVER

Payment shall include the removal of the sewer manhole ring and cover; any additional excavation and backfill needed to remove ring and cover; the hauling of the salvaged ring and cover to the designated City site, or satisfactory disposal as directed; furnishing and installing new ring and cover (Cover - nonventilated, self sealing D&L Foundry A-1161; Ring - D&L Foundry A-1071, A-1043, or A-1161 (4", 6", or 8" respectively, as specified); adjusting rings, joint sealer, all tools and labor; and all other incidentals required to complete the item.

15. 02570.15 ADJUST SUBDRAIN CLEANOUT

Payment shall include all materials; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of the pavement; excavation, backfill and compaction; cleaning of the pavement; installation of a concrete collar around the cleanout; and all labor, tools and incidentals to complete this item.

SECTION 02645

FIRE HYDRANTS

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of installation of fire hydrants together with related appurtenances, complete.

1.02 REFERENCES

A. AWWA C-105: Polyethylene encasement for ductile-iron pipe systems.
B. AWWA C-502: Standard for dry barrel fire hydrants.

PART 2 PRODUCTS

2.01 MATERIALS

A. DRY-BARREL FIRE HYDRANTS

1. Fire hydrants shall conform to dry barrel hydrants, AWWA C-502, and modifications herein specified.

2. Hydrants shall be furnished with five inch (5") minimum valve openings, one (1) four and one-half inch (4 ½") pumper connection and two (2) two and one half inch (2 ½") hose connections. Hose nozzle threads and pumper nozzle thread shall be National Standard hose thread. The operating nut shall be left opening or match existing hydrant. All bolts shall be 316 or 304 stainless steel.

3. Hydrants shall be of the "Compression" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water. Hydrants shall be of the dry top design with two (2) or more "O" rings sealing the water from the operating mechanism. The portion of the hydrant above the ground line shall be painted "Red" in accordance with the OWNER's standards. Hydrants shall be furnished for six-foot (6') cover unless specified otherwise in the Special Provisions. Hydrants installed behind curbs typically require an additional six inches (6") height. CONTRACTOR should take this into consideration.

4. Hydrants shall be American AVK 2780 (mechanical joint), Mueller Super Centurion 250 (A-423-mechanical joint), American Flow Control Waterous Pacer (WB-67-250-mechanical joint), or Engineer approved equal.

B. JOINT BOND WIRE

1. Joint bond wire shall be in accordance with Section 02665 Water Distribution and Transmission Systems.

C. POLYETHYLENE ENCASEMENT

1. Polyethylene encasement shall be in accordance with section 02665, Water Distribution and Transmission Systems.

D. GALVANIC ANODES

1. Galvanic anodes shall be in accordance with section 02665, Water Distribution and Transmission Systems.

PART 3 EXECUTION

3.01 INSTALLATION

A. All hydrants shall stand plumb with the pumper nozzle facing the street. Hydrants shall be set with the ground line at the location indicated by the hydrant manufacturer. Hydrants shall be installed such that they have drainage toward the street. Proper boot lengths shall be used to avoid hydrants installed in holes or depressions. A concrete splash pad shall be placed around the base of the hydrant. The concrete splash pad shall be installed in accordance with Standard Drawing No. 02645-05 OR AS SPECIFIED IN THE SPECIAL PROVISIONS.

B. Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant. Sufficient gravel shall be used to provide a minimum of one foot (1') on all sides from the base of the hydrant to the point at least six inches (6") above the drain opening. Hydrant shall be braced against unexcavated earth at the end of the trench with concrete backing as detailed on the plans. Hydrants shall be furnished with auxiliary gate valves. Hydrant installation shall be in accordance with Standard Drawing No. 02645-01 OR AS SPECIFIED IN THE SPECIAL PROVISIONS.

C. The fire hydrant shall be bonded, polyethylene encased, and cathodically protected with seventeen-pound (17 lb) galvanic anode or six-ounce (6 oz) Mars Company Zinc Caps on all tee bolts.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02645.01 INSTALL FIRE HYDRANT ASSEMBLY COMPLETE

   This item shall be measured by the numerical count of new fire hydrant assemblies installed.

2. 02645.02 INSTALL FIRE HYDRANT BOLLARDS

   This item shall be measured by the numerical count of new fire hydrant bollards installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02645.01 INSTALL FIRE HYDRANT ASSEMBLY COMPLETE

   Payment shall include furnishing and installing the fire hydrant assembly, joint bonding, polyethylene encasement, cathodic protection, thrust blocking, anchor blocking and drain gravel; all excavation, backfill and special compaction as required; and all other work necessary or incidental for completion of the item.

2. 02645.02 INSTALL FIRE HYDRANT BOLLARDS

   Payment shall include all materials, excavation, backfill, forming and curing of concrete, equipment, labor, tools, and incidental to install the bollards

SECTION 02665

WATER DISTRIBUTION AND TRANSMISSION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of construction of Water Mains, including fittings, water valves, water services, water service piping, tapping the main, corporation stops, curb stops, and other appurtenances normally used for water supply and distribution systems, including furnishing and installing pipe, water valves, and fittings, construction of thrust blocking, testing, cleaning and disinfection of mains and other related work.

1.02 REFERENCES

A. AWWA C 105: Polyethylene encasement for ductile-iron pipe systems.
B. AWWA C110 (A21.10-87): Standard for Ductile-Iron and Gray-Iron Fittings, three inch (3") through forty-eight inch (48"), for Water.
C. AWWA C 153 (A21.53-06): Ductile-Iron Compact Fittings for Water Service.
D. AWWA C 207; Steel Pipe Flanges for Waterworks Services, Sizes four inch (4") through one hundred forty-four (144")
E. AWWA C 500; Gate Valves for Water and Sewerage Systems.
F. AWWA C 504; Rubber-Seated Butterfly Valves.
G. AWWA C 509; Resilient-Seated Gate Valves for Water and Sewerage Systems.
H. AWWA C 515; Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
I. AWWA C 550; Protective Interior Coatings for Valves and Hydrants.
J. AWWA C 800; Underground Service Line Valves and Fittings.
K. AWWA C 900; PVC Pressure Pipe, four inch (4") through twelve inch (12") for Water.
L. AWWA C 905; Large Diameter (greater than twelve inch (12")) PVC Pipe.
M. AWWA C 906; Polyethylene (PE) Pressure Pipe and Fittings four inch (4") through sixty-three inch (63") for Distribution and Transmission.
N. AWWA C 907; Polyvinyl Chloride (PVC) Pressure Fittings for Water – four inch (4"). through eight inch (8").
O. AWWA C 909; Molecular Oriented Polyvinyl Chloride (PVCO) Pressure Pipe (four inch (4") through twelve inch (12")).

1.03 QUALITY ASSURANCE

A. When required by ENGINEER, CONTRACTOR shall furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe and fittings comply with the applicable specifications. REQUIRED CERTIFICATION SHALL ACCOMPANY EACH DELIVERY OF MATERIAL.

B. All pipe shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. PIPE

1. Pipe used in water main construction shall be as called out in the Special Provisions and shall be in accordance with the following specifications:

2. DUCTILE IRON PIPE

   a. Ductile iron pipe shall conform to the provisions of AWWA C151. Pipe shall be pressure class 350.

   b. Pipe joints shall be mechanical joint or "Push-On" joints conforming to AWWA C11.

   c. The interior of the pipe shall have a cement mortar lining conforming to the requirements of AWWA C104. The outside surface of pipe designed for underground service shall receive a bituminous coating approximately one (1) mil thick.

   d. When polyethylene encasement is required, the requirements of AWWA C105/A21.5-88 shall be met.

3. POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

   a. PVC pipe for water mains twelve inches (12") or smaller shall meet the requirements of AWWA C900, "Polyvinyl Chloride Pressure Pipe", made to ductile iron O.D.'s for "Push-On" joints. Pipe joints shall be with an elastomeric gasket or joint. Pipe shall be DR-18 pressure class 150.

   b. Large diameter (greater than twelve inches (12")) PVC PIPE shall conform to AWWA C900 Specifications.

4. MOLECULARLY ORIENTED POLYVINYL CHLORIDE (PVCO) PRESSURE

   a. PVCO pipe for water mains twenty-four inches (24") or smaller shall meet the requirements of AWWA C909, "Molecularly Oriented Polyvinyl Chloride Pressure Pipe", made to ductile iron O.D.'s for "Push-On joints. Pipe joints shall be with an elastomeric gasket or joint. Pipe shall be pressure class 150.

5. POLYETHYLENE PRESSURE PIPE

   a. Black Polyethylene material used for the manufacture of polyethylene pipe and fittings shall be PE 3608 high density polyethylene meeting ASTM D 3350 cell classification 345464C and the name of the pipe and fitting manufacturer shall be listed in PPI (Plastic Pipe Institute) TR-4 with a standards grade HDB rating of one thousand six hundred (1600) psi at seventy-three degrees Fahrenheit (73ºF). The material shall be listed and approved for potable water in accordance with National Sanitation Foundation (NSF) Standard 61.

   b. HDPE pipe shall be manufactured to the requirements of ASTM F 714 and AWWA C906. Pipe shall be DR-11 pressure class 160.

   c. HDPE pipe shall have three equally spaced pairs of longitudinal blue color stripes or the pipe specification in blue text co-extruded into the pipe outside surface or the pipe specification printed in blue text on the outside surface of the pipe.

B. TAPPING SLEEVES

1. Tapping sleeves shall be made of three-eighths (3/8)-inch carbon steel meeting ASTM A 285, with a fusion bonded epoxy coating with a minimum thickness of ten (10) mils. Flanges shall be Class D ANSI one hundred fifty pound (150 lb), complying with AWWA C 207. A properly sized gasket is to be provided to create a watertight seal. Bolts and nuts are to be either 304 or 316 stainless steel. The tapping sleeves are to be Dresser Style 610, TPS Triple-Tap, or Engineer approved equal.

C. COUPLINGS

1. Couplings shall be of ASTM A 53, ASTM A 512, or carbon steel having a minimum yield strength of thirty thousand (30,000) psi. Coating shall be fusion bonded epoxy coated and be a minimum of ten (10) mils thick. Bolts and nuts are to be either 304 or 316 stainless steel. Couplings are to be Smith-Blair 411 series, Dresser Style 38, or Engineer approved equal.

D. FITTINGS

1. Cast iron or ductile iron fittings used for water mains shall be Class 250 conforming to AWWA C110, "Gray-Iron and Ductile Irons Fittings for Water" or AWWA C153, "Ductile-Iron Compact Fittings for Water Service". Joints for Ductile Iron and PVC Pipe shall be mechanical joint or "Push-On" joints conforming to AWWA C111. The interior and exterior of the fitting shall have a fusion bonded epoxy coated lining conforming to AWWA C116.

2. PVC fittings may be used for water mains four inches (4") through twelve inches (12") in diameter and shall conform to AWWA C907 or an Engineer approved equal.

3. HDPE butt fusion fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D 3350, and approved for AWWA use. Butt fusion fittings shall have a manufacturing standard of ASTM D 3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. All fittings shall be suitable for use as pressure conduits, and per AWWA C 906, have nominal burst values of three and one-half (3-1/2) times the Working Pressure Rating (WPR) of the fittings.

4. HDPE fittings may be joined together using Mechanical Joint (MJ) adapters. These fittings shall be made from PE 3408 HDPE, with a cell Classification of 345464C as determined by ASTM D 3350. MJ adapters shall have a manufacturing standard of ASTM D 3261. They shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

5. HDPE pipe and fittings may be joined to water pipe and fittings made of a different material using Engineer approved electrofusion couplings. Fittings shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D 3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, as per AWWA C 906, have nominal burst values of three and one-half (3-1/2) times the Working Pressure Rating (WPR) of the fitting.

E. AIR RELIEF VALVES, BLOW OFFS, FLUSHING HYDRANTS

1. These shall meet pressure and flow requirements equal to or exceeding the water main installation or as required by the manufacturer.

F. PRESSURE REDUCING VALVES

1. Pressure Reducing Valves shall be Cla-Val Model 90-01/690-01 or approved equal. The Pressure Reducing Valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

2. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern. The valve shall consist of three (3) major components: the body, with seat installed; the cover, with bearings installed; and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing Glands and/or stuffing boxes are not permitted and there shall be no piston operating the main valve or pilot controls.

3. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be Ductile Iron. No fabrication or welding shall be used in the manufacturing process.

4. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides (3.5) by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

5. The diaphragm assembly containing a non-magnetic 303 stainless steel stem with sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

6. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of six hundred (600) psi per layer of nylon fabric and shall be cycle tested one hundred thousand (100,000) times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and covered by machined surfaces with support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

7. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in six inch (6”) and smaller size valves shall be threaded into the cover and body. The valve seat in eight inch (8”) and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to flow on all sides to avoid deposits. To insure proper alignment of

the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modification other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted.

8. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include an opening speed control on all valves. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge. A full range of spring settings shall be available in ranges of zero (0) to four hundred fifty (450) psi.

G. BUTTERFLY VALVES

1. Butterfly valves shall be Mueller Line Seal III or Engineer approved equal.

2. Butterfly valves for use in the water distribution system, sizes fourteen (14") and larger shall be Class 150 rubber seated, tight closing butterfly valves conforming to AWWA C504. Butterfly valves shall be furnished with mechanical joint ends and lubricated screw type operators designed for underground service. Butterfly valves installed on HDPE pipe shall have a beveled flange adapter.

3. Rubber valve seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body. Shaft packing shall be of the self-adjusting permanent type.

4. Operators for underground service shall be permanently lubricated screw type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of four hundred fifty (450) foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A two-inch (2") square wrench nut and valve box shall be provided for operating the valve. Valves shall open counter clockwise unless indicated otherwise in the Special Provisions.

5. The Butterfly Valve surfaces shall be internally and externally fusion bonded epoxy coated in accordance with AWWA C550.

6. Certification of performance, leakage and hydrostatic tests as described in Section 13 of AWWA C504 shall be furnished when required by ENGINEER. Valves shall be the product of a manufacturer having a minimum of five years' experience in the manufacture of water works and distribution valves.

7. All bolts shall be either 304 or 316 stainless steel.

H. RESILIENT SEATED GATE VALVES

Resilient Seated Gate Valves, sizes four inch (4") through twelve inch (12") shall be American AVK Series 25, American Flow Control Series 2500, Mueller A-2360, or Engineer approved equal. Matco 4" valves are disallowed. The valve shall have an iron body, with non-rising stems with design, construction, and pressure rating conforming to

AWWA C509 or C515, standard for Resilient Seated Gate Valves with modifications specified herein.

1. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.

2. Stem seals shall be triple "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure in full open position.

3. Resilient Seated Gate Valves for underground installation shall have two-inch (2") square wrench nut for key operation. All valves shall open counter clockwise unless indicated otherwise in the Special Provisions.

4. The Resilient Seated Gate Valves surfaces shall be internally and externally fusion bonded epoxy coated in accordance with AWWA C550.

5. All bolts shall be either 304 or 316 stainless steel.

I. VALVE RESTRAINTS

1. Mechanical Joint Valve: EBAA Iron Series 2000 or approved equal.

2. Push-on Joint Valve: Ford Series 1300, EBAA Iron Series 1600, or approved equal.

J. VALVE BOXES

1. Valve boxes shall be cast iron, five and one-fourth inch (5¼") diameter adjustable valve boxes. Valve boxes shall be of the screw type and of sufficient length for the pipe bury as specified. The cast iron cover of the valve box shall have the word "Water" stamped thereon.

2. Valve boxes shall be Tyler 6850 series cast iron, five and one-fourth inch (5¼") shaft-screw type with five and one-fourth inch (5¼") drop in lid or an Engineer approved equal.

3. All valve boxes shall be installed upon the valve with the use of a Valve Box Adaptor II as manufactured by Adaptor Inc. or Engineer approved equal.

K. WATER SERVICE PIPE

1. Pipe used in water service line construction shall be copper or polyethylene service pipe as called out in the Special Provisions and shall conform to the following specifications:

   a. Copper Service Pipe shall be type K soft, conforming to Federal Specification WW-T-799 or ASTM B 88.

   b. Polyethylene Service Pipe shall conform to the requirements of AWWA C901, "Polyethylene (PE) Pressure Pipe, Tubing and Fittings, one-half inch (1/2") through three inch (3") for water." PE Pipe shall be pressure tubing PE-3408 material conforming to Table 7 of said specification. Tubing shall be class 160 with a DR of 11 or class 200 with a DR of 9. If not specified, DR 9 shall be used.

L. CORPORATION STOPS

1. Corporation stops shall be Mueller® 300 ™ brass corporation stops with AWWA/CC taper thread inlet and Mueller 110® compression connection outlet or Ford F-1000 brass corporation stop with AWWA/CC taper thread inlet and Quick Joint compression connection outlet or Engineer approved equal.

M. COMPRESSION CONNECTIONS

1. Ends of polyethylene tubing inserted in compression connections should be fitted with insert reinforcement.

N. SERVICE CLAMPS

1. Service clamps, where required, shall be Mueller BR2S Series, or Ford 202 BS Series or Engineer approved equal, flat double stainless steel strap, bronze metal body, with Neoprene gaskets and AWWA tapered corporation stop threads. Service clamps for PVC shall provide full support around the circumference of the pipe, and have a bearing area of sufficient width along the axis of the pipe so that the pipe will not be distorted when tightened.

O. CURB STOPS

1. Curb stop shall comply with AWWA C800, be Mueller® Series 300™ with Mueller 110™ compression connection or Engineer approved equal. For Type K Copper services, the curb stop shall be electrically insulated type.

P. CURB STOP BOXES

1. Curb boxes for copper water services shall be cast iron, arch pattern base with a stationary rod. Curb boxes for one-inch (1") shall be Mueller Type H 10334, or Engineer approved equal. All curb boxes shall have a fully extended length of at least six inches (6") more than the required length to ground surface. Curb boxes shall include a series 304 or 316 stainless steel stationary rod. The stationary rod shall be pinned to the curb stop. The stationary rod connection pin shall be either 304 or 316 stainless steel. The lid shall have a larger outer lid with a smaller internal plug.

Q. PIPE INSULATION

1. Pipe insulation shall be high density, extruded polystyrene foam insulation board for buried service.

2. The five-year (5) aged R Value per inch shall be five (5) when tested at seventy-five degrees Fahrenheit (75°F) mean temperature in accordance with ASTM C 518.

3. Pipe insulation shall have a minimum compressive strength of twenty-five (25) psi when tested in accordance with ASTM D 1621.

4. The pipe insulation shall have a maximum water absorption of 0.1% by volume when tested in accordance with ASTM C 272.

R. TRACER WIRE

1. Tracer wire for open cut trenching installations shall be Copperhead® SuperFlex 1030, #10 AWG copper-clad steel conductor with 30 mil HDPE insulation rated for direct bury use and 513 lb minimum break load, or Engineer approved equal. Insulation shall be blue in color.

2. All wire connectors for splicing of tracer wire shall be rated for direct bury applications.

3. racer wire for directional drilling or boring shall be Copperhead® SoloShot 1045, #10 AWG high strength copper-clad steel conductor with 45 mil HDPE insulation rated for direct bury use and 2,032 lb minimum break load, or Engineer approved equal. Insulation shall be blue in color.

S. WARNING TAPE

1. Warning tape shall be at least three inches (3") in width and shall have a minimum overall thickness of five (5) mils. Tape shall be impervious to all known alkalis, chemical reagents, and solvents found in soil. Color coding shall be in conformance with the APWA/ULCC Color Code. Warning tape shall have a maximum imprint length of thirty-six inches (36").

T. JOINT BOND WIRES

1. Joint bond wires shall be single-conductor, stranded copper wire with six hundred (600)-volt HMWPE insulation. Supply all joint bonds complete with a formed copper sleeve on each end of the wire. Wire conductor shall extend one-quarter inch (¼") beyond the end of the sleeves.

2. Install one joint bond wire per joint on all ductile iron pipe smaller than ten inches (10") in diameter.

3. Install two joint bond wires per joint on ductile iron pipe ten inches (10") in diameter or larger.

4. Push-on, mechanical, or flanged joint: No. 4 AWG wires, eighteen inches (18") long for sixteen inch (16") and smaller pipe and No. 2 AWG wires, eighteen inches (18") long for larger pipe.

U. STEEL CASING FOR BORES

1. Welded steel casing pipe shall meet the requirements of ASTM A 53 Grade B and shall have an inside diameter of at least twelve inches (12") greater than the outside diameter of the bell joint of the carrier pipe to be installed therein or be sized per the casing spacer manufacturers minimum requirements for casing size. Casing pipe that is bored shall have thirty-two pound (32 lb) anode bags cad welded to each end. The minimum wall thickness of the tubing shall be:

Wall Thickness	Casing O.D.
3/8"	30" and smaller
½"	33"- 42"

V. CASING SPACERS

1. Casing spacers for carrier pipe shall be Ford Uni-flange or Engineer approved equal installed at a maximum center to center spacing of seven feet (7') along the carrier pipe with additional spacer placed within twelve inches (12") of each end of the casing pipe. The casing spacer shall be restrained at all carrier pipe joints.

W. END SEALS FOR CASING PIPE

1. The end seal shall be one-eighth inch (1/8") thick synthetic rubber wrap around water tight with stainless steel bands installed on the casing pipe after carrier pipe insertion. End seal shall be APS Model AW Wrap Around End Seal as manufactured by Advance Products and Systems, Inc. Lafayette, LA or Engineer approved equal.

X. GALVANIC ANODES

1. High-Potential Magnesium Composition:

ELEMENT	CONTENT
Aluminum (Al)	0.010% maximum
Manganese (Mn)	0.500% to 1.300%
Silicon (Si)	.05% maximum
Copper (Cu)	0.020% maximum
Iron (Fe)	0.030% maximum
Nickel (Ni)	0.001% maximum
Total Others	0.050% each or 0.300% maximum, total
Magnesium (Mg)	Remainder

2. Magnesium Anode Dimensions:

Bare Anode Size	17 Pound Anode
Bare Anode Nominal Dimension	3 inches by 25 inches long minimum
Packaged Weight	42 pounds minimum
Nominal Package size	6 inch diameter by 29 inches long minimum

3. Acceptable High Potential Magnesium Anodes: Ultra Mag™ manufactured by Farwest Corrosion Control Company or Engineer approved equal.

   a. Compliance Statement: Furnish an independent laboratory analysis guaranteeing that all anodes supplied meet all the requirements of the section.

   b. Anode Wire: Supply each anode with No. 12 AWG Stranded copper wire with THWN insulation, ten feet (10') long when attached to the pipe line, fitting, hydrant.

   c. Backfill Composition:

Ground Hydrated Gypsum	75 percent
Powdered Wyoming Bentonite	20 percent
Anhydrous Sodium Sulfate	5 percent

4. Zinc Anode Caps

   a. Zinc Anode Caps shall be Mars Company six ounce (6 oz) Cap or Engineer approved equal.

Y. UTILITY MARKERS

1. Utility markers shall be Carsonite® Utility Markers or Engineer approved equal. The markers shall be made of a blue composite material and be three and three-quarters inch (3.75") wide and sixty-six inches (66") long. The utility marker shall be designed in accordance with Standard Drawing 01015-01.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. GENERAL

1. Pipe shall be installed in accordance with the manufacturer's recommendation for installing the type of pipe used unless otherwise noted in the Special Provisions. CONTRACTOR shall provide all tools and equipment including any special tools designed for installing each particular type of pipe used.

2. Service pipe shall be of the size or sizes designated in the Contract Documents. Service lines shall be considered two inch (2") size and under. Service lines over two inch (2") size shall be considered as water mains and shall be as specified under the applicable sections.

B. DEWATERING OF TRENCH

1. Where water is encountered in the trench, it shall be removed during pipe laying operations and the trench so maintained until the ends of the pipe are sealed and provisions are made to prevent floating of the pipe.

C. RESPONSIBILITY FOR MATERIAL

1. CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for the placement of installed material discovered damaged or defective prior to the final acceptance of the work, or during the warranty period.

2. CONTRACTOR shall be responsible for the safe and proper storage of material furnished by him or to him and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

D. HANDLING OF PIPE

1. All pipe furnished by CONTRACTOR shall be delivered and distributed at the site by CONTRACTOR. Pipe, fittings, valves and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

2. In distributing the materials at the site of work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

3. Pipe shall be handled such that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by CONTRACTOR at his expense in a manner satisfactory to ENGINEER.

E. LAYING OF PIPE

1. Before installation, the pipe and pipe coating shall be inspected for defects. Any damage to pipe coatings shall be repaired AS RECOMMENDED BY THE PIPE MANUFACTURER before laying the pipe.

2. The pipe shall be installed with a minimum of five and one-half feet (5.5') to six feet (6.0') of cover from final grade.

3. Grade and alignment on ungraded streets will be given from hubs set parallel to the line of the pipe, and on graded streets the grade and alignment shall be taken from established points on the existing curbs or sidewalks, when directed by ENGINEER. Trenches for the pipe shall be opened in accordance with the lines and grades given or to the standard depth of cover provided on the Drawings, and/or in the Special Provisions. CONTRACTOR shall transfer lines and grades to the pipe from marks set by ENGINEER or from existing concrete curbs or sidewalks as an incidental part of his work.

4. Wherever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, ENGINEER shall have the authority to change the plans and order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation and reconstruction of the obstructions. If the change in plans results in a change in the amount of work by CONTRACTOR, such altered work shall be done on the basis of payment to CONTRACTOR for extra work or credit to the OWNER for less work.

5. Proper implements, tools and facilities satisfactory to ENGINEER shall be provided and used by CONTRACTOR for a safe and convenient prosecution of the work. All pipe, fittings and valves shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

6. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by ENGINEER.

7. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, CONTRACTOR can assume that the curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.

8. Where field conditions require deflection or curves not anticipated by the plans, ENGINEER will determine the methods to be used. No additional payment will be made for laying pipe on curves as shown on the plans, nor for field changes involving standard lengths of pipe deflected at the joints. When fittings, thrust blocking, or gravity blocking not shown on the plans are required to meet field conditions, additional payment will be made under raising or lowering water line standard item.

9. Maximum deflections of the pipe shall not exceed the applicable material and joint specifications of AWWA nor shall they exceed the recommendations of the pipe manufacturer. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wide on curves for this purpose.

10. Reaction or thrust blocking shall be applied at all reducers, tees, plugs, caps and at bends deflecting eleven and one-fourth (11 ¼) degrees or more, and movement shall be prevented by attaching suitable metal rods or straps to gravity blocks as approved by ENGINEER. Reaction blocking shall be concrete having a

compressive strength of not less than two thousand (2,000) pounds per square inch at twenty-eight (28) days. Blocking shall be placed between solid ground and the fitting to be anchored. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair.

11. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or coating and so as to leave a smooth end at right angles to the primary axis of the pipe. The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.

12. Warning tape shall be buried twenty-four inches (24") above the top of the pipe unless specified otherwise.

13. Tracer wire shall be installed on all pipes. The wire shall be located on top of the pipe as shown on the plans. The tracer wire shall be insulated and brought to the surface and terminated in a flush mounted test station box at all fire hydrants, or at other termination points as identified on the plans. Tracer wire shall be attached to the top of the pipe with polyethylene tape at 10-foot maximum intervals to keep wire in place during backfilling. CONTRACTOR shall test all tracer wire, and all tracer wire shall have continuous conductivity, prior to placing the water line into service or prior to street or alley surfacing, whichever is earlier or applicable. Owner may also request to verify conductivity prior to placing the water line into service.

14. Polyethylene encasement shall be installed as per AWWA C-105 on all fire hydrants, ductile iron pipe and fittings; and curb stop boxes. Overlaps shall be secured to top of pipe by the use of adhesive tape, plastic string or other material capable of holding the polyethylene encasement in place until backfilling operations are complete.

15. All valve boxes on Transmission Mains that are outside of a roadway shall be marked with a Utility Marker.

F. BORING, JACKING AND THREADING OF CARRIER PIPE

1. Pit Excavation

Pits shall be excavated such that timber blocking can be installed to give an unyielding backing for the hydraulic boring machine or jacks and to prevent sloughing of the header face. Subgrade on which rails or guides are to be set shall be stabilized with washed rock where soft and springy ground is encountered.

Excavation and casing installation shall be performed simultaneously. At no time shall advancing edge of the casing trail the excavation by more than twelve inches (12").

2. Casing Pipe Joints

Sections of the steel casing shall be trimmed, beveled and aligned in the pit so when welded together the thrust of the boring machine will be uniformly transmitted through the casing in a horizontal plane. Welds shall be made to provide solid firm watertight connection without the use of butt straps.

3. Casing Pipe Section Alignment

The casing pipe shall be installed by boring or jacking upgrade from the outlet end. The horizontal and vertical alignments of the casing pipe, when in place, shall not vary from those called for on the plans by more than the following:

ALIGNMENT	ENTRANCE	MIDPOINT	OUTLET
Horizontal	0.02’	0.35’	0.70’
Vertical	0.02’	+0.10’ to -0.05’	+0.20’ to -0.10’

4. Installing Carrier Pipe

Carrier pipe interior and the access pits at each end shall be kept free of water at all times during the insertion and backfilling of the carrier pipe. The carrier pipe shall have casing spacers at approximately seven (7) foot centers and restrained casing spacers installed at all carrier pipe joints with an additional spacer within twelve inches (12”) of each end of the casing pipe.

Once the casing spacers are properly attached to the carrier pipe barrel, the section is ready for insertion. Subsequent sections shall be properly lubricated, gasketed and joined to each other as they are set. The assembled line shall be progressively threaded through the casing by means of applying force at the exposed end of the carrier pipe.

It may be necessary to vary the location and thickness of the casing spacers to obtain a uniform invert grade throughout the carrier pipe. This is especially critical when the alignment and grade for the casing pipe approaches the minimum allowable limits specified.

The casing shall be sealed at both ends with material to prevent the migration of water into the annular space.

5. Bulldog® Restraint System

Bulldog® type restraints are not allowed to be used in cased bore applications. External restraint harnesses and casing spacers as shown in the Standard Drawing for Water Bore Casing shall be used on standard bell and spigot pipe in cased bores.

G. SEPARATION OF WATER MAINS AND SEWERS

1. Horizontal and vertical separation from sewer lines. Minimum horizontal clear separation shall be ten feet (10’) where the invert of the water main is less than one and half feet (1.5’) above the crown of the sewer line. Minimum vertical clear separation shall be one and one half feet (1.5’) at crossings. Joints in sewers at crossings shall be located at least six feet (6’) from water mains. The upper line of a crossing shall be specially supported. Where vertical and/or horizontal clearance cannot be maintained, the sewer or water line shall be placed in a separate conduit pipe or a cement treated fill saddle.

3.02 SETTING VALVES AND VALVE BOXES

A. Resilient Seated Gate Valves shall be set and jointed to the pipe in the manner specified for pipe laying and jointing. Valves shall be set with operating nut vertical. A rubber valve box adaptor shall be installed between the valve bonnet and valve box and shall be centered and plumb over the operating nut such that no shock or stress will be transmitted to the valve.

B. Valve boxes shall be centered and plumb over the operating nut of the valve. Tops of valve boxes shall be set ¼" maximum below street surfacing unless otherwise directed by ENGINEER. The valve box shall be set in concrete collar with dimensions as shown on the applicable Standard Drawing. Valve boxes shall not be installed in the curb and gutter area.

3.03 SERVICE CONNECTIONS

A. GENERAL

1. CONTRACTOR shall provide all work and materials for the complete service line installation, including trench excavation and backfill; making the water main tap; furnishing and installing the corporation stop, curb stop and box or meter pit, service clamp where necessary, and service line with fittings as required to make the connections to the stops. The service line adjacent to the water main shall be bent slightly into a figure "S" to avoid a rigid connection. All services shall have a minimum of five and one half feet (5½') and a maximum of six feet (6') of cover from final grade. See Standard Drawing No. 02665-10.

2. CONTRACTOR shall furnish and install the service pipe from the main to the property line with a curb stop and extension service box installed at the property line.

3. Installation of water service lines shall be in accordance with Standard Drawing No. 02665-10.

4. In the case of extended service lines (one hundred feet (100') in length or greater) and mobile home or enhanced manufactured home subdivisions meter pits shall be installed in-lieu-of curb stops. Installation of meter pits shall be in accordance with Standard Drawing No. 02665-12 through 02665-14.

B. SEPARATIONS

1. The service connection shall be installed such that a minimum horizontal separation from sewer services, measured center to center of ten feet (10') is maintained within the right-of-way or easement. The service connection within private property shall be installed in accordance with the adopted version of the International Plumbing Code.

C. TAPPING

1. Actual tapping of the water mains shall be made by CONTRACTOR unless otherwise specified in the Special Provisions. CONTRACTOR shall be responsible for notifying OWNER and ENGINEER in advance of the time that a tap will be made, and coordinating all activities in this regard with OWNER and ENGINEER.

2. Tapping directly into the barrel of PVC pipe will be done using service clamps.

3.04 VALVE RESTRAINTS

A. All valves to be installed shall be restrained as detailed on Standard Drawing No. 02665-02.

3.05 PIPE JOINTING

A. RUBBER GASKET "PUSH-ON" JOINTS

1. Jointing of pipe and fittings with a rubber gasket "push-on" joint shall be as recommended by the manufacturer. The rubber gasket and gasket seat inside the bell shall be wiped clean with a cloth. A thin film of lubricant, furnished with the pipe, shall be applied to the inside surface of the gasket. The plain end of the adjoining pipe shall be wiped clean and inserted into the bell a sufficient distance to make contact with the gasket. The plain end shall then be forced "home" by the use of a crow bar, fork tool, or jack assembly.

B. MECHANICAL JOINTS

1. The inside of the bell and the outside of the spigot of the mechanical joint fittings shall be brushed thoroughly with a wire brush to remove all other foreign material just prior to assembly. The cleaned surfaces shall be brushed with soapy water just prior to slipping the gasket over the spigot end and into the bell.

2. The spigot end of the pipe or fitting shall be accurately centered in the bell before jointing is begun. After the gasket is in place the gland shall be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Bolts shall be partially tightened alternately around the socket maintaining approximately equal tension until the final tension is reached.

3. The normal range of bolt torques to be applied to the cast iron bolts in the joints shall be as follows:

BOLT SIZE	RANGE OF TORQUE
(inch)	(ft. lb)
5/8	40-60
3/4	60-90
BOLT SIZE	RANGE OF TORQUE
1	70-100
1-1/4	90-120

C. CONNECTIONS TO EXISTING MAINS

1. All connections to water mains in use shall be made by CONTRACTOR unless otherwise provided in the Special Provisions. CONTRACTOR shall furnish all materials as required. He shall make all necessary excavations to assure gradual transition between the new and existing water main, and he shall perform all necessary backfilling.

2. Where the connection of new work to old required interruption of service and notification of customers affected, the superintendent of the utility, ENGINEER and CONTRACTOR shall mutually agree upon a date for connections which will allow ample time to assemble labor and materials, and to notify all customers affected.

D. BULLDOG® RESTRAINT SYSTEM

1. All manufacturer recommendations for installation of the Bulldog® Restraint System shall be followed.

2. Prior to installation of the pipe, all witness marks on the pipe shall be visible to assure over-belling or over-homing of the pipe does not occur. Any pipe joint(s) where witness mark(s) are not visible shall be rejected.

3. Where multiple joints of pipe are assembled prior to installation, external joint harnesses shall be installed on every joint of the assembly, on a temporary basis, to ensure the pipe is not accidentally over-homed prior to installation.

4. Bulldog® type restraints are not allowed to be used in cased bore applications. External restraint harnesses and casing spacers as shown in the Standard Drawing for Water Bore Casing shall be used on standard bell and spigot pipe in cased bores.

3.06 INSTALLATION OF SHALLOW WATERLINES

A. SHALLOW WATER LINES

1. Installation of shallow water lines shall only be permitted as shown by the contract documents.

2. All installation procedures shall be reviewed by the ENGINEER prior to execution of the work.

3. Pipe insulation shall be installed where called for on the plans or required by the ENGINEER. Insulation shall be eight feet (8') wide by four inches (4") thick rigid insulation centered over the pipe. Where shown on the plans or drawings, insulation may be extended vertically on both sides of the pipe.

4. Compact pipe bedding material to top of pipe bell, provide smooth compacted surface for insulation board, center insulation board on pipe, and place four inches (4") to six inches (6") of pipe bedding material over insulation board.

3.07 CATHODIC PROTECTION

A. PVC PIPE AND POLYETHYLENE PIPE FITTING REQUIREMENTS

1. Ductile iron fittings shall be internally and externally fusion bonded epoxy coated (AWWA C 550) and each bolt on the fitting shall have a 6 oz. Mars Company Zinc Cap placed on it

2. All curb boxes shall be installed with eight (8) mil minimum polyethylene encasement.

3. Buried nuts, washers, and bolts shall be either 304 or 316 stainless steel.

B. DUCTILE IRON PIPE REQUIREMENTS

1. The ductile iron pipe shall be installed with eight (8) mil minimum polyethylene encasement. All defects in the polyethylene encasement shall be repaired prior to placement of backfill. Care should be taken during installation of service connections, fittings and backfilling not to tear or damage the encasement.

2. Ductile iron piping and all ductile iron fittings shall be cathodically protected with galvanic anodes. The galvanic anodes shall consist of seventeen-pound (17 lb) magnesium anodes spaced along the pipeline. The anode spacing shall be one

hundred feet (100') for twelve inch (12") and larger pipelines and two hundred feet (200') for pipelines smaller than twelve inches (12"). Anodes shall also be installed at the end of all ductile iron runs, fire hydrants, buried insulators, and at foreign pipeline crossings.

3. Ductile iron fitting shall receive eight (8) mil minimum polyethylene encasement.

4. All ductile iron fittings and joints shall be made electrically continuous by joint bonds, except those joints to be welded, treated or insulated. A minimum of two No. 4 AWG copper insulated bond wires shall be installed on ten inch (10") and larger pipe. A minimum of one No. 4 AWG bond wire shall be provided for eight inch (8") and smaller pipe. The joint bonds shall be cad welded to the pipeline or fitting.

5. All curb boxes shall be installed with 8 mil minimum polyethylene encasement.

6. Buried nuts, washers and bolts shall be either 304 or 316 stainless steel.

C. VALVE REQUIREMENTS

1. Valves shall be internally and externally fusion bonded epoxy coated (AWWA C 550).
2. All curb boxes shall be installed with 8 mil minimum polyethylene encasement.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02665.01X INSTALL X" WATER MAIN

This item shall be measured by the lineal feet of ___ inch (_") water main installed along the centerline of the pipe through all valves, fittings and appurtenance.

2. 02665.02X INSTALL X" END OF LINE PLUG

This item shall be measured by numerical count of _____ inch (_") plugs installed.

3. 02665.03XYZ INSTALL X"xY"xZ" TEE

This item shall be measured by numerical count of _____ inch by _____ inch by _____ inch (_"x_"x_") tees installed.

4. 02665.04XY INSTALL X"xY" CROSS

This item shall be measured by numerical count of ____ inch by ____ inch (X"xY") crosses installed.

5. 02665.05XY INSTALL X"xY" REDUCER

This item shall be measured by numerical count of _____ inch by _____ inch (_"x_") reducers installed.

6. 02665.06X INSTALL X"x11¼ ° ELBOW

This item shall be measured by the numerical count of ___ inch (_") eleven and one-quarter degree (11¼°) elbows installed.

7. 02665.07X INSTALL X"x22½° ELBOW

This item shall be measured by the numerical count of ___ inch (_") twenty-two and one-half degree (22½°) elbows installed.

8. 02665.08X INSTALL X"x45° ELBOW

This item shall be measured by the numerical count of ___ inch (_") forty-five degree (45°) elbows installed.

9. 02665.09X INSTALL X"x90° ELBOW

This item shall be measured by the numerical count of ___ inch (_") ninety degree (90°) elbows installed.

10. 02665.10X INSTALL X" MJ SLEEVE

This item shall be measured by the numerical count of ___ inch (_") MJ Sleeve installed.

11. 02665.11X INSTALL X" GATE VALVE

This item shall be measured by the numerical count of ____ inch (_") gate valves installed.

12. 02665.12X INSTALL X" BUTTERFLY VALVE

This item shall be measured by the numerical count of ____ inch (_") butterfly valves installed.

13. 02665.13X EXTEND & RECONNECT X" WATER SERVICE

This item shall be measured by the numerical count of _____ inch (_") water services reconnected.

14. 02665.14X RECONNECTION OF EXISTING X" WATER SERVICE

This item shall be measured by the numerical count of ___ inch (___) water service reconnected.

15. 02665.15X INSTALL X" WATER SERVICE

This item shall be measured by the lineal feet of _____ inch (__") water service installed.

16. 02665.16 INSTALL TEMPORARY WATER SERVICE

This item will be paid as a lump sum for the temporary water service system installed.

17. 02665.17 INSTALL WATER METER PIT

This item shall be measured by the numerical count of water meter pits installed.

18. 02665.18 CONNECT TO EXISTING WATER MAIN

This item shall be measured by numerical count of connections to existing water mains.

19. 02665.19 INSTALL AIR VACUUM AND AIR RELEASE VALVE

This item shall be measured by numerical count of air vacuum and air release valves installed complete.

20. 02665.20 INSTALL PRESSURE REDUCER VALVE

This item shall be measured by numerical count of pressure reducer valves installed complete.

21. 02665.21 RAISING OR LOWERING WATER LINE

This item shall be measured by the lineal feet of water line raised or lowered. This shall be measured from the point of the beginning of the raising or lowering to the end point of the raising or lowering.

22. 02665.22 INSTALL BASIC WATERLINE ACCESS MANHOLE (5' DEPTH)

This item shall be measured by the numerical count of manholes installed on the Water Line.

23. 02665.23 INSTALL ADDITIONAL WATERLINE ACCESS MANHOLE DEPTH

This item shall be measured by additional vertical feet of Water Line access manhole depth installed to the nearest tenth foot (0.1') and will be calculated by subtracting five feet (5.0') from the total depth measured from the bottom of the concrete lid to the top of the footing.

24. 02665.24 INSTALL TEST STATION

This item shall be measured by numerical count of Water Line Electrical Test Stations installed.

25. 02665.25 CASING PIPE – JACKING OR BORING

This item shall be measured along the pipe centerline of casing pipe installed between the limits designated on the plans or as directed.

26. 02665.26X INSTALL X" WET TAP TRANSMISSION LINE

This item shall be measured by numerical count of _____ inch (X") wet taps to the Transmission Line installed.

27. 02665.27 INSTALL UTILITY MARKER

This item shall be measured by the number of utility markers to be installed as called for on the drawings.

28. 02665.28 INSTALL TEMPORARY WATER SERVICE

This item shall be measured as a lump sum for the temporary water service system installed as indicated on the Drawings.

29. 02665.29X INSTALL X" HORIZONTAL DIRECTIONAL DRILLED WATER MAIN

This item shall be measured by the lineal feet of "X" inch (X") horizontal direction drilled water main along the centerline of pipe through all valves, fittings, and appurtenances.

30. 02665.30X INSTALL REPLACEMENT CURB STOP FOR X" WATER SERVICE

This item shall be measured by the number of replacement curb stops installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02665.01X INSTALL X" WATER MAIN

Payment shall include trench excavation and backfill; furnishing and installing pipe; furnishing and placing native pipe bedding material; furnishing and installing warning tape, tracer wire and cathodic protection if required; cleaning and disinfecting the water main; pressure and leakage testing; and all other work necessary or incidental for completion of the item.

2. 02665.02X INSTALL X" END OF LINE PLUG

Payment shall include furnishing and installing the plug, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

3. 02665.03XYZ INSTALL X"xY"xZ" TEE

Payment shall include furnishing and installing the tee, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction as required; and all other work necessary or incidental for completion of the item.

4. 02665.04XY INSTALL X"xY" CROSS

Payment shall include furnishing and installing the cross, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction as required; and all other work necessary or incidental for completion of the item.

5. 02665.05XY INSTALL X"xY" REDUCER

Payment shall include furnishing and installing the reducer, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction as required; and all other work necessary or incidental for the completion of the item.

6. 02665.06X INSTALL X"x11¼ ° ELBOW

Payment shall include furnishing and installing the elbow, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

7. 02665.07X INSTALL X”x22½° ELBOW

Payment shall include furnishing and installing the elbow, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

8. 02665.08X INSTALL X”x45° ELBOW
Payment shall include furnishing and installing the elbow, thrust blocking; and cathodic protection if required all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

9. 02665.09X INSTALL X”x90° ELBOW

Payment shall include furnishing and installing the elbow, thrust blocking and cathodic protection if required; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

10. 02665.10X INSTALL X” MJ SLEEVE

Payment shall include furnishing and installing the MJ Sleeve and cathodic protection; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

11. 02665.11X INSTALL X” GATE VALVE

Payment shall include furnishing and installing the valve, valve box adaptor, valve box, and thrust restraints; all excavation, backfill and special compaction required; final adjustment of the valve box; concrete collar; all labor and all other work necessary or incidental for completion of the item.

12. 02665.12X INSTALL X” BUTTERFLY VALVE

Payment shall include furnishing and installing the valve, valve box adaptor, valve box, and thrust restraints; all excavation, backfill and special compaction required; final adjustment of the valve box; concrete collar; all labor and all other work necessary or incidental for completion of the item.

13. 02665.13X EXTEND & RECONNECT X” WATER SERVICE

Payment shall include furnishing and installing the water service line and marking tape from the main to the existing water service; tapping the main; furnishing and installing all fittings, corporation stops, locating tape and tapping saddles if required; all trench excavation and backfill, pipe bedding, shoring and dewatering; cleanup and all other work necessary or incidental for completion of the item.

14. 02665.14X RECONNECTION OF EXISTING X” WATER SERVICE

Payment shall include furnishing and installing the water service line from the main to the existing water service; tapping the main; furnishing and installing all fittings, corporation stops, and tapping saddles if required; all trench excavation and backfill, pipe bedding, shoring, and dewatering; cleanup and all other work necessary or incidental for completion of the item.

15. 02665.15X INSTALL X” WATER SERVICE

Payment shall include furnishing and installing the water service line, curb stop if required, corporation stop and tapping saddle; furnishing and installing all required fittings; all trench excavation, backfill, pipe bedding, shoring, and dewatering; cleanup and all other work necessary or incidental for completion of the item.

16. 02665.16 INSTALL TEMPORARY WATER SERVICE

Payment shall include all materials, equipment, tools, testing, labor and other incidentals necessary to install, chlorinate, maintain, and remove the temporary water service system.

17. 02665.17 INSTALL WATER METER PIT

Payment shall include all excavation and backfill, materials, equipment, tools, labor and other incidentals necessary to install the new water meter pit. The OWNER will supply the pit cover, yoke and meter.

18. 02665.18 CONNECT TO EXISTING WATER MAIN

Payment shall include all materials, including the properly sized mechanical joint sleeve, equipment, tools, labor and other incidentals necessary to connect the new fittings to the existing water main.

19. 02665.19 INSTALL AIR VACUUM AND AIR RELEASE VALVE

Payment shall include furnishing and installing the valve, manhole, cover, fittings and drain rock; connecting the air release valve to the water main; all necessary excavation and backfill; and all other work necessary or incidental to complete the item.

20. 02665.20 INSTALL PRESSURE REDUCER VALVE

Payment shall include furnishing and installing the valve, manhole, cover, fittings and drain rock; connecting the air release valve to the water main; all necessary excavation and backfill; and all other work necessary or incidental to complete the item.

21. 02665.21 RAISING OR LOWERING WATER LINE

Payment shall include raising or lowering the water line to clear the item of concern; furnishing and installing pipe; furnishing and installing all elbows, fittings, and restraints; furnishing and installing thrust blocks, gravity blocks, and backfill; and all other work necessary or incidental to complete the item.

22. 02665.22 INSTALL BASIC WATERLINE ACCESS MANHOLE (5' DEPTH)

Payment shall include furnishing and installing all materials for the footings, five feet (5') of wall height, and concrete lid, including reinforcing steel, concrete, and steps; furnishing and installing the HDPE adjusting rings and cast iron ring and cover; curing of concrete; excavation, backfill and special compaction; concrete collar around manhole ring and cover; all tools and labor; and all other work necessary or incidental for completion of the item.

23. 02665.23 INSTALL ADDITIONAL WATERLINE ACCESS MANHOLE DEPTH

Payment shall include furnishing and installing all materials, including reinforcing steel, concrete, and steps; curing of concrete; excavation, backfill and

special compaction; all tools and labor; and all other work necessary or incidental for completion of the item. Payment shall include manhole sections, steps, joint sealer, and all other incidentals to complete this item.

24. 02665.24 INSTALL TEST STATION

Payment shall include furnishing and installing the wire, splices and concrete; installing all materials supplied by the OWNER; all excavation, backfill and special compaction required; all tools and labor; and all other work necessary or incidental for completion of the item.

25. 02665.25 CASING PIPE – JACKING OR BORING

Payment shall include furnishing and installing the casing pipe, carrier pipe, excavation, pit sheeting and shoring, dewatering, pressure grouting, skids, anchoring carrier pipe, installing end seals, cathodic protection, backfill, disposal of surplus materials; and all other work necessary or incidental for the completion of the item.

26. 02665.26X INSTALL X" WET TAP TRANSMISSION LINE

Payment shall include furnishing and installing the collar, service outlet, coal tar coating, tapping valve, valve box, anchor rods, stainless steel strapping, and thrust blocking; all excavation, backfill and special compaction required; all tools and labor; and all other work including welding, and recoating of the mortar lining, necessary or incidental for completion of the item.

27. 02665.27 INSTALL UTILITY MARKER

Payment shall include all utility marker, materials, excavation, backfill, equipment, labor, tools, and incidentals to complete the item.

28. 02665.28 INSTALL TEMPORARY WATER SERVICE

Payment shall include all materials, equipment, tools, testing, labor and other incidentals necessary to install, chlorinate, maintain, and remove the temporary water service system as indicated on the drawings.

29. 02665.29X INSTALL X" HORIZONTAL DIRECTIONAL DRILLED WATER MAIN

Payment shall include drilling, excavation and backfill of pits, furnishing and installing pipe; special materials required for connection to new PVC pipe; furnishing and installing locating tape, tracer wire and cathodic protection if required; cleaning and disinfecting the water main; pressure and leakage testing; and all other work necessary or incidental for completion of the item.

30. 02665.30X INSTALL REPLACEMENT CURB STOP FOR X" WATER SERVICE

Payment shall include furnishing and installing replacement curb stop, making connection to the existing water service, all excavation, backfill and special compaction required; all labor and all other work necessary or incidental for completion of the item.

SECTION 02670

HYDROSTATIC TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of testing of water main, sanitary sewer force mains and related appurtenances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 HYDROSTATIC TESTING OF PRESSURE PIPE AND FITTINGS

A. RESPONSIBILITY FOR MATERIAL

1. The CONTRACTOR shall provide measurement gauges and recording devices for the test, including pump, pipe, connections and necessary assistance to conduct the test.
2. Before testing, the CONTRACTOR shall place sufficient backfill to prevent pipe movement. The CONTRACTOR shall ensure thrust-blocking or other types of restraining systems will provide adequate restraint before pressurizing the pipeline.

B. PVC, GRAY AND DUCTILE CAST IRON PIPE

1. PRESSURE TEST

After the pipe has been laid, all newly laid pipe or any valved section hereof shall be subjected to a hydrostatic pressure not less than one and a half (1.5) times the stated sustained working pressure at the lowest elevation of the test section or a minimum of one hundred twenty-five (125) psi, whichever is greater. Hydrostatic testing shall include all service line connections from the point of connection to the curb stop.

a. Test Pressure Restrictions – Test Pressure shall:

1) Not be less than one and one-half (1.5) times the working pressure at the lowest point along the test section and at least one hundred twenty-five (125) psi.

2) Not exceed pipe or thrust restraint of manufacturer's maximum design pressures.

3) Be of at least two-hour duration.

4) Not vary by more than five (5) psi (34.5 kPa)

5) Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.

6) Not exceed the rated pressure of the valves if resilient-seated butterfly valves are used.

b. Pressurization

1) Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the OWNER.

c. Air Removal

1) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the CONTRACTOR shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the OWNER.

d. Examination

1) All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the OWNER.

2. LEAKAGE TEST: A leakage test must be conducted concurrently with the pressure test.

a. Leakage Defined

1) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi (34.5 kPa) of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

b. Allowable Leakage

1) No pipe installation will be accepted if the leakage is greater than that determined by the following AWWA -C605 formula:

$$Q = \frac{\mathrm{LD}\sqrt{\mathrm{P}}}{148{,}000}$$

Where:
Q = quantity of makeup water, in gallons per hour
L = length of pipe section being tested, in ft.
D = nominal diameter of the pipe, in in.
P = average test pressure during the hydrostatic test, in psi

2) Additional provisions pertaining to closed, metal-seated valves per AWWA C-600 may be included at the ENGINEER's discretion.

C. WITNESS OF TESTING

All pressure and leakage tests shall be witnessed by the ENGINEER. The OWNER's representative shall also be notified a minimum of forty-eight (48) hours prior to the testing in case they would elect to also witness these tests.

PART 4 METHOD OF MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices for the various contract items and no additional compensation will be allowed therefore.

SECTION 02675

DISINFECTION

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of essential procedures for disinfecting new and repaired water mains. The testing requirements of this section are the responsibility of the Contractor, and all tests shall achieve passing status prior to placing the water system into use.

1.02 REFERENCES

A. AWWA C-651: Disinfecting Water Mains

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DISINFECTING WATER MAINS

A. BASIC PROCEDURE: This basic procedure comprises:

1. Preventing contaminating materials from entering the water mains during construction or repair and removing by flushing materials that may have entered the water main.

2. Disinfecting any residual contamination that may remain.

3. Determining the bacteriologic quality by laboratory test after disinfection.

4. Reporting of all test results to the ENGINEER, and recording of all test results by the ENGINEER.

B. Supplementary Information to be supplied by ENGINEER. When the disinfection of water mains is to be done under a separate contract or as part of contract for installing the mains, the ENGINEER shall provide the following items of specific information in his supplementary specifications:

1. Standard of reference; that is—AWWA C-651.

2. Standard of reference: that is – NSF/ANSI Standard 61

3. Places where flushing may be done, rates of flushing, and locations of drainage facilities (Item D, PRELIMINARY FLUSHING, and Table 2).

4. Form of chlorine to be used (Item E, FORM OF CHLORINE FOR DISINFECTION) and method of application (Item F, METHODS OF CHLORINE APPLICATION).

5. The number and frequency of samples for bacteriologic tests (Item H, BACTERIOLOGIC TESTS).

6. Method of taking samples (Item H, BACTERIOLOGIC TESTS, Paragraph (2)).

7. Disposal of chlorinated water shall meet requirements of the Water Quality Division of Wyoming Department of Environmental Quality.

8. City Water Division representative shall be present during Disinfection/Dechlorination filling and flushing procedures.

C. PREVENTIVE MEASURES DURING CONSTRUCTION

1. KEEPING PIPE CLEAN AND DRY

a. Precautions shall be taken to protect pipe interior, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipelaying is not in progress, as, for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipes in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

Note: Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipelaying, the less the delay.

b. If dirt that, in the opinion of the OWNER's engineer or job superintendent, will not be removed by the flushing operation (Item D, PRELIMINARY FLUSHING) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five percent (5%) hypochlorite disinfecting solution.

2. PACKING MATERIAL AND JOINTS

a. No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination.

b. Yarning or packing material for cast iron pipe shall consist of molded or tubular rubber rings, or treated paper. Materials such as jute or hemp shall not be used.

c. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

3. PRELIMINARY FLUSHING:

The main shall be flushed prior to disinfection, except when the tablet method is used (Item F, METHODS OF CHLORINE APPLICATION, Paragraph (3)). The sites and velocities of flushing shall be as specified in the supplemental specifications.

Note 1: The flushing velocity shall not be less than 2.5 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in Table 2. No site for flushing should be chosen unless it has been determined that drainage is adequate at that site.

Note 2: Flushing is no substitute for preventive measures taken before and during pipelaying (Item C, PREVENTIVE MEASURES DURING CONSTRUCTION). Certain contaminants, especially in caked deposits, resist flushing at any velocity. Furthermore, with diameters of 16 inches

or more, even the minimum flushing velocity of 2.5 ft/sec is sometimes difficult to achieve.

TABLE 2
Required Openings to Flush Pipelines* (40 psi Residual Pressure)

Pipe Size in	Pipe Size mm	Flow required to produce 2.5 fps (0.76 m/sec) gpm	Flow required to produce 2.5 fps (0.76 m/sec) (liters/minute)	Orifice Size in	Orifice Size mm	Hydrant Outlet Number	Hydrant Outlet Size in	Hydrant Outlet Size mm
				Hydrant Outlet Nozzles				
4	100	100	378.5	15/16	23.8	1	2-½	64
6	150	220	832.7	1-3/8	35.0	1	2-½	64
8	200	390	1476.2	1-7/8	47.5	1	2-½	64
10	250	610	2308.9	2-5/16	58.7	1	2-½	64
12	300	880	3330.8	2-13/16	71.4	1	2-½	64
14	350	1,200	4542.0	3-1/4	82.5	2	2-½	64
16	400	1,565	5923.5	3-5/8	92.0	2	2-½	64
18	450	1,980	7494.3	4-3/16	106.4	2	2-½	64

*With 40 psi (276 kPa) residual pressure, a 2-1/2" (64 mm) hydrant outlet nozzle will discharge approximately 1,000 gpm and a 4-1/2" (114 mm) hydrant nozzle will discharge approximately 2,500 gpm.

4. FORM OF CHLORINE FOR DISINFECTION

The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite tablets.

a. Liquid Chlorine: Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of the element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine gas directly from the supply cylinder is unsafe and shall not be permitted.

Note: The preferred equipment consists of a solution feed chlorinator in combination with a booster pump for injecting the chlorine-gas water mixture into the main to be disinfected. Direct feed chlorinators are not recommended because their use is limited to situations where the water pressure is lower than the chlorine cylinder pressure.

b. Hypochlorites

1) Calcium Hypochlorite

i. Calcium hypochlorite contains sixty-five (65) PERCENT available chlorine by weight.

ii. A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

2) Sodium Hypochlorite

i. Sodium hypochlorite is supplied in strengths from 5.25 to 16 percent available chlorine. It is packaged in liquid form in glass, rubber, or plastic containers ranging in size from one-

quart (1 qt) bottles to five-gallon (5 gal) carboys. It may also be purchased in bulk for delivery by tank truck.

ii. The chlorine-water solution is prepared by adding hypochlorite to water. Product deterioration must be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.

3) Application

i. The hypochlorite solutions shall be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

5. Methods of Chlorine Application

a. Continuous Feed Method

1) This method is suitable for general application.

i. Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The (2) two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 6.67 oz/1000 gal (50 mg/l) available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals. Note: In the absence of a meter, the rate may be determined either by placing a pitot gage at the discharge or by measuring the time to fill a container of known volume.

ii. Table 3 below gives the amount of chlorine residual required for each one hundred foot (100 ft) of pipe of various diameters. Solutions of one percent (1%) chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately one pound (1 lb) of calcium hypochlorite in eight and one-half gallons (8.5 gal) of water.

2) During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this twenty-four-hour (24) period, the treated water shall contain no less than 10 mg/l chlorine throughout the length of the main.

TABLE 3
Chlorine required to produce 50mg/l concentration
In 100 feet of pipe – by diameter

Pipe Size		100 percent Chlorine		1 percent Chlorine Solutions	
in.	mm.	lb.	kg.	gallons	liters
4	100	0.027	0.012	0.33	1.25
6	150	0.061	0.028	0.73	2.76
8	200	0.108	0.049	1.30	4.92
10	250	1.170	0.077	2.04	7.72
12	300	0.240	0.109	2.88	10.90

b. Slug Method

This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

1) Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (Item F, METHODS OF CHLORINE APPLICATION, Paragraph (1), Note) into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two (2) rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/l for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.

2) As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

c. Tablet Method

Tablet disinfection is a requirement for a short extensions (up to five hundred feet (500')) and smaller diameter mains (up to twelve inches (12")). Because the preliminary flushing step must be eliminated, this method shall be used only when scrupulous cleanliness has been exercised. It shall not be used if trench water or foreign material has entered the main or if the water is below forty-one degrees Fahrenheit (41°F).

1) Placement of Tablets

i. Tablets are placed in each section of pipe and also in hydrants, hydrant braches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position should be marked on the section to assure that there will be no rotation. In placing tablets in joints, they are either crushed and placed on the inside annular space, or, if the type of assembly does not permit, they are rubbed like chalk on the butt ends of the sections to coat them with calcium hypochlorite.

ii. The adhesive shall meet NSF/ANSI Standard 61, AWWA Standard C-651, or other food grade alternative only as approved by the ENGINEER. There shall be no adhesive on the tablet except on the broad side next to the surface to which the tablet is attached.

2) Filling the Contact

i. When installation has been completed, the main shall be filled with water at a velocity of less than one-foot/second. This water shall remain in the pipe for at least twenty-four (24) hours.

ii. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

iii. A City Water Division representative shall be present during Disinfection/Dechlorination filling and flushing procedures.

TABLE 4
Number of Hypochlorite tablets of 5-G
required for dose of 50 mg/l*

Length of section		Diameter of pipe in inches and (millimeters)					
feet	meters	2 (50)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)
13 or less	4 m or less	1	1	2	2	3	5
18	5.5	1	1	2	3	5	6
20	6.0	1	1	2	3	5	7
30	9.2	1	2	3	5	7	10
40	12.5	1	2	4	6	9	14

*Based on 3-3/4 g available chlorine per tablet.

6. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than one mg/l. Points of discharge of heavily chlorinated water shall be permitted by the Contractor through the Wyoming Department of Environmental Quality. The chlorinated water shall be dechlorinated prior to discharge. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline. All testing requirements are the responsibility of the Contractor. All circumstances causing failing tests shall be corrected, and retesting shall occur until passing tests are achieved. Contractor must provide Engineer with all passing test results prior to placing the water system into service. A City Water Division representative shall be present during Disinfection/Dechlorination filling and flushing procedures.

7. Bacteriologic Tests

a. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one (1) sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies, at least two (2) samples shall be collected at least twenty-four (24) hours apart.

Note: In the case of extremely long mains, it is desirable that samples be collected the length of the line as well as at its end.

b. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulfate. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

c. Repetition of Procedure: If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

d. Procedure after Cutting into or Repairing Existing Mains: The procedures outlined in this section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1) Trench "Treatment": When an old line is opened, either by accident or by design, the excavation will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2) Main Disinfection

i. Swabbing and Flushing

The following procedure is considered as a minimum that may be used.

ii. Swabbing with Hypochlorite Solution: The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a five percent (5%) hypochlorite solution before they are installed.

iii. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

iv. Slug Method: Where practicable, in addition to the procedures of Paragraph (b), SWABBING WITH HYPOCHLORITE SOLUTION, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Item F, METHODS OF CHLORINE APPLICATION, Paragraph (2), SLUG METHOD, except that the dose may be increased to as much as 500 mg/l, and the contact time reduced to as little as one-half hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

3) Sampling: Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 02700

SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of construction of sanitary sewer mains, including manholes, service lines, and other appurtenant structures, complete.

1.02 REFERENCES

A. Where the reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision at the times of call for bids, except as noted on the Drawings or in the Special Provisions.

1.03 QUALITY ASSURANCE

A. Sewer pipe and fittings furnished under this contract shall be as called out in the Contract Documents. Wye or tee branches shall be of the same material and design as the sewer pipe used. Pipe strength classifications shall be as listed in the Contract Documents.

B. When required by ENGINEER, CONTRACTOR shall furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe and fittings comply with the applicable specifications. Required certification shall accompany each delivery of material.

C. All pipe shall be clearly marked with type, class and/or, thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

D. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall be as specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. SEWER MAINS

1. POLYVINYL CHLORIDE (PVC) PIPE

a. PVC Sewer Pipe shall be produced by a continuous extrusion process, employing a prime grade of unplasticized polyvinyl chloride. The grade used shall be highly resistant to hydrogen sulfide, sulfuric acid, gasoline, oil, detergents and other chemicals commonly found in sewage and industrial wastes. The material shall conform to the requirements of ASTM D 1784, “Rigid Polyvinyl Chloride Compounds”. The pipe shall have self-extinguishing flammability characteristics.

b. Pipe and fittings shall conform to ASTM D 3034, “Standard Specification for Polyvinyl Chloride Sewer Pipe and Fittings”, or ASTM F 679 for sizes over fifteen (15) inches in diameter. PVC pipe shall have a minimum Standard Dimension Ratio (SDR) of 35.

c. Nominal laying lengths shall be not less than twelve and a half (12.5) feet, except shorter lengths may be used adjacent to manholes or other appurtenances. Each length of pipe shall be marked with size, SDR, "Sewer Pipe" and Code Number.

d. Pipe Jointing

1. Each length of pipe shall be provided with a bell designed so that a watertight joint will be obtained when jointing the bell and spigot with a rubber ring.

2. The rubber gasket joint for PVC pipe and fittings shall consist of rubber gasket, which is compressed between the outer surface of the spigot and the inner surface of a retaining groove in the bell. The joint shall be completely sealed by the gasket so that the assembly will remain watertight under all conditions of service, including movements resulting from expansion, contraction, settlement and deformation of the pipe. The rubber ring joint assembly shall be made in strict accordance with the manufacturer's recommendations.

e. Wye or tee fittings for connecting service line shall be of the same material, construction and joint design as the main sewer pipe.

2. Polyvinyl Chloride (PVC) Horizontal Directional Drilling Pipe

a. The pipe material to be used shall meet AWWA C 900 standards for Polyvinyl Chloride pressure pipe and fittings with a dimension ratio DR 18. All other pipe shall have a written approval of the ENGINEER and meet all submittal review as an optional approved product.

b. Pipe and fittings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D 1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4° F, in accordance with the requirements of ASTM D 2837.

c. All pipe shall be joined with gasketed restrained joints according to manufacturer's specifications.

d. CONTRACTOR shall adhere to the pipe manufacturer's most current calculation regarding tensile load limitations for trenchless application.

3. CONCRETE PIPE

a. Concrete sewer pipe shall conform to ASTM C 14 and/or ASTM C 76, except as noted hereafter. Strength classifications for C 14 and/or C 76 specification pipe shall be as listed in the Contract Documents. Concrete pipe shall not be used unless specifically listed in the Contract Documents.

b. The maximum absorption allowed shall be eight percent (8%), as stated in the above ASTM Specification. For pipe sizes smaller than twelve inches (12") in diameter the proportion of Portland Cement in the concrete mixture shall not be less than six and one-half (6.5) U.S. standard bags (94 pounds) per cubic yard of concrete, and the water cement ratio shall not exceed 0.53.

c. The referenced ASTM specifications list permissible variations in pipe dimensions. They shall be strictly adhered to, and the uniformity of

barrel thickness shall be such that a constant flow area without projections exists across joints.

d. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe.

e. Joints for concrete pipe shall be made using flexible watertight, rubber-type gaskets conforming to ASTM C-443.

f. The pipe supplier shall furnish ENGINEER with certified test results from an independent testing laboratory on the following: (1) crushing strength using 3-edge bearing method, (2) absorption, and (3) hydrostatic performances Test results shall be furnished for each pipe size supplied for this project and the number of tests performed shall be in accordance with ASTM C 14 and/or ASTM C 76, or a minimum of two percent (2%) of the number of pipe supplied, whichever is greater. Cost of these tests shall be borne by the pipe supplier and/or CONTRACTOR.

4. POLYETHYLENE (PE) GRAVITY SANITARY SEWER PIPE

a. Material used for the manufacture of polyethylene pipe and fitting shall be PE 3408 high density polyethylene meeting cell classification 345464C for color and stripes per ASTM D 3350; and shall be listed in the name of the pipe and fitting manufacturer in PPI (Plastic Pipe Institute) TR-4 with a standard grade HDB rating of one thousand six hundred (1600) psi at seventy-three degrees Fahrenheit (73°F).

b. Polyethylene pipe shall be manufactured in accordance with ASTM F 714 and shall have a minimum DR rating of 21.

c. All pipe shall be suitable for use as a gravity sewer conduit. Pipe shall have three (3) equally spaced pairs of longitudinal green color stripes or have the pipe specification in green colored text co-extruded into the pipe outside surface or have the pipe specification text in green color printed on the outside of the pipe surface.

B. FORCE MAINS

1. POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

a. PVC pipe for sanitary sewer force mains twelve inches (12”) or smaller shall meet the requirements of AWWA C900, “Polyvinyl Chloride Pressure Pipe”, made to ductile iron O.D.’s for “Push-On” joints. Pipe joints shall be with an elastomeric gasket or joint. Pipe shall be DR-18 pressure class 150.

2. POLYETHYLENE PRESSURE PIPE

a. Black Polyethylene material used for the manufacture of polyethylene pipe and fittings shall be PE 3408 high density polyethylene meeting ASTM D 3550 cell classification 345464C and the name of the pipe and fitting manufacturer shall be listed in PPI (Plastic Pipe Institute) TR-4 with a standards grade HDB rating of one thousand six hundred (1600) psi at seventy-three degrees Fahrenheit (73ºF). The material shall be listed and approved for potable water in accordance with National Sanitation Foundation (NSF) Standard 61.

b. HDPE pipe shall be manufactured to the requirements of ASTM F 714 and AWWA C906. Pipe shall be DR-11 pressure class 160.

c. HDPE pipe shall have three (3) equally spaced pairs of longitudinal green color stripes or the pipe specification in green text co-extruded into the pipe outside surface or the pipe specification printed in green text on the outside surface of the pipe.

C. SEPARATION CASING PIPE

1. Pipe used to case waterline crossings shall be DR-26 PVC water pipe or SDR-35 PVC sewer pipe with a minimum diameter of 1.25 times the outside diameter of the carrier pipe.

2. Acceptance of the pipe at point of delivery will not relieve CONTRACTOR of full responsibility for any defects in material or workmanship of the completed pipeline.

3. Casing pipe shall be sealed to prevent the entry or exiting of water to or from the carrier pipe.

D. STEEL CASING FOR BORES

1. Welded steel casing pipe shall meet the requirements of ASTM A 53 Grade B and shall have an inside diameter of a minimum of twelve inches (12") greater than the outside diameter of the bell joint of the carrier pipe to be installed therein or be sized in accordance with the casing spacer manufacturers minimum sizing requirements. Casing pipe that is bored shall have thirty-two pound (32 lb) anode bags cad welded to each end. The minimum wall thickness of the tubing shall be:

Wall Thickness	Casing O.D.
3/8"	30" and smaller
½"	33"- 42"

E. JACKING PIPE

1. Reinforced concrete pipe of the class specified in ASTM C 76, ASTM C 361, and ASTM C655 and having Rubber and Steel Type R-2 joints. Joint bearing plates and longitudinal steel bars, to properly transmit the jacking thrust, shall be cast in place when specified in the special conditions.

F. CASING SPACERS

1. Casing spacers for carrier pipe shall be Ford Uni-flange or Engineer approved equal installed at a maximum center to center spacing of seven (7) feet along the carrier pipe with additional spacer placed within twelve (12) inches of each end of the casing pipe. The casing spacer shall be restrained at all carrier pipe joints.

G. END SEALS FOR CASING PIPE

1. The end seal shall be 1/8" thick synthetic rubber wrap around water tight with stainless steel bands installed on the casing pipe after carrier pipe insertion. End seal shall be APS Model AW Wrap Around End Seal as manufactured by Advance Products and Systems, Inc. Lafayette, LA or Engineer approved equal.

H. MANHOLES

1. Manholes shall be constructed of precast concrete rings with frames and covers and steps in accordance with details shown on Standard Drawings No. 02700-01 through 02700-05.

2. All manholes shall be designed to withstand AASHTO HS-20 (MSI18) loading.

3. All connections between manhole wall sections shall be joined with "Kent Seal" manufactured by K.T. Snyder Company, "Con Seal" or Engineer approved equal, or rubber "O" rings in such a manner to make the manhole watertight.

I. RINGS AND COVERS

1. Rings and covers shall be in accordance with OWNER's Standards. Covers shall be nonventilated, self-sealing, recessed lug lid design, D&L Foundry A-1161 (self-seal) with closed pick hole or Engineer approved equal type unless otherwise noted in the Special Provisions.

2. Rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer approved equal type unless otherwise noted in the Special Provisions.

J. ADJUSTING RINGS

1. Adjusting rings may be used for adjusting the manhole top elevation to coincide with existing ground surface elevations, however, the total combined height of the manhole ring and adjusting rings used per manhole shall not exceed sixteen inches (16").

2. High Density Polyethylene (HDPE) ring for manholes shall be used and shall conform to ASTM D 1248.

K. STEPS

1. When required, noncorrosive steps of rubber encased steel, aluminum, or nylon shall be used. Steps shall withstand vertical loads of four hundred pounds (400 lb) and pullout resistance of one thousand pounds (1,000 lb). The maximum distance from the surface to the first step shall be no greater than thirty inch (30") and each set below this first step shall be spaced a minimum of twelve inches (12") to a maximum of sixteen inches (16").

L. CONCRETE BASE

1. Concrete bases shall be precast or poured in the field on undisturbed earth. Concrete shall conform to Section 03304, PORTLAND CEMENT CONCRETE.

M. GRAVITY SEWER SERVICE MATERIALS

1. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall comply with the requirement identified in this section Paragraph 201.A Sewer Mains.

N. WARNING TAPE

1. Warning tape shall be at least three inches (3") in width and shall have a minimum overall thickness of five (5) mils. Tape shall be impervious to all known alkalis chemical reagents, and solvents found in the soil. Color-coding shall be in conformance with the APWA/ULC Color Code. Warning tape shall have a maximum imprint length of thirty-six inches (36").

O. TRACER WIRE

1. Tracer wire shall be a minimum of No. 10 AWG insulated copper wire with stranded conductor. Insulation shall be green in color.

P. UTILITY MARKERS

1. Utility markers shall be Carsonite® Utility Markers or Engineer approved equal. The markers shall be made of a green composite material and be three and three-quarter inches (3.75”) wide and sixty-six inches (66”) long. The Utility Marker shall be designed in accordance with Standard Drawing 01015-01.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. RESPONSIBILITY FOR MATERIAL

1. CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the warranty period.

2. CONTRACTOR shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

B. HANDLING OF PIPE

1. All pipe furnished by CONTRACTOR shall be delivered and distributed at the site by CONTRACTOR. Pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

2. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

3. Pipe shall be handled so that no coating or lining will be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by CONTRACTOR at his expense in a manner satisfactory to ENGINEER.

C. LAYING PIPE

1. All pipes shall be laid and maintained to the required lines and grades with fittings, wyes or tees and manholes at the required locations.

2. CONTRACTOR shall use good workmanship. All pipe shall be properly jointed home, using wood cushion and protective devices in accordance with manufacturer’s recommendations.

3. Proper tools and equipment satisfactory to ENGINEER shall be used by CONTRACTOR for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

4. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a plug or other means approved by ENGINEER.

CONTRACTOR shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction.

5. The bottom of the trench shall be shaped to fit the bottom quadrant of the pipe, with holes for couplings just large enough to permit their assembly.

D. BORING, JACKING AND THREADING OF CARRIER PIPE

1. Pit Excavation

Pits shall be excavated such that timber blocking can be installed to give an unyielding backing for the hydraulic boring machine or jacks and to prevent sloughing of the header face. Subgrade on which rails or guides are to be set shall be stabilized with washed rock where soft and springy ground is encountered.

Excavation and casing installation shall be performed simultaneously. At no time shall advancing edge of the casing trail the excavation by more than twelve (12) inches.

2. Casing Pipe Joints

Sections of the steel casing shall be trimmed, beveled and aligned in the pit so when welded together the thrust of the boring machine will be uniformly transmitted through the casing in a horizontal plane. Welds shall be made to provide solid firm watertight connection without the use of butt straps.

3. Casing Pipe Section Alignment

The casing pipe shall be installed by boring or jacking. The horizontal and vertical alignments of the casing pipe, when in place, shall not vary from those called for on the plans by more than the following:

ALIGNMENT	ENTRANCE	OUTLET
Horizontal	0.02’	0.70’
Vertical	0.02’	+0.20’ to –0.10’

4. Grouting Casing Pipe

When excavation exceeds the advancing edge of the casing pipe such that voids are created along or above the casing, external pressure grouting of the casing pipe will be required.

Grouting shall be accomplished by pumping at between five (5) and ten (10) lbs. Per square inch pressure, equal parts of Portland Cement and mortar sand mixed with sufficient water to provide slump of less than two inches (2”) through grout holes in the casing until all voids are filled. Grouted holes (1”-2” in. diameter) shall be provided or drilled in the casing on four foot (4’) centers along the pipe arch and on eight foot (8’) centers along each spring line. As grouting advances each of the completed grout holes shall be plugged to a watertight condition.

5. Installing Carrier Pipe

Carrier pipe interior and the access pits at each end shall be kept free of water at all times during the insertion and backfilling of the carrier pipe. The carrier pipe shall have casing spacers at approximately seven foot (7’) centers and restrained casing spacers installed at all carrier pipe joints with an additional spacer within twelve inches (12”) of each end of the casing pipe.

Once the casing spacers are properly attached to the carrier pipe barrel, the section is ready for insertion. Subsequent sections shall be properly lubricated, gasketed and joined to each other as they are set. The assembled line shall be progressively threaded through the casing by means of applying force at the exposed end of the carrier pipe.

It may be necessary to vary the location and thickness of the casing spacers to obtain a uniform invert grade throughout the carrier pipe. This is especially critical when the alignment and grade for the casing pipe approaches the minimum allowable limits specified.

The casing shall be sealed at both ends with material to prevent the migration of water into the annular space.

E. JOINTS

1. The spigot and bell ends of the pipe and couplings shall be thoroughly cleaned before joint assembly. Jointing of the pipe shall be in strict accordance with the recommendation of the manufacturer of the pipe and fittings.

2. BULLDOG® RESTRAINT SYSTEM

All manufacturer recommendations for installation of the Bulldog® Restraint System shall be followed.

Prior to installation of the pipe, all witness marks on the pipe shall be visible to assure over-belling or over-homing of the pipe does not occur. Any pipe joint(s) where witness mark(s) are not visible shall be rejected.

Where multiple joints of pipe are assembled prior to installation, external joint harnesses shall be installed on every joint of the assembly, on a temporary basis, to ensure the pipe is not accidentally over-homed prior to installation.

Bulldog® type restraints are not allowed to be used in cased bore applications. External restraint harnesses and casing spacers as shown in the Standard Drawing for Sewer Bore Casing shall be used on standard bell and spigot pipe in cased bores.

F. TOLERANCES

1. The sewer shall be installed within ±1” for grade and shall not be off more than ± 2” for alignment. ENGINEER shall specify joint deflection tolerance where acceptable.

G. SEPARATION OF WATER INSTALLATION

1. Horizontal and vertical separation from sewer lines. Minimum horizontal clear separation shall be ten feet (10’) where the invert of the water main is less than one and one half feet (1.5’) above the crown of the sewer line. Minimum vertical clear separation shall be one and one half feet (1.5’) at crossings. Joints in sewers at crossings shall be located at least six feet (6’) from water mains. The upper line of a crossing shall be specially supported. Where vertical and/or horizontal clearance cannot be maintained, the sewer or water line shall be placed in a separate conduit pipe or a cement treated fill saddle.

H. WARNING TAPE

1. Warning tape shall be buried twenty-four inches (24”) above the sewer pipe unless specified otherwise.

I. TRACER WIRE

1. Tracer wire shall be installed on all force mains and pressure sewers. The wire shall be located on top of the pipe as shown on the plans. The tracer wire shall be insulated and brought to the surface and terminated in a flush mounted test station box at five hundred foot (500') intervals. Tracer wire shall be attached to the top of the pipe by tape or plastic nylon ties as required to keep wire in place during backfilling.

3.02 MANHOLE INSTALLATION

A. Manholes shall be constructed to the general dimensions shown. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base or may be half-pipe laid in concrete. Inverts shall provide a minimum of one tenth foot (0.1') drop in a straight through manhole or a manhole angled at ninety degrees (90°) to two hundred and seventy degrees (270°); and two tenths foot (0.2') drop in manholes angled less than ninety degrees (90°) or greater than two hundred and seventy degrees (270°). The floor of the manhole outside the channel shall be smooth and shall slope toward the channel not less than one inch (1") per foot, nor more than two inches (2") per foot. Pipe crown elevations shall match when the upstream line is smaller in diameter than the downstream sewer line. All lifting holes must be grouted. Where HDPE adjusting rings are used, ramneck joint sealant shall be provided between the top HDPE adjusting ring and the cast iron ring as well as between the bottom HDPE adjusting ring and the concrete manhole.

B. Free drop inside the manhole shall not exceed two feet (2') measured from the invert of the inlet pipe to the invert of the outlet pipe. Where the drop exceeds two feet (2'), drop manholes shall be constructed as shown on the typical manhole detail.

C. All connections between wall sections shall be joined with "Kent Seal" manufactured by K.T. Snyder Company, "Con Seal" or Engineer approved equal, or rubber "O" rings in such a manner to make the manhole watertight.

D. Manhole construction shall not be greater than one manhole distance behind sewer line construction unless otherwise approved by ENGINEER.

E. Pipe to manhole connections shall be resilient connectors which satisfy ASTM C 923 such as PSX Boot by Press-Seal Gasket or Alok Gasket by Alok Products, Inc. or equal. The annular space around the pipe shall be grouted inside the manhole.

F. All manholes located outside of a roadway shall be marked with a Utility Marker.

3.03 SERVICE LINE INSTALLATION

A. GENERAL

1. Service lines shall be constructed in accordance with the appropriate Standard Drawing. The service lines shall be installed to the property line. The end of the service line shall be plugged with an approved stopper or plug. Grouting of plugs will not be permitted.

2. Wye or tee fittings shall be installed in the mainline sewer for connection of sewer lines. Wye or tee fittings shall be of the same material and design and of the same specifications of the sewer main pipe. Jointing of service pipe to wye or tee

branches of main line pipe other than PVC shall be accomplished with special joint adapters manufactured specifically for jointing the two different types of pipe.

B. CROSSING

1. NORMAL CONDITIONS – Sanitary sewer service lines crossing water mains shall be laid to cross beneath the water line and provide a vertical clear separation of at least eighteen inches (18") whenever possible. The distance shall be measured from the top of the sewer service to the bottom of the water main.

2. UNUSUAL CONDITIONS – When local conditions prevent a vertical clear separation of at least eighteen inches (18") as noted above, the sanitary sewer service line shall be placed in a separate casing pipe or cement treated fill saddle. The casing pipe shall extend a minimum of six feet (6') each side of center of the crossing.

C. EXTENDING SEWER SERVICES INTO PRIVATE PROPERTY

1. Unless otherwise provided by local sewer ordinances, the property owners will be permitted to extend sewer services onto their property and connect fixtures thereto, as soon as the main sewer construction has progressed past the point of side sewer construction and leakage tests have been satisfactorily completed, provided the use of the connections will not interfere with the completion of the other parts of the contract work and provided the extension is approved by ENGINEER. Such sewer service connections shall be allowed only after final inspection and acceptance of main sewer.

D. END PIPE MARKER

The end of newly installed sewer service lines shall be marked by the CONTRACTOR at the property line by a post buried in the ground to the invert of the service line. A minimum of two feet (2') of the marker post shall be located above ground.

3.04 TESTING

A. LIGHT TEST

After the trench had been backfilled and compacted as specified in Section 02225, TRENCH BACKFILL, a light test shall be made between manholes to check alignment and grade for displacement of pipe. The completed pipeline shall be such that a true circle of light can be seen from one manhole to the next. If alignment or grade is other than specified and displacement of pipe is found, CONTRACTOR shall remedy such defects at his own expense.

B. VIDEO INSPECTION

1. The OWNER may at his option require any sanitary sewer, to be inspected by the use of a video camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the OWNER unless otherwise noted.

3. 2. CONTRACTOR shall bear all costs incurred in correcting any deficiencies found during video inspection including the cost of any additional television inspection that may be required by the OWNER to verify the correction of said deficiency. CONTRACTOR shall be responsible for all costs in any video inspection performed solely for the benefit of CONTRACTOR.

C. LEAKAGE TEST

1. New sewer line will not be finally accepted until leakage tests have been made to assure ENGINEER that pipe laying and jointing are satisfactory.

    a. Water Test

        1) When groundwater is a minimum of two (2) feet above the sewer line, tests shall be made by sealing off the section of lines between manholes and measuring the infiltration by collecting or pumping the discharge into barrels or other approved methods. Tests shall be continued over a period of at least four (4) hours for each section tested. Sufficient time shall be allowed to soak lines and manholes in advance of performing tests.

        2) When groundwater is not above the pipe, testing shall be as follows:

            a) On flat slopes where the depth over the centerline of the pipe in the lower manhole of the section being tested will be not more than ten feet (10'), the upper manhole shall be filled to a depth of two feet (2') over the top of the pipe and the lower manhole blocked. When the above conditions cannot be met, ENGINEER may order CONTRACTOR to test the line in sections between manholes. The leakage shall be measured by checking the drop in water level in the manhole over a period of four (4) hours.

            b) The maximum allowable infiltration or exfiltration, including manholes, shall not exceed two hundred (200) gallons per day per mile of sewer, per inch of pipe diameter. This does not preclude the fact that obvious and concentrated leaks, such as open joints, pinched gaskets, cracked barrels or bells, etc., will not be allowed. CONTRACTOR shall make repairs on concentrated leaks, and as necessary to reduce infiltration or exfiltration leakage below the specified rate, and at his own expense.

    b. Air Test (Alternate)

        1) As an alternate method to water testing, CONTRACTOR may utilize low-pressure air as a means of testing the sewer mains. The test procedure shall be as described in ASTM C 828 for Vitrified Clay Pipe, ASTM C 924 for Concrete Pipe and ASTM F-1417 for Plastic Pipe.

2. When manholes are being constructed in areas where the groundwater is elevated or anticipated to be elevated above the manhole base, the CONTRACTOR shall conduct a vacuum test to ensure protection against infiltration. Test shall be conducted in accordance with ASTM C 1244.

    a. All lift holes shall be plugged with non-shrink grout.

    b. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

c. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

d. A vacuum of ten inches (10") of mercury (Hg) shall be drawn on the manholes, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to nine inches (9") of mercury (Hg).

e. The manholes shall pass if the time for the vacuum reading to drop from ten inches (10") of mercury (Hg) to nine inches (9") of mercury (Hg) meets or exceeds the minimum time specified in Table 1 below.

f. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

TABLE 1
Minimum test times for Various Manhole Diameter

Depth h (ft)	Diameter				
	48	54	60	66	72
	Time, Sec.				
8	20	23	26	29	33
10	25	29	33	36	41
12	30	35	39	43	49
14	35	41	46	51	57
16	40	46	52	58	67
18	45	52	59	65	73
20	50	53	65	72	81
22	55	64	72	79	89
24	59	64	78	87	97
26	67	75	85	94	105
28	69	81	91	101	113
30	74	87	98	108	121

D. DEFLECTION TESTING

After the pipe has been laid and backfilled, all flexible pipe systems shall be tested for deflection in the presence of ENGINEER. This test shall consist of pulling a mandrel (Go-No Go Device) through the pipe. The maximum deflection allowable shall not exceed five percent (5%) of the pipe's internal diameter for final inspection. CONTRACTOR shall conduct the test and shall furnish all necessary test equipment and labor. All pipe sections failing the test shall be removed and replaced at CONTRACTOR's expense.

E. NUMBER OF TESTS

A sufficient number of leakage tests shall be performed to assure ENGINEER that materials and workmanship are acceptable. Defective joints shall be repaired only by use of approved jointing material, which is flexible when set and that has a permanent bond to the pipe. Pipe having cracked or broken barrels shall be replaced. The length of sewer main line tested per test shall not exceed eight hundred feet (800').

F. MATERIALS AND EQUIPMENT FOR TESTING

Except as noted in paragraph B, all labor, equipment and materials (including water) for making the tests of sewer lines shall be furnished by CONTRACTOR.

G. WITNESS OF TESTING

All light, leakage and deflection tests shall be witnessed by the ENGINEER. The OWNER's representative shall also be notified a minimum of one (1) hour prior to the testing in case they would elect to also witness these tests.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02700.01X INSTALL X" SANITARY SEWER

   This item shall be measured by the lineal feet of _____ inch (_") sewer main installed along the centerline of pipe from center to center of manholes.

2. 02700.02X INSTALL X" FORCE MAIN

   This item shall be measured by the lineal feet of _____ inch (_") sewer force main installed along the centerline of pipe through fittings and cleanouts.

3. 02700.03 INSTALL BASIC SANITARY SEWER MANHOLE (5' DEPTH)

   This item shall be measured by numerical count of manholes installed.

4. 02700.04 INSTALL ADDITIONAL SANITARY SEWER MANHOLE DEPTH

   This item shall be measured by additional vertical feet of sewer manhole depth installed to the nearest tenth foot (0.1') and will be calculated by subtracting five feet (5.0') from the total depth measured from the top of the cover to the lowest invert.

5. 02700.05 INSTALL SANITARY SEWER DROP TO MANHOLE

   This item shall be measured by numerical count drops install in a manhole.

6. 02700.06 INSTALL INVERT IN EXISTING MANHOLE

   This item shall be measured by numerical count to install an invert in an existing manhole.

7. 02700.07 REPLACE SANITARY SEWER MANHOLE CONE SECTION

   This item will be measured by numerical count of manhole cone sections replaced.

8. 02700.08 INSTALL X" SANITARY SEWER END-OF-LINE PLUG

   This item shall be measured by the numerical count of _____ inch (__") sanitary sewer end-of-line plugs installed.

9. 02700.09 CONNECT TO SANITARY SEWER MAIN

   This item shall be measured by numerical count of new pipe connections to existing sanitary sewer mains

10. 02700.10 CONNECT TO SANITARY SEWER MANHOLE

This item shall be measured by the number of connections made to existing sanitary sewer manholes.

11. 02700.11 CONNECT TO EXISTING FORCE MAIN

This item shall be measured by numerical count of connections to existing force mains.

12. 02700.12 X" EXTEND & RECONNECT EXISTING SANITARY SEWER SERVICE

This item shall be measured by the lineal feet of _____ inch (__") sanitary sewer service to be extended or reconnected.

13. 02700.13X INSTALL X" SANITARY SEWER SERVICE

This item shall be measured by the lineal feet of _____ inch (__") sanitary sewer service installed.

14. 02700.14X X" PVC SANITARY SEWER SERVICE CLEANOUT

This item shall be measured by the numerical count of _____ inch (___") PVC cleanouts installed as shown on the Drawings.

15. 02700.15 CASING PIPE – JACKING OR BORING

This item shall be measured along the pipe centerline between the limits designated on the plans or as directed.

16. 02700.16 INSTALL UTILITY MARKER

This item shall be measured by the number of utility markers to be installed as called for on the drawings.

17. 02700.17 INSTALL SEWER MANHOLE RING AND COVER

This item shall be measured by the numerical count of sewer manhole ring and covers installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02700-01X INSTALL X" SANITARY SEWER

Payment shall include trench excavation and backfill; furnishing and installing pipe; furnishing and placing native pipe bedding material; furnishing and installing warning tape; special materials required for connection to manholes; alignment and pressure testing; and all other work necessary or incidental for completion of the items.

2. 02700.02X INSTALL X" FORCE MAIN

Payment shall include trench excavation and backfill; furnishing and installing pipe, tracer wire and test station, and marking tape; furnishing and placing native

pipe bedding material; pressure and leakage testing; and all other work necessary or incidental for completion of the items.

3. 02700.03 INSTALL BASIC SANITARY SEWER MANHOLE (5’ DEPTH)

   Payment shall include base, manhole sections, steps, cast iron ring and cover, adjusting rings, joint sealer, vacuum testing, concrete collar, and all other incidentals required to complete the item.

4. 02700.04 INSTALL ADDITIONAL SANITARY SEWER MANHOLE DEPTH

   Payment shall include manhole sections, steps, joint sealer, vacuum testing, and all other incidentals to complete this item.

5. 02700.05 INSTALL SANITARY SEWER DROP TO MANHOLE

   Payment shall include furnishing and installing pipe, fittings, concrete encasement, and all incidentals required to complete the item.

6. 02700.06 INSTALL INVERT IN EXISTING MANHOLE

   Payment shall include furnishing and installing a new pipe invert, and all incidentals required to complete the item.

7. 02700.07 REPLACE SANITARY SEWER MANHOLE CONE SECTION

   Payment shall include furnishing and installing the replacement cone section with steps; removing and resetting the cast iron ring and cover to grade; installing new or replacement concrete collar; furnishing and installing joint sealer and grout; and all other incidentals required to complete the item.

8. 02700.08X INSTALL X” SANITARY SEWER END-OF-LINE PLUG

   Payment shall include furnishing and installing the fitting and wood marker post; all necessary excavation and backfill; and all work necessary or incidental for completion of this item.

9. 02700.09 CONNECT TO SANITARY SEWER MAIN

   Payment shall include all materials, equipment, tools, labor and other incidentals necessary to modify the existing main such that the new pipe flowline matches the flowline of the existing main; also included will be any work necessary to provide a watertight seal around the new pipe.

10. 02700.10 CONNECT TO SANITARY SEWER MANHOLE

    Payment shall include removal of existing concrete; installing the connecting sanitary sewer pipe; supplying and installing grout and rubber seal; excavation and backfill; and all other work necessary or incidental for completion of the item.

11. 02700.11 CONNECT TO EXISTING FORCE MAIN

    Payment shall include all materials, including the properly sized mechanical joint sleeve, equipment, tools, labor and other incidentals necessary to connect the new fittings to the existing force main.

12. 02700.12X X” EXTEND & RECONNECT EXISTING SANITARY SEWER SERVICE

    Payment shall include furnishing and installing the sanitary sewer service line, and wyes; furnishing and installing all required fittings; all trench excavation, backfill, pipe bedding, shoring, and dewatering; cleanup and all other work necessary or incidental for completion of the item.

13. 02700.13X INSTALL X" SANITARY SEWER SERVICE

Payment shall include furnishing and installing the sanitary sewer service line, and wyes; furnishing and installing all required fittings; all trench excavation, backfill, pipe bedding, shoring, and dewatering; installation of marker post; cleanup and all other work necessary or incidental for completion of the item.

14. 02700.14X X" PVC SANITARY SEWER SERVICE CLEANOUT

Payment shall include excavation and backfill; furnishing and installing the pipe, fittings and screw plug and all labor, tools, and other necessary items required to complete the item of work.

15. 02700.15 CASING PIPE – JACKING OR BORING

Payment shall include furnishing and installing the casing pipe, carrier pipe, excavation, pit sheeting and shoring, dewatering, pressure grouting, skids, anchoring carrier pipe, installing end seals, cathodic protection, backfill, disposal of surplus materials; and all other work necessary or incidental for the completion of the item.

16. 02700.16 UTILITY MARKER

Payment shall include all utility marker, materials, excavation, backfill, equipment, labor, tools, and incidentals to complete the item.

17. 02700.17 INSTALL SEWER MANHOLE RING AND COVER

Payment shall include the installation of the new sewer manhole ring and cover; any additional excavation and backfill needed to install ring and cover; furnishing and installing new ring and cover; adjusting rings, joint sealer, all tools, labor, and all other incidentals required to complete the item.

SECTION 02710

WATER AND SEWER HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 SCOPE

A. The work covered by this Section includes furnishing all labor, materials and equipment required to install water and sewer pipe on grade by horizontal directional drilling as described herein and/or shown on the Drawings. Horizontal directional drilling (HDD) is a trenchless excavation method, which is accomplished in two phases. The first phase consists of drilling a small diameter pilot hole along a designed directional path. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the pipe or conduit, and pulling the pipe or conduit into the enlarged hole. Horizontal directional drilling is accomplished using a specialized horizontal drilling rig with ancillary tools and equipment.

B. The Contractor shall be responsible for locating any and all underground facilities, regardless of any previous efforts in this regard. The Contractor shall be responsible for all losses and repairs occasioned by damage to underground facilities resulting from drilling operations. The Contractor shall be responsible for locating and protecting all aboveground facilities, utilities, structures, landscaping, trees, shrubs, and other permanent objects against damage due to work access, equipment staging, drilling fluid operations, or pipe pullback activities.

C. The Contractor shall be responsible for protecting land surfaces, storm drains, water mains, sewers, and watercourses from pollution and contamination by fuels, oils, lubricants, and drilling fluids.

D. The Contractor shall be responsible for determining the methods required for drilling based on the presence of groundwater and the types of soils anticipated, including percentages of gravels, cobbles, and boulders, at the drilling location(s). Other environmental conditions that might affect the Work shall also be appropriately considered by the Contractor. The Contractor shall be responsible for reviewing the findings in the Geotechnical Report, as available, and shall consider those findings in the performance of HDD.

E. The proposed vertical and horizontal alignment installation locations are based on alignments to accommodate acquired easements, to avoid obstructions, and to properly maintain operation flow velocities. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer in writing prior to construction.

1.02 QUALIFICATIONS

A. Directional drilling and pipe installation shall be performed only by an experienced Contractor or Subcontractor specializing in directional drilling, and their key personnel must have at least three (3) years experience in this type of work. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.

B. <u>Contractor or HDD Subcontractor shall have:</u>

1. Experience installing directionally drilled pipe at least as large as 8 inches in diameter.

2. Minimum experience of two thousand (2,000) L.F. of directionally drilled water pipe or gravity sanitary sewer pipe successfully installed on grade within the last three (3) years.

C. If the Contractor does not meet all the experience requirements as set forth in sections 1.02 A and B, the Contractor must satisfy the following:

1. The Contractor must obtain consulting services from someone that meets the experience qualifications as outlined in sections 1.02 A and B for the duration of the project. The consultant must be onsite for all boring activities until the contractor has successfully installed two thousand (2,000) L.F. of directionally drilled water or gravity sanitary sewer pipe.

2. The Contractor's key personnel who will perform the directional drilling work shall complete an educational program that provides the Contractor a reasonably high probability of successfully completing the bore, under the direction of the consultant. The Contractor shall submit, in writing, documentation of the educational program and the names of the personnel who completed it to the Engineer two weeks prior to any directional drilling activities.

D. If polyethylene pipe is used, pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by a qualified representative.

1.03 RELATED SECTIONS

A. The Work shall comply with the following Sections of the City of Gillette Standard Construction Specifications. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of the Work.

1. Section 02220: Trench Excavation

2. Section 02225: Trench Backfill

3. Section 02700: Sanitary Sewer Systems

4. Section 02665: Water Distribution and Transmission Systems

1.04 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the latest edition of the City of Gillette Standard Construction Specifications.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. ASTM D 1248 Polyethylene Plastics Molding and Extrusion Material

2. ASTM D 2321 Underground Installation of Thermoplastic Flexible Sewer Pipe

3. ASTM D 422 Test Method for Particle-Size Analysis of Soils

4. ASTM D 1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

5. ASTM D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils

6. ASTM D 2166 Test Method for Unconfined Compressive Strength of Cohesive Soil

7. ASTM D 2216 Test Method for Laboratory Determination of Water Content (Moisture Content of Soil and Rock)

8. ASTM D 4944 Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide, Gas Pressure Test Method

9. ASTM D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

10. ASTM D 4829 Test Method for Expansion Index of Soils

1.05 REGULATORY REQUIREMENTS

A. The Work of this Section shall comply with the current applicable versions, with revisions, of the following:

1. OSHA 29 CFR 1910

B. All work and testing shall comply with the applicable federal codes, including Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended, and applicable state and local codes and standards; and to the extent applicable with the requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.

1.06 RESPONSIBILITY FOR OVERFLOWS OR SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system, and overflows or spills of drilling fluids from the drill site.

B. In the event that the Contractor work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the designated Engineer in a timely manner.

C. Contractor will indemnify and hold harmless the Owner for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor, including the legal, engineering and administrative expenses of the Owner in defending such fines and claims.

1.07 SUBMITTALS

A. Material Submittals: The Contractor shall submit the following shop drawings and other pertinent specifications and product data for approval before ordering pipe materials or starting operations:

1. Data sheets and specifications describing in detail the directional drilling system to be used.

2. Data sheets and specifications describing in detail the grade and alignment control systems to be used.

3. Pipe specifications.

4. Data sheets and specifications for Electrofusion couplings or restrained joint mechanism.

5. Data sheets and specifications describing the grout to be used to fill the annular space between the product pipe and the outside soil or rock (if the annular space exceeds 1-inch).

6. MSDS sheets for all chemicals or other substances to be used at the site, including details of any drilling fluid additives and the physical properties of the fluid mixture(s) proposed.

B. Pre-construction Submittals: The Contractor shall provide the following sketches, drawings and descriptions as follows before initial mobilization for the work:

1. Safety procedures and equipment for record purpose only (not subject to approval by the Owner or Engineer).

2. Preliminary drilling plan describing pilot hole, hole enlargement, and pullback procedures.

3. Set up plan showing proposed equipment and typical access pit locations.

4. Description of quality control methods including examples of all boring and product installation operations daily logs.

5. Description of method to contain drilling fluids and dispose of spoils.

6. Contingency plans for correction of the following potential conditions: inability to complete the pilot hole, excessive fluid loss or hydraulic fracturing, and inability to pull the pipe.

7. Proposed method, sequence, and materials for connection of product pipes to new or existing manholes, pipes, or other appurtenances.

8. Proposed method, sequence, and materials for installation of water or sewer service connections, cleanouts, or other appurtenances.

1.08 QUALITY ASSURANCE

A. The Contractor shall provide a minimum of three (3) days advance notice before the start of excavation or drilling operations. No work shall be performed without prior approval from the Engineer.

The Contractor shall continuously monitor line and grade of the drilled pipe. Extreme care shall be exercised to maintain line and grade during drilling operations, and modifications in the manner in which the drilling operation is being conducted may be required to correct any deviation. The Engineer shall have access to the drilling site and such use of the Contractor's facilities as are necessary to monitor and verify accuracy of water or sewer pipe line and grade. The Contractor shall notify the Engineer of Work in progress in order to coordinate monitoring requirements.

B. The Contractor shall provide a "hands-on" orientation session to the Engineer prior to commencement of drilling operations. The orientation session shall include discussions of the various drilling operating parameters and equipment components. The instrument displays and read-outs shall be clearly explained, including the implications of real-time monitoring, potential difficulties which can be encountered on site, and various "what-if" scenarios. The location and date of the orientation session shall be negotiated between the Engineer and Contractor. The orientation session shall be provided by the Contractor at no additional cost to the Owner.

1.09 STORAGE AND PROTECTION

A. All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe shall be in accordance with the Project Specifications.

B. Drilling Fluids and Grout

1. No drilling fluid or grout will be approved or utilized that does not comply with permit requirements and environmental regulations. The Contractor is responsible for ensuring that the drilling fluids utilized are compatible with the in-situ soils. When drilling in the vicinity of potable water supplies or facilities, the Contractor is responsible for ensuring that the drilling fluids utilized will not contaminate or pose a health hazard to the potable water supplies or facilities. The Contractor shall perform all tests necessary (e.g., marsh funnel viscosity test).

2. The Contractor is responsible for obtaining, transporting, and storing any water required for drilling fluids.

3. If the annular space between the product pipe and the outside soil or rock is in excess of one inch (1"), the annular space shall be grouted with cementitious grout. Cement shall conform to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of one hundred (100) psi attained within twenty-four (24) hours.

2.02 DELIVERY, STORAGE, AND HANDLING

A. Transportation, handling, and storage of the pipe and fittings shall be as recommended by manufacturer.

B. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor expense, before proceeding further.

C. Deliver, store and handle other materials as required to prevent damage.

2.03 MATERIAL TESTS

A. Contractor shall furnish samples and material tests, upon request, demonstrating compliance with this specification from an independent laboratory to verify the required physical properties and characteristics of supplied materials in accordance with the applicable ASTM Specification.

B. A certificate shall be furnished by the manufacturer, upon request, for all material furnished under this specification. Pipe and fittings may be rejected that does not meet any requirements of this specification. The Owner shall pay for tests on pipe material which meets specification requirements. Contractor shall pay for failed tests and re-testing of failed materials.

2.04 EQUIPMENT

A. The equipment used to drill the pilot hole, back ream and pull the product pipe in place shall be adequately sized and compatible to the expected ground conditions as determined by the Contractor. It shall be equipped with instrumentation to accurately locate the alignment and grade of the pilot hole, to real time monitor the drilling fluid flow and pressure, and to real-time monitor the pulling force applied to the product pipe. The Engineer shall have access to these instruments and their real-time readings at all times. Steering information of the drill string, pressures, and pulling forces shall be continuously monitored during operations. The equipment shall be capable of using mechanical and/or hydraulic means to change the boring course.

B. The tracking system shall be of a proven type for installation of either water or gravity sanitary sewer lines, as applicable, and shall be set up and operated by personnel trained and experienced with the

system. The system shall measure the pitch of the pilot hole to the nearest tenth of a percent for gravity sewer lines being placed at a slope of 2% or less. For all other installations, the system shall measure the pitch of the pilot hole to the nearest percent. The Contractor shall use the system to accurately locate and continuously monitor the pilot hole. All tracking system equipment shall be calibrated to the site conditions according to the manufacturer's recommendation.

C. The Contractor shall submit daily reports that include hours worked, the on-site personnel, the length of pipe installed, identification of pilot/reaming bore, description of problems encountered and/or excessive downtime, location of drilling head or reaming assembly, slurry pumping rates, drilling fluid pressures, drilling fluid losses, re-drills for position, times of lost circulation, and slurry additives.

PART 3 - EXECUTION

3.01 GENERAL

A. Investigation of the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be permitted or approved by the appropriate authority having jurisdiction over the site.

B. The drilling installation shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the product pipe, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from drilling operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.

C. The Contractor shall be fully responsible for the structural sufficiency of the product pipe and installation thereof. The details shown on the Drawings and specified herein shall be considered minimum standards.

3.02 GROUNDWATER CONTROL

A. The Contractor shall control the groundwater throughout the construction of the casing.

B. Methods of dewatering shall be the responsibility of the Contractor and shall be in accordance with the Project specifications.

3.03 EXISTING FLOW

A. The Contractor shall be responsible for maintaining continuous sanitary sewer service to each and every sewer connected to the manhole or sewer subject to connection of the new product pipe. The cost of dealing with tanking, bypass pumping and all other private service flow management shall be included in the rate for horizontal directional drilling.

B. If sewage backup occurs and enters buildings due to the Work related to the drill operation or installation and connection of the product pipe, the Contractor shall be responsible for clean-up, disinfection, repair, property damage as well as all resultant costs and claims.

C. The Contractor shall be responsible for maintaining continuous water service to each service line connected to the water main and subject to connection of the new product pipe. Any proposed temporary water shutoffs shall be discussed with the Engineer and approved at least 48 hours prior to the planned shutoff. The City's Temporary Water Shutoff Form shall be appropriately delivered the required agencies and effected customers at least 48 hours in advance.

3.04 TRENCH SAFETY

A. The Contractor shall be responsible for the design, installation, maintenance, and removal of any sheeting and shoring necessary for the drilling operation, including fluid containment and permitted disposal practices. Excavation practices shall comply with the City of Gillette Standard Construction Specifications Section 2220, Trench Excavation and Section 02225 Trench Backfill.

3.05 DRILLING FLUID MANAGEMENT

A. Disposal: Disposal of excess drilling fluids and cuttings is the responsibility of the Contractor and shall be conducted in compliance with all environmental regulations, right-of-way and workspace agreements, and permit requirements. The Contractor shall be responsible for the disposal of excavated material as well as excess drilling fluid, water, cuttings, trash and waste. The Contractor shall utilize qualified disposal service providers. Containment barriers shall be used to prevent drilling fluid runoff from the construction site and frequent inspections performed along the drill path for upwelling drilling fluid.

B. Inadvertent Returns: The Contractor shall use full annular circulation of drilling fluids to maintain stability of the drilled hole and efficient conveyance of cuttings. Drilling fluid returns at locations other than the entry and exit points shall be strictly controlled. The Contractor shall continuously monitor the Work for evidence of actual or imminent release of drilling fluids due to hydraulic fracture or other causes. In the event that annular circulation is lost, the Contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained or controlled using specific methods defined in the approved project submittals. The Contractor shall be responsible for all costs associated with inadvertent returns of drilling fluids including clean up, fines, damage, etc. Clean up of any inadvertent returns shall be performed in a timely manner.

C. Pressure: The Contractor shall be responsible for maintaining appropriate drilling fluid pressure to prevent hydraulic fracturing. If hydraulic fracturing or excessive loss of fluid is discovered, the process shall be halted until actions are taken to control the losses.

3.06 PILOT HOLE

A. The Contractor shall drill the pilot hole along the path shown on the Drawings to within the tolerance limits specified. The exit point of the drill string shall also meet the specified tolerance limits. At the completion of the pilot hole, the Contractor shall provide an as-built survey consisting of three-dimensional coordinates accurately referencing the pilot hole to the drilled entry point. Drilling must be accomplished with fluid assisted mechanical cutting. Uncontrolled jetting (where fluid force is the primary means for creation of the final bore hole diameter) is prohibited.

3.07 REAM AND PULL BACK

A. Equipment used to perform the work shall be located away from buildings in order to minimize noise impact.

B. The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the polyethylene pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances shall the pipe be stressed beyond its elastic limit.

C. A swivel connection shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the pipe. The maximum allowable tensile load imposed on the pull section shall be equal to eighty percent (80%) of the specified minimum yield strength of the pipe for the pipe cross sectional area. If more than one (1) value is involved for a given pull section, the

lesser shall govern. The maximum allowable tensile load of the pipe shall not be exceeded during pullback operations.

D. The pull section shall be adequately supported as it proceeds during pull back, so that it moves freely, and the pipe is not damaged.

E. The pull section shall be installed in the reamed hole in such a manner that unbalanced external pressures are minimized. Any damage to the pipe resulting from unbalanced external pressure during installation shall be the responsibility of the Contractor.

F. For polyethylene pipe:

1. The installed pipe shall be allowed to relax and cool following installation, in accordance with the manufacturer's recommended time, but not less than four (4) hours, prior to any reconnection of service lines, scaling of the annulus, or backfilling of the insertion pit. Sufficient excess length of new sewer pipe, but not less than twenty-four inches (24"), shall be allowed to protrude into the manhole to provide for further length reduction and inspection of the condition of the pipe exterior.

2. Following the relaxation period, the Engineer shall inspect the exterior of the excess length of new sewer pipe protruding into the manhole. Upon acceptance of the exterior pipe condition by the Engineer, the excess length of new pipe shall be trimmed to four inches (4"), and the annular space may be sealed (if required). The grout seal shall be placed in such a manner as to form a smooth, uniform, watertight joint with the manhole wall.

3.08 PIPE JOINING

A. <u>High Density Polyethylene (HDPE):</u>

1. The polyethylene pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint in strict accordance with the manufacturer's instructions and ASTM D 2657. Threaded or solvent-cement joints and connections are not permitted.

B. All equipment and procedures used shall be used in strict compliance with the manufacturer's instructions and recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

1. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe.

2. All joints shall be subject to acceptance by the Engineer and/or his representative prior to insertion. All defective joints shall be cut out and replaced at no cost to the Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

3. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer and/or his representative shall be discarded and not used.
4. Terminal sections of pipe that are joined within the insertion pit shall be connected with Electrofusion Couplings or connectors with tensile and shear strength equivalent to that of the pipe being joined.

5. The rollback bead on the inside of all sanitary sewer pipe shall be removed with an inside bead remover tool.

6. The pull section shall be preassembled, continuously for its entire length, before installation begins.

C. Polyvinyl Chloride (PVC):

1. All pipe shall be joined with gasketed restrained joints according to the manufacturer's specifications.

D. Bulldog® Restraint System

1. All manufacturer recommendations for installation of the Bulldog® Restraint System shall be followed.

2. Prior to installation of the pipe, all witness marks on the pipe shall be visible to assure over-belling or over-homing of the pipe does not occur. Any pipe joint(s) where witness mark(s) are not visible shall be rejected.

3. Where multiple joints of pipe are assembled prior to installation, external joint harnesses shall be installed on every joint of the assembly, on a temporary basis, to ensure the pipe is not accidentally over-homed prior to installation.

4. Bulldog® type restraints are not allowed to be used in cased bore applications. External restraint harnesses and casing spacers as shown in the Standard Drawing for Water Bore Casing shall be used on standard bell and spigot pipe in cased bores.

3.09 TOLERANCES

A. General

1. The installed pipe must be horizontally located as shown on the Drawings and must be on-grade. Monitoring of bore, reamer, and pipe shall be accomplished by manual plotting based on location and depth readings provided by the locating/tracking system or by computer generated bore logs which map the bore path based on information provided by the locating/tracking system. The Contractor shall at all times provide and maintain instrumentation that will accurately measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the pilot bore and the fluid pressures and flows. When requested, the Contractor shall provide explanations for the position monitoring data. The Contractor shall employ experienced personnel to operate the drilling equipment, in particular, the position monitoring and steering equipment.

2. The horizontal alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. The sanitary sewer line must comply with the City of Gillette Standard Construction Specifications Section 02700. The water line must comply with Section 02665.

B. Line and Grade

1. Record the exact position of the drill bit every three to five feet (3' to 5') to ensure the alignment is within specified tolerances. Corrections to the alignment shall be made immediately, before allowable tolerances are exceeded.

2. When alignment is off line or grade, make ongoing corrections to avoid major changes and keep within specified tolerances. A belly in the bore for sewer pipe that will hold water and/or a reverse grade is not acceptable and shall be replaced at no additional cost to the Owner.

3. Deviations of grade (in the plan direction of flow) in the upward direction are allowed only for corrective means; however, a uniform downward grade must be maintained at all times.

4. Deviations in horizontal alignment shall be a maximum of ± twelve inches (12") in any one hundred-foot (100') section.

5. Pipe installed outside tolerances and subsequently abandoned shall first be fully grouted.

3.10 CONNECTION OF PRODUCT PIPE TO NEW OR EXISTING MANHOLES

A. The Contractor shall note that in connecting product pipes to new or existing manholes, every care shall be taken to ensure that the connections are watertight and that the existing sewers and manholes are not damaged and/or are fully remediated as appropriate.

B. The Contractor shall ensure that there is no interruption to existing flows during the connection works.

C. The Contractor shall not allow sewage to flow into newly placed pipelines, unless the pipeline concerned and the downstream pipelines have been completed, inspected, and certified complete by the Engineer. (Refer to Sections 3.12 and 3.13 below).

D. The Contractor shall adjust manhole benchings and bases to accommodate new pipelines to ensure a continuous invert without steps.

E. All connections into manholes shall be designed and installed so as to ensure that groundwater is not permitted to enter the confines of the sewer or manhole, and shall be sealed in accordance with the construction method outlined in Section 02700 of the City of Gillette Standard Construction Specifications. The Contractor shall submit proposals together with any material specification for making such connections to the Engineer for approval.

3.11 CONNECTION OF PRODUCT PIPE TO EXISTING MAIN LINE

A. All existing main line connections shall be done with an Electrofusion connection or other fitting that is compatible with the pipe. No flexible coupling will be allowed.

3.12 SEWER SERVICE CONNECTIONS

A. All sewer service connections shall be identified, located, and exposed to verify depth prior to drilling. Upon completion of pullback of the new pipe, and subsequent to the sufficient relaxation period of the new pipe (if required), the Contractor shall complete the connection.

B. The method of connection to the main line shall be:

<u>For High Density Polyethylene (HDPE) Main Pipe:</u>
Electrofusion saddle connection (as manufactured by Central Plastics or approved equal). Saddle material shall be compatible with that of the main pipe and shall be installed in accordance with the manufacturer's recommended procedure.

<u>For Polyvinyl Chloride (PVC) Main Pipe:</u>
PVC Wye fitting. Fitting material shall be compatible with that of the main pipe and shall be installed in accordance with the manufacturer's recommended procedure

C. The method of connection for the lateral, existing service line, and cleanouts shall be:

<u>For High Density Polyethylene (HDPE) Service Pipe:</u>

Electrofusion coupling connection (as manufactured by Central Plastics or approved equal). Coupling material shall be compatible with that of the connecting pipes and shall be installed in accordance with the manufacturer's recommended procedure.

For Polyvinyl Chloride (PVC) Service Pipe:
Fittings compatible with the pipe or Rigid Fernco Couplings (Flexible couplings will NOT be allowed). Fittings and couplings shall be installed in accordance with the manufacturer's recommended procedure.

3.13 POST-INSTALLATION CCTV INSPECTION OF SEWER MAINS AND SERVICES

A. Following installation of new sewer pipelines where drilling has occurred, CCTV inspection shall be performed by the Contractor.

B. The finished tape shall be continuous over the entire length of the sewer reach and shall be completely free from visual defects.

C. Defects which may affect the integrity or strength of the pipe, in the opinion of the Engineer, shall be repaired or the pipe replaced at the Contractor's expense.

D. Post construction videotape upon completion of construction of each reach of sewer as appropriate with stationing. Data and stationing to be on video.

E. Video tapes shall remain property of the Owner. Contractor shall retain a second copy for their use.

F. Should any portion of the inspection tapes be of inadequate quality or coverage, as determined by the Engineer or Owner, the Contractor will have the portion re-inspected and video taped at no additional expense to the Owner.

G. All costs associated with the post-installation CCTV inspection and the requirements of this Subsection shall be considered incidental the horizontal directional drilling Work.

H. Additionally, the CCTV inspection shall include a measurement of the grade of each section (segment) of the installed pipe. The inclinometer shall be calibrated immediately before the CCTV camera is put into the pipe. The grade measurement recording shall be started after a pipe section has been televised, and the camera is located at the end of the pipe section. Grade readings shall be recorded as the camera travels back, at a constant speed, until stopping at the start location of the televised inspection (start of the pipe section). The resulting grade report(s) for the installed pipe section(s) shall be submitted to the ENGINEER for review.

3.14 INSPECTION AND TESTING

A. Inspection and testing of the installed pipe shall be conducted according to the City of Gillette Standard Construction Specifications Section 02700, Sanitary Sewer Systems, and Section 02665, Water Distribution and Transmission Systems. The light test for sanitary sewer will not be required. The Contractor shall be responsible for all costs associated with the required inspection and testing.

B. For sanitary sewer installations, the mains and services shall be inspected with a camera and the inspection recorded on video or other media, as specified in Section 3.13 above. The Engineer shall review the post construction videotape and grade report for the installed pipe. If the Engineer identifies pipe sag or deformation, the Contractor shall repair the pipe sag or deformation as directed by the Engineer. The Contractor shall be responsible for all costs associated with the pipe repair.

C. If the pipe grade is found to be out of spec by either the CCTV, or the manual plot of location and depth readings or computer generated bore logs, upon request by the Engineer or the Owner, after the pipe pullback operation, the Contractor shall dig small observation shafts over the length of the pipe installation up to fifteen to twenty feet (15' to 20') apart. The observation shafts shall be of sufficient size to allow for a measuring pole to be inserted to the level of the top of the installed pipe, and/or to allow for visual inspection of the condition of the installed pipe and any crossing utilities present during or after the pull back operation. Upon request by the Engineer or the Owner, the depth to the top of the installed pipe at each vertical hole shall be surveyed to measure the accuracy of the line and grade of the installed pipe. The Contractor shall be responsible for all costs associated with the requested observation shafts and/or survey.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASURMENT

A. STANDARD ITEMS

1. 02710.01X Install X" Horizontal Directional Drilled Sanitary Sewer. This item shall be measured by the lineal feet of _____ inch (____") horizontal direction drilled sewer main along the centerline of pipe from center to center of manholes.

2. 02710.02X Install X" Horizontal Directional Drilled Water Main. This item shall be measured by the lineal feet of _____ inch (_____ ") horizontal direction drilled water main along the centerline of the pipe.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02710.01X Install X" Horizontal Directional Drilled Sanitary Sewer. Payment shall include drilling, excavation and backfill of pits, furnishing and installing pipe; special materials required for connection to manholes; alignment and pressure testing; and all other work necessary or incidental for completion of the items.

2. 02710.02X Install X" Horizontal Directional Drilled Water Main. Payment shall include drilling, excavation and backfill of pits, furnishing and installing pipe; special materials required for connections; alignment and pressure testing; all acceptance testing of the new water main; and all other work necessary or incidental for the completion of this item.

SECTION 02725

STORM DRAINS, TRICKLE CHANNELS, AND CULVERTS

PART 1 GENERAL

1.01 SUMMARY

A. This section consists of construction of subdrain systems, drainage culverts, and storm drains, including manhole, inlets and other appurtenant structures, complete.

1.02 REFERENCES

A. Where the reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision at the time of call for bids, except as noted on the Drawings or in the Special Provisions.

B. Most recent edition of the City's Storm Drainage Design Manual.

1.03 QUALITY ASSURANCE

A. CERTIFICATION BY MANUFACTURER

1. CONTRACTOR shall furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe complies with the applicable specifications, when required by ENGINEER. Required certification shall accompany each delivery of material.

2. All pipe shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

3. Type of joint, class, thickness designation, casting, lining, marking, testing, etc., shall be specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. All storm drain and culvert piping shall be as called out in the Contract Documents and shall be in accordance with materials and testing as specified in this section. Pipe sizes and strength classifications shall be as shown on the Drawings and/or as listed in the Special Provisions. All storm drain improvements placed under traffic carrying routes shall be designed to withstand static and live loads in accordance with the pipe manufacture's recommendations. As a minimum, all storm drains shall be designed to withstand an AASHTO HS-20 loading. Storm drain pipes may be of any material specified in the City's Storm Drainage Design Manual and as specified herein.

B. CONCRETE PIPE

1. Pipe for Storm Drains and Culverts shall be reinforced concrete pipe conforming to ASTM C 76 or non-reinforced concrete pipe conforming to ASTM C 14. Joints for concrete pipe shall be rubber gasket type conforming to ASTM C 443, ramneck joint sealant, or as otherwise specified by ENGINEER. Nonreinforced pipe shall use only the ASTM C 443 type joint.

C. CORRUGATED ALUMINUM ALLOY CULVERT PIPE AND TYPE 2 COATED ALUMINIZED STEEL PIPE

1. This pipe shall conform to the requirements of AASHTO M-196 and AASHTO M-197.

   a. Corrugations for pipe designated as 2 2/3" x ½" (67.8 mm x 12.7 mm) shall conform to the requirements of AASHTO M-196.

   b. Corrugations for pipe designated as 3" x 1" (75 x 25 mm) shall conform to the requirements of AASHTO M-196.

2. Corrugated metal pipe (CMP) is not permitted for storm drain construction, with the exception of slotted drain and private driveway culverts. Other pipe materials may be used under driveways, and through drainageways and open space areas. All other pipe materials shall be subject to City approval.

3. Installation shall be in accordance with ASTM A798 and A796 (steel) and B788 and b790 (aluminum).

D. HIGH DENSITY POLYETHYLENE (HDPE) PIPE

1. This pipe shall conform to AASHTO M-294 Specifications for corrugated smooth interior (Type S) polyethylene pipe.

2. Installation shall be in accordance with ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Sewer Pipe.

3. The joints of the Polyethylene Pipe shall be bell/spigot storm drainage application, meeting modified ASTM D 3212 and ASTM F-477 (Elastomeric gaskets).

E. STEEL REINFORCED POLYETHYLENE PIPE (SRPE)

1. Pipe shall be a reinforced polyethylene pipe with a smooth waterway wall and exterior profile that is reinforced with high strength galvanized steel ribs. The continuous reinforcing ribs shall be completely encased within the polyethylene profile. The pipe shall be manufactured using a helical winding process that results in a continuously fusion welded lap seam.

2. The pipe and fittings shall meet the steel reinforced thermoplastic ribbed pipe requirements of ASTM F2562, or AASHTO Designation MP-20.

3. Resins shall conform to the minimum requirements of cell classification 345464C, as defined and described in ASTM D3350.

4. This pipe shall be installed in accordance with ASTM D2321.

5. Steel reinforcement shall have a minimum strength of 80 ksi.

6. The joints of the pipe shall be watertight in accordance with ASTM D3212. Pipe shall be joined on site using coupling bands, gasketed bell & spigots, or ElectroFusion couplers specifically designed for the specified joint performance level of the pipe.

F. MANHOLES

Manholes shall be constructed of precast concrete materials with frames and covers in accordance with details shown on the Drawings

G. RINGS AND COVERS

1. Rings and covers shall be in accordance with OWNER's Standards. Covers shall be non-ventilated, self-sealing, recessed lug lid design, D&L Foundry A-1161 (self-seal) with closed pick hole or Engineer approved equal type unless otherwise noted in the Special Provisions.

2. Rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer approved equal type unless otherwise noted in the Special Provisions.

H. ADJUSTING RINGS

1. Adjusting rings may be used for adjusting the manhole top elevation to coincide with existing ground surface elevations, however, the total combined height of the manhole ring and adjusting rings used per manhole shall not exceed sixteen inches (16").

2. High Density Polyethylene (HDPE) adjusting rings for manholes shall be used and shall conform to ASTM D 1248.

I. STEPS

1. When required, non-corrosive steps of rubber encased steel, aluminum, or nylon shall be used. Steps shall withstand vertical loads of four hundred pounds (400 lbs) and pull-out resistance of one thousand pound (1,000 lb). The maximum distance from the surface to the first step shall be no greater than thirty inch (30") and each set below this first step shall be spaced a minimum of twelve inches (12") to a maximum of sixteen inches (16").

J. CONCRETE BASE

Concrete bases shall be precast or poured in the field on undisturbed earth. Concrete shall conform to Section 03304, PORTLAND CEMENT CONCRETE.

K. INLETS AND CATCH BASINS

SINGLE INLETS

1. Inlet frames and gratings shall be Neenah R-3246-AL "L", D & L Foundry I-3520 "L" or approved equal or as specified in the Special Provisions. Inlet structure may be precast or cast-in place. Concrete for inlet structure shall be class "B" as specified in Section 03304 Portland Cement Concrete.

MULTIPLE INLETS

2. Inlet frames and grating shall be Neenah R-3293-2 "L", D & L Foundry I-3520 "L" Double, Neenah R-3293-3 "L" or approved equal or as specified in the Special Provisions. Inlet structure may be precast or cast-in place. Concrete for inlet structure shall be class "B" as specified in Section 03304 Portland Cement Concrete.

L. PERFORATED SUB-DRAIN PIPE

1. Drain pipe shall be 4-inch (4") perforated corrugated polyethylene, complying with AASHTO M252-851, Contech A-2000 and ADS N-12 Pipe are pre-approved products for this application. (Other types of perforated drain pipe may be used upon obtaining written permission from the ENGINEER.)

M. SUB-DRAIN GRAVEL

1. Sub-Drain gravel shall conform to the requirements of Grading B, Gravel for Drains as listed in Section 02190 paragraph 2.13.A of the Construction Specifications.

N. WARNING TAPE

1. Warning tape shall be at least three inches (3") in width and shall have a minimum overall thickness of five (5) mils. Tape shall be impervious to all known alkalis, chemical reagents, and solvents found in soil. Color coding shall be in conformance with the APWA/ULCC Color Code. Warning tape shall have a maximum imprint length of thirty-six inches (36").

O. TRACER WIRE

1. Tracer wire shall be a minimum of No. 10 AWG insulated copper wire with stranded conductor. Insulation shall be brown in color.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. RESPONSIBILITY FOR MATERIAL

1. CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the guarantee period.

2. CONTRACTOR shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

B. HANDLING OF PIPE

1. All pipe furnished by CONTRACTOR shall be delivered and distributed at the site by CONTRACTOR. Pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

2. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

3. Pipe shall be handled so that no coating or lining will be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by CONTRACTOR at his expense in a manner satisfactory to ENGINEER.

C. LAYING PIPE

1. All pipe shall be laid and maintained to the required lines and grades with manholes at the required locations.

2. Proper tools and equipment satisfactory to ENGINEER shall be used by CONTRACTOR for the safe and convenient prosecution of the work. All pipe shall be carefully lowered into the trench in such a manner as to prevent damage

to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

3. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. CONTRACTOR shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction.

4. The bottom of trench shall be shaped to fit the bottom quadrant of the pipe, with holes for joints just large enough to permit assembly.

5. In the event a curved horizontal alignment is permitted, tracer wire, test stations, and warning tape shall be provided for locating purposes. Test stations shall be provided at all pipe junctions.

D. TOLERANCES

1. The sewer shall be installed within ± one inch (1") for grade and shall not be off more than ± two inches (2") for alignment.

E. STORM SEWERS CROSSING WATER MAINS AND SANITARY SEWER

1. NORMAL CONDITIONS - Storm sewers crossing water mains or sanitary sewer mains shall be laid above or below these mains to provide a vertical clear separation of at least eighteen inches (18") between the bottom of the upper main and the top of the lower main.

2. UNUSUAL CONDITIONS – When local conditions prevent a vertical clear separation of at least eighteen inches (18"), storm sewer mains passing under or over water mains or sanitary sewer mains shall be protected by providing:

a. Adequate structural support for the mains to prevent excessive deflection of joints and settling on and breaking the lower main; and

b. That the full-length of main be centered at the point of crossing so that the joints will be equidistant and as far as possible from the other main, and

c. That the water main shall be protected by a suitable casing pipe or cement treated fill saddle.

F. FILTER FABRIC SUB-DRAIN

1. All installations shall be done as per the Manufacturer's recommended criteria unless specifically noted otherwise on the Drawings. In all installations, the fabric shall be placed so as to completely surround the drain gravel and provide a minimum eighteen inch (18") overlap on top. All overlaps necessary in the longitudinal direction of the drain shall be a minimum of twenty-four inches (24").

3.02 MANHOLE INSTALLATION

A. Manholes shall be constructed to the general dimensions shown. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Inverts shall provide a minimum of one tenth foot (0.1') drop through the manhole. Changes in direction of flow shall be made with a smooth curve of as large radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Inverts shall be formed using concrete within the manhole base or may be a half-pipe laid in concrete (not to exceed twelve inches (12") in total depth). The

floor of the manhole outside the channel shall be smooth and shall slope toward the channel not less than one inch (1") per foot, nor more than two inches (2") per foot.

B. All connections between wall sections or between storm sewer pipe and manhole walls shall be jointed with either grout, resilient connectors which satisfy ASTM C 923 such as PSX Boot by Press-Seal Gasket or "Ram-Nek" "Kent Seal" manufactured by K.T. Snyder Company, or approved equal. What ever connection is used it should be watertight. Storm sewer pipe shall be extended through the wall of the manhole for a sufficient length to allow for the proper installation of the jointing connection.

C. Manhole construction shall not be greater than one manhole distant behind storm sewer construction, unless approved by ENGINEER.

D. The access step shall be installed per the applicable Standard Construction Detail (02725-08)

3.03 INLET AND CATCH BASINS

A. Inlets and catch basins shall be constructed as shown on the Plans for the type designated.

B. Inlets structures shall be constructed to the line, cross section and dimension shown. Concrete and reinforcing steel shall conform to Section 03304, Portland Cement Concrete and Section 03200, Concrete Reinforcement. Inlet structures may be precast or cast-in-place.

3.04 TESTING

A. LIGHT TEST

1. After the trench has been backfilled, a light test shall be made between drainage structures (manholes, junction box, etc.) to check alignment and grade for displacement of pipe. The completed pipeline shall be such that a true circle of light can be seen from one structure to the next. If alignment or grade is other than specified and displacement of pipe is found, CONTRACTOR shall remedy such defects at his own expense.

B. LEAKAGE TEST

1. Unless specified in the Special Provisions, a leakage test will not be required. However, this does not preclude the fact the obvious and concentrated leaks (such as open joints, pinched gaskets, cracked barrels or bells, etc.) will not be allowed.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02725.01X INSTALL X" RCP STORM DRAIN PIPE

   This item shall be measured by the lineal feet of ____ inch (__") reinforced concrete storm drainpipe installed along the centerline of pipe for the length of pipe installed.

2. 02725.02X INSTALL X" ARCH RCP STORM DRAIN PIPE

This item shall be measured by the lineal feet of _____ inch (__") equivalent arch reinforced concrete storm drainpipe installed along the centerline of pipe for the length of pipe installed.

3. 02725.03X INSTALL X" ELLIPTICAL RCP STORM DRAIN PIPE

   This item shall be measured by the lineal feet of _____ inch (__") equivalent elliptical reinforced concrete storm drainpipe installed along the centerline of pipe for the length of pipe installed.

4. 02725.04X INSTALL X" CORRUGATED POLYETHYLENE STORM DRAIN PIPE

   This item shall be measured by the lineal feet of _____ inch (_") corrugated polyethylene storm drainpipe installed along the centerline of pipe for the length of pipe installed.

5. 02725.05X INSTALL X" PERFORATED STORM DRAIN PIPE

   This item shall be measured by the lineal feet of _____ inch (_") perforated storm drainpipe installed along the centerline of pipe for the length of pipe installed.

6. 02725.06X INSTALL X" CORRUGATED POLYETHYLENE PERFORATED STORM DRAIN PIPE

   This item shall be measured by the lineal feet of _____ inch (_") corrugated geotech fabric wrapped polyethylene storm drain pipe installed along the centerline of pipe from center to center of cleanouts, or center of cleanout to center of culvert at discharge point.

7. 02725.07X INSTALL X" CULVERT

   This item shall be measured by the lineal feet of _____ inch (__") culvert installed along the centerline of pipe for the length of pipe installed.

8. 02725.08X INSTALL X" RCP FLARED END SECTION

   This item shall be measured by the number of _____ inch (__") reinforced concrete flared end sections installed.

9. 02725.09X INSTALL X" ARCH RCP FLARED END SECTION

   This item shall be measured by the number of _____ inch (__") Arch reinforced concrete flared end sections installed.

10. 02725.10X INSTALL X" ELLIPTICAL RCP FLARED END SECTION

    This item shall be measured by the number of _____ inch (__") equivalent elliptical reinforced concrete flared end sections installed.

11. 02725.11X INSTALL X" CORRUGATED POLYETHYLENE FLARED END SECTION

    This item shall be measured by the number of _____ inch (__") corrugated polyethylene flared end sections installed.

12. 02725.12X INSTALL X" CULVERT FLARED END SECTION

This item shall be measured by the number of _____ inch (__") flared end sections installed.

13. 02725.13X INSTALL X " BASIC STORM DRAIN MANHOLE (5' DEPTH)

    This item shall be measured by numerical count of _____ inch (__") manholes installed.

14. 02725.14X INSTALL X" FLAT TOP STORM DRAIN MANHOLE (5' DEPTH)

    This item shall be measured by numerical count of _____ inch (__") flat top manholes installed.

15. 02725.15 ADDITIONAL STORM DRAIN MANHOLE DEPTH

    This item shall be measured by additional vertical feet of storm drain manhole depth installed to the nearest one-tenth foot (0.1') and will be calculated by subtracting five feet (5.0') from the total depth measured from the top of the cover to the lowest invert.

16. 02725.16 INSTALL OPEN THROAT STORM DRAIN INLET

    This item shall be measured by the numerical count of open throat storm drain inlets installed.

17. 02725.17 INSTALL SINGLE GUTTTER STORM DRAIN INLET

    This item shall be measured by the numerical count of single gutter storm drain inlets installed.

18. 02725.18 INSTALL DOUBLE GUTTER STORM DRAIN INLET

    This item shall be measured by the numerical count of double gutter storm drain inlets installed.

19. 02725.19 INSTALL TRIPLE GUTTER STORM DRAIN INLET

    This item shall be measured by the numerical count of triple gutter storm drain inlets installed.

20. 02725.20 INSTALL SLOTTED DRAIN CLEANOUT

    This item shall be measured by the numerical count of slotted drain cleanouts installed.

21. 02725.21X INSTALL X" SLOTTED DRAIN

    This item shall be measured by the lineal feet of _____ inch (__") slotted drainpipe installed.

22. 02725.22 INSTALL SUB-DRAIN SYSTEM

    This item shall be measured by the lineal foot along the center of the sub-drain through all fittings and appurtenances.

23. 02725.23 INSTALL SUB-DRAIN CLEANOUT

    This item shall be measured by the numerical count of sub-drain clean-outs installed.

24. 02725.24 CONNECT SUB-DRAIN TO STORM DRAIN INLET

    This item shall be measured by the numerical count of sub-drain connections to existing storm drain inlets.

25. 02725.25 CONNECT SUB-DRAIN TO SUB-DRAIN

    This item shall be measured by the numerical count of sub-drain connections made to new or existing sub-drain systems.

26. 02725.26 CONNECT SUB-DRAIN TO STORM DRAIN PIPE

    This item shall be measured by the numerical count of sub-drain connections to existing storm drainpipe. This item shall include proper vertical and horizontal alignment so as to match the sub-drain with the existing storm drain as shown on the drawings.

27. 02725.27 CONNECT SUMP DISCHARGE TO SUB-DRAIN

    This item shall be measured by numerical count of existing sump pump discharge outlets connected to the sub-drain system.

28. 02725.28 INSTALL SUB-DRAIN HEADWALL

    This item shall be measured by the numerical count of sub-drain headwalls installed.

29. 02725.29 INSTALL TRASH GUARD

    This item shall be measured by the number of trash guards installed.

30. 02725.30 CONNECT TO STORM DRAIN INLET

    This item shall be measured by numerical count of connections to storm drain inlets.

31. 02725.31 CONNECT TO STORM DRAIN MANHOLE

    This item shall be measured by numerical count of connections to storm drain manholes.

32. 02725.32 REBUILD TOP SECTION STORM DRAIN MANHOLE

    This item shall be measured by the numerical count of existing storm drain manholes modified.

33. 02725.33 CONNECT TO EXISTING STORM DRAIN

    This item shall be measured by the numerical count of connections to existing storm drain pipes.

34. 02725.34X INSTALL X" BAFFLE RINGS

    This item shall be measured by the numerical count of _____ inch (___") baffle rings installed.

35. 02725.35X INSTALL X" RCP STORM DRAIN PLUG

    This item shall be measured by numerical count of _____ inch (__") RCP storm drain plugs installed.

36. 02725.36 INSTALL CONCRETE TRICKLE CHANNEL

This item shall be measured by the lineal footage along the flow line of the concrete trickle channel installed to the dimensions indicated on the Drawings.

37. 02725.37 INSTALL APPROACH FOR CONCRETE TRICKLE CHANNEL

This item shall be measured by the number of trickle channel approaches installed.

38. 02725.38 INSTALL CONCRETE LOW FLOW CHANNEL

This item shall be measured by the lineal footage along the flow line of the concrete low flow channel installed to the dimensions indicated on the Drawings.

39. 02725.39 REMOVE CULVERT

This item shall be measured by the lineal footage of pipe culvert removed.

40. 02725.40XY INSTALL X' x Y' BOX CULVERT

This item shall be measured by the lineal footage of ____ foot by ____ foot (__'x__') reinforced box culverts installed along the centerline of the culvert for the length of the culvert installed.

41. 02725.41 INSTALL GRATED AREA INLET

This item shall be measured by the number of grated inlets installed as called for on the Drawings.

42. 02725.42 INSTALL OUTLET STRUCTURE

This item shall be measured by the number of outlet structures installed as called for on the Drawings.

43. 02725.43 INSTALL STEEL REINFORCED POLYETHYLENE PIPE (SRPE)

This item shall be measured by the lineal feet of _____ inch (_") steel reinforced polyethylene pipe installed along the centerline of pipe for the length of pipe installed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02725.01X INSTALL X" RCP STORM DRAIN PIPE

Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

2. 02725.02X INSTALL X" ARCH RCP STORM DRAIN PIPE

Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

3. 02725.03X INSTALL X" ELLIPTICAL RCP STORM DRAIN PIPE

Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

4. 02725.04X INSTALL X" CORRUGATED POLYETHYLENE STORM DRAIN PIPE

   Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

5. 02725.05X INSTALL X" PERFORATED STORM DRAIN PIPE

   Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

6. 02725.06X INSTALL X" CORRUGATED POLYETHYLENE PERFORATED STORM DRAIN PIPE

   Payment shall include trench excavation and backfill; furnishing and installing pipe, geotech fabric wrap and necessary fittings; specials required for connection to inlets or outfall headwalls; and all other work necessary or incidental for completion of the item.

7. 02725.07X INSTALL X" CULVERT

   Payment shall include trench excavation and backfill; furnishing and installing pipe and any specials; furnishing and placing native pipe bedding material; alignment testing and all other work necessary or incidental for completion of the item.

8. 02725.08X INSTALL X" RCP FLARED END SECTION

   Payment shall include trench excavation and backfill; furnishing and installing flared end section and any specials for connection to culverts; furnishing and placing bedding; and all other work necessary or incidental for completion of the item.

9. 02725.09X INSTALL X" ARCH RCP FLARED END SECTION

   Payment shall include trench excavation and backfill; furnishing and installing flared end section and any specials for connection to culverts; furnishing and placing bedding; and all other work necessary or incidental for completion of the item.

10. 02725.10X INSTALL X" ELLIPTICAL RCP FLARED END SECTION

    Payment shall include trench excavation and backfill; furnishing and installing flared end section and any specials for connection to culverts; furnishing and placing bedding; and all other work necessary or incidental for completion of the item.

11. 02725.11X INSTALL X" CORRUGATED POLYETHYLENE FLARED END SECTION

    Payment shall include trench excavation and backfill; furnishing and installing flared end section and any specials for connection to culverts; furnishing and

placing bedding; and all other work necessary or incidental for completion of the item.

12. 02725.12X INSTALL X" CULVERT FLARED END SECTION

Payment shall include trench excavation and backfill; furnishing and installing flared end section and any specials for connection to culverts; furnishing and placing bedding; and all other work necessary or incidental for completion of the item.

13. 02725.13X INSTALL X" BASIC STORM DRAIN MANHOLE (5' DEPTH)

Payment shall include base, manhole sections, steps, cast iron ring and cover, adjusting rings, joint sealer and all other incidentals required to complete the item.

14. 02725.14X INSTALL X" FLAT TOP STORM DRAIN MANHOLE (5' DEPTH)

Payment shall include base, manhole sections, steps, cast iron ring and cover, adjusting rings, joint sealer and all other incidentals required to complete the item.

15. 02725.15 ADDITIONAL STORM DRAIN MANHOLE DEPTH

Payment shall include manhole sections, steps, joint sealer, and other incidentals to complete this item.

16. 02725.16 INSTALL OPEN THROAT STORM DRAIN INLET

Payment shall include furnishing and installing reinforced base, reinforced walls, cast iron frame and grate; excavation and backfill; and all other incidentals required to complete the item.

17. 02725.17 INSTALL SINGLE GUTTTER STORM DRAIN INLET

Payment shall include furnishing and installing reinforced base, reinforced walls, cast iron frame and grate; excavation and backfill; and all other incidentals required to complete the item.

18. 02725.18 INSTALL DOUBLE GUTTER STORM DRAIN INLET

Payment shall include furnishing and installing reinforced base, reinforced walls, cast iron frame and grate; excavation and backfill; and all other incidentals required to complete the item.

19. 02725.19 INSTALL TRIPLE GUTTER STORM DRAIN INLET

Payment shall include furnishing and installing reinforced base, reinforced walls, cast iron frame and grate; excavation and backfill; and all other incidentals required to complete the item.

20. 02725.20 INSTALL SLOTTED DRAIN CLEANOUT

Payment shall include furnishing and installing elbows, pipe, frame and grate, casting, grout, and all other incidentals required to complete this item.

21. 02725.21X INSTALL X" SLOTTED DRAIN

Payment shall include furnishing and installing the pipe and welded-on slots; furnishing and installing concrete slurry bedding; excavation and backfill; and other incidentals required to complete this item.

22. 02725.22 INSTALL SUB-DRAIN SYSTEM

Payment shall include trench excavation and backfill; removal and disposal of waste material; furnishing and installing drain pipe and all needed fittings, filter fabric; furnishing, hauling, placing and compacting drain gravel; slurry installation, any required surface restoration outside street section; all equipment, tools, labor, and other incidentals necessary to complete this item.

23. 02725.23 INSTALL SUB-DRAIN CLEANOUT

Payment shall include furnishing and installing all fittings, ring and cover, excavation, surface restoration within or outside street section, all other materials, tools, labor, and equipment necessary to complete this item.

24. 02725.24 CONNECT SUB-DRAIN TO STORM DRAIN INLET

Payment shall include all materials, equipment, tools, labor and other incidentals necessary to modify the existing inlet such that the new storm drainpipe can convey water into the inlet. Payment shall also include any work necessary to provide watertight seal around the new pipe that matches the existing storm drain walls.

25. 02725.25 CONNECT SUB-DRAIN TO SUB-DRAIN

Payment shall include all fittings, materials, equipment, tools, labor, and all other incidentals required to complete the item.

26. 02725.26 CONNECT SUB-DRAIN TO STORM DRAIN PIPE

Payment shall include all materials, equipment, tools, labor, including banding, concrete collars, or joint sealant, and all other incidentals required to complete the item.

27. 02725.27 CONNECT SUMP DISCHARGE TO SUB-DRAIN

Payment shall include any trenching or excavation, backfill, wye or tee, extension pipe, any adapter needed to make the connection, and any additional fabric, gravel, sodding, or landscape replacement, and all labor, tools, and other necessary or incidental items required to complete the item of work.

28. 02725.28 INSTALL SUB-DRAIN HEADWALL

Payment shall include all materials including concrete and wood marker post; curing of concrete; excavation and backfill; and all other work necessary or incidental for completion of this item.

29. 02725.29 INSTALL TRASH GUARD

Payment shall include furnishing and installing the trash guard and other incidentals necessary to complete the item.

30. 02725.30 CONNECT TO STORM DRAIN INLET

Payment shall include all materials, equipment, tools, labor and other incidentals necessary to modify the existing inlet such that the new storm drainpipe can convey storm water into or out of the inlet. Payment shall include any work necessary to provide a watertight seal around the new pipe that matches the inlet walls.

31. 02725.31 CONNECT TO STORM DRAIN MANHOLE

Payment shall include all materials, equipment, tools, labor and other incidentals necessary to modify the existing manhole such that the new storm drainpipe can convey storm water into or out of the manhole. Payment shall include any work necessary to provide a watertight seal around the new pipe that matches the manhole walls.

32. 02725.32 REBUILD TOP SECTION STORM DRAIN MANHOLE

Payments shall include furnishing and installing reinforced walls, reinforced lid with cast iron grate and frame, all excavation, compaction; any demolition, removal and disposal of materials, rebar, special materials for connection, and other incidentals required to complete the item.

33. 02725.33 CONNECT TO EXISTING STORM DRAIN

Payment shall include all materials, equipment, tools, labor and other incidentals necessary to modify the existing pipe such that the new storm drainpipe can convey storm water into or out of the existing pipe. Payment shall also include any work necessary to provide a watertight seal around the new pipe that matches the existing pipe walls.

34. 02725.34X INSTALL X" BAFFLE RINGS

Payment shall include trench excavation and backfill; furnishing and installing baffle rings, tie rods, tie bolts and any specials for connection culverts; furnishing and placing bedding; and all other work necessary or incidental for completion of the item.

35. 02725.35X INSTALL X" RCP STORM DRAIN PLUG

Payment shall include furnishing, installing the plug and thrust blocking; all excavation, backfill and special compaction required; and all other work necessary or incidental for completion of the item.

36. 02725.36 INSTALL CONCRETE TRICKLE CHANNEL

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of twelve inches (12") of subgrade preparation under the concrete trickle channel; placing topsoil along the edges of the concrete trickle channel; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

37. 02725.37 INSTALL APPROACH FOR CONCRETE TRICKLE CHANNEL

Payment will be for all materials, including concrete, pre-molded mastic material for expansion joints, sealant for all mastic material, contraction joints, curing of concrete; any required saw cutting to produce a neat line and the subsequent removal and satisfactory disposal of existing pavement; excavation, placing and compaction of six inches (6") of subgrade preparation under the channel; placing topsoil behind the curb; and all equipment, tools, and labor for the performance of all work and incidentals necessary to complete the item.

38. 02725.38 INSTALL CONCRETE LOW FLOW CHANNEL

Payment will be for all materials, including concrete, premolded mastic material for expansion joints, sealant for all mastic material, contraction joints; curing of concrete; excavation, placing and compaction of twelve inches (12") of subgrade preparation under the concrete low flow channel; placing topsoil along the edges

of the concrete low flow channel; and all equipment, tools and labor for the performance of all work and incidentals necessary to complete the item.

39. 02725.39 REMOVE CULVERT

Payment shall include the removal of the pipe culvert; excavation and backfill; and satisfactory disposal of the pipe culvert.

40. 02725.40XY INSTALL X' x Y' BOX CULVERT

Payment shall include trench excavation and backfill; furnishing and installing box culvert and any specials; furnishing and placing native bedding material; alignment testing and all other work necessary or incidental for completion of the item. Item shall also include the costs of preparing and furnishing design computations, working drawings, final drawings and erection drawings.

41. 02725.41 INSTALL GRATED AREA INLET

This item shall be measured by the numerical count of grated area inlets installed. Payments shall include furnishing and installing reinforced base, reinforced walls, reinforced lid with cast iron grate and frame, all excavation, backfill, compaction, and other incidentals required to complete the item.

42. 02725.42 INSTALL OUTLET STRUCTURE

This item shall be measured by the numerical count of outlet structures installed. Payments shall include furnishing and installing reinforced base, reinforced walls, reinforced lid and grates and frames, all excavation, backfill, compaction, and other incidentals required to complete the item.

43. 02725.43 INSTALL STEEL REINFORCED POLYETHYLENE PIPE (SRPE)

Payment shall include trench excavation and backfill; furnishing and installing pipe and specials; furnishing and placing native pipe bedding material; alignment, testing and all other work necessary or incidental for completion of the item.

SECTION 02805

STREET SIGNS, UTILITY POLES, AND MAILBOXES

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of the installation, removal, and/or relocation of street signs, traffic control signs, utility poles, streetlights, mailboxes of new street signs.

B. Location of street signs and private mailboxes "to be removed", are approximate only. The survey for curb or sidewalk alignment as a part of actual construction shall be the determining factor as to which of these facilities are to be moved or removed by the CONTRACTOR or others. The U.S. Postal Service shall be notified prior to removing and replacing mailboxes.

PART 2 PRODUCTS

2.01 SIGN SHEETING

A. REGULATORY SIGNS. Regulatory signs shall be made of High Intensity Prismatic Sheeting (HIP), 3M 3990 Series Type III, IV, X, or ENGINEER approved equal.

B. WARNING SIGNS. Warning signs shall be made of Diamond Grade VIP Reflective Sheeting, 3M 3930 Series Type IX, or ENGINEER approved equal. For Pedestrian, Bike, and applicable downward arrow signs, the Strong Yellow Green color shall be used.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. STREET AND TRAFFIC CONTROL SIGNS. The ENGINEER's decision to move or relocate street or traffic control signs shall be based on the location of the sign with respect to curb line, sidewalk line and the staked grading limits.

B. Signs within the staked grading limits whose existing location (both vertically and horizontally) conform to final plan location within a six-inch (6") tolerance will not be relocated. If no street signs exist, then new ones shall be installed.

C. Signs within the staked grading limits whose existing location does not conform to final plan location tolerance above will be relocated. Signs outside the staked grading limit shall also be relocated to conform to final plan location.

D. The preservation of the street, stop and other traffic control and direction signs that are to remain in place shall be the responsibility of the CONTRACTOR while the job is under construction. Should any of the signs need to be moved for the CONTRACTOR's convenience, they shall be removed by the CONTRACTOR, either temporarily reinstalled if necessary or stored, and permanently reinstalled by the OWNER when construction or curb and gutter is completed. The CONTRACTOR shall be held liable for any damage to these signs caused by neglect on his part and no extra compensation will be allowed for preserving, removing or replacing stop and other traffic control and direction signs designated to remain in place, but rather this work shall be considered as included in the contract unit prices for the various items of the contract.

E. Street, stop and other traffic control and direction signs designated to be relocated shall be removed by the CONTRACTOR and reinstalled by the OWNER in the locations shown on the Plans or designated by the ENGINEER. The cost of removing will be compensated at the unit price bid for relocating such signs.

F. The following procedures will be followed in removing and relocating both signs removed by the CONTRACTOR for his convenience and signs designated by the ENGINEER for relocation:

1. After it has been determined which signs shall be relocated at project expense, and which signs the CONTRACTOR will remove and replace for his convenience, the ENGINEER will notify the OWNER which street, stop and traffic direction signs are to be stored and reinstalled.

2. Upon receiving the CONTRACTOR's notification, a representative of the OWNER will inspect the signs that the CONTRACTOR is to remove, to determine the condition of the signs. Signs which require repair will be delivered by the CONTRACTOR to the OWNER. Signs not requiring repair will be removed and reinstalled as specified below. Signs delivered to the OWNER will be repaired and ready for pickup within forty-eight (48) hours, unless new street sign blanks are required to be ordered from the factory.

3. Where stop signs and traffic direction or control signs are removed, the CONTRACTOR shall place a temporary sign in its place. This temporary sign shall remain in place until the OWNER permanently reinstalls the stop or traffic control signs.

4. Street signs may be installed temporarily upon approval of the ENGINEER.

5. Signs not required or used for temporary installation shall be stored by the OWNER.

6. All stop, traffic direction, street signs or control signs shall be reinstalled by the OWNER in the permanent location shown on the plans or designated by the ENGINEER as soon as possible after the curb or curb and gutter forms have been removed. Signs which have been damaged after removal shall be replaced with new signs at the CONTRACTOR's expense.

G. All sign locations shall conform to the latest issue of the Manual on Uniform Traffic Control Devices for Streets and Highways published by the U.S. Department of Transportation.

H. Private Mailboxes. Private mailboxes within the staked grading limits generally are not shown on the plans. Mailboxes within the staked grading limits designated for relocation by the ENGINEER shall be removed by the CONTRACTOR and temporarily installed outside, but immediately adjacent to the construction limits. Mailboxes shall be reinstalled in accordance with U.S. Post Office regulations.

I. Power, Street Lights, and Telephone Poles. It shall be the CONTRACTOR's responsibility to coordinate the removal or relocation of utility poles with the utility owner.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02805.01 INSTALL SIGN

This item shall be measured by the number of signs installed.

2. 02805.02 REMOVAL OF SIGN

This item shall be measured by the number of signs removed.

3. 02805.03 INSTALL MAIL BOX (SINGLE)

This item shall be measured by the number of mailbox units installed.

4. 02805.04 REMOVAL OF MAIL BOX (SINGLE)

This item shall be measured by the number of existing mail box units removed.

5. 02805.05 INSTALL NEIGHBORHOOD MAIL BOXES

This item shall be measured by the number of neighborhood mail box units installed.

6. 02805.06 REMOVAL OF NEIGHBORHOOD MAIL BOXES

This item shall be measured by the number of existing mail box units removed.

7. 02805.07 INSTALL TEMPORARY MAIL BOXES

This item shall be measured by the number of temporary mailboxes provided.

8. 02805.08 REMOVE TEMPORARY MAIL BOXES

This item shall be measured by the number of temporary mailboxes removed.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02805.01 INSTALL SIGN

Payment shall include all materials, excavation, forming and curing of concrete, equipment, labor, tools and incidentals to complete this item.

2. 02805.02 REMOVAL OF SIGN

Payment shall include all materials, excavation, equipment, labor, tools and incidentals to complete this item.

3. 02805.03 INSTALL MAIL BOX (SINGLE)

Payment shall include all materials, excavation, forming and curing of concrete, equipment, labor, tools and incidentals to complete this item.

4. 02805.04 REMOVAL OF MAIL BOX (SINGLE)

Payment shall include all materials, excavation, equipment, labor, tools and incidentals to complete this item

5. 02805.05 INSTALL NEIGHBORHOOD MAIL BOXES

Payment shall include all materials, excavation, forming and curing of concrete, equipment, labor, tools and incidentals to complete this item.

6. 02805.06 REMOVAL OF NEIGHBORHOOD MAIL BOXES

Payment shall include all materials, excavation, equipment, labor, tools and incidentals to complete this item.

7. 02805.07 INSTALL TEMPORARY MAILBOXES

Payment shall include all materials, excavation, forming and curing of concrete, equipment, labor, tools, and incidentals to complete this item.

8. 02805.08 REMOVE TEMPORARY MAILBOXES

Payment shall include all materials, excavation, equipment, labor, tools and incidentals to complete this item.

SECTION 02895

GEOSYNTHETICS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers materials and work associated with providing engineering fabric for drainage and filtration, erosion control, separation and stabilization, embankment, and retaining wall reinforcement, and asphalt paving. The fabrics covered in this section shall be woven or non-woven fabric consisting only of long chain polymeric filaments or yarns such as polyethylene, polyester, polyamide, or polyvinilidene-chloride formed into a stable network such that the filaments or yarns retain their relative positions of each other.

1.02 SUBMITTAL

A. Submit for approval product name, manufacturer, minimum or maximum average roll values (MARV/MaxARV) for specification requirements, and installation procedures of the geosynthetic.

1.03 QUALITY ASSURANCE

A. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years or greater. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions. All test methods shall be in accordance with latest ASTM procedures.

PART 2 PRODUCTS

2.01 MATERIALS

A. Drainage and filtration fabric shall be continuous filament non-woven needle punched engineering fabric and meet the following minimum performance and strength requirements listed in Table 02895-1 during its service life.

B. Paving fabric shall meet the following minimum performance and strength requirements listed in Table 02895-1 during its service life.

C. Separation Fabric shall meet the following minimum performance and strength requirements listed in Table 02895-1 during its service life.

D. Biaxial Geogrid shall meet the minimum performance and strength requirements as listed here.

1.	Aperture Dimensions (MD-XMD Values)		1.0 in – 1.3 in
2.	Min Rib Thickness		0.03 in
3.	Ultimate Tensile Strength (MD-XMD)	ASTM D6637	850 lb/ft – 1,300 lb/ft
4.	Tensile Strength at 2% Strain (MD-XMD)		280-480 lb/ft
5.	Junction Efficiency	ASTM D7737	93%
6.	Flexural Stiffness	ASTM D7748	250,000 mg-cm
7.	Aperture Stability	GRI GG9	0.32 m-N/deg
8.	Resistance to Long Term Degradation	EPA 9090	100%
9.	Resistance to UV Degradation	ASTM D4355	100%

E. Uniaxial or Triaxial Geogrid shall meet the specifications as called out in the Plans. The application for uniaxial geogrids are in retaining walls and reinforced slopes.

F. Paving Grid shall meet the specifications as called out in the Plans.

GEOTEXTILE SPECIFICATION TABLE 02895-1

		Fabric Requirements (Minimum Average Roll Values – MARV)			
Fabric Property	Test Method	Drainage & Filtration	Erosion Control	Separation & Stabilization	Paving
PERFORMANCE CRITERIA DURING SERVICE LIFE					
Apparent Opening Size U.S. Standard Sieve (MaxARV)	ASTM D4751	70.		30/70	
Water Permeability gal/min/ft^2	ASTM D4491	50			
Asphalt Retention	ASTM D6140				0.2
Melting Point °F	ASTM D7138				300
STRENGTH REQUIREMENTS					
Wide Width strip tensile	ASTM D4595	40	65	90	
Tensile Strength lbs.	ASTM D4632	80	200	180	80
Elongation, %	ASTM D4594		15	15	50
Burst Strength, psi	ASTM D3786/3786M	130	320	400	
Trapezoid tear strength, lbs.	ASTM D4533	25	50	70	
Puncture strength, lbs.	ASTM D4833	25	80	70	
Seam strength, lbs./in	ASTM D4884	40	180	65	
ENVIRONMENTAL REQUIREMENTS					
Mildew, rot resistance %	AATCC30	100	100	100	
Insect rodent resistance %	AATCC24	100	100	100	
Ultraviolet resistance % strength retention	ASTM D4355	70	70	70	

PART 3 EXECUTION

3.01 PACKAGING AND ON SITE STORAGE

A. Engineering fabric shall be uniformly rolled onto a cardboard core, and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Protective wrapping shall be left on the fabric until installation. The product must not be allowed to get wet prior to installation to prevent weakening of the cardboard core. Rolls shall be externally tagged for easy field identification. External tagging shall include the following: 1) Name of Manufacturer; 2) Product type; 3) Product grade; 4) Lot number; and, 5) Physical dimensions.

3.02 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02895.01 INSTALL FABRIC (SEPARATION)

This item shall be measured by the square yardage of horizontal surface area covered by fabric (separation).

2. 02895.02 INSTALL GEOGRID

This item shall be measured by the square yardage of horizontal surface covered by geogrid.

3. 02895.03 INSTALL PAVING GRID

This item shall be measured by the square yardage of horizontal surface covered by paving grid.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02895.01 INSTALL FABRIC (SEPARATION)

Payment shall include all furnishing and installing of materials including those required for the specified overlaps, equipment, labor, tools and incidentals to complete this item.

2. 02895.02 INSTALL GEOGRID

Payment shall include all furnishing and installing all materials including those required for the specified overlaps, equipment, labor, tools and incidentals to complete this item.

3. 02895.02 INSTALL PAVING GRID

Payment shall include all furnishing and installing of all materials, including those required for the specified overlaps, applying any necessary manufacturer-specified asphalt tack coat or primer, and all equipment, labor, tools, and incidentals to complete this item.

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the plant material, and warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included:

1. Procurement and installation of Plant Material.

2. Maintenance period.

3. Warranty.

1.02 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract, and Division 1 Specification Sections. Direct submittals to the Engineer/Architect and receive approval in writing before work commences.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Samples of each of the following:

1. One pound (1 lb.) sample of organic mulch for material and composition required for project, in labeled plastic bags.

2. One pound (1 lb.) of organic compost required for project, in labeled and sealed plastic bags.

3. One pounds (1 lb.) of landscaping topsoil (import) required for project, in labeled and sealed plastic bags.

4. One gallon (1 gal.) of rock mulch required for project, labeled in plastic container (or similar).

5. Fertilizer- provide label.

6. Provide list of equipment to be used for the following tasks:

Seeding or over-seeding
Application of fertilizer

7. Wood fiber for hydro-seeding tackifier.

D. Imported Landscaping Topsoil and Compost Testing Requirements:.

1. Imported Landscaping Topsoil shall comply with ASTM D 5268- Provide topsoil analysis by a qualified soil testing lab stating the material meets the criteria.

2. Contractor-provided Compost shall have test results meet or exceed US EPA class A standard, 40CFR 503.32 (a) levels and test methods for the examination of composting and compost.

3. Test results shall be reported in the units listed. Test results shall also include certified recommendations for amendments and fertilizers required to adjust topsoil to meet the specified requirements. Contractor shall pay for all costs associated with testing. Contractor shall apply any necessary amendments and fertilizers at no additional cost to owner.

4. Certification of Testing: The Contractor shall furnish to the City a signed statement certifying that the topsoil/compost product furnished is from the lot that has been tested.

5. If the use of in-place Landscaping Topsoil is elected by the Engineer, the City will have tested the soil and any necessary Imported Compost or soil amendments will be paid for under the associated bid item.

E. Maintenance instructions: Recommended procedures to be established by Owner for maintenance of landscaping for one full year. Submit prior to completion of planting for review by Project Manager.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this project and with a record of successful landscape establishment.

1. Contractor's Field Supervision: Contractor shall have as their field supervisor, a person with a minimum of three (3) years' experience installing projects of similar scope and size. This person shall be on the project site full-time when landscaping is in progress. Supervisor should be designated in the Pre-Construction Meeting.

B. Quality:

1. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock".

2. Plants shall be sound, healthy, vigorous, symmetrically proportioned, well branched, densely foliated when in leaf, free of diseases and insect pests, eggs, larvae, and have well developed root systems. All plants will have well-formed buds with size normal for the species. Growth increments of shoots for the previous year shall be of a length that is consistent with normal growth for that season.

3. All plants shall be free of harmful insects, mites, diseases and mechanical injuries to trunks and major scaffold branches.

4. The plants supplied under these specifications shall consist of plants coming from propagating houses, beds, frames or nurseries. "Collected stock" will not be accepted unless specified or as approved substitute. All plants shall conform to the American Standard for Nursery Stock.

5. Sod shall be well established lawn grass turf of approved grasses. It shall be vigorous, well rooted, healthy turf, free from disease, insect pests, weeds, other grasses, stones, roots and any other deleterious matter.

6. Grass Seed shall meet the requirements of this specification and comply with the Wyoming Seed Law, Act No. 424, General Acts 1963, and rules and regulations promulgated there under, and any revision to the act. The seed will have been tested within nine (9) months prior to use, in accordance with the latest edition of "Rules for Seed Testing" approved by the Association of Official Seed Analysts. It shall meet or exceed the standard for purity and germination. Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the contracting officer. Bag tag figures are evidence of purity and germination and will be inspected and approved by the Engineer prior to planting. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. No seed shall contain more than one (1) percent weed seed. Limitations of noxious weed seeds will be as specified by "Rules and Regulations for Administration of Wyoming Seed Law".

C. Size:

1. All plants shall be of size(s) specified. All Deciduous trees shall be a minimum of 1.5" in diameter and all Evergreens shall be a minimum of 5' in height.

2. Measure trees and shrubs according to ANSI Z60.1 "American Standard for Nursery Stock", with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements six inches (6") above ground for trees up to four-inch (4") caliper size, and twelve inches (12") above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

D. Source Quality Control: Ship landscape materials with certificates of inspection as required by governing authorities. Comply with governing regulations applicable to landscape materials.

E. Growing Area-Provide trees and shrubs grown in one of the following areas:

1. Wyoming/Colorado Grown: Trees and shrubs grown in Colorado or Wyoming nursery fields for major portion of plant life.

2. Northern Grown: Trees and shrubs grown in nurseries for at least one year in USDA Hardiness Zones one (1) through four (4).

F. Planting seasons shall be from April 15- June 15 and from September 1- November 15, unless otherwise coordinated. Exceptions shall be coordinated with the landscape architect and owner. Trees planted outside of these dates will still have the same warranty. See Planting Plan for further coordination.

G. Inspection: The Project Manager reserves the right to inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for name, variety, size and quality. All plant material must be acceptable to Project Manager. Acceptance at time of inspection does not waive final inspection requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in original containers with all labels intact and legible at the time of inspection. Containers should show weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Trees and Shrubs: Deliver freshly dug or delivered trees and shrubs. Do not prune before delivery, except as approved by Project Manager. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering (shade cloth) during delivery. Do not drop trees and shrubs during delivery.

C. Handle balled and burlapped stock by the root ball.

D. Deliver trees, shrubs, ground covers, and sod after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, provide shade, and protect from weather and mechanical damage, and keep roots moist.

1. If planting is of trees or shrubs is delayed more than (24) hours after delivery, set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable materials. Sod must be planted within 24 hours of being harvested. Sod that sits longer than this can be rejected by Owner's Representative.

2. Do not remove container grown stock from containers before time of planting.

3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

E. Upon delivery of plants the contractor shall protect and maintain the plant materials until they are planted. Immediately remove from the site all plants which are not true to name and all materials which do not comply with the provisions of this section of specifications.

F. Deliver fertilizer in unopened containers bearing the manufacturers statement of analysis.

1.05 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Project Manager before planting.

C. Open Holes or Pits: No hole or pit shall remain open without safety devices to protect the Owner from liability for personal accidental injury.

D. Preservation of Properties: The Contractor shall be responsible for the preservation of all public or private property including: existing trees, shrubs, turf, fences and other landscape features. If any direct or indirect damage or injury is done to public or private properties by or on account of any act, omission, neglect or misconduct in the execution of the work, on the part of the Contractor, such property shall be restored by the Contractor, at his expense. Restoration shall be to a condition similar or equal to that existing before such damage or injury in such other manner as may be acceptable to the Project Manager.

E. No tree shall be planted directly above underground utilities unless approved by Owner's Representative.

1.06 COORDINATION AND SCHEDULING

A. The landscape construction schedule is to be provided at the Pre-Construction meeting depicting the dates the various stages of the project will start and when they will be completed.

B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required, only when weather and soil conditions permit and are in accordance with locally accepted practices, and approved by the Project Manager.

C. If planting of trees and shrubs occurs after turf installation, protect lawn areas and promptly repair damage to lawns resulting from planting operations. Insure irrigation system is operating to provide adequate water.

D. Trees shall be planted in the same growing season in which they were dug (unless prior arrangement and approval from Owner's Representative.

E. If plant material is to be stored on site for more than eight (8) consecutive hours, submit a detailed staging and care plan.

1.07 RECORD DRAWINGS

A. During the course of the installation, carefully record in red line on a print of the planting plans all changes made to the planting system layout during installation all deviations from the plans shall be pre-approved by the Owner's Representative.

B. Deliver this drawing to the Owners Representative at final inspection.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of one (1) year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions, unusual for warranty period, or incidents such as damage due to vandalism, hail, fire, owner neglect, or other circumstances that are beyond Contractor's control.

1. Trees

2. Shrubs

3. Ground Covers

4. Sod

C. Remove plants within seven (7) days of notification; replace dead planting materials within ten (10) days of notification from owner's representative unless required to plant in the succeeding planting season.

D. Replace planting materials that are more than twenty-five percent (25%) dead or in an unhealthy condition at end of warranty period.

E. All plant material is to be warranted throughout the warranty period and shall be replaced with plants of the same size and variety.

F. A new 1-year warranty shall be provided for all replaced items starting at the time of replacement.

1.09 MAINTENANCE

A. Maintain trees, shrubs, ground covers and sod by cultivating, watering, weeding, fertilizing, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree protection devices. Maintain all plant material for the following period:

1. Maintenance Period: Contractor responsible for plant and landscape maintenance up until project is turned over to owner upon acknowledgment of final completion.

2. Installation of irrigation system will include system winterization in the fall at an accepted date by the Owner.

3. Installation of irrigation system will include one spring startup following the fall winterization.

4. Contractor to repair any items that are damaged or impaired due to these processes.

PART 2 PRODUCTS

2.01 MATERIALS

A. Trees and Shrubs: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, and conform to the requirements of the American Standard for Nursery Stock, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1, for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Project Manager, with a proportionate increase in size of root balls.

1. Containers: All plants specified in containers shall be container grown as defined by the American Standard for Nursery Stock. Container grown stock will have a healthy vigorous root system, not overgrown, not root bound, and no encircling roots. Containerized stock that has been transplanted up to the next container size will be well established in its new container.

2. Balled and Burlapped: All balled and burlapped (B&B) trees shall conform to or exceed the minimum sizes specified in the American Standard for Nursery Stock (24”). No balled and burlapped plant shall be accepted if the ball is broken or the trunk loose in the ball or viable roots exposed. Root balls will be solid (not soft, spongy or excessively sandy) and free from large cracks or other damage to the ball.

    a. Label all trees and all shrubs of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

    b. Plants that do not appear to conform to the American Standard for Nursery Stock may be subject to official inspection the City Arborist. If any plant or plants are condemned by the City Arborist, replacement with plants that conform to the American Standard for Nursery Stock will be at the expense of the Contractor.

2.02 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1, for type of trees required.

B. Small Flowering Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as indicated on plan planting schedule.

2.03 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1, for type, shape, and height of shrub.

B. Provide container-grown deciduous shrubs as indicated. Container-grown stock to meet ANSI Z60.1, limitations.

2.04 CONIFEROUS EVERGREEN TREES AND SHRUBS

A. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens of the following grade:

B. Provide balled and burlapped (B&B) coniferous evergreen trees conforming to ANSI Z60.1

C. Provide container-grown evergreen shrubs as indicated. Container-grown stock to meet ANSI Z60.1, limitations.

2.05 STAKES AND GUYS

A. As presented in tree planting detail.

B. Upright and Guy Stakes: Steel "T" posts six feet (6') in length or round wood stakes 2" in diameter and 6' in length. Two (2) stakes per deciduous tree and three (3) stakes per coniferous tree required.

C. Guy and Tie Wire: shall be galvanized wire or similar.

D. Chafing Straps: Two inch (2") wide nylon straps with grommets at each end, cut to lengths required to protect tree trunks from damage and shall be placed above the first union branch.

E. Use safety caps on all T-Posts.

F. Standard surveyor's plastic flagging tape, white, six inches (6") long should be placed on all guy wires.

2.06 GROUND COVERS

A. Ground covers shall include all plants with the exception of trees and shrubs required for the project. This includes vines, annuals, perennials and ornamental grasses.

B. All plant material shall be true to name, which shall conform to standardized plant names of the American joint committee on horticultural nomenclature, and shall be legibly tagged with the name and size of the material according to the general nursery practice as recommended by the American Association of Nurserymen.

C. All plants shall be first class representatives of their normal species or varieties. Unless otherwise specified, plants shall have average or normally developed systems and vigorous root systems. Plants shall be free from scale, disfiguring knots, sunscald injuries, abrasions, or other objectionable blemishes. Weak plants will not be accepted. Plants must show appearance of normal health and vigor in strict accordance with these Specifications. All stock shall be nursery grown.

D. All plant material shall comply with state and federal laws with respect to inspection for plant disease and infection. Any inspection certificates required by law shall accompany each shipment, invoice, or order of stock.

E. When planted in masses, plants shall be subject to tests that will eliminate more than 20 percent variance from uniform size and that will ensure at least fifty percent conformity to larger rather than smaller sizes.

2.07 SOD, LAWNS

A. Vigorous, viable, strongly rooted sod, not dormant or less than two years old, free of weeds and undesirable native grasses, insect infestations and fungus, and machine cut to a pad thickness of at least one inch. Sod shall be composed principally of at least 50% drought tolerant species.

B. Species of Sod as per specified in the plans.

2.08 SEED, LAWNS

A. Turf seed blend shall have no more than 30% bluegrass. It can be tuff turf blend which is 30% bluegrass, 30% ryegrass, 40% fine leaf fescue containing drought tolerant varieties that exhibit dark green color.

2.09 SEED, DRYLAND

A. Dryland seed: with guaranteed 95% pls.

1. Nordan crested wheatgrass
2. Russian Wild Rye
3. Slender Wheatgrass
4. Oahe Intermediate wheatgrass
5. Fairway Crested wheatgrass
6. Western Wheatgrass

B. Other mixes-

1. JA Low profile mix.- 57% wheatgrasses, 3% buffalograss, 20% blue grama, 20% ryegrass
2. Wyoming Dryland mix- 24% ryegrass, 66% wheatgrass, 10% Blue Grama
3. Or other approved seed mixes as specified.

C. All seed shall be delivered to the job site in the original bags with tags certifying purity, germination, common and botanical name for each species, and percent weed seed. All tags shall be removed from the bags by the owner's representative. Untagged seed bags shall be rejected.

D. In the event of rejection of the seed, immediately make all replacements necessary to the approval of the owner's rep. and at no additional cost to the owner.

2.10 HYDROSEEDING

A. Use equipment designed for such work. Seeding shall be carried out by means of a proper hydroseeder where approved slurry of seeds, mulch, fertilizer, binders, and organic matter are sprayed onto the prepared soil surface.

2.11 FERTILIZER

A. Commercial grade of neutral character, with some elements derived from organic sources.

B. Lawns: farm-type, such as 18-46-0 applied at five pounds (5 lbs) per one thousand square feet (1,000 sq ft.) of lawn area, or 16-20-0, at seven pounds (7 lbs) per one thousand square feet. Provide Nitrogen in

a form that will be available to lawns during initial growth period. Established lawns shall not receive more than one and a half pounds of soluble nitrogen per thousand square feet, applied 4 times annually.

C. Trees and shrubs: not less than 5% total nitrogen, ten percent available phosphoric acid, and 5% soluble potash.

D. Dryland seeding: not less than a 2:1:1 ratio of nitrogen, phosphorus and potassium.

E. All fertilizer applications are to follow manufacturer's recommendations and shall, at minimum, meet the application requirements above.

2.12 LANDSCAPING TOPSOIL (IMPORT)

A. Topsoil: ASTM D 5268, PH range of five and one half (5.5) to eight (8), four percent (4%) organic material minimum, free of stones one inch (1") or larger in any dimension, and other extraneous materials harmful to plant growth.

2.13 SOIL AMENDMENTS/COMPOST

A. Compost: One hundred percent (100%) humus rich organic matter. The compost shall be a well decomposed, stable, weed free organic matter derived from agricultural, food, or industrial residuals; bio-solids (treated sewage sludge); yard trimmings, or source-separated or mixed solid waste. Product must be certified as fully composted at a permitted solid waste processing facility. Product to be registered with the Wyoming Department of Agriculture. Product shall contain no solid particle greater than one-half inch (1/2") in length or diameter and be free from un-composted or non-stabilized wood bulking agents. Product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived. Compost shall meet or exceed US EPA Class A standard, 40CFR 503.32 (a) levels and Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council)

B. Certification of Compost Testing: The Contractor shall furnish to the owner a signed statement certifying that the compost furnished is from the lot that has been tested.

C. Only used when specified in the construction plans

2.14 HERBICIDES

A. Coordinate EPA registered and approved.

B. Applicators must possess Wyoming commercial applicator's license.

2.15 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials, noxious weed seed and all foreign matter harmful to plant life, suitable as a top dressing of trees and shrubs.

1. Product to be as specified in project details. (submit sample for review)

2. Wood Mulch shall be either western red cedar, redwood medium bark or "gorilla hair" shredded redwood mulch.

3. Rock mulch should be as specified in project details (submit sample for review) should be free from all organic and inorganic debris and trash.

2.16 LANDSCAPE EDGING

A. Comparable products by other manufacturers will be considered provided complete supporting from the manufacturer is submitted to the owner's representative. Comparable products must be architecturally similar in size, type, and grading of materials, dimensions, finishes and textures.

1. Landscape edging shall be installed per manufacturer's specifications, in all locations shown on drawings.

B. Edging stakes shall be a minimum of 12" long and tapered in design and finished to match specified landscape edging (header). Stakes used shall be designed specifically to anchor landscape edging, and shall be made by the manufacturer of the landscape edging for which they will be used

C. Acceptable materials for edging shall be:

1. Metal edging

i. Steel Edging

1. Shall be powder coated- any chips or uncoated surfaces will be rejected.

2. Must be a minimum of 1/8" in thickness for radiuses or flowing curves and 3/16" minimum for all other applications

3. Shall be a minimum of 6" in height.

2. Concrete Edging

i. Cast in place

1. Concrete edging shall be a minimum of 4" in depth and a minimum of 6" in width, with tooled joints spaced evenly at 3-4' centers

2. Concrete shall be a 4,000 psi strength concrete.

3. Concrete shall be reinforced with steel cable or an approved equal.

2.17 LANDSCAPE FABRIC

A. Landscape Fabric shall be commercial grade, black or gray polypropylene polyester blend non-woven and should be a minimum of 5 oz/sy..

Landscape fabric staples should be common sod staples of 11 gauge and 6" in length made of steel material.

2.18 BOULDERS

A. Contractor shall furnish boulders similar in appearance, color, type, and approximate size as shown on drawings or specified in the contract documents. No evidence of drilling, scrapes, large flakes, or cracks shall be visible after the boulder is set in place

B. As presented in the Standard detail drawings.

PART 3 EXECUTION

3.01 EXAMINATION/INSTALLATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Prior to any excavation, all underground utilities shall be identified by the proper authority.

3.02 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings in accordance with the plan. Stake locations, outline areas, and secure Project Manager's acceptance before the start of planting work. Make minor adjustments as may be required. Expect minor adjustments to the plans for location of all plant materials.

3.03 PLANTING SOIL PREPARATION

A. Bed preparation shall pertain to the preparation of the surface of the ground to receive the sod. The ground shall be hand or machine raked so as to remove all debris, clods, stones or other foreign material larger than 1 inch. Such debris, clods rocks, and other material so removed shall be disposed of off the immediate property. Bed preparation shall not commence until the moisture conditions make the soil friable. Any areas that are not friable or are compacted shall be raked or amended physically until a uniform planting bed is achieved.

3.04 GRADING

A. Grade all lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls such as sidewalks etc.

B. Roll, scarify, rake and level as necessary to obtain true even lawn surfaces. Prior to sodding, finish grade of compacted topsoil shall be 1” below all paved surfaces.

C. All finish grades shall be approved by the owner’s representative in writing before any sod is laid or seed is planted.

3.05 SOIL AMENDMENTS

A. When using compost.

1. Compost shall be uniformly applied over the entire area at an average depth of 1-2 inches.

2. Incorporate to a depth of 5-7 inches (for a 20-30% inclusion rate) using a rotary tiller or other appropriate equipment. Higher inclusion rates are necessary for upgrading marginal soils.

B. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. For tree pit or trench backfill, if specified-mix planting soil before backfilling and stockpile at site.

2. Any and all excess material and or debris including rocks or boulders shall be removed from site and properly disposed of.

3.06 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Tree planting pits may be excavated by hand or by mechanical means. Pits dug mechanically will have the resulting walls scarified to eliminate glazing. Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

B. Balled and Burlapped Trees (B & B): Excavate pit a minimum of two times as wide as the ball diameter, with ball depth (per drawings) so that top of root flare is level or slightly higher than finish grade. The root ball shall be placed on firm, undisturbed soil in the planting pit to prevent settling.

C. Container grown Trees and Shrubs: Excavate pit a minimum of two (2) times container width, and depth per drawings.

D. Obstructions: Notify Project Manager if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

E. Drainage: Notify Project Manager if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

3.07 PLANTING TREES AND SHRUBS

A. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before installation.

B. Set balled and burlapped stock plumb, and in center of pit or trench with top of ball level or above adjacent finish grades as indicated.

1. Place stock on undisturbed soil at bottom of planting pit.

2. Wire baskets will be removed completely prior to completion of backfilling. All twine or plastic and all burlap will be removed from the root ball. Do not use planting stock if ball is cracked or broken before or during planting operation.

3. Set top of Root Flare 1” to 2” above grade. Trunk flare must be visible after backfilling.

C. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 (one-half) backfilled, water thoroughly before placing remainder of backfill to allow soil to settle around the roots. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill. Any settlement shall be brought to grade with planting mix.

D. Create 4” high earth saucer beyond edge of the root ball outside of the planting pit. The earth saucer can be eliminated if sod is to be placed around tree.

E. Additional watering is required every two weeks, or as needed, until final acceptance.

F. Set container-grown stock plumb, and in center of pit or trench with top of ball raised 1-2” above adjacent finish grades .

1. All containers will be removed and root balls scarified. Carefully remove containers so as not to damage root balls.

2. Place stock on undisturbed soil at bottom of planting pit.

G. All trees planted shall be supported with guys or stakes.

1. Upright Staking and Tying: Use a minimum of two (2) stakes on deciduous trees and (3) stakes for coniferous trees of length required to penetrate at least twelve inches (12") below finish grade and to extend at least forty-eight inches (48") above grade. For deciduous trees one stake will be placed on the northwest side of the tree and the other 180° opposite on the southeast side. For evergreen trees one stake will be placed on the northwest side of the tree and the others at 120° around the tree. Safety caps will be installed on all metal posts. Set vertical stakes in undisturbed soil to avoid penetrating balls or root masses. Support trees with two (2) strands of tie wire attached to nylon tree straps at contact points with tree trunk above the 1st branch. Allow enough slack to avoid rigid restraint of tree. Flag guy wire with standard surveyor's plastic flagging tape.

2. Owner will be responsible for removal of stakes after the warranty period.

3.08 LAWNS, SOD

A. Sodding

1. Application

i. Sod may be placed at any time when the ground is not frozen and the irrigation system is operational and will remain so for 6 weeks minimum. If irrigation system (including electronic controller) is not operational the contractor must have a plan in place to provide irrigation and plan must be approved by Owner's Representative.

ii. During laying operation handle and lay all sod with approved machinery having high flotation tires or tracks, so that the finish grade is not damaged.

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iii. Lay sod parallel to the direction of the slope and in a manner permitting butt joints to alternate. Fit sod pieces tightly together so that no joints are visible and tamp sod firmly and evenly by hand

iv. Roll sod with a one hundred fifty pound (150) roller to level and seal seams. After rolling, water sod until water soaks through into topsoil to a depth of not more than three inches (3"). Water, weed and replace sod, if required until final completion. Erect and maintain temporary protection devices where deemed necessary

v. All edges of sod areas shall be smooth, clean edges having a straight line or a nice smooth look. Where sod areas meet seed areas the levels should meet so that the soil level within the sod is even with the seed bed level

B. Maintenance

1. General: Maintain all lawn areas until final completion of the job but in no case less than 30 days

2. Work included: all areas shall be watered as required. Watering shall follow general guidelines. Contractor is responsible to adjust for localized conditions.

3. Apply enough water to keep sod moist and enough water to penetrate soil to 3" at all times.

4. All areas shall be watched closely so that they are not permitted to dry out or form puddles of water, or to be washed out by over application. Contractor is responsible for any damage incurred by irrigation such as washouts, flooding, etc.

5. All areas shall me mowed as required. First mowing to be 7-10 days after sod is laid. Withhold water for one full day prior to mowing. Insure that the sod and soil can support the weight of the proposed mowing. Mow all lawn at 2 ½ "never removing more than 1/3 the leaf blade. If any damage to the sod occurs, immediately report same to Owner's Representative and proceed as directed. Cost for all damage restoration shall be borne entirely by contractor.

6. Mow sod at least twice before final completion.

C. Replacements

1. Any area that fails to produce an adequate stand of grass or that turns yellow shall be re-sodded by the contractor at no additional expense to the owner. Replacements required because of vandalism or other causes beyond the control of the contractor are not part of the contract.

3.09 IRRIGATED LAWN SEED

A. Prior to seeding, areas that have become muddy or hard shall be scarified to a depth of 4", and left in a friable condition.

1. Apply superphosphate at a rate of 10 lbs. per 1000 sf or as recommended by soil analysis.

2. Apply seed, per manufacturers' recommended rates using a drop spreader. Divide into 2 halves and distribute one half on the north south direction and the other half from east to west.

3. Rake seed into the soil and commence light watering, at least 4 times per day for 2 weeks or until seed germinates.

4. Germination of seed and establishment of grass shall be at the 70% of ground coverage at the time of acceptance. This will be tested by taking a 3'x3' representative sample of the area and measuring grass density. Any areas not meeting this density shall be re-seeded. If acceptance of the project occurs before the germination of seed, this shall become a warranty item.

3.10 HYDROSEEDING

A. Prior to seeding, areas that have become muddy or hard shall be scarified to a depth of 4", and left in a friable condition.

1. Use equipment designed for such work. Before application of hydro-seed, apply a minimum of ½ of seed to the areas by the method of broadcasting, drilling, or hydro-seeding without the mulch being applied. The remaining seed shall be mixed and uniformly applied to the areas scheduled to be seeded. Fertilizer, water, seed and approximately 1 ton (2000 lbs) of hydraulic mulch shall be homogenously mixed and uniformly applied to a 1 acre seeded area. The hydro-mulch shall be applied heavy enough to have 90% coverage on the ground.

2. All hydro-seeding applications are to be applied in a sweeping motion to form a uniform application and form a mat at the specified rates. It shall also be applied in a 2-part process of seed application alone, then mulch being application.

3. Unused loads: if mixture remains in tank for more than 8 hours it shall be removed from the job site at the contractor's expense.

3.11 DRILL SEEDING Broadcasting will be allowed in areas that cannot be drilled.

A. Drilling: Drills shall be set for uniform rows with spacing not to exceed 8" inches for dryland applications and 4" for lawn areas, and depth for the type of seed being drilled, for a distribution rate of 20 lbs per acre or as recommended by the local soil conservation service or by the seed blend rate.

3.12 STRAW MULCHING

A. Straw mulching: spread mulch uniformly over the seeded area at a rate of one and a half tons per acre. Crimp mulch in the soils with a smooth or serrated coulter disc.

3.13 HYDROMULCHING

A. Mulch used shall be composed of or wood fibrous products with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water in the proportions specified, will form a homogenous slurry which is capable of being sprayed to form a porous mat. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye for visual metering of application and shall be accompanied by a certificate of compliance stating that the fiber conforms to these specifications.

B. Organic Stabilizer/tackifier - Shall be an organic substance supplied in powder form and shall be psyllium based and packed in clearly marked bags stating the contents of each package. Percentage of tackifier shall be not less than 2% and not more that 10%.

C. Equipment- equipment used for application of slurry shall be a commercial-type hydro-seeder and have a built in agitation system with an operation capacity sufficient to agitate, suspend, and homogeneously mix slurry. Distribution lines shall be large enough to prevent stoppage and allow for even distribution of slurry over the site- Pump shall be able to generate 150 psi at the nozzle.

3.14 MULCHING

A. Mulch all trees inside of bermed tree wells and around all shrubs as indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

C. Thickness: Four inches (4") of watered and settled tree mulch, or as indicated on the plans.

3.15 BOULDERS

A. The contractor shall coordinate with the engineer prior to setting boulders to ensure desired face and orientation is achieved. Boulders shall be placed on site as directed by the Owner's Representative.

B. The contractor shall form a pocket for boulder installation, ensuring that the boulder is even and true to line, buried one third to one half of the boulder depth, and in accordance with the standard detail, or as shown in the drawings.

C. Boulders shall be buried in ground with no more than 50% of boulder unseen.

3.16 FERTILIZER

A. For sod and seed plantings: Fertilizer shall be placed in a spreader that is calibrated to apply the proper amount of material per 1,000 sq ft. Care should be taken to avoid excessive overlapping. Fertilizer should be applied before sod or seed is applied

B. Hydro-seeding application 500 lbs. of fertilizer 6-24-24 per 2000 lbs of cellulose or wood fiber.

3.17 LANDSCAPE EDGING

A. Install landscape edging where indicated on contract drawings, according to manufacturer's recommendations. Anchor metal edging with stakes spaced a minimum of 30 inches on center, driven below top elevation of edging, or at every stake pocket location in landscape edging sections designed and manufactured to receive stakes. Stakes shall be located in solid undisturbed soil, or in soil set at relative 85% compaction. The ends of all edging shall have a stake within 6" of that spot (cut edging to ensure stake will be at end of piece).

B. Horizontal alignment-install straight sections true to the alignments as indicated, free of waves or bends, using strings as guides. Install curved sections true to the alignments as indicated, free of waves or bends following marked alignments approved in the field by the owner's representative. Field weld all butt joints

3.18 LANDSCAPE FABRIC

A. Install all weed barrier fabric strictly in conformance with manufacturer's recommendations and installation procedures.

1. Weed barrier shall be laid on finish grade in all shrub and tree beds following plant installation or as shown in the design drawings. Weed barrier shall be completely covered by mulch. Anchor weed barrier with stakes placed 4' o. c. around edges and along splices. Lap all splices a minimum of 6".

3.19 CLEANUP AND PROTECTION

A. During landscaping, store materials and equipment where directed.

B. The City prohibits the tracking, dropping, or depositing of soils or any other materials onto City streets by or from a vehicle or machinery. Any inadvertent deposited material shall be removed by the end of business day.

C. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

D. At the end of construction, all holes, ruts, settlements, and depressions resulting from the work will be filled and graded to match elevations of adjacent surfaces, and all areas disturbed by construction shall be restored to their original condition to the maximum extent practicable and as acceptable to the Project Manager.

E. Protect all sod by erecting temporary fences, barriers, signs, etc. as necessary to prevent traffic. Barriers shall remain in place for at least 6 weeks unless other arrangements are made with the owner's representative.

F. Hydro-seeding overspray. Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.

3.20 INSPECTION AND ACCEPTANCE

A. When the landscape work is complete, the Project Manager will, upon request, make an inspection to determine acceptability, giving the Owner's Representative 48 hours prior notice of readiness for inspection.

B. In addition to the normal progress inspections, schedule and conduct the following formal inspections, giving the owner's representative at least 48 hours prior notice of readiness for inspection.

1. Inspection of plants in containers prior to planting.

2. Inspection of plant locations, to verify compliance with the plans.

3. Inspection of germination and irrigated seed densities.

4. Substantial completion inspection after completion of planting. Schedule the substantial inspection sufficiently in advance, and in cooperation with the owner representative so that the final inspection may be conducted within 24 hours after completion of planting.

C. Where inspected landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until re-inspected by the Project Manager and found to be acceptable. Replace all such plantings at one time and within ten (10) working days of notifications whether for acceptance or warranty inspections. Remove rejected plants and materials promptly from the project site.

D. All plants rejected during final inspection shall be replaced immediately by new healthy plants of equal size. All replacements shall be the same species as originally installed.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Upon completion of work, clean adjacent streets and site paving of dirt and debris accumulation.

B. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the owner's property.

PART 4 METHODS OF MEASUREMENTS AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 02900.01 INSTALL TREE (type)

This item shall be paid by numerical count for all trees installed throughout the project.

2. 02900.02 INSTALL BUSH (type)

This item shall be paid by numerical count for all bushes installed throughout the project.

3. 02900.03 INSTALL GROUND COVER (type)

This item shall be paid by the numerical count of all ground covers installed throughout the project.

4. 02900.04 IMPORTED LANDSCAPING TOPSOIL

This item shall be paid by the cubic yard at the point of loading

5. 02900.05 IMPORTED COMPOST/SOIL AMENDMENTS

   This item shall be paid by the cubic yard at the point of loading.

6. 02900.06 INSTALL MULCH

   This item to be paid by the cubic yardage or ton at the point of loading.

7. 02900.07 SODDING

   This item shall be paid by the square foot of area sodded.

8. 02900.08 SEEDING

   This item shall be paid by the acres of area seeded.

9. 02900.09 HYDROSEEDING

   This item shall be paid by the square foot of area hydro-seeded.

10. 02900.10 HYDROMULCH

    This item shall be paid by the square foot of area hydro-mulched.

11. 02900.11 STRAW MULCH

    This item shall be measured by the number of tons of straw mulch applied to the seeded areas.

12. 02900.12 INSTALL LANDSCAPE EDGING

    This item shall be paid by the lineal foot of landscape edging installed.

13. 02900.13 INSTALL LANDSCAPE FABRIC

    This item shall be paid by the square yard of landscape fabric installed.

14. 02900.14 INSTALL BOULDERS (size)

    This item shall be paid by the numerical count of all boulders installed.

15. 02900.16 INSTALL BLOCK RETAINING WALL (type)

    This item shall be measured by the square foot of retaining wall installed to the dimensions as indicated on the drawings.

16. 02900.17 INSTALL FENCE (type)

    This item shall be measured by the lineal foot of permanent fences installed as called for on the drawings.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 02900.01 INSTALL TREE (type)

   Payment shall include all materials, excavation, backfill, equipment, labor, tools and incidentals to complete this item.

2. 02900.02 INSTALL BUSH (type)

   Payment shall include all materials, excavation, backfill, equipment, labor, tools and incidentals to complete this item.

3. 02900.03 INSTALL GROUND COVER (type)

   Payment shall include all materials, excavation, backfill, equipment, labor, tools and incidentals to complete this item.

4. 02900.04 IMPORTED LANDSCAPING TOPSOIL

   Payment shall include furnishing and spreading the landscaping topsoil, providing all soil testing and lab results, and all incidentals necessary to complete this item.

5. 02900.05 IMPORTED COMPOST/SOIL AMENDMENTS

   Payment shall include furnishing, spreading and incorporation, providing all compost or soil amendments testing and lab results, and all incidentals necessary to complete this item.

6. 02900.06 INSTALL MULCH

   Payment shall include furnishing, spreading, and all incidentals necessary to complete this item.

7. 02900.07 SODDING

   Payment shall include furnishing the sod, fertilizer, preparing the seed bed, laying the sod, watering and maintenance of the sod, and all labor, equipment, tools and incidentals necessary to complete the item.

8. 02900.08 SEEDING

   Payment shall include furnishing the seed, fertilizer, equipment, preparing the seed bed, drilling or broadcasting the seed, including all labor, equipment, tools, and incidentals necessary to complete the item.

9. 02900.09 HYDROSEEDING

   Payment shall include furnishing the seed, fertilizer, hydro-mulch, preparing the seed bed, broadcasting of at least ½ the seed rate, a physical method of incorporation, and all labor equipment, tools, and incidentals necessary to complete the item.

10. 02900.10 HYDROMULCH

    Payment shall include furnishing the fertilizer and hydro-mulch, application of the hydro-mulch, and all labor equipment, tools, and incidentals necessary to complete the item.

11. 02900.11 STRAW MULCH

Payment shall include furnishing, spreading and crimping the straw, and all labor, equipment, tools, and incidentals necessary to complete this item.

12. 02900.12 INSTALL LANDSCAPE EDGING

    Payment shall include furnishing all materials and installation of the edging. This shall include all labor, equipment, tools, and incidentals necessary to complete this item.

13. 02900.13 INSTALL LANDSCAPE FABRIC

    Payment shall include furnishing all materials and installation of the fabric. This shall include all labor, equipment, tools, and incidentals necessary to complete this item.

14. 02900.14 INSTALL BOULDERS

    Payment shall include furnishing and installation of the boulders. This shall include all labor, equipment, tools, and incidentals necessary to complete this item.

15. 02900.16 INSTALL BLOCK RETAINING WALL (type)

    Payment shall be for all materials, including modular blocks, drain gravel, drainage pipe, excavation, placing and compaction of six inches (6") of sub-grade preparation under the retaining wall; and all equipment, tools, and labor for the performance of all work and incidentals necessary to complete the item.

16. 02900.17 INSTALL FENCE (TYPE)

    Payment shall include all materials, excavation of post holes, backfill, compaction, concrete, equipment, labor, tools, and incidentals to complete this item.

SECTION 02920

IRRIGATION

PART 1 GENERAL

1.01 SCOPE

A. Provide labor, materials, supplies, equipment, tools, transportation and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system; and guarantee/warranty as shown on the drawings, installation details and as specified herein.

1.02 SUBMITTALS

A. The Contractor shall submit one (1) PDF copy of all submittals to the Project Engineer prior to the commencement of the work.

1. Provide a table of contents and index

a. Unless otherwise provided for in the contract documents, index shall be organized into sections based on pay items provided in Method of Measurement and Basis of Payment (see Part 4 below).

b. Index for each section must show the specific components and model numbers being provided for that section.

c. If components or items apply to multiple Method of Measurement and Basis of Payment sections, the components shall be shown or listed in all applicable sections of the index. However, cut sheets need only be supplied once at the first applicable Section.

2. Submittals must be made of all the components on the material list. Additional components may be necessary due to Special Provisions. Such Special Provision items shall be indicated as such in the index by their respective Special Provision numbers.

3. Highlight, or otherwise clearly indicate, which items are being supplied on catalog cut sheets. Also highlight, or otherwise clearly indicate, options as there may be for any given item.

4. Submittal package (including table of contents and index) must be complete prior to being reviewed by the Project Engineer. Incomplete submittals may be returned without review at the option of the Project Engineer.

B. Materials List: Include sprinklers, bubblers, pipe, sleeving, controller, communication system, valves, valve boxes, meters, hydrometers, wire, wire connectors, gate valves, fittings, solvents, cements, air relief valves, conduit, shop drawings and all other components shown on the drawings and installation details and/or as described in these specifications for any pay item applicable to the work. Components such as pipe sealant, pipe solvent cements, wire, wire connectors, ID Tags must be included. Quantities of materials need not be included.

C. Manufacturers Data: Submit manufactures' catalog cuts, specification and operating instruction for equipment shown on the materials list. For sprinklers, bubblers and other

end-point irrigation water delivery devices, head performance data and/or charts must be provided.

D. Shop Drawings: Submit shop drawings as called for in the installation details, design drawings and/or contract documents. Show products required for proper installation, their relative locations and critical dimensions. Note modifications to the installation detail if applicable.

1.03 RULES AND REGULATIONS

A. Provide work and materials in accordance with latest edition of National Electric Code, Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws, regulations and codes of governing authorities.

B. When contract documents call for materials or construction of better quality or larger size than required by above-mentioned rules and regulations, provide quality and size required by contract documents.

C. If quantities are furnished either in specification or on drawings, quantities are furnished for information only and are understood to be estimates. It is Contractor's responsibility to determine actual quantities of material, equipment and supplies required by the project and to complete independent estimates of quantities and wastage.

D. Notify Owner's Representative in writing prior to construction about any discrepancies between contract documents and existing site conditions or manufactures specific recommendation for use of their product.

E. Contractor is responsible for damage to existing site amenities, features, fixtures and appurtenances during construction. Replace damaged items with identical material of equal value to match conditions prior to construction. Make replacements at no additional cost to the contract price. Penalty for any specific damage shall be on the basis of the value determined by an independent auditor or as mutually agreed to by Owner and Contractor in writing.

1.04 QUALITY ASSURANCE

A. Engage an experienced Installer who has completed irrigation work similar in material, design and extent to that indicated by the contract documents and with a record of successful irrigation installations.

1. Installer's Field Supervision: Installer shall have their Onsite Supervisor (or Foreman); a person with a minimum of three (3) years' experience installing projects of similar size and scope. This person shall be on the project site full-time when irrigation installation activities are in progress. The onsite supervisor will be designated at the Pre-Construction conference.

B. Additional qualifications, experience, references and documentation may be required by special provision.

1.05 TESTING

A. Except as specifically provided for in Part 4 or by Special Provision, all testing described herein shall be considered incidental to the completion of the work and no separate payment shall be made for the completion of testing or retesting.

B. Schedule testing with Engineer and Owner's Representative a minimum of three (3) days in advance of testing.

C. Mainline pipe jointed with rubber gaskets or threaded connections may be subjected to pressure test at any time after partial completion of backfill. Allow irrigation pipe jointed with solvent welded PVC joints to cure at least twenty-four (24) hours before testing.

D. Subsection(s) of mainline pipe may be tested independently, subject to review and approval of Engineer.

E. Provide clean, clear water, pumps, tools, instruments, labor, fittings and equipment necessary to conduct tests or retests.

F. Testing Documentation

1. Submit a written report of all tests to Owner and Engineer. Each test report shall provide:

a. Test type or name

b. Date of test

c. Name of individual(s) performing the test on behalf of Contractor

d. Name of subcontractor or company performing the test on behalf of Contractor

e. Test results as appropriate and required for the test being performed

f. Hydrostatic Pressure Tests and Volumetric Pressure Tests shall clearly indicate the section(s) of mainline being tested.

G. Hydrostatic Pressure Test

1. Hydrostatic pressure test to be conducted for all mainline pipe.

2. Subject mainline pipe to hydrostatic pressure equal to 140 psi for two (2) full hours.

3. All mainline components must be installed for the mainline section to be tested. All RCV's and/or RCV Isolation Valves installed on the mainline section shall be in a MANUALLY CLOSED position.

4. Backfill trenches sufficient to prevent pipe movement under pressure. Expose couplings, fittings, changes in direction and mainline components.

5. Purge air from mainline pipe before test. Attach pressure gauge to mainline pipe in test section.

6. Observe pressure loss on pressure gauge. If pressure loss is greater than five (5) psi, identify reason for pressure loss. Replace defective pipe(s), fitting(s), joint(s), valve(s) or appurtenance(s) as necessary. Make replacements at no

additional cost to Owner. Repeat test until pressure loss is equal to or less than five (5) psi.

7. Visually inspect irrigation pipe for leakage and replace defective pipe(s), fitting(s), joint valve(s) or appurtenance(s). Repeat test until pipe passes test.

8. Cementing, cement or concrete encasement, caulking, taping, heating or any similar methods to seal leaks is prohibited.

9. Repeat test(s) until entire mainline passes all tests. Repeat tests, replace components, appurtenances and correct deficiencies at no additional cost to Owner.

H. Volumetric Leakage Test

1. Shall only be performed by approval of Engineer on mainline sections greater than or equal to three (3) inches in diameter if mainline section does not pass the Hydrostatic Pressure Test.

2. All mainline components must be installed for the mainline section to be tested. All RCV's and/or RCV Isolation Valves installed on the mainline section shall be in a MANUALLY CLOSED position.

3. Backfill trenches sufficient to prevent pipe movement under pressure. Expose couplings, fittings, changes in direction and mainline components.

4. Purge air from mainline pipe before test. Attach pressure gauge to mainline pipe in test section.

5. Provide all necessary pumps, bypass piping, storage tanks, meter, 3-inch test gauge, supply piping, fittings and all other necessary tools, equipment and materials in order to properly perform testing.

6. Testing pump must provide minimum continuous 140 psi of pressure to the mainline pipe for a period of two (2) full hours. Test pressure shall not deviate by more than five (5) psi during test period. Restore test pressure to 140 psi at conclusion of test period.

7. Water added to mainline pipe must be measured volumetrically to nearest tenth (0.10) gallon.

8. Allowable maximum volume loss during test shall be calculated according to the following method and table:

a. Allowable Leakage (Gallons per (100 Joints)/Hour)

PIPE SIZE (INCHES)	Test Pressure (psi)								
	60	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**
3”	0.31	0.34	0.36	0.38	0.41	0.43	0.44	0.46	0.48
4"	0.42	0.45	0.48	0.51	0.54	0.57	0.59	0.62	0.64
6"	0.63	0.68	0.73	0.77	0.81	0.85	0.89	0.92	0.96
8”	0.84	0.90	0.97	1.03	1.08	1.13	1.18	1.23	1.28

Note: Allowable Leakage Formula $L=(ND\sqrt{P})/7400$ where:
L = Allowable Leakage per Hour (gph)
N=Number of Joints within Mainline Section

D=Nominal Diameter of Pipe (inches)
P=Average Test Pressure (psi)

9. Replace defective pipe(s), fitting(s), joint(s), valve(s) or appurtenance(s) as necessary at no additional cost to Owner. Repeat test(s) until entire mainline passes test.

10. Cementing, cement or concrete encasement, caulking, taping, heating or any similar methods to seal leaks is prohibited.

11. Contractor may sub-contract testing as approved by Engineer and Owner.

12. Repeat test(s) until entire mainline passes all tests. Repeat tests, replace components, appurtenances and correct deficiencies at no additional cost to Owner.

I. Operational Test

1. Charge POC Assembly and Mainline. Ensure all air is evacuated from POC Assembly and Mainline.

2. Activate and fully cycle each Remote-Control Valve (RCV) in sequence from controller. Sequencing may be non-linear; provided each and every RCV is fully cycled at least once.

   a. If controller is remote capable, valve activation must be remote. If controller is not remote capable, provide one (1) additional personnel to operate controller to activate and fully cycle each and every RCV from controller while Contractor and Owner's Representative observe system operation.

3. Manual operation of an RCV using manual bleed mechanism of any kind at RCV is not an acceptable method of testing.

4. Owner's Representative will directly observe operation, water application patters, leakage and valve cycling. Operational Testing without an Owner's Representative present shall not be accepted.

5. Replace defective RCV's, solenoids, wiring or other appurtenances as necessary to correct operational deficiencies.

6. Replace, adjust or move water emission devices to correct operation or coverage deficiencies. Refer to contract documents and/or design drawings for minimum coverage efficiency requirements.

7. Replace defective pipe, fittings, joints, valves, sprinklers or other appurtenances to correct leakage problems. Cementing, cement or concrete encasement, caulking, taping, heating or other similar methods to seal leaks are prohibited.

8. Repeat test(s) until each and every RCV and its connected lateral line passes all tests. Repeat tests, replace components, appurtenances and correct deficiencies at no additional cost to Owner.

J. Copper Tracing Wire

1. Using an underground utility locate device approved by Engineer, demonstrate that wire is capable of locating entirety of mainline pipe.

2. If wire is not capable of locating entirety of mainline pipe, locate break or deficiency in tracing wire and replace wire section, splice or defect as indicated.

3. Repeat test(s) until entire mainline can be located with tracing wire per its intended use.

K. Control System Grounding

1. Test for proper grounding of control system per manufacturer's recommendations and requirements. Test results must meet or exceed manufacturer's guidelines for acceptance.

2. Replace defective wire, grounding rod or other appurtenances as necessary. Repeat test(s) until the manufacturer's guidelines are met. Make such replacements as required at no additional cost to Owner.

L. Compaction Testing

1. Unless specifically provided for in these specifications or by the contract documents, the minimum compaction result of any compaction test referred to herein shall be ninety-five percent (95%) of Standard Proctor Density, ATSM D689-78.

2. Compaction Testing at POC Assembly: Contractor shall be required to hire an independent certified testing agency as approved by the Engineer to provide compaction testing a the POC Assembly.

a. Requirements and Frequency

i. A minimum of three (3) compaction tests shall be required at the POC Assembly

I. At two (2) feet of cover around and above the upstream connection to the vertical riser pipe out of the Meter Vault to above grade POC components: Contractor shall bed, backfill and compact to two (2) feet of cover over all horizontally installed pipe and fitting and provide a compaction test.

II. At surface grade around Vertical Riser Pipe out of Meter Vault: Contractor shall backfill and compact to not less than six (6) inches but not more than two (2) inches below finished grade and provide a compaction test.

III. At surface grade around downstream vertical riser pipe from above grade POC components to connection with existing irrigation mainline: Contractor shall bed, backfill and compact to not less than six (6) but not more than two (2) inches below finished grade and provide a compaction test.

3. Mainline Trench Backfill Compaction Testing: As indicated in design drawings and/or contract documents.

4. Compaction Testing at Sleeves: As indicated in design drawings and/or contract documents.

M. Testing Review: Failure of initial testing review will require additional review. Payment of costs, including travel expenses and site visit by Engineer and/or Owner's Representative, for additional reviews as may be required due to non-compliance with these specifications and/or the contract documents will be at the expense of the Contractor.

1.06 CONSTRUCTION REVIEW

A. The purpose of on-site construction reviews by Owner's Representative is to periodically observe work in progress, Contractor's interpretation of construction documents and to address questions with regard to installation.

1. Schedule review for irrigation system layout or testing with Engineer and/or Owner's Representative as required by these specifications and/or the contract documents.

2. Impromptu review may occur at any time during the installation of the project.

3. A review will occur at completion of irrigation system installation and Project record Drawing submittal.

1.07 GUARANTEE/WARRANTY AND REPLACEMENT

A. The purpose of guarantee/warranty is to ensure that Owner receives irrigation materials and workmanship of prime quality, installed in a thorough and careful manner.

B. For a period of One Year from the date the project improvements are formally accepted by Owner, Contractor shall warranty irrigation materials, equipment and workmanship against defects. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by defective item(s). Contractor shall make repairs within thirty (30) days of notification by the Owner's Representative.

C. Contract documents govern replacements identically as with new work. Make replacements and correct deficiencies at no additional cost to the Owner.

D. Guarantee/warranty applies to both originally installed and replaced materials and equipment during the guarantee/warranty period.

PART 2 MATERIALS

2.01 QUALITY

A. Use new materials without flaws or defects of any type and which are the best of their class and kind.

2.02 SUBSTITUTIONS

A. Alternative equipment must be approved by the Owner and Engineer prior to bidding per the policies and procedures provided for in the Instructions to Bidders. The Contractor is responsible for making any changes to the design to accommodate alternative equipment.

B. Pipe sizes referenced in the construction documents are minimum sizes and may be increased at the option of the Contractor with approval of the Engineer at no additional cost to the Owner.

2.03 SLEEVING

A. Install separate sleeves for control and communication wires (min 2" diameter). Wire sleeves must be separate from pipe sleeves. Wire sleeves shall not be routed inside pipe sleeves.

B. Sleeves shall be installed under all paved surfaces whether indicated on the plan or not.

C. Extend all sleeves twelve inches (12") past any pavement edge.

D. Sleeve sizes for solvent weld pipe shall be two times (2X) the size of the pipe being run through the sleeve. Sleeve diameter for gasketed pipe must accommodate outside diameter of joint-restraint casing spacers (refer to joint restraint manufacturer's sizing recommendations).

E. All sleeves shall be a minimum of Schedule 40 PVC.

F. When sleeves are installed and irrigation pipe or wire is not run through said sleeves, the end of the unused sleeve shall be completely sealed so as to prevent intrusion of soil and water. End of sleeve shall be marked with a 2 x 4 stake brought to the surface. Any concrete being placed over unused sleeves shall be marked with a three inch (3") "SLV" stamp to indicate sleeve location. Each individual sleeve shall be stamped, multiple sleeves shall not be marked with a single stamp. Such unused sleeves shall be extended eighteen inches (18") past any pavement edges.

2.04 PIPE AND FITTINGS

A. PVC Mainline Pipe and Fittings

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end.

2. Use Class 200, SDR-21, rated at 200 PSI, conforming to dimensions and tolerances established by ASTM Standard D2241.

3. For Direct Bury Mainlines of nominal pipe diameter of greater than or equal to three inches (3"): Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe. Use Gasketed pipe joints conforming to "Laboratory Qualifying Tests" section of ASTM D3139. Use gasket material conforming to ASTM F477. Use lubricant approved by pipe and fitting manufacturers.

4. For Direct Bury Mainlines of nominal pipe diameter less than three inches (3"): Use Schedule 40 solvent weld pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by pipe manufacturer. Clear primers shall not be used. Use solvent cement conforming to ASTM Standard D2564 and these specifications.

5. Mainline pipe within sleeves: Use solvent weld pipe for mainline pipe with nominal diameter 3- inches and smaller installed within sleeves. Use pipe equipped with factory installed reinforced gaskets for mainline pipe with nominal diameter of 4-inches and larger installed within sleeves. Provide restrained casing spacers where gasketed joints occur within sleeve.

6. PVC Fittings General: Use minimum Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by pipe manufacturer and these specifications. Clear primers shall not be used. Use solvent cement conforming to ASTM Standard D2564.

   a. PVC Cross type fittings shall not be used.

   b. PVC expansion fittings (aka "Flow-Spans") and PVC Compression fittings shall not be used.

B. HDPE Mainline Pipe and Fittings

1. Use high density, extra high molecular weight polyethylene pipe (HDPE), extruded from material meeting the specifications of cell classification on PE 4710, ASTM standard D 3350, SDR 11, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM F 714 for mainline pipe.

2. Join pipe lengths using butt-fusion technique as recommended by pipe manufacturer.

3. The following are acceptable methods to join HDPE pipe to dissimilar materials:

   a. MNPT (316 Stainless) x Butt Fusion

   b. IPS Spigot x Butt Fusion, with Pipe Stiffener and Joint Restrained Gasketed DI Coupling and necessary restraining harness conforming to these specifications for DI Fittings and joint restraint harnesses.

   c. Flange x Butt Fusion, with ductile iron backup ring.

C. Lateral Pipe and Fittings

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end suitable for solvent welding.

2. Use minimum Schedule 40 conforming to dimensions and tolerances established by ASTM Standard D1785; UV radiation resistant. Class 200 PVC shall not be used for lateral pipe.

3. Use solvent weld pipe for lateral pipe. Use UV radiation resistant Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by pipe manufacturer and these specifications. Clear primers shall not be used. Use solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer and these specifications.

D. Specialized Pipe, Fittings, Sealants and Solvent Cements

1. Copper Pipe: Use Type "K" rigid pipe conforming to ASTM Standard B88.

2. Flexible HDPE Service Pipe: Use minimum SDR9 CTS pipe rated to minimum 200 PSI per ASTM D2737 and meets requirements of AWWA C901 and ANSI 61-G.

3. Copper, Brass and Bronze Fittings:

   a. Copper and Brass Press to Connect Fittings: Shall be compatible with ASTM B88 and conform to ANSI 372. May be installed above or below grade as presented in installation details and construction drawings.

   b. Bronze Fittings: Shall conform to ASTM B62, UNS C83600, ANSI B16.16 and ANSI B1.20.1.

   c. Brass Fittings: Use lead-free seamless red brass nipples conforming to ASTM B43-09 and UNS C23000. Use lead free brass fittings and valves conforming to ANSI 372.

4. Ductile Iron (DI) Pipe: Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use minimum of Class 53 thickness pipe for flanged piping. All ductile iron pipe installed below grade shall be red-prime coated or as presented in construction drawings, details and contract documents. Construction drawings, details and contract documents may call for 6-mil polyethylene film per AWWA C105 in certain situations, refer to contract documents.

5. Use mechanical joints conforming to ANSI A 21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).

6. Use dielectric union wherever non-ferrous materials (copper, brass, bronze) are joined to ferrous materials (iron, galvanized steel, stainless steel).

7. Low Density Polyethylene Hose:

   a. Use pipe specifically intended for use as flexible swing joint.
   Inside diameter: 0.490+0.010 inch.
   Wall thickness: 0.100+0.010 inch.
   Color: Black.

   b. Use spiral barb fittings supplied by same manufacturer as hose.

8. Use stainless steel fasteners and rubber gaskets for flanged connections.

9. Use PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings for threaded pipe connections.

    a. When transitioning from DI threaded pipe to PVC threaded pipe, use only PVC MIPT fittings into DI FIPT fittings. Do not use PVC FIPT over DI MIPT.

10. Joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by pipe fitting or valve manufacturer.

11. PVC Primers and Solvent Cements

    a. Use purple primer and heavy-set (aka "Gold") solvent cements. Use solvent cement conforming to ASTM Standard D2564. Clear primers and "hot-set" or "quick-set" cements shall not be used.

E. Joint Restraint Harness

1. Provide joint restraint harness components as recommended by pipe and fitting manufacturer and in accordance with accepted industry practices. For joint restraints on ductile iron pipe applications, use restraint components constructed of 60-42-10 ductile iron conforming to ASTM A536. For joint restraints on PVC pipe applications, use restraint components constructed of 60-42-10 ductile iron conforming to ASTM A536-80 and ASTM F1674-96.

2. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials which are stainless steel, zinc plated, galvanized or epoxy coated. Field application of epoxy coatings to such components shall be permitted.

3. Restrained Casing Spacers: Provide Ford Uni-Flange Restrained Casings Spacers or equal. Use restrainer body and runner supports constructed of high strength ductile iron meeting ASTM A536 and grade 65-42-12. Use Connecting rods conforming to ASTM A242, ANSI/AWWA C111/A21.11. Use runners constructed of ultra high molecular weight polymer.

F. Ductile Iron (DI) Fittings

1. All ductile iron fittings shall be fusion bond epoxy coated per AWWA C116 except as indicated in construction drawings, details or as approved by Engineer.

    a. Materials with damaged or chipped epoxy coating shall not be acceptable and must be immediately removed from the job site.

    b. Use bolts, nuts, retaining clamps, all-thread, or other hardware which are stainless steel, zinc plated, galvanized or epoxy coated. Field application of epoxy coatings to such components shall be permitted.

2. Ductile Iron Flanged Fittings

    a. Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use minimum of Class 53 thickness pipe for flanged piping.

3. Ductile Iron IPS Gasketed Fittings:

    a. Shall be manufactured of Grade 65-45-12 ductile iron in accordance with ATSM A536.

b. Fittings shall have deep bell, push-on ends with gaskets meeting ATSM F477.

c. Fitting to pipe restraints shall:

i. Meet the requirements of UNI-B-13-94. Grip ring serrations shall be machined. Cast serrations shall not be permitted. Restraint rods, bolts and nuts shall be of ductile iron conforming to ASTM A563 or low alloy steel to ANSI A21.11 (AWWA C111)

—OR—

ii. Shall be knuckle style composed of a one-piece grip ring residing within a ductile iron housing having machined serrations and shall be activated by one bolt. Housing and grip ring shall be of ductile iron to ASTM A536. Bolt and nut shall be Type 304 Stainless Steel.

2.05 COPPER TRACING WIRE

A. Use American Wire Guage (AWG) No. 12-1 solid copper, 600-volt, Type UF or PE cable, UL approved for direct underground burial.

B. Color: Yellow is preferred. Tracing wire shall be of color different and distinct from that of any active two wire cable, two wire cable jacketing, control wire and/or common wire. Wire color shall be continuous over entire length.

C. Splices: Use 3M DBR/Y-6 wire connectors with waterproof sealant or approved equal.

2.06 MAINLINE COMPONENTS

A. POC Assembly: In accordance with all applicable specifications, codes and as presented in drawings and installation details.

B. Isolation Gate Valve Assembly: as presented in drawings and installation details

C. Quick Coupling Valve Assembly: as presented in drawings and installation details.

D. Air Vent Assembly: as presented in drawings and installation details.

E. Manual Drain Valve Assembly: as presented in drawings and installation details.

2.07 IRRIGATION LATERAL COMPONENTS

A. Remote Control Valve (RCV) Assembly for Laterals: as presented in drawings and installation details.

B. Sprinkler Head Assemblies:

1. Spray Heads: As Presented in drawings and installation details. All spray heads shall be a minimum riser height of six-inches (6”).

2. Rotary Spray Heads: As presented in drawings and installation details. All rotary spray heads shall be minimum riser height of six-inches (6”).

3. Rotary Heads: As Presented in drawings and installation details. All rotary heads shall have a riser height of five-inches or greater (5”).

C. Bubbler Assemblies: As Presented in drawings and installation details.

D. Root Watering System (RWS) Assemblies As Presented in drawings and installation details

E. Inline Drip Systems or Point-Source Emitter Systems (aka “Bug Emitters”) are not to be used except by approval of Owner and Engineer.

2.08 CONTROL SYSTEM COMPONENTS

A. Irrigation Controller Assembly

1. As presented in drawings and installation details

2. Lighting protection: Per manufacturer specifications and requirements and as presented in drawings and installation details.

B. Power Wire and Components

1. Use AWG #12, solid or stranded copper, Type UF single-conductor cable or multi-conductor with ground cable, UL approved for direct underground burial from power source to Controller Assembly.

2. Splices: Use 3M #82-A2 Series with Split Bolts or Butt Connectors for inline splices and 82-B1 or 90-B1 Series for wye splices.

3. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.

4. Warning tape: Use inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW.”

C. Two Wire System From Controller to Decoders and Two Wire Devices (Two Wire, 2-Wire, 2W)

1. Two Wire Cable (aka Two Wire Path): Use jacketed cable containing two listed Golf Course Sprinkler wires, single conductor, suitable for direct burial and operation up to 600 volts and temperature up to sixty degrees Celsius (60°C).

a. Inner Conductors: Conductors shall be minimum 14 AWG. Conductors shall be soft drawn bare copper meeting ASTM B-3 or B-8. The two conductors shall be twisted with a minimum lay of 4-inches.

b. Overall Jacket: Shall be composed of high-density polyethylene with a thickness of 0.035”. Allowable jacket colors are BLUE, PURPLE, TAN, or RED. Use unique colors for distinct two-wire runs and/or as presented in construction drawings and installation details.

2. Splices: Use only 3M Scotchlok 3750 Connector Sealing Packs (aka Epoxy Packs). 3M DBR-Y connectors or similar products shall not be used on any Two Wire Path splice or Two Wire splice connection to any Two Wire path component or device.

3. Electrical Conduit for Two-Wire Path: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations, except as presented in construction drawings, details or as approved by Engineer.

4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

5. Ground two wire cable per manufacturer's guidelines and as presented in installation details and construction drawings.

D. Conventional Wire Path (Low Voltage Control Wire)

1. Control Wire: Use American Wire Gauge (AWG) No. fourteen (#14) solid copper, six hundred (600) volt, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote-control valve.

2. Common Wire: Use American Wire Gauge (AWG) No. twelve (#12) solid copper, six hundred (600) volt, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote-control valve.

3. Color: Wire color shall be continuous over its entire length

a. Control Wire(s): Red. If Project requires multiple controllers whose wire trunks will be installed in a common trench, use different color control wire(s) for each controller. Unacceptable colors are Black, Yellow, Grey, White, Green, Blue.

b. Common Wire(s): White. If Project requires multiple controllers, use White wire with a colored stripe matching the Control Wire color of the same controller.

c. Spare Control Wire: Green. If Project requires multiple controllers, use Green wire with colored stripe matching Control Wire color of the same Controller.

d. Spare Common Wire: Blue. If Project requires multiple controllers, use Blue wire with colored stripe matching Control Wire of the same Controller.

4. Splices: Use 3m DBR/Y-6 connectors with waterproof sealant.

5. Warning tape: Use inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW".

E. Instrumentation:

1. Soil Moisture Sensors: As presented in drawings and installation details.

2. Tipping Rain Bucket: as presented in drawings and installation details.

3. Provide, install, program and test sensors for irrigation controller installed.

2.09 OTHER COMPONENTS

A. Tools and Spare Parts: As presented in construction drawings, installation details and contract documents.

B. Other Materials: Provide all other materials or equipment shown on drawings or installation details that are part of the irrigation system, even though items may not have been referenced in these specifications.

PART 3 EXECUTION

3.01 INSPECTIONS AND REVIEWS

A. Site Inspections:

1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities in writing to Owner's Representative and Engineer prior to beginning work.

2. Commencement of work implies acceptance of existing site conditions.

B. Utility Locates ("Call Before You Dig")

1. Arrange and coordinate Utility Locates with local authorities and private utility owners prior to construction.

2. Repair underground utilities that are damaged during construction. Make repairs at no additional cost to Owner.

3.02 LAYOUT OF THE WORK

A. Stake out irrigation system. Items staked may include sprinklers, directional pipe changes, sleeves, RCV's, ground rods, isolation valves, mainline components and other irrigation features and appurtenances as may be requested by Owner's Representative or Engineer.

B. Irrigation System Layout Review: Irrigation system layout review will occur after staking has been completed. Notify Owner's Representative one week in advance of review. Modifications will be identified by Owner's Representative at this review.

C. Install irrigation components inside of project boundaries. Notify Owner's Representative and Engineer immediately of any component that may be installed outside of project boundaries prior to installation.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Excavate and install pipes at minimum cover indicated in drawings or specifications, whichever is greater or by approval of Engineer. Excavate trenches at appropriate width for connections and fittings.

B. Trenches receiving PVC Pipe may be curved to change direction or avoid obstructions within limits of the curvature of pipe. Curvature results from bending of pipe lengths. Do not exceed pipe and fitting manufacturer's allowable deflection at joints. Minimum radius of curvature and offset per 20- foot length of pipe by pipe size are shown in following table:

SIZE	RADIUS	OFFSET PER 20' LENGTH
1 ½"	25'	3'-4"
2"	25'	3'-4"
2 ½"	100'	2'-6"
3"	100'	2'-6"
4"	100'	1'-4"
6"	150'	1'-4"
8"	200'	1'-0"

C. Minimum Cover (measured from top of pipe, conduit, wire or wire trunk to finish grade)

1. Mainline Pipe:

   a. Four Inch (4”) Nominal Diameter and Smaller: Twenty-four inches (24”)

   b. Six Inch (6”) Nominal Diameter and Larger: Thirty inches (30”)

2. Electrical Conduit: Twenty-four (24”)

3. Control Wires (Two Wire Cable, Two Wire Cable Conduit, Low Voltage Common/Control Wire(s): Minimum four inches (4”) lower than bottom of mainline pipe and opposite in trench from tracing wire.

4. Copper Tracing Wire: Minimum four inches (4”) lower than bottom of mainline pipe and opposite in trench from control wire(s).

5. Lateral pipe to sprinklers (6-inch and less pop-up height): 14-inches to top of pipe.

6. Lateral pipe to sprinklers (12-inch pop-up height): 18-inches to top of pipe.

D. Install mainline pipe with a continuously positive or negative slope between distinct high and low points. Field verify location of planned high points and Air Relief Valves and report any deviations.

E. Maintain at least fifteen feet (15’) clearance from the centerline of trees.

F. PVC lateral pipes must be installed in open trench. Pipe pulling is not allowed. Install pipe at burial depths listed above.

1. Generally, lateral lines should not be installed in common trench with other laterals or mainlines except as presented in construction drawings and installation details. When installing in common trench ensure minimum separation of four inches (4”) from any pipe wall to any other pipe wall.

G. Excavated material is generally satisfactory for backfill. See pipe bedding requirements below. Use backfill free from rubbish, vegetable matter, frozen materials, and stones larger than 2-inches in maximum diameter. Remove material not suitable for backfill. Use backfill free of sharp objects next to pipe.

1. Pipe Bedding Requirements: Use backfill material free from rubbish, vegetable matter, frozen materials and stones larger than ¾" inches. Install bedding material below, around and above pipe to minimum of 4-inches above top of pipe. Install bedding material consistently such that no voids exist between pipe, trench bottom, trench walls or commonly installed laterals, wire paths, wire trunks and/or conduits. Use of flowable fill shall be permitted only on approval of owner and engineer.

H. After bedding pipe as required and/or approved by Engineer, Backfill buried pipe in either of the following manners:

1. Backfill and puddle lower half of trench. Allow to dry 24 hours. Backfill remainder of trench in 6-inch lifts. Compact each lift to 95 percent of Standard Proctor Density.

2. Backfill trench by depositing backfill material equally on both sides of pipe in 6-inch lifts and compacting each lift to 95 percent of Standard Proctor Density.

I. Enclose pipe and wiring beneath roadways and hardscapes in separate sleeves. Neither wire nor wire sleeves may occupy the same sleeve as water carrying pipe or pipe sleeves. Minimum compaction of backfill around sleeves shall be 95 percent of Standard Proctor Density, ASTM D698-78 or as required by construction drawings, details and contract documents. Use of water for compaction around sleeves (aka "puddling") will not be permitted without prior approval by Engineer.

J. Dress backfilled areas to original grade. Incorporate excess backfill into existing grades.

K. Contact Owner's Representative for trench depth adjustments where utilities conflict with irrigation trenching and pipe work.

3.04 SLEEVING AND BORING

A. Provide sleeving at depth that permits encased pipe or wiring to remain at proper burial depth presented in these specifications unless otherwise specified by construction drawings, details or as approved by Engineer.

B. Extend sleeve ends twelve to eighteen (12" to 18") inches beyond edge of hardscape as required by these specifications.

C. Cap sleeve ends and mark with stakes and/or concrete stamps as may be required by these specifications.

D. Provide rope or pull-string through sleeve and secure to stake at surface grade at each end for future sleeve location.

E. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

3.05 ASSEMBLING PIPE AND FITTINGS

A. General Considerations

1. Keep pipe free from dirt and debris. Cut pipe end square, deburr and clean as recommended by manufacturer and according to accepted industry practices.

2. Use only strap-type friction wrenches for threaded plastic, epoxy coated or red prime coated pipe and fittings.

3. Keep ends of assembled pipe capped or plugged. Remove caps or plugs only when necessary to continue assembly.

    a. Contractor shall be responsible for replacing any damaged components of and/or repairing any other damages to irrigation system caused by any debris of any kind which has entered assembled pipe at no additional cost to Owner.

B. PVC Mainline and Lateral Pipe and Fittings

1. Rubber Gasketed Pipe: Use pipe lubricant approved for use with pipe and fitting manufacturers. Joint pipe in manner recommended by manufacturer and in accordance with accepted industry practices.

2. PVC Solvent Welded Pipe and Fittings:

    a. Use only purple primer and heavy-set (aka “Gold”) solvent cement. Clear primers and “hot-set” or “quick-set” cements shall not be used. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices, including:

        i. Ensure pipe and fitting are free of debris, dirt, dust, water, oils and are generally entirely clean at the pipe joint.

        ii. Score male pipe with medium sand-paper or emery cloth along a pipe length at least one quarter inch (1/4)” longer than the depth of the female socket receiving the male pipe.

        iii. Make cuts square to pipe center line.

        iv. Chamfering of male pipe ends when joining to female socket fittings.

        v. Ensure male pipe end is inserted fully into female socket.

    b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.

    c. Snake pipe from side to side within trench.

3. PVC Threaded Fittings

    a. Use only factory-formed threads. Field-cut threads are not permitted.

    b. Apply thread sealant in manner recommended by component, pipe and sealant manufacturers and in accordance with accepted industry practices.

    c. Use plastic components with male threads and metal components with female threads where connection is plastic-to-metal.

4. Other considerations:

    a. Use of cross type fittings is not permitted.

    b. Use of PVC expansion fittings (aka “Flow-Spans”) or PVC Compression Couplings and Fittings are not permitted.

C. HDPE Mainline Pipe and Fittings

1. Join pipe lengths using butt-fusion technique as recommended by pipe manufacturer.

2. The following are acceptable methods to join HDPE pipe to dissimilar materials:

   a. MNPT (316 Stainless) x Butt Fusion

   b. IPS Spigot x Butt Fusion, with Pipe Stiffener and Joint Restrained Gasketed DI Coupling and necessary restraining harness conforming to these specifications for DI Fittings and joint restraint harnesses.

   c. Flange x Butt Fusion, with ductile iron backup ring.

D. Specialized Pipe and Fittings

1. Copper Pipe:

   a. Use flux and solder. Join pipe in manner recommended by manufacturer and in accordance with local codes and accepted industry practices.

   b. Solder so that continuous bead shows around the joint circumference.

2. Ductile Iron Pipe: Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices and as presented in installation details and construction drawings.

3. Insert dielectric union or flange wherever non-ferrous materials (copper, brass, bronze) and ferrous materials (iron, galvanized steel, stainless steel) are joined.

4. Low Density Polyethylene Hose: Install hose and compatible fittings in manner recommended by manufacturer and in accordance with accepted industry practices.

5. Flanged connections: Install fittings, fasteners and gaskets in manner recommended by manufacturer and in accordance with accepted industry practices.

E. Joint Restraint Harness:

1. Use on pipe greater than or equal to 3-inch diameter or any diameter of rubber gasketed pipe. Use a joint restraint harness wherever joints are not positively restrained by flanged or threaded fittings.

2. Use a joint restraint harness with transition fittings between metal and PVC pipe or where extra support is required to retain fitting or joint.

3. Use restrained casing spacers for gasketed pipe routed through sleeving. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices. Install self-restraining casing spacers at all gasketed pipe bell joints and every 10-feet along the gasketed mainline pipe installed through sleeving. Provide correct number and type of restraints per manufacturer's requirements.

3.06 INSTALLATION OF COPPER TRACING WIRE

A. Install tracing wire as shown in the details.

B. Do not tape tracing wire to pipe. Install tracing wire minimum of four inches (4") away from and below pipe; opposite in trench from any control wire, two wire path or wire trunk.

C. Bring tracing wire to the surface in all mainline component valve boxes as shown on the details. Provide a thirty-inch (30") loop of wire, coiled about a one-inch PVC Pipe.

3.07 INSTALLATION OF MAINLINE COMPONENTS

A. POC Assembly: Provide where indicated on drawings per installation details. All Master Valves or Hydrometers shall be installed above grade with the POC Assembly. Installation of Master Valves or Hydrometers below grade shall not be permitted.

B. Isolation Gate Valve Assembly: Provide where indicated on drawings per installation details. Install at least 12-inches from and aligned with adjacent walls or edges of paved areas. Brand "GV" on valve box lid two inch (2") high letters.

C. Quick Coupling Valve Assembly: Provide where indicated on drawings per installation details. Brand "QC" on valve box lid in two inch (2") high letters.

D. Vent Assembly: Install where indicated on drawings or nearest high point, not closer than 2-feet from nearest fitting. Brand "AV" on valve box lid in two inch (2") high letters.

E. Manual Drain Valve Assembly: Provide where indicated on drawings per installation details. Brand "DV" on valve box lid in two inch (2") high letters.

3.08 INSTALLATION OF IRRIGATION HEADS AND END-POINT DELIVERY COMPONENTS

A. Remote Control Valve (RCV): Provide where indicated on drawings per installation details.

1. Provide thirty inches (30") of control wire/cable on both the incoming and outgoing wire paths at each RCV. These lengths may be coiled together or separately.

2. Flush mainline before installation of RCV assembly.

3. Provide where indicated on drawings. Use wire connectors as specified for the wiring type to connect control wire to RCV solenoid wires.

4. Provide only one RCV to a valve box. Co-locating multiple RCV's in one valve box shall not be permitted. Locate valve box at least twelve inches (12") from and aligned with nearby walls or edge of paved areas. Group RCV assemblies together were practical. Align grouped valve boxes in uniform patterns. Allow at least twelve inches (12") between valve boxes. Brand station number on valve box lid in two inch (2") high letters. Brand controller number, where applicable to sites with multiple controllers, in two inch (2") high letters. Branding device must create letters a minimum of two inches (2") in height and an impression into lid of no less than 0.2 inches.

5. Tee and elbow fittings shall not be located inside valve box. Tee and elbow fittings shall be outside of the box. No part of the box shall be in contact with mainline or lateral pipe or fittings.

6. Valve box shall be supported in all corners of the box with bricks to minimize settling of the box.

7. Bring wire carrying conduit into box such that it does not interfere with the operation of any valve stem, union, solenoid or other irrigation component or appurtenance.

8. Locate valve within box such that the box walls and lid do not interfere with the operation of any valve stem, union, solenoid or other irrigation component or appurtenance.

9. Attach ID tag with controller number to control wiring. Brand ID tag with RCV number and controller identifier, where applicable to sites with multiple controllers.

10. Install RCV assemblies such that valve stem and isolation valves are plumb, can be operated freely and are not obstructed by any other component or appurtenance.

B. Rotary, Rotary Spray and Spray Head Assemblies

1. Flush lateral pipe before installing sprinkler assembly.

2. Provide per installation details at locations shown or directed on drawings.

3. Locate rotary and rotary spray heads 6-inches from adjacent walls, fences, or edges of paved areas.

4. Locate spray heads 3-inches from adjacent walls, fences, or edges of paved areas.

5. Install sprinklers perpendicular to finish grade or as indicated on construction drawings, details or as approved by Engineer or Owner's Representative.

6. Provide appropriate nozzle or adjust arc of coverage of each sprinkler for best performance and uniform coverage.

7. Adjust radius of throw of each sprinkler for best performance and uniform coverage.

C. Bubbler Assemblies

1. Flush lateral pipe before installing bubbler assembly.

2. Provide bubbler assembly per installation details at locations shown or directed on drawings.

D. Root Watering System (RWS) Assemblies

1. Flush lateral pipe before installing RWS assemblies.

2. Provide RWS assembly per installation details at location shown or directed on drawings.

3.09 INSTALLATION OF CONTROL SYSTEM COMPONENTS

A. Irrigation Controller Assembly:

1. Location of Controller Assembly as depicted on drawings is approximate. Owner's Representative will approve exact site location during Irrigation System Layout Review. Install controller assembly and enclosure in accordance with controller manufacturer recommendations and as presented in installation details and construction drawings.

2. Lightning Protection: As recommended and required by manufacturer and presented in installation details and construction drawings.

3. Coordinate installation of electrical service in accordance with local electric codes. Contractor is responsible for obtaining all permits, permit fees, meter fees and other costs incidental to the completion of the work.

B. Power Wire:

1. Install with minimum number of field splices. If power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in standard rectangular valve box. Coil 3-feet of wire in valve box.

2. Install power wire using open trenches. Use of a vibratory plow is not permitted.

3. Use green wire as common ground wire from power source to controller assembly.

4. Carefully backfill around power wire to avoid damage to wire insulation or wire connectors.

5. Install wire in conduit parallel with mainline pipe unless noted otherwise on plans. Install wire offset from bottom of mainline pipe or at depth required by local codes, whichever is deeper. Ensure edge of conduit is a minimum of 4-inches away from edge of any other conduit, mainline pipe, lateral pipe, wire path and/or wire trunk.

6. Encase wire in electrical conduit with a continuous run of warning tape placed in the backfill, 6- inches above the conduit.

7. When bringing power wire into irrigation controller, ensure power wire is isolated from low voltage wire. Power and low-voltage wire shall not occupy the same space. Isolation may be accomplished by running power wire in conduit inside the controller enclosure.

C. Two Wire System From Controller to Decoders and Two Wire Devices (Two Wire, 2-Wire, 2W)

1. Install cable in minimum one-inch (1") PVC Sch 40 conduit parallel with, and not less than four inches (4") lower than and offset from mainline pipe unless noted otherwise on plans. Install cable in conduit on opposite side of trench from tracer wire.

2. All two-wire cable shall be installed within one-inch (1") or larger conduit. Conduit shall be water tight and shall only contain the two-wire cable. No other wire, pipe or conduit may occupy the same conduit as the two-wire cable. Use long radius sweep elbows. Heat bending is not allowed. Conduit ends shall be sealed with a duct sealant.

3. Provide thirty inches (30") of wire/cable on both the incoming and outgoing wire paths at each control valve box, master valve and any other electrically controlled in-ground component. These lengths may be coiled together or separately.

4. Install Two-Wire with the minimum possible number of field splices. If cable must be spliced, make splice with only 3M Scotchlok 3570 Connector Sealing Packs (aka "Epoxy Packs"), installed per manufacturer's recommendations. Locate splices in housing afforded by other control system components or separate ten-inch (10") round valve box. Coil thirty inches (30") of wire/cable on both the incoming and outgoing wire paths in each box containing a splice.

5. 3M Scotchlok 3570 Connector Sealing Packs shall only be installed:

    a. At temperatures at or above 55 degrees Fahrenheit (55°F)

    b. If the ambient air temperature will be maintained at or above 55 degrees Fahrenheit (55°F) for a twenty-four (24) hour period after installation.

6. Direct Bury Two-Wire shall only be used as indicated on the drawings or by approval of Owner's Representative and Engineer. Unless otherwise noted, protect cable not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill twelve inches (12") above the wiring.

7. Lightning protection: Install grounding equipment per manufacturer's guidelines and as presented in installation details and construction drawings.

8. When stripping control wire, only expose minimum necessary length of copper to connect into terminal or construct proper wire splice. Bare copper left exposed outside of a terminal or splice shall not be accepted.

9. Terminate two-wire dead ends per manufacturer requirements and recommendations.

D. Low Voltage Control Wire (Conventional Wire)

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at ten foot (10') intervals.

2. Provide thirty inches (30") of wire/cable on both the incoming and outgoing wire paths in each control valve box, master valve and any other electrically controlled in-ground component. These lengths may be coiled together or separately.

3. Install common ground wire and one (1) control wire for each remote-control valve. Multiple valves on a single control wire are not permitted.

4. Spare Control Wires:

    a. Non-Looped Mainlines or Mainline Sections: Provide minimum of two (2) continuous spare control wires from controller to the last RCV on any given mainline section(s). Separate sections may share spare control wires.

    b. Looped Mainlines: Provide a minimum of two (2) continuous spare control wires from controller. Route spare control wires such that they will intercept each and every RCV's on looped mainline sections. Dead end terminate spare wire(s) at last RCV in sequence. Do not loop-connect spare control wires. Separate mainline loops shall have separate spare control wires.

    c. Terminate all spare wires in separate water-proof connectors per these specifications for conventional wire splices.

5. Spare Common Wires:

    a. Non-Looped Mainlines or Mainline Sections: Provide minimum of one (1) continuous spare common wire from controller to the last RCV on any given mainline section(s). Separate sections may share a spare common wire.

    b. Looped Mainlines: Provide a minimum of one (1) continuous spare common wire from controller. Route spare common wire such that it will intercept each and every RCV on any given looped mainline sections. Dead ends terminate spare wire(s) at last RCV in sequence. Do not loop-connect spare control wires. Separate mainline loops shall have separate spare common wires.

    c. Terminate all spare wires in separate water-proof connectors per these specifications for conventional wire splices.

6. No control wires shall be spliced under 2000 LF of wire without approval of Owners Representative or Engineer. If a control wire must be spliced, make splice with wire connectors and waterproof sealant per these specifications or as indicated in the Contract Documents, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation mainline component, RCV assembly, or in a separate ten inch (10") standard round valve box. Use same procedure for connection to valves as for in-line splices. Brand this valve box with an (SPL) for splice.

7. Install wire parallel with and offset from mainline pipe unless noted otherwise on plans. All wire(s) shall be a minimum of four inches (4") below and away from bottom of mainline pipe. Wire must be offset from mainline pipe and installed in trench opposite from Copper Tracer Wire. Wires installed shall not be in contact with mainline pipe at any point.

8. Unless otherwise noted, protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill twelve inches (12”) above the wiring.

9. When stripping control wire, only expose minimum necessary length of copper to connect into terminal or construct proper wire splice. Bare copper left exposed outside of a terminal or splice shall not be accepted.

E. Instrumentation

1. Provide, install, and program sensors and instruments as indicated on drawings and installation details, and in accordance with manufacturer's recommendations.

3.10 INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts: Prior to Review at completion of construction, supply to Owner such additional equipment, tools, spare parts and other items as may be indicated on the construction drawings, details and contract documents.

B. Other Materials: Provide other materials or equipment shown on drawings or installation details that are part of the irrigation system, even though items may not have been referenced in specifications.

3.11 PROJECT RECORD (AS-BUILT) DRAWINGS

A. The Contractor is responsible for documenting changes to the design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.

B. Record pipe and wiring network alterations. Record work that is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box.

C. Turn over the "Record Drawings" to the Project Manager. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.

3.12 WINTERIZATION AND SPRING START-UP

A. Unless specifically provided for otherwise in the contract documents, Contractor shall be responsible for one (1) full Winterization of all irrigation components and one (1) full Spring Start-Up of all irrigation components following final completion and acceptance of the irrigation system. All necessary winterization and start-up prior to final completion shall be the Contractor’s responsibility.

B. Winterize the irrigation system in the fall after the installation and acceptance of the irrigation system. Start-up the irrigation system the following spring. Repair any damage caused in improper winterization at no additional cost to the Owner. Coordinate the winterization and start-up with the Owner’s Representative and Engineer.

C. All winterizations shall be witnessed by the Owner's Representative. A representative of the Parks Department shall also be notified a minimum of (1) day prior to the winterization in case they would elect to witness this process.

D. If the winterization affects a separate irrigation system, Owner's Representatives will be on site to assist with this process. Contractor is responsible for coordinating with the Owner.

E. Perform Spring-Start up in manner substantially identical to System Operational Test (See Part 1.05.I).

F. Unless specifically provided for otherwise in the contract documents, all labor, equipment, and materials related to the Winterization and Spring Start-Up of the irrigation system shall be considered incidental to the completion of the work. No separate payment shall be made regarding the Contractor's performance and completion of Winterization or Spring Start-Up as described in these specifications.

3.13 MAINTENANCE

A. Upon completion of construction and Review by the Owners Representative and/or Engineer, maintain irrigation system for a duration of thirty (30) calendar days. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.

B. Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing or avoiding damage during Owner's landscape maintenance operations.

3.14 CLEANUP

A. Remove any machinery, tools, excess materials, and rubbish from the site upon completion of the work.

PART 4 METHODS OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Standard Items

1. 02920.01 INSTALL IRRIGATION CONTROLLER
This item shall be paid by the numerical count of all irrigation controllers installed throughout the project.

2. 02920.02 INSTALL MAINLINE PIPE (size)(type)
This item shall be paid on a lineal foot basis.

3. 02920.03 INSTALL LATERAL PIPE (size)(type)
This item shall be paid on a lineal foot basis.

4. 02920.04 INSTALL SLEEVE (size)
This item shall be paid on a lineal foot basis.

5. 02920.05 INSTALL IRRIGATION CONTROL VALVE ASSEMBLY (size)
This item shall be measured by the numerical count of all control valve assemblies installed.

6. 02920.06 INSTALL 2-WIRE IRRIGATION CONTROL VALVE ASSEMBLY
This item shall be measured by the numerical count of all 2-wire control valve assemblies installed.

7. 02920.07 INSTALL ISOLATION VALVE ASSEMBLY (size)
This item shall be paid by the numerical count of all isolation valves installed.

8. 02920.08 INSTALL AIR VENT ASSEMBLY (size)
This item shall be paid by the numerical count of all Air vents installed.

9. 02920.09 INSTALL QUICK COUPLING VALVE ASSEMBLY
This item shall be paid by the numerical count of all quick coupler assemblies installed.

10. 02920.10 INSTALL POC ASSEMBLY (size)
This item shall be paid by the numerical count of all POC assemblies installed.

11. 02920.11 INSTALL IRRIGATION HEAD ASSEMBLY (type)
This item shall be paid by the numerical count of all irrigation head assemblies installed.

12. 02920.12 INSTALL BUBBLER HEAD ASSEMBLY (model)
This item shall be paid by the numerical count of all bubbler head assemblies installed.

13. 02920.13 INSTALL RWS ASSEMBLY (depth)
This item shall be paid by the numerical count of all RWS assemblies installed.

14. 02920.14 INSTALL WIRE (without trench)
This item shall be paid on a lineal foot basis.

15. 02920.15 INSTALL WIRE (with trench) This item shall be paid on a lineal foot basis.

16. 02920.16 INSTALL TWO-WIRE (without trench) This item shall be paid on a lineal foot basis.

17. 02920.17 INSTALL TWO-WIRE (with trench)
This item shall be paid on a lineal foot basis.

4.02 BASIS OF PAYMENT

A. Standard Items

1. 02920.01 INSTALL IRRIGATION CONTROLLER
Payment shall include all materials, excavation, backfill, controller and related components, controller enclosure, conduit, wire, sub-grade preparation, grading, compacted gravel base, cast in place concrete base, programming, secondary wiring (including providing trench and wire to secondary power source), grounding, equipment, rain bucket/sensor, labor, tools and incidentals to complete this item.

2. 02920.02 INSTALL MAINLINE PIPE (size)
Payment shall include all material, fittings, trenching, backfill, compaction, reseeding/sodding, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

3. 02920.03 INSTALL LATERAL PIPE (size)
Payment shall include all material, fittings, trenching, backfill, compaction, reseeding/sodding, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

4. 02920.04 INSTALL SLEEVE (size)
Payment shall include all material, fittings, trenching, boring, backfill, compaction and all other work, labor, and equipment necessary to complete this item.

5. 02920.05 INSTALL IRRIGATION CONTROL VALVE ASSEMBLY (size)
Payment shall include all materials, excavation, backfill, compaction, valve box, true union ball valve, remote control irrigation valve and valve components, fittings, pipe, wire splice kits, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

6. 02920.06 INSTALL 2-WIRE IRRIGATION CONTROL VALVE ASSEMBLY (size)
Payment shall include all materials, excavation, backfill, compaction, valve box, true union ball valve, remote control irrigation valve and valve components, fittings, pipe, wire splice kits, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

7. 02920.07 INSTALL ISOLATION VALVE ASSEMBLY (size)
Payment shall include all materials, excavation, backfill, compaction, isolation valve and related components, pipe, fittings, valve box, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

8. 02920.08 INSTALL AIR VENT ASSEMBLY (size)
Payment shall include all materials, excavation, backfill, compaction, air relief valve and related components, pipe, fitting, valve box, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

9. 02920.09 INSTALL QUICK COUPLING VALVE ASSEMBLY
Payment shall include all materials, excavation, backfill, compaction, quick coupling valve and related components, pipe, fittings, valve box, flushing, and testing and all other work, labor, and equipment necessary to complete this item.

10. 02920.10 INSTALL POC ASSEMBLY
Payment shall include all materials, excavation, backfill, compaction, decoders, valve boxes, junction boxes, splice boxes, wire to POC Assembly from controller, wiring, flushing, operational testing and all other work, labor, and equipment necessary to complete this item.

11. 02920.11 INSTALL IRRIGATION HEAD ASSEMBLY (type/model)
Payment shall include all materials, irrigation heads and related components, excavation, backfill, compaction, flushing, adjustment, and all other work, labor, and equipment necessary to complete this item.

12. 02920.12 INSTALL BUBBLER HEAD ASSEMBLY (model)
Payment shall include all materials, excavation, backfill, compaction, flushing, adjustment, irrigation bubbler heads and related components, and all other work, labor, and equipment necessary to complete this item.

13. 02920.13 INSTALL RWS ASSEMBLY (depth)
Payment shall include all materials, excavation, backfill, compaction, flushing, adjustment, irrigation root watering system assembly and related components, and all other work, labor, and equipment necessary to complete this item.

14. 02920.14 INSTALL CONVENTIONAL WIRE (without trench)
Payment shall include all materials, and all other work, labor, and equipment necessary for installation of wire in existing trench.

15. 02920.15 INSTALL CONVENTIONAL WIRE (with trench)
Payment shall include all materials, excavation, backfill, compaction, reseeding/sodding, and all other work, labor, and equipment necessary to complete this item.

16. 02920.16 INSTALL TWO-WIRE (without trench)
Payment shall include all materials, two-wire cable, conduit, junction boxes, splice boxes, soil moisture sensors, surge arrestors, grounding components, and all other work, labor, and equipment necessary for installation of wire in existing trench.

17. 02920.17 INSTALL TWO-WIRE (with trench)
Payment shall include all materials, excavation, backfill, compaction, reseeding/sodding, two- wire cable, conduit, junction boxes, soil moisture sensors, surge arrestors, grounding components, and all other work, labor, and equipment necessary to complete this item.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. Formwork for cast-in place concrete
B. Opening in formwork for other affected work
C. Form accessories such as snap ties, bracing, etc.
D. Stripping formwork

1.02 SUBMITTALS

A. Shop Drawings: Fabrication and erection drawings of forms for specific finished concrete surfaces, as indicated. Show general construction of form, jointing, special joints or reveals, location and pattern of form tie placement, and other items affecting exposed concrete visibility.

B. Form Release Agent: Where concrete surfaces are scheduled to receive special finishes or applied coverings which may be affected by agent, submit manufacturer's instruction for use of agent.

1.03 QUALITY ASSURANCE

A. Design, engineering, and construction of formwork are the CONTRACTOR's responsibility.

B. Standards: Comply with all pertinent provisions of the ACI 347.

C. Qualification of Workmen: Provide at least one person who shall be present at all times during the work of this Section and who shall be thoroughly familiar with the type of materials being installed, the reference standards, and the requirements of this work.

D. Design Forms:

1. With sufficient strength to maintain finished tolerances indicated in Section 03345, to support loads, pressures, and allowable stresses as outlined in ACI 347.

2. To permit easy removal.

3. For required finishes.

E. Product Handling:

1. Take all means necessary to protect formwork materials before, during, and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

1.04 DEFINITIONS

A. Shoring: The activity to support formwork.

B. Reshoring: The activity to reduce the amount of formwork supporting concrete elements. As concrete sets and strength increases, less need for formwork occurs gradually until concrete becomes free standing.

1.05 REFERENCES

A. ACI 347: Recommended Practice for Concrete Formwork

1.06 JOB CONDITIONS

A. For reference purposes, establish and maintain sufficient control points and benchmarks to check tolerances. Maintain in an undisturbed condition and until final completion and acceptance of Work.

B. Regardless of tolerances specified, allow no portion of Work to extend beyond legal boundaries.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Construct formwork for concrete concealed from view with plywood, sawn boards of sound grade or steel forms as approved by the ENGINEER.

B. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without excessive and objectionable bow or deflection.

C. Do not use material with raised grain, patches, or other defects, which will impair texture of concrete surface.

2.02 FORMWORK ACCESSORIES

A. Form ties and spreaders

1. Provide factory-fabricated, removable or snapoff metal form ties, designated to prevent form deflection and to prevent spalling of concrete surfaces upon removal.

2. Provide ties so that the portion remaining within concrete after removal of exterior parts is at least one and half inch (1-1/2") from the outer concrete surface. Provide form ties which will not leave a hole larger than one inch (1") diameter in the concrete surface.

3. Wire ties will be permitted where surfaces on either side of a formed member will not be exposed to view or will be painted. Projecting ends of wire ties shall be cut off flush with the concrete surfaces. Job fabricated ties will not be acceptable.

B. Premolded Expansion Joint Filler: Unless indicated otherwise, provide Type F1, in accordance with Section 03251.

C. Form Release Agent

1. Provide commercial formulation form release agent compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

2. Surplus oil on forms and form oil on reinforcing steel and construction joints shall be removed before concrete is placed.

D. Fillets for Chamfered Corners: Wood strips shall be installed to the dimensions shown on the plans.

2.03 DESIGN OF FORMWORK

A. General

1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by concrete structure.

2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.

3. Construct formwork so that concrete members and structure are of correct size, shape, alignment, elevation, and position.

4. Design forms and falsework to include assumed values of live loads, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

5. Support form facing materials by structural member spaced sufficiently close to prevent objectionable deflection.

6. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities, and within allowable tolerances.

7. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the substrata and conditions under which work of this section is to be performed, and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 FORM CONSTRUCTION

A. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grade, level, and plumb work in finished structures.

B. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.

C. Forms for openings and construction, which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which affects such installations, shall be

accurately sized and located as dimensioned on the Drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the CONTRACTOR shall be responsible for resolution of the conditions as approved by the ENGINEER without additional expense to the OWNER.

D. Fabrication: Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Notch wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

E. Provision for other trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses, and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.

F. Cleaning: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed.

3.03 FORM COATINGS

A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for the other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instruction, and directions provided by suppliers of the items to be attached thereto.

B. Edge forms and screed strips for slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

3.05 REMOVAL OF FORMS

A. Forms shall be removed in a manner to insure complete safety of the structure. Forms shall not be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. Due to weather conditions or for other reasons, the forms shall remain in place for longer periods than stated above, when directed by the ENGINEER.

B. Do not pry against face of concrete. Use only wooded wedges.

C. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.

D. Formwork for columns, walls, sides of beams, and other members not supporting the weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal.

E. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength.

F. Where reshoring is planned, supporting formwork may be removed when concrete has reached seventy percent (70%) of specified strength, provided reshoring is installed immediately.

3.06 RESHORING

A. When reshoring is permitted or required, plan operations in advance and obtain approval from ENGINEER.

B. During reshoring, do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads and live loads in excess of loads permitted for developed concrete strength at time of reshoring.

C. Place reshores as soon as practical after stripping operations are complete, but in no case later than end of working day on which stripping occurs.

D. Tighten reshores to carry required loads without overstressing the concrete.

E. Leave reshores in place until the concrete being supported has reached its specified strength.

F. For floors supporting shores under newly placed concrete, level original supporting shore or reshore.

1. Reshoring system shall have a capacity to resist anticipated loads in all cases equal to at least one half (½) the capacity of the shoring system.

2. Unless otherwise specified, locate reshores directly under a shore.

3. In multistory buildings, extend reshoring through a sufficient number of stories to distribute the weight of newly placed concrete, forms and construction live loads in such a manner that design loads of floors and supporting shores are not exceeded.

G. Design, engineering, and construction of Shoring and Reshoring are the responsibility of the CONTRACTOR.

3.07 REMOVAL STRENGTH

A. When removal of formwork or Reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions have been met:

1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength.

2. When concrete has been cured in accordance with provisions of Section 03370 for the same length of time as the field-cured cylinders, which reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above fifty degrees Fahrenheit (50° F) and concrete has been damp or sealed from evaporation and loss of moisture.

3.08 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated, or otherwise damaged formfacing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork. When forms are re-used for successive concrete placement, thoroughly clean surfaces,

remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.09 FIELD QUALITY CONTROL

A. Before commencing a placement, verify connections, form alignment, ties, inserts, and shoring are laced secure.

B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Reinforcing steel bars, wire fabric, or rod mats for cast-in-place concrete.
B. Support chairs, bolsters, bar supports, and spacers for supporting reinforcement.
C. Fiber reinforced concrete.

1.02 REFERENCES

A. AASHTO M 254: Standard Specification for Corrosion Resistant Coated Dowel Bars.
B. ACI 301: Specifications for Structural Concrete for Buildings.
C. ACI 315: Details and Detailing of Concrete for Buildings.
D. ASTM A 82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
E. ASTM A 185: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
F. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
G. ASTM A 706: Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
H. AWS D1.1: Structural Welding Code Steel.
I. ASW D1.4: Structural Welding Code Reinforcing Steel.
J. CRSI Document: Manual of Standard Practice.

1.03 SUBMITTALS

A. Manufacturer's Certificate: Submit mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis.

B. Welder's certification.

C. Shop Drawings.

1. Indicate sizes, spacing, locations, and quantities of reinforcing steel, wire fabric, bending and cutting schedule, splicing, stirrup spacing, supporting, and spacing devices.

2. When required, Shop Drawings shall be prepared under the direction of a Wyoming licensed professional engineer acceptable to the agency having jurisdiction.

1.04 PRODUCT HANDLING

A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Storage: Take all means necessary to protect reinforcement materials before, during, and after installation and to protect the installed work of other trades. Store all reinforcement materials in a manner to prevent excessive rusting and fouling with grease, dirt, and other bond-breaking coatings. Take all necessary precautions to maintain identification after

bundles are broken. In the event of damage or errors, immediately make all repairs or replacements necessary at no additional cost to the OWNER.

1.05 FIBER REINFORCED CONCRETE

A. Submit one (1) copy of manufacturer's printed product data, clearly marked, indicating proposed fibrous concrete reinforcement materials. Printed data should state one and one half (1.5) lbs. of fiber to be added to each cubic yard or as recommended by the manufacturer of each type of concrete.

B. Submit one (1) copy of manufacturer's printed batching and mixing instructions.

C. Submit one (1) copy of a certificate prepared by the concrete supplier stating that the approved fibrous concrete reinforcement materials at the rate of one and one half (1.5) lbs. per cubic yard or as recommended by the fiber reinforcement manufacturer were added to each batch of concrete delivered to the project site. Each certificate shall be accompanied by one (1) copy of each batch delivery ticket indicating amount of fibrous concrete reinforcement material added to each batch of concrete.

PART 2 PRODUCTS

2.01 CONCRETE REINFORCEMENT MATERIALS

A. Reinforcing Steel: Shall be in accordance with ASTM A 615, including supplementary requirements S1, either uncoated or as indicated. When no grade is indicated, use 60 ksi yield grade steel. Use ASTM A 706 steel if welding is indicated or allowed.

In all new or substantially rehabilitated roadway pavement and bridge construction, and in other locations as determined by the ENGINEER, use only epoxy-coated reinforcing steel bars, ensuring coating is in accordance with ASTM A775 and is applied by the electrostatic spray method. From the epoxy coating manufacturer, obtain patching or repair material that is compatible with the coating, inert in concrete, and suitable for field use.

B. Welded Steel Wire Fabric: In accordance with ASTM A 185 plain type; in flat sheets or coiled rolls either uncoated or coated as indicated. If epoxy coated, ASTM A884 Standard Specifications for Epoxy-Coated Steel Wire and Welded Wire Reinforcement shall be followed.

C. Plain Dowel Bars for Expansion Joints: In accordance with ASTM A 615, 60 ksi yield grade steel.

1. Epoxy coated in roadway pavement.

2. Provide metal dowel so that one end of dowel permits longitudinal movement within the concrete section. Design caps with one (1) end closed.

3. Provide for movement equal to joint width plus one half (½) inch.

4. For load transfer bars, paint with one (1) coat of paint conforming to AASHTO M 254 and coat one half (½) of the bar with grease.

D. Fibrous Concrete Reinforcement Material

1. One hundred percent (100%) virgin polypropylene fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Volume per cubic yard shall equal a minimum of 0.1% (1.5 pounds).

2. Fibrous concrete reinforcement (fibermesh) shall be as manufactured by Fibermesh Company, 4019 Industry Drive, Chattanooga, TN 347416; Grade MD or approved equal.

3. Physical Characteristics:

   a. Specific gravity: 0.91

   b. Tensile strength: 50 to 110 ksi.

   c. Fiber length: graded per manufacturer: or, as specified by project engineer.

4. Fibrous concrete reinforcement materials provided in this Section shall produce concrete conforming to the requirements for each type and class of concrete required, as indicated on the drawings and specified in Section 03304 Portland Cement Concrete where the concrete is tested in accordance with ASTM C-94 and ASTM C-1116 Type III 4.1.3 and ASTM C-116 (Ref: ASTM C-1018) Performance Level I5 outlined in Section 21 Note 17.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage steel wire shall be plain, cold drawn and shall comply with ASTM A 82.

B. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:

1. Use wire bar type supports complying with CRSI recommendations unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

3. For exposed-to-view surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

2.03 FABRICATION

A. Fabricate reinforcement in accordance with ACI 315, providing for the concrete cover specified in paragraph 3.04 of this section.

B. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate location of splices on Shop Drawings.

C. Weld reinforcing bars in accordance with AWS D1.4.

D. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work:

1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.

2. Bends or kinks not indicated on Drawings or final Shop Drawings.

3. Bars with excessive rusting or loose rust scale that would impair bonding.

PART 3 EXECUTION

3.01 PLACING

A. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.

B. Place all reinforcement in the position indicated. Tie bars together at all intersections with tie wire.

C. Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the work must be approved by the ENGINEER before concrete is placed.

D. Overlap sheets of metal mesh one square plus six inches (6") to maintain a uniform strength. Securely fasten at the ends, edges, and supports to maintain clearances.

3.02 SPLICING

A. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated, is not permitted without written approval. Stagger splices where possible.

B. Unless indicated otherwise, overlap reinforcing bars a minimum of thirty (30) diameters to make the splice. In lapped splices, place the bars and wire to maintain the minimum distance for clear spacing to the surface of the concrete.

C. Do not use lap splices on bars greater in diameter than No. 11 unless approved by the Engineer.

D. Weld reinforcing steel only if indicated or if authorized in writing by the Engineer. Weld in conformance to AWS D1.4.

E. Do not bend reinforcement after embedding in hardened concrete.

F. Do not permit reinforcement or other embedded material items bonded to the concrete, to extend continuously through any expansion joint, except dowels in floors bonded on only one side of joints.

3.03 PLACING EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors, and embedded items prior to concrete placement. Temporarily fill voids in embedded items to prevent entry of concrete.

B. Give all trades whose work is related to the concrete section ample notice and opportunity to introduce or finish embedded items before concrete placement.

3.04 CONCRETE COVER

A. Provide minimum concrete covering for reinforcement as follows:

1. Concrete cast and permanently exposed to earth shall have a minimum of three inches (3") cover.

2. Concrete exposed to earth or weather shall have a minimum of two inches (2") cover for reinforcing bars No. 6 or larger or one and one half inches (1-½") cover for reinforcing bars less than No. 6.

3. Concrete not exposed to weather or in contact with ground shall have a minimum of one and one half inches (1-½") cover for beams, girders, and columns; three quarter inch (3/4") for slabs, walls and joists with No. 11 bars or smaller, and one and one half inches (1-½") cover with No. 14 and No. 18 bars.

3.05 REINFORCEMENT TOLERANCES

A. Reinforcement bars shall be placed to the following tolerances:

1. Minimum spacing between parallel bars: shall be the diameter of the bar but not less than one inch (1").

2. Top bars in slabs and beams:

a. Member eight inches (8") deep or less: ±three eighths inch (3/8").

b. Members greater than eight inches (8") deep: ± one half inch (1/2").

3.06 CONSTRUCTION METHODS FOR FIBER REINFORCED CONCRETE

A. Add fibrous concrete reinforcement to concrete materials at the time concrete is batched in amounts in accord with approved submittals for each type of concrete required.

B. Mix batched concrete in strict accord with fibrous concrete reinforcement manufacturer's instructions and recommendations for uniform and complete dispersion.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASURMENT

A. The cost of fibrous concrete reinforcing is to be included as a part of the appropriate item in which it is being used. There will be no separate measurement or payment for this item.

B. The cost of reinforcing steel is to be included as a part of the appropriate item in which it is being used. There will be no separate measurement or payment for this item.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03251

EXPANSION AND CONTRACTION JOINTS

PART 1 GENERAL

1.01 SUMMARY

A. Joints and joint sealants in horizontal traffic surfaces for cast-in-place concrete sidewalks, curb, gutter, and pavement slabs.

1.02 SUBMITTALS

A. Manufacturer's certification that product was manufactured, tested, and supplied in accordance with source quality control requirements specified herein, together with a report of the test results and the date each test was completed.

B. Manufacturer's instruction for joint preparation, type of cleaning, and installation.

C. Manufacturer's Product Data and Samples for each joint sealant product required.

D. Material safety data sheets

1.03 REFERENCES

A. AASHTO C 920: Standard Specification for Elastromeric Joint Sealants.
B. ASTM D 545: Standard Methods of Testing Preformed Expansion Joint Filler for Concrete Construction (Non-extruding and Resilient Types).
C. ASTM D 994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
D. ASTM D 1056: Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.
E. ASTM D 1190: Standard Specification for Concrete Joint Sealer, Hot-Poured Elastic Type.
F. ASTM D 1191: Standard Method for Testing Concrete Joint Sealers.
G. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
H. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
I. ASTM D 1850: Standard Specification for Concrete Joint Sealer, Cold-Application Type.
J. ASTM D 1851: Standard Method of Testing Concrete Joint Sealer, Cold- Application Type.
K. ASTM D 2240: Standard Test Method for Rubber Property – Durometer Hardness.
L. ASTM D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
M. ASTM D 3405: Standard Specification for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.
N. ASTM D 3406: Standard Specification for Joint sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
O. ASTM D 3407: Standard Methods of Testing Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.
P. ASTM D 3408: Standard Methods of Testing Joint Sealants, Hot-Poured, Elastomeric – Type, for Portland cement Concrete Pavements.
Q. ASTM D 3542: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges.

R. ASTM D 3569: Standard Specification for Joint Sealants, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements.

S. ASTM D 3581: Standard Specification for Joint Sealant, Hot-Poured, Jet-Fuel-Resistant-Type, for Portland Cement Concrete and Tar-Concrete Pavements.

T. ASTM D 3582: Standard Methods for Testing Joint Sealant, Hot-Poured, Jet-Fuel-Resistant-Type for Portland Cement Concrete and Tar-Concrete Pavements.

U. ASTM D 3583: Standard Methods of Testing Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements, or Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant, for Portland Cement Concrete and Tar-Concrete Pavements.

V. FS SS-S-200: Sealants, Joints, Two Component, Jet-Blast Resistant, Cold-Applied, for Portland Cement Concrete Pavement.

1.04 QUALITY ASSURANCE

A. Obtain joint sealing materials from a single manufacturer for each different product required.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperature, contaminants, or other causes.

1.06 SYSTEM PERFORMANCES

A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.

B. Provide joint sealants that maintain watertight and airtight continuous seals.

PART 2 PRODUCTS

2.01 GENERAL

A. Compatibility: Provide joint filler, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2.02 JOINT VOID-FORMER

A. Plastic with water stop.

B. 1/4 depth of concrete structural section.

2.03 JOINT FILLER-SHEET TYPE

A. F1 Joint filler: Bituminous (asphalt or tar) mastic in accordance with ASTM D 994; formed and encased between two (2) layers of bituminous saturated felt or two (2) layers of glass-fiber felt.

B. F2 Joint Filler: Cane or other cellulosic fiber in accordance with ASTM D 1751; saturated with asphalt.

C. F3 Joint Filler: Granulated cork in accordance with ASTM D 1751; in an asphalt binder, encased between two (2) layers of asphalt saturated felt or two (2) layers or glass-fiber felt.

D. F4 Joint Filler: Sponge rubber fully compressible in accordance with ASTM C 1752; with resiliency recovery rate of ninety percent (90%) minimum.

E. F5 Joint Filler: Cork in accordance with ASTM C 1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of ninety percent (90%) if not compressed more than fifty percent (50%) of original thickness.

F. F6 Joint Filler: Plastic foam (for cold-applied sealants only) preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 30 lb/ft^3 density maximum; and of size and shape to control sealant depth and performance.

2.04 JOINT FILLER – BACKER ROD AND TAPE TYPE

A. Elastomeric Tube (Backer Rod): Neoprene, butyl, EPDM, closed cell polyethylene foam, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperature down to negative twenty-six degrees Fahrenheit (-26°F). Provide product with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

B. Tape: Self-adhesive polyethylene bond breaker tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to joint filler materials or joint surfaces at back or bottom of joint.

2.05 JOINT SEALANT – GENERAL

A. Color of exposed joint sealant indicated, or if not, as selected from manufacturer's standard colors.

2.06 JOINT SEALANT – HOT APPLIED

A. HAS1 Sealant: Resilient and adhesive compound type in accordance with ASTM D 3405; for Portland cement concrete or asphalt concrete pavements.

B. HAS2 Sealant: Thermoplastic type in accordance with ASTM D 3581; jet-fuel resistant without rubber unless indicated otherwise.

C. HAS3 Sealant: Elastic type in accordance with ASTM D 1190.

D. HAS4 Sealant: Elastomeric type in accordance with ASTM D 3406; one component, for Portland cement concrete pavements.

E. HAS5 Sealant: Elastomeric type in accordance with ASTM D 3569; one component, jet-fuel resistant, for Portland cement concrete pavements.

2.07 JOINT SEALANT – COLD-APPLIED

A. Silicon Sealant: Silicon type in accordance with ASTM D 5893; Type NS

B. CAS1 Sealant: Elastomeric type in accordance with ASTM C 920; Chemically curing, for vehicular or pedestrian use, and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O.

1. Shore A Hardness: 40 ± 5 ASTM D 2240.

2. Final Cure: 4 days maximum.

3. Service Range: -20 + 150° F (-23° to 66° C).

C. CAS2 Sealant: Mastic type in accordance with ASTM D 1850; single or multiple components; for joints having a minimum width of one-half inch (1/2").

D. CAS3 Sealant: Coal-tar modified urethane type in accordance with FS SS-S-200; one part, jet fuel resistant; Type H.

E. CAS4 Sealant: Elastomeric preformed polychloroprene type with lubricant adhesive and indicated movement ratio.

1. For concrete pavement seal; ASTM D 2628.

2. For concrete bridge seals; ASTM D 3542.

2.08 SOURCE QUALITY CONTROL

A. Preformed Expansion Joint Fillers: Non-extruding and resilient types; ASTM D 545.

B. Hot-Applied Joint Sealants:

1. Elastic type in concrete pavements, bridges, other structures; ASTM D 1191.

2. Bituminous type of hydraulic and asphaltic concrete pavements; ASTM D 3407.

3. Elastromeric type of hydraulic concrete pavements; ASTM D 3408.

C. Jet-Fuel-Resistant Joint Sealant: Hot-applied; ASTM D 3582 and ASTM D 3583.

D. Cold-Applied Mastic Joint Sealant: In accordance with ASTM D 1851.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation of joint sealants under unfavorable weather conditions.

B. Install elastomeric sealants when temperature is stable in temperature range recommended by manufacturer for installation.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealer until contaminants capable of interfering with their adhesion are removed from joint substrates.

3.02 PREPARATION

A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

B. Verify that joint shaping materials and release tapes are compatible with sealant.

C. Examine joint dimensions and size materials to achieve required width to depth ratio.

D. Adjust joint depths to allow sealants to perform properly.

E. Remove moisture on substrate.

F. Bond Breaker Tape: Install where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.03 JOINTS-GENERAL

A. Construct all joints as follows:

1. At right angles to top surface of placement.

2. Straight unless indicated otherwise.

3. Before uncontrolled shrinkage cracking takes place.

3.04 EXPANSION JOINTS

A. Expansion joints shall be in locations as shown on drawings or as approved by the ENGINEER. Expansion joints for curb and gutter and sidewalks shall be placed where shown on drawings or at a maximum distance of one hundred fifty feet (150').

B. Premolded filler strips shall extend full depth of slab.

C. Isolation joints shall be used in all areas where slabs abut vertical surfaces. Joint material shall be placed on levels called for and in good alignment.

D. In no case shall the reinforcing or other fixed metal items embedded or bonded into concrete be run continuous through expansion joint.

E. Finish at joints shall be neatly finished with an edging tool providing a slightly rounded edge on each side of the joint filler material.

3.05 CONSTRUCTION JOINTS

A. Construction joints shall be placed in flat slabs in locations as shown on the drawings or as approved by the ENGINEER.

B. The preformed metal keyway joints shall be set to obtain accurate alignment, grades, level and plumb in the work and shall be furnished the full depth of the slab.

C. Where a joint is made to a previously placed concrete section, care should be taken to remove all laitance prior to new placement of concrete.

D. The CONTRACTOR may elect to place concrete on both sides of a construction joint or placing through the joint. When this method is employed, a temporary backer such as a 2 x 4 shall be provided to stiffen and hold the preformed metal joint in alignment ahead of the work and shall be removed as the work progresses.

3.06 CONTROL JOINTS

A. Tooled Joint

1. Tooled joints shall be formed by scoring the slab the full depth with a steel trowel along a straight edge in locations as shown on the drawings or if not shown, not to exceed one hundred forty-four square feet (144 SF) in area.

2. The joint shall be finished using a joint tool guided by a straight edge leaving a slightly rounded edge on each side of the joint.

B. Sawn Joints

1. Sawn joints shall be sawn into interior concrete floors as indicated on the drawings and at CONTRACTOR's option in place of preformed metal keys.

2. Joints shall be sawn with a power saw designed to saw depth and width as shown on drawings. Hand held saws will not be accepted.

3. Sawing of the joints with a diamond blade shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually four (4) to twenty-four (24) hours. Sawing of the joints with an early entry dry cut saw shall commence per saw manufacturers recommendation, which is usually one (1) to four (4) hours.

4. Joint Sealant installation shall be in strict accordance with manufacturer's specifications.

3.07 JOINT SEALING

A. Surface Preparation

1. Remove oil, grease, wax, form-release-agents, curing compounds, bitumen, laitance, and old chalking material by sandblast, or water blast as recommended by manufacturer of sealant. Maximum sand blast angle, twenty-five degrees (25°) $\pm$ 5.

2. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.

3. Remove moisture in concrete joint substrates before commencing sealing.

B. Installation

1. Ensure that sealants are installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding to joint surfaces on opposite sides.

2. Except as otherwise indicated, fill sealant joint flush with surface.

3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

4. Depths: The depth, width, and line shall be as shown on the plans.

C. Spillage: Do not allow poured sealant compounds to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.

D. Heating: Do not overheat hot – applied sealants.

E. Edges: Unless indicated otherwise, recess exposed edges of gasket and exposed joint filler slightly behind adjoining surfaces so compressed units will not protrude from joints.

3.08 CARE AND PROTECTION

A. Cure sealants and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

B. Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Substantial Completion.

3.09 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of products in which joints occur.

B. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

3.10 PROTECTION

A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Substantial Completion.

B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joint with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to OWNER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03304

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Portland cement concrete material requirements.
B. Mix design requirements.
C. Method of measurement and basis of payment

1.02 SUBMITTALS

A. Mix Design: Submit each proposed mix design a minimum of fourteen (14) days prior to use in the work. Indicate whether mixes have been designed for pumping. Include in the report the following information.

1. Water-cement ratio.

2. Proportion of materials in the mix.

3. Source and type of cement.

4. Analysis of water to be used unless potable.

5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.

6. Slump, air content, and temperature of samples.

7. Unit weight of fresh and dry lightweight concrete.

B. Concrete Quality Charts. Comply with ACI 214 and ACI 301, and submit the following.

1. Specified strength (f_c')

2. Required average strength (f_{cr}).

3. Compressive strength versus date of sample.

C. Optional design mix.

1. At the CONTRACTOR's option, he may elect to provide a concrete mix that has been previously designed, tested, and used and which provides the quality required by these Specifications.

2. If the CONTRACTOR exercises this option, he shall submit to the ENGINEER for approval all pertinent data, including test results to substantiate the design requested to be furnished.

D. Aggregate Test Report: Submit for each aggregate source.

1. Date of test analysis.

2. Sieve analysis.

3. Organic impurities.

4. Sodium sulfate soundness test.

5. Reactivity of aggregate.

6. Complete identification of aggregate source of supply.

1.03 QUALITY ASSURANCE

A. Do not change materials sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or an aggregate without ENGINEER's approval.

B. In proportioning materials for mixing, use scales certified by the State of Wyoming. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard from approved mix design without written approval of ENGINEER.

D. Use of admixture will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C 94 and requirements in this Section.

F. Control Testing of Concrete: In Accordance with Section 03305.

1.04 REFERENCES

A. AASHTO 26: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
B. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
C. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
D. ACI 211.3: Standard Practice for Selecting Proportions for Non-Slump Concrete.
E. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete.
F. ACI 301: Specifications for Structural Concrete Buildings.
G. ASTM C 33: Standard Specification for Concrete Aggregates.
H. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
I. ASTM C 94: Standard Specification for Ready-Mix Concrete.
J. ASTM C 150: Standard Specification for Portland Cement.
K. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.
L. ASTM C 289: Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
M. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
N. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
O. ASTM C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

1.05 DEFINITIONS

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures no more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (f_c'): The required compressive strength.

1.06 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.01 CEMENT

A. ASTM C 150, Type II, or as recommended by the ENGINEER. Type I in above grade structure if approved, or as recommended by the ENGINEER.

B. Do not use air entraining cement.

2.02 WATER

A. Clean, and potable.

B. Comply with AASHTO 26.

2.03 AGGREGATES – GENERAL

A. Gravel, crushed slag, crushed stone, or other inert materials, composed of hard, strong, durable particles free of injurious coatings.

B. The materials passing the No. 200 (75µm) sieve shall not exceed four percent (4%) by weight in the combined coarse and fine aggregate.

2.04 COARSE AGGREGATE

A. Sieve Analysis: Graded in accordance with Section 02190, part 2.02, Table No. 02190-2.02B.

B. Gradation limits of Table No. 02190-2.02B may be changed if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids, and the maximum aggregate size does not exceed the following requirements.

1. 1/5 of narrowest dimension between forms.

2. 1/3 of depth of slabs.

3. 3/4 of minimum clear spacing between reinforcing bars.

C. Deleterious Substances: Maximum percentage by weight shall be in accordance with Section 02190, part 2.02.

2.05 FINE AGGREGATE

A. Sieve Analysis: Grade in accordance with Section 02190, part 2.02, Table 02190-2.02A.

B. Deleterious Substances: Maximum percentage by weight shall be in accordance with Section 02190, part 2.02.

2.06 ADMIXTURES

A. Air Entrainment: ASTM C 260

B. Water Reducing and Set Retarding Agents: ASTM C 494.

1. Type A: Set water reducing.

2. Type B: Set retarding.

3. Type C: Set accelerating.

4. Type D: Water reducing and set retarding.

5. Type E: Water reducing and set accelerating.

6. Type F: High range water reducing (super plasticizer). *

7. Type G: High range water reducing and set retarding. *

* The relative durability factor of water reducing admixtures shall not be less than eighty (80), and the chlorides content (as Cl-) shall not exceed 1 percent by weight of the admixtures.

C. Calcium Chloride: None allowed.

D. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class C or F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is twenty percent (20%).

2. The ratio of replacement by weight of Pozzolan to cement shall be 1.0 to 1.0.

3. Loss of ignition of pozzolan is less than 3 percent, and the water requirement does not exceed one hundred percent (100%).

4. All other requirements of this Section still apply.

5. Mix designs including trial batches are required for each aggregate source and for each concrete class.

2.07 ACI MIX DESIGN

A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f_c') shall be based upon no more than one (1) in one hundred (100) random individual strength tests falling more than five hundred (500) psi (3.45 mPa) below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2, or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03304-2.08.

TABLE NO. 03304-2.08

CONCRETE MIX PROPERTIES					
CONCRETE	CONCRETE CLASSIFICATIONS				
PROPERTIES	Class A	Class B	Class C	Class D	Class S
Specified Compressive Strength F_c' at 28 days, min., psi (mPa)	5000 (34.5)	4000 (27.6)	3000 (20.7)	2000 (13.8)	45-200 (0.31-1.4)
Compressive Strength at 7 days, psi, min. (a) (mPa)	4000 (23.1)	3200 (18.5)	2400 (13.9)	1600 (9.2)	40 (0.28)
Cement content (94 lb sacks of cement per cubic yard of concrete), min. (b)	(c)	6.0	5.5	4.5	(e)
Entrained air content, (% by column)	6½ ± 1½	6½ ± 1½	6½ ± 1½	6½ ± 1½	-
Slump range, in (d) (mm)	1-5 (25-127)	1-5 (25-127)	2-5 (51-127)	2-5 (51-127)	(e)

(a) Used for monitory purposes only.
(b) Includes pozzolan replacements.
(c) Cement content shall be appropriate to produce a mixture meeting the requirements for water/cement ratio and workability for the specific job conditions.
(d) Ensure that concrete with slump greater than 4 in contains a water-reducing admixture (super-plasticizer).
(e) As determined in the mix design, not to exceed specified compressive strength.

C. The maximum water to cement ratio (w/c) shall be 0.45:1 for all mixes

2.08 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards.

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.09 HEATING (WATER AND AGGREGATE)

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water to one hundred fifty degrees Fahrenheit (150°F) maximum. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than one hundred degrees Fahrenheit (100°F).

PART 3 EXECUTION

3.01 INSTALLATION

A. CONCRETE WORK; Section 03310.

B. CONCRETE QUALITY CONTROL; Section 03305

C. CONCRETE CURING; Section 03370.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 03304.01 CLASS A CONCRETE

   This item shall be measured by the cubic yard for the accepted quantity of Class A Portland Cement Concrete complete in place.

2. 03304.02 CLASS B CONCRETE

   This item shall be measured by the cubic yard for the accepted quantity of Class B Portland Cement Concrete complete in place.

3. 03304.03 CLASS C CONCRETE

   This item shall be measured by the cubic yard for the accepted quantity of Class C Portland Cement Concrete complete in place.

4. 03304.04 CLASS D CONCRETE

   This item shall be measured by the cubic yard for the accepted quantity of Class D Portland Cement Concrete complete in place.

5. 03304.05 CLASS S PORTLAND CEMENT CONCRETE

   This item shall be measured by the cubic yard for the accepted quantity of Class S Portland Cement Concrete complete in place.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 03304.01 CLASS A CONCRETE

   Payment shall include erecting and stripping forms; furnishing and installing concrete and any other specials; finish work; and all other work necessary or incidental for completion of the item.

2. 03304.02 CLASS B CONCRETE

   Payment shall include erecting and stripping forms; furnishing and installing concrete and any other specials; finish work; and all other work necessary or incidental for completion of the item.

3. 03304.03 CLASS C CONCRETE

   Payment shall include erecting and stripping forms; furnishing and installing concrete and any other specials; finish work; and all other work necessary or incidental for completion of the item.

4. 03304.04 CLASS D CONCRETE

Payment shall include erecting and stripping forms; furnishing and installing concrete and any other specials; finish work; and all other work necessary or incidental for completion of the item.

5. 03304.05 CLASS S PORTLAND CEMENT CONCRETE

Payment shall include furnishing and placing the Class S Portland Cement Concrete; all tools, labor, equipment and incidentals necessary for the placement of the Class S Portland Cement Concrete.

SECTION 03305

CONCRETE QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Testing requirements for CONTRACTOR's quality control of Portland cement concrete mixtures.
B. Re-testing potentially defective concrete.

1.02 SUBMITTALS

A. Field and laboratory control test reports for material properties enumerated herein.

B. Material certificates.

1.03 QUALITY ASSURANCE

A. Test Forms and Storage Areas: ASTM C 31.

1.04 REFERENCES

A. ACI 318: Building Code Requirements for Reinforced Concrete.
B. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
D. ASTM C 42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
E. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
F. STM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
G. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.
H. ASTM C 173: Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
I. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
J. ASTM C 567: Standard Test Method for Unit Weight of Structural Lightweight Concrete.
K. ASTM D 4832: Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders.

1.05 PROJECT CONDITIONS

A. Furnish labor to assist in obtaining and handling samples at site or sources.

B. As a result of failed tests, perform remedial work at no additional cost to the OWNER.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TESTING FREQUENCY

A. The CONTRACTOR shall furnish the concrete necessary for testing and shall cooperate fully with the ENGINEER in obtaining the material for testing purposes.

B. Tests will be performed on pours over five cubic yards (5 CY). Slump, Air Content and Unit Weight tests will be performed within every twenty-five cubic yards (25 CY). For strength testing, one group of four (4) test specimens will be made within every fifty cubic yards (50 CY). Test ages will be one (1) at seven (7) days, two (2) at twenty-eight (28) days and one (1) hold.

C. All testing will be performed by an ACI certified technician.

3.02 TESTING COMPRESSIVE STRENGTH

A. Obtaining Samples: Unless indicated otherwise, secure composite samples in accordance with ASTM C 172. Obtain samples from different portions of the batch of concrete.

B. Casting:

1. Cast and cure four (4) concrete cylinders in accordance with ASTM C 31, three (3) for testing and one (1) to be cured as a spare. Determine unit weight, slump, air content, and temperature of concrete casting.

2. For controlled low-strength material (CLSM) and lime treated fills, cast concrete cylinders in accordance with ASTM D 4832.

C. Testing: Perform compression tests on samples in accordance with ASTM C 39.

1. Two specimens shall be tested at twenty eight (28) days for acceptance and one shall be tested at seven (7) days for information. The acceptance test results shall be the average of the strengths of the two specimens tested at twenty eight (28) days. If one specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the spare specimen shall be tested and averaged as one of the two constituting the twenty-eight (28) day test. If any one cylinder in a twenty-eight (28) day test shows definite evidence, other than low strength, of improper sampling, molding, handling, curing, or testing, discard. The average strength of the remaining cylinders shall be considered the test result.

2. For controlled low-strength material (CLSM) and lime treated fills, test one (1) cylinder at three (3) days and the remainder at twenty eight (28) days.

3.03 TESTING FLEXURAL STRENGTH

A. Obtaining Samples: Secure composite samples in accordance with ASTM C 172. Obtain samples from different portions of the batch of concrete.

B. Casting: Cast and cure four (4) concrete beams in accordance with ASTM C 31. Determine slump, air content, and temperature of concrete casting. Report deviations from requirements.

C. Testing: Perform flexural tests on samples; ASTM C 78.

1. Test one (1) beam at seven (7) days or as approved by ENGINEER for determining when construction traffic is permitted on paved surfaces.

2. Test the remaining beams at twenty-eight (28) days. If any one beam in a twenty-eight (28) day test shows definite evidence, other than low strength, of improper sampling, molding, handling, curing, or testing, discard. The average strength of the remaining beams shall be considered the test results.

3.04 TESTING CONCRETE PAVEMENT THICKNESS

A. Determined from cores secured in accordance with ASTM C 42.

3.05 ADDITIONAL TESTING

A. Slump Test: ASTM C 231.

B. Air Test:

1. Normal weight concrete air content; ASTM C 231.

2. Lightweight concrete air test; ASTM C 173.

C. Unit Weight:

1. Normal weight concrete; ASTM C 138

2. Lightweight concrete; ASTM C 567.

D. When requested, test concrete in place by impact hammer, sonoscope, or other non-destructive device:

1. To determine relative strengths in various locations in work.

2. To aid in evaluating concrete strength.

3. To select areas to be cored.

4. To verify quality control in the absence of Control Testing.

3.06 RE-TESTING POTENTIALLY DEFECTIVE CONCRETE

A. If a concrete test result is below specification and the work is considered potentially deficient:

1. A request to ENGINEER for re-testing must be made within forty (40) days from time of placement if CONTRACTOR desires re-test.

2. No coring or re-testing shall be done after sixty (60) days have elapsed from the time of placement.

3. Only one (1) re-test shall be allowed for a test sublot.

B. Obtain and test cores in accordance with ASTM C 42. Secure a minimum of three (3) cores from each sublot considered potentially deficient. Coordinate test locations with ENGINEER.

C. If concrete work will be dry under service condition, air-dry cores for seven (7) days before tests. Unless otherwise specified, use air temperature sixty to eighty degrees Fahrenheit (60 to 80° F) and relative humidity less than sixty percent (60%).

D. If concrete in work under service conditions will be more than superficially wet, test cores after moisture conditioning (liquid or vapor water cure).

E. If one (1) or more cores show evidence of having been damaged before testing, provide replacement.

F. Evaluate cores in accordance with ACI 318.

G. If core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the work, load testing may be required and evaluated in accordance with ACI 318.

H. Fill core holes with non-shrink, low slump concrete mortar. Coat sides of holes with an approved concrete epoxy resin adhesive. Match color and texture of surrounding concrete.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03310

CONCRETE WORK

PART 1 GENERAL

1.01 SUMMARY

A. Concrete placement operations for cast-in-place slabs on grade, slabs on fill, structural building frames, and other concrete components.

1.02 SUBMITTALS

A. Quality control test reports and material certificates; Section 03305.

B. Product name, type, and chemical analysis of the following as applicable:

1. Curing compound.
2. Sealing compound.
3. Chemical hardener.
4. Bonding compound.

C. Batch Delivery Ticket: Submit for each batch delivered to site.

1. Date.
2. Producer and plant.
3. Job.
4. Name of contractor.
5. Serial number of ticket.
6. Truck number and time dispatched.
7. Volume of concrete.
8. Reading of revolution counter at first addition of water.
9. Signature or initials of Ready-Mix representative.
10. Type and brand of cement.
11. Amount of cement.
12. Total water content.
13. Water added at the site for receiver of concrete and receiver's initials.
14. Admixture types and amounts.
15. Maximum size of aggregate.

16. Separate weights of fine and coarse aggregate.

17. Indication that all ingredients are as previously certified or approved.

1.03 QUALITY ASSURANCE

A. Rejection: Concrete work which fails to meet one (1) or more of the following requirements and which cannot be brought into compliance shall be rejected. ENGINEER shall determine appropriate modifications or payment adjustment to be made.

1. Appearance: Concrete exposed to view with defects, which adversely affect appearance of specified finish.

2. Strength: Strength of concrete fails to comply with any of the following requirements.

a. The average of two (2), twenty-eight (28) day compressive or flexural strength samples made from the same batch of concrete falls below the acceptance level.

b. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.

c. Concrete which differs from required dimensions or location in such a manner as to reduce its strength or load carrying capacity.

d. Method of curing is not as specified.

e. Inadequate protection of concrete from extremes of temperature during the early stages of hardening and strength development.

f. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

g. Workmanship likely to result in deficient strength.

3. Slab Tolerance: Finishing which fails to comply with Section 03345 requirement.

4. Material Sources: Failure to comply with Section 03305.

1.04 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.

B. ACI 305: Hot Weather Concreting

C. ACI 306.1: Cold Weather Concreting

D. ACI 309: Standard Practice for Consolidation of Concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Class as indicated, material in accordance with Section 03304.

B. Bonding Compound: Polyvinyl acetate base or acrylic base, non-rewettable type.

C. Vapor Barrier: Ten (10) mil thick, clear, polyethylene sheet. Type recommended for below grade application and shall be free from pin hoes, tears, scars, and other defects.

D. Forms: In accordance with Section 03100.

E. Reinforcement: In accordance with Section 03200.

F. Coverings and Curing Compound: In accordance with Section 03370.

G. Non-shrink Grout: Adhesives epoxy, in accordance with Section 03600.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not impede placing concrete.

B. Do not allow construction loads to exceed member capacity.

C. Prepare previously placed concrete by cleaning with steel brush and applying bonding compound. Apply bonding compound in accordance with manufacturer's instructions.

D. At locations where new concrete is dowelled to existing Work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout or approved epoxy adhesive.

3.02 DELIVERY

A. Slump: Do not discharge concrete if its slump is greater or less than permissible slump. Report results of slump test on batch delivery tickets.

B. Concrete Placement Time Limit: After the introduction of cement to aggregate or mixing water at the batch plant, discharge concrete from truck mixer within the following air temperatures and time periods.

1. Air temperature less than eighty degrees Fahrenheit (80°F): One and one-half (1-1/2) hours.

2. Air temperature over eighty degrees Fahrenheit (80°F) without a retarder added to the mix: One (1) hour maximum.

3. Air temperature over eighty degrees Fahrenheit (80°F) with retarder added to the mix as part of an approved mix design: One and one-half (1-1/2) hour maximum.

C. Tempering

1. When concrete arrives at site with slump below specified, water may be added if the maximum approved water/cement ratio and the maximum slump is not exceeded, provided that:

a. The approved mix design has allowed for on-site addition of water.

b. The amount of water added at the site is accurately measured to $\pm$ one (1) gallon of the desired added amount.

c. That water addition is followed by thirty (30) revolution of mixing at mixing speed prior to discharge.

2. Do not add water after concrete discharge from the mixer commences unless approved by the ENGINEER.

D. Ensure that the mixed concrete temperature immediately prior to placement is from fifty degrees Fahrenheit (50°F) and ninety degrees Fahrenheit (90°F).

E. Super-plasticizer

1. Pre-measure and add high range water reducing agent in accordance with manufacturer's instructions.

2. If added at site, add agent using bottle or jug capable of rapidly and uniformly distributing the admixture to the concrete. Prior to discharge, mix for a minimum of five (5) minutes at a drum rate not less than twelve (12) rpm or more than fifteen (15) rpm.

3. If added at plant, do not deliver to site unless batch delivery ticket displays water/cement ratio prior to super-plasticizer addition.

4. Tempering with super-plasticizer after expiration of allowable delivery times is prohibited.

3.03 CONCRETE PLACEMENT

A. Notify ENGINEER minimum twenty-four (24) hours prior to commencement of concrete placement operations.

B. Place concrete in accordance with ACI 301.

C. Hot Weather Placement

1. General

a. Comply with the provisions of ACI 305, except as modified herein.

b. When hot weather conditions exist the CONTRACTOR shall implement precautionary procedures to effectively minimize the detrimental effects to concrete caused by hot weather conditions. Hot weather concreting procedures shall be determined in advance of concrete placement and are subject to approval by the ENGINEER.

c. Precautionary procedures for hot weather concreting may include (but are not limited to) one or more of the following:

1. Use chemical admixtures to lower mixing water requirements and to extend working time of fresh concrete.

2. Maintain concrete temperature at time of placement below eighty five degrees Fahrenheit (85°F).

3. Moisten the forms, subgrade, and reinforcing before placing concrete; keep exposed surfaces continually moist.

4. Cover the reinforcing steel with water-soaked burlap so steel temperature will not exceed ambient air temperature prior to concrete placement.

2. Plastic Shrinkage Cracking

a. When conditions of high ambient temperature, high concrete temperature, low relative humidity, high wind, or any combination thereof are present, the rate of evaporation of surface moisture from concrete shall be determined by the CONTRACTOR in accordance with ACI 305, Figure 2.1.5.

b. When the rate of evaporation exceeds, or may be expected to exceed, two tenths (0.2) lb/sq. ft/hr during the placement and finishing of concrete, precautions against plastic shrinkage cracking are necessary.

c. The potential for plastic shrinkage cracking may be reduced by implementing one or more of the following procedures:

1. Scheduling concrete placements early in the morning during periods of high temperatures.

2. Re-scheduling or canceling concrete placements during periods of unfavorable conditions.

3. Erecting windbreaks and/or sunshades to protect exposed concrete surfaces during placing and finishing operations.

4. Providing a continuous fog spray of water above concrete surfaces during finishing operations. Fogging must be closely monitored to avoid contributing additional water to surface of concrete.

5. Applying temporary plastic sheeting or a sprayable evaporation retardant to concrete surfaces between finishing passes.

6. Beginning curing of concrete as soon as possible after finishing. When applying membrane-forming curing compounds, application should be started immediately after disappearance of any surface water sheen after the final finishing pass.

D. Cold Weather Placement

1. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. If necessary to place concrete under conditions of low temperature, placement shall be approved by the ENGINEER.

2. When air temperature has fallen to or is expected to fall below forty degrees Fahrenheit (40°F), uniformly heat all water and aggregates before mixing, as required to obtain an as-mixed concrete temperature of not less than sixty five degrees Fahrenheit (65°F) and not more than ninety degrees Fahrenheit (90°F).

3. Minimum concrete temperature as-placed and maintained at the concrete surface is fifty five degrees Fahrenheit (55°F) for seventy-two (72) hours after placing.

4. Concrete must remain protected until a minimum strength of 500 psi is achieved if a single freeze cycle is expected. If recurring freezing cycles are expected, concrete must be protected at a minimum of forty degree Fahrenheit (40°F) for an additional ninety-six (96) hours, or until 3,500 psi strength is achieved.

5. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen material.

E. Do not use calcium chloride, salt and other material containing antifreeze agents, or chemical accelerators

F. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified in section 03251.

G. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than twenty-four (24) inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

H. Do not disturb reinforcement, inserts, embedded parts, and formed joints.

I. Do not break or interrupt successive pours such that cold joints occur.

J. Honeycomb or embedded debris in concrete is not acceptable.

3.04 JOINTS AND JOINT SEALING

A. Expansion and contraction joints, in accordance with Section 03251.

3.05 CONSOLIDATION

A. In accordance with ACI 309.

B. Keep spare vibrators available during concrete placement operations.

C. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

D. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least six inches (6”) into proceeding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3.06 FINISHING

A. Do not add water to concrete surface (i.e., sprinkle) without written approval.

B. Slab Finishing Tolerance: In accordance with Section 03345.

C. Finishes: In accordance with Section 03345. When type of finish is not indicated, use following finishes as applicable.

1. Sidewalks, garage floors, and ramps: Broom.

2. Exterior concrete pavement: Broom.

3. Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials: Non-slip finish.

4. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.

5. Surfaces intended to receive roofing, except future floors, waterproofing, membranes, and roof surfaces which are future floors or sand bed terrazzo: Floated finish.

6. Floors and roof surfaces which are floors intended as walking surfaces or to receive floor coverings: Troweled finish.

7. Unpainted concrete surfaces not exposed to public view: Rough as-cast form finish.

8. Unpainted concrete surfaces exposed to public view: Smooth as-cast form finish.

9. Concrete surfaces to receive paint or plaster: Grout cleaned finish.

3.07 CURING

A. Cure in accordance with Section 03370. Unless specified otherwise, apply a liquid membrane-curing compound.

3.08 CONTROL TESTING

A. Arrange for and perform all control testing required for qualification of proposed materials and the establishment of mix designs, in determining strengths for early form removal and other needs of CONTRACTOR.

B. One slump test within each twenty-five cubic yards (25 CY) or days production of concrete placed in the work.

C. Two (2) slump tests, one (1) before and one (1) after the addition of super-plasticizer.

3.09 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE

A. General:

1. Completed concrete work which conforms to applicable requirements of Contract Documents will be accepted without qualification.

2. Concrete work which fails to conform to one or more requirements of Contact Documents is rejected and will not be accepted or paid for until remedied.

3. CONTRACTOR shall pay costs incurred in providing remedial work necessary to change rejected work to accepted work. Remedial work includes, but is not necessarily limited to, applicable repair, replacement, reinforcement, engineering, and testing as denoted in following paragraphs.

B. Dimensional tolerances:

1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to rejection.

2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength of finish of structure is not acceptable, or function is adversely affected. Otherwise members will be accepted. If surfaces are rejected, and removal of excess material is permitted, repair of surfaces in an approved manner will constitute acceptance. If surfaces are rejected, and removal of excess material is not

permitted, replacement of member(s) in an approved manner will constitute acceptance.

3. Concrete member(s) cast in wrong location will be rejected if strength or finish is not acceptable, function is adversely affected or they interfere with other construction. Otherwise, member(s) will be accepted. If they are rejected, replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.

4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view will be rejected. Repair of surfaces or replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.

C. Finish:

1. Slabs:

a. Finished slabs exceeding tolerance limits of Section 03345 will be rejected if finish is not acceptable and function is adversely affected. If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.

b. Repair may involve removing high spots with a terrazzo grinder, filling low spots with a patching compound, or other remedial measures as permitted.

2. Formed surfaces:

a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected. Repair of surface defects in conformance with Section 03345 will constitute acceptance.

b. Concrete not exposed to view is not subject to rejection of defective finish.

D. Strength of structure:

1. Strength of structure in place will be considered potentially deficient and will be rejected if it fails to comply with requirements which control strength of the structure, including by not necessarily limited to the following:

a. Deficient concrete strength based on compressive strength tests.

b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Curing less than that specified, likely to result in deficient concrete strength.

e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.

f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.

g. Substandard workmanship likely to result in deficient strength.

2. When strength of structure is considered potentially deficient and is rejected, it will not be accepted until one of the following remedies is completed. Remedy used by Contractor shall be approved.

    a. Confirmation of safety of structure by structural analysis.

    b. Core test per Section 03305. Performed only when concrete strength is potentially deficient, and when safety of structure is not confirmed by structural analysis. Do not use if impractical to obtain or not feasible.

    c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318. Do not use if impractical to perform or not feasible.

    d. Replacement of structure deficient in strength.

    e. Subject to functional feasibility and Owner/Engineer approval, structure deficient in strength may be reinforced with supplement supports as directed by the Owner/Engineer.

3.10 PROTECTION AND REPAIRS

A. Protection: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimum moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Random Cracks in Pavement Slab on Grade: When cracks occur within two feet (2') of expansions or construction joints, or in the judgment of the ENGINEER will cause future maintenance problems, then remove and replace slab, otherwise repair by grouting with Section 03600 epoxy adhesive grout. Use saw cuts and dowels in all cut planes.

D. When plastic shrinkage cracking is observed and when, in the opinion of the ENGINEER, the proper precautions outlined in 03310-3.03-C were not taken, CONTRACTOR may be required to remove and replace the affected work, pending the evaluation by the ENGINEER of the severity and extent of the plastic shrinkage cracking.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03345

CONCRETE FINISHING

PART 1 GENERAL

1.01 SUMMARY

A. Finishing interior and exterior concrete surfaces.

1.02 SUBMITTALS

A. Name, type, chemical analysis and manufacturer's recommended rate of application for liquid chemical hardener.

1.03 REFERENCES

A. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.

1.04 PROJECT CONDITIONS

A. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during finishing operations. Provide protections as required and remove from site at completion of Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mortar and Grout: In accordance with Section 03600.

B. Dry Shake: Blend of metallic or mineral aggregate with Portland cement concrete in proportions recommended by manufacturer.

C. Proprietary Materials: If permitted or required, proprietary compounds may be used in lieu of or in addition to foregoing materials. Use such compounds in accordance with manufacturer's recommendations.

D. Liquid-Chemical Hardener: Colorless, aqueous solution containing a blend of magnesium fluosilicate, zinc fluosilicate, and a wetting agent. Mixture contains not less than two (2) pounds fluosilicate per gallon (0.24 kilograms fluosilicate per liter) and does not interfere with adhesives and bonding of finishing where such is indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper finishing.

C. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINISHING OF FORMED SURFACES

A. General

1. Allow concrete to cure not more than seventy-two (72) hours before commencing surface finish operations, unless approved otherwise.

2. Revise the finishes as needed to secure approval.

B. As-Cast Form Finish

1. Rough: Patch defects, chip or rub off fins exceeding one quarter inch (1/4") height.

2. Smooth: Patch tie holes and defects and remove fins completely.

   a. When surface texture is impaired and form joints misaligned, grind, bushhammer, or correct affected concrete.

   b. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.

   c. Repair major mortar leakage as a defective area.

   d. When workmanship is less than acceptable standard, provide one of rubbed finishes at no additional cost to OWNER.

C. Rubbed Finish

1. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.

   a. Finish newly hardened concrete no later than twenty-four (24) hours following form removal.

   b. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.

2. Grout Cleaned: Undertake no cleaning operations until all contiguous surfaces are completed and accessible.

   a. Wet surface of concrete sufficiently to prevent absorption of water from grout.

   b. Apply grout uniformly.

   c. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.

   d. While grout is still plastic, remove excess grout by working surface with rubber float or sack.

   e. After surface whitens from drying, rub vigorously with clean burlap.

   f. Keep damp for at least thirty-six (36) hours after final rubbing.

3. Cork Floated: Remove forms within two (2) to three (3) days of placement where possible.

a. Remove ties.

b. Remove all burrs and fins.

c. Dampen wall surface.

d. Apply mortar with firm rubber float or with trowel, filling all surface voids.

e. Compress mortar into voids.

f. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.

g. Produce final texture with cork float using a swirling motion.

D. Unformed Finish

1. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

2. Float to texture, which is reasonably consistent with formed surfaces.

3. Continue final treatment on formed surfaces uniformly across unformed surfaces.

E. Blasted Finish

1. Perform abrasive blasting within twenty-four (24) to seventy-two (72) hours after casting.

2. Coordinate with form work construction, concrete placement schedule, and form work removal to ensure that surfaces are blasted at the same age for uniform results.

3. Re-apply curing protection after blast finishing.

F. Architectural Finish

1. General: In accordance with ACI 303.

2. Tooled Finish:

a. Dress thoroughly cured concrete surface with electric, air, or hand tools to uniform texture, and give a bushhammered surface texture.

b. Remove sufficient mortar to expose coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

G. Patched Finish

1. Repair defective areas.

a. Remove honeycomb and defective concrete to sound concrete.

b. Make edges perpendicular to surface or slightly undercut.

c. Feather edges are not permitted.

d. Dampen area to be patched and at least six inches (6") surrounding it to prevent absorption of patching mortar water.

e. Prepare bonding grout.

f. Mix patching mortar to consistency of thick cream.

g. Brush into surface.

2. Tie Holes: Unless indicated otherwise, after being cleaned and thoroughly damped, fill tie holes solid with patching mortar.

3. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.

a. Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint.

b. Use a minimum amount of mixing water.

c. Mix patching mortar in advance and allow to stand without frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.

d. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.

4. After surface water has evaporated from patch area, brush bond coat into surface.

a. When bond coat begins to lose water sheen, apply curing compound.

b. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.

c. Leave undisturbed for at least one (1) hour before final finish.

d. Keep patched area damp for seventy-two (72) hours or apply curing compound.

e. Do not use metal tools in finishing an exposed patch.

5. Where as-cast finishes are indicated, total patched area may not exceed one (1) in five hundred (500) of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.

6. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.

a. Outer one inch (1") of patch shall contain same aggregates as surrounding concrete.

b. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.

c. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

3.03 FINSHING SLABS

A. Slab Finishing Tolerances:

1. Class A finish: maximum of one-eighth inch (1/8”) in ten feet (10’).

2. Class B finish: maximum of one-quarter inch (1/4”) in ten feet (10’).

3. Class C finish: maximum of one-half inch (1/2”) in ten feet (10’).

B. Broom and Belt Finish: After concrete has been placed, consolidated, struck-off, and leveled to the required tolerance, roughen surface transversely with stiff brushes, rakes, or burlap belt before final set.

C. Floated Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating.

1. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation.

2. During or after first floating, check planeness of entire surface with a ten foot (10’) long straightedge applied at two (2) or more different angles.

3. Cut down high spots and fill low spots to the required tolerance.

4. Re-float slab immediately to a uniform sandy texture.

D. Trowel Finish

1. Float finish surface.

2. Power trowel.

3. Hand trowel as required to provide surface. Do not apply water (i.e., sprinkle) to surface of concrete in finishing operations.

4. First troweling after power floating shall produce smooth surface relatively free of defects but which may still show some trowel marks.

5. Second trowel by hand after surface has hardened.

6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.

7. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.

E. “Dry Shake” Finish: Give surface a floated finish.

1. Apply approximately two-thirds (2/3) of a blended material for required coverage to surface by a method that ensures even coverage without segregation.

2. Begin floating immediately after application of first “dry shake”.

3. After floating has embedded material, apply remainder of blended material to surface at right angles to prevent reapplication.

4. Make second application heavier in any areas not sufficiently covered by first application.

5. Immediately follow with second floating.

6. After selected material has been embedded by second floating, complete operation with a broomed, floated, or troweled finish, as indicated.

F. Non-slip Finish: Give surface a "dry shake" application using crushed, ceramically bonded, aluminum oxide particles. Apply at twenty-five pounds (25 lbs) per one hundred square feet (100 SF).

G. Exposed Aggregate Finish: Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone.

1. Embed aggregate into surface by light tamping.

2. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance.

3. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgment.

4. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.

5. Continue until aggregate is uniformly exposed.

6. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

H. Chemical-Hardener Finish: Apply liquid chemical-hardener to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring, or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat, and allow twenty-four (24) hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provision, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03370

CONCRETE CURING

PART 1 GENERAL

1.01 SUMMARY

A. Concrete curing material requirements and methods.

1.02 SUBMITTALS

A. Manufacturer's specifications, test data, and other data required to prove compliance with the specified requirements.

B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, will become the basis for accepting or rejecting actual installation procedures used in the Work.

1.03 QUALITY ASSURANCE

A. Use workers who are trained, experienced, and completely familiar with the curing and protection requirements of ACI 301 and the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Maintain concrete with minimum moisture loss at relatively constant temperature recommended by manufacturer for a period necessary for hydration of cement and hardening of concrete.

1.04 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.
B. ACI 308: Standard Practice for Curing Concrete.
C. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
D. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
E. ASTM C 642: Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

1.05 PRODUCT HANDLING

A. Protect the materials of this Section before, during, and after installation, and protect the work and materials of other trades.

B. In the event of damage, immediately make replacement and repair at no additional cost to OWNER.

PART 2 PRODUCTS

2.01 WATER

A. Clean, non-straining and non-detrimental.

2.02 MOISTURE-RETAINING SHEET MATERIALS

A. Compliant with ASTM C 171, white, waterproof paper, polyethylene film, or burlap-polyethylene sheet.

2.03 ABSORPTIVE MAT MOISTURE COVER

A. Cotton or burlap fabric, clean roll goods.

2.04 CURING COMPOUND

A. White pigmented liquid membrane – Forming Compounds for curing shall be Dayton Superior J-9-A or Engineer approved equal conforming to ASTM C 309 or AASHTO M-148 Type 2, Class A.

B. Clear or translucent liquid membrane – Forming Compounds for curing shall be Dayton Superior J-11-W or Engineer approved equal conforming to ASTM C 309 or AASHTO M-148 Type 1, Class A.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify concrete surfaces are ready for curing. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Prepare the surface in strict accordance with manufacturer's recommendations.

3.03 MOISTURE COVER CURING

A. Apply one or both of the following methods.

1. Water or continuous water-fog spray.

2. Cover concrete surface with absorptive mat, thoroughly saturate with water, and keep continuously wet.

B. Place absorption mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers.

3.04 MOISTURE-RETAINING SHEET CURING

A. Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss.

B. Repair any loss or tears during curing period.

3.05 FORMED SURFACE CURING

A. Cure formed concrete surface, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed.

B. If forms are removed, continue curing by curing compound or methods indicated above, as applicable.

3.06 UNFORMED SURFACE CURING

A. Cure unformed surfaces, such as slabs, floor toppings, and other surfaces by application of appropriate curing methods.

B. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless approved otherwise.

3.07 CURING COMPOUNDS

A. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.

B. Apply immediately following the final finishing operation as soon as the concrete is firm enough to work on.

C. Apply uniformly in continuous operation.

D. Maintain continuity of coating and repair damage during cure period.

E. Should side forms be removed before expiration of cure period, coat exposed surface with curing compound.

F. Unless specified otherwise by manufacturer of curing compound, do not use curing compound on surfaces which are to be covered with coating materials.

3.08 SCHEDULE OF CURING APPLICATIONS

A. Concrete Exposed to Potable Water (as in Water Storage Reservoirs): Moisture cover curing.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Unless otherwise noted in the special provisions, no separate measurement will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

4.02 BASIS OF PAYMENT

A. Unless otherwise noted in the special provisions, no separate payment will be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes pre-mixed non-metallic shrinkage resistant, pre-mixed water stop hydraulic cement, epoxy, and Portland cement grouts.

1. Grouting for leveling beds of structural steel plates.

2. Sealing of joints and gaps between piping and structures.

3. Sealing of joints between construction components.

1.02 REFERENCES

A. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).
B. ASTM C144: Standard Specification for Aggregate for Masonry Mortar.
C. ASTM C 150: Standard Specification for Portland Cement.
D. ASTM C 157: Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
E. ASTM C 190: Standard Test Method for Tensile Strength of Hydraulic Cement Mortars.
F. ASTM C 207: Standard Specifications for Hydrated Lime for Masonry Purposes.
G. ASTM C 472: Standard Methods for Physical Testing of Gypsum Plasters and Gypsum Concrete.
H. ASTM C 595: Standard Specification for Blended Hydraulic Cements.
I. ASTM C 827: Standard Test Method for Early Volume Change of Cementitious Mixtures.
J. ASTM C 881: Standard Specification for Epoxy – Resin – Base Bonding Systems for Concrete.
K. ASTM D 570: Standard Test Method for Water Absorption of Plastics.
L. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.
M. ASTM D 695: Standard Test Method for Compressive Properties of Rigid Plastics.
N. CE-CRD-C-621: Corps of Engineers specification for grouts.

1.03 SUBMITTALS

A. Group mix components. Indicate proportions used, environmental conditions, and admixture limitations. Indicate material “Type”, “Grade”, and “Class” which suits project requirements.

B. Manufacturer’s data for latex bonding agent.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

A. Portland Cement: ASTM C 150, natural color Type II (normal) or Type IIA (air entraining).

B. Lime: ASTM C 207, Type S, hydrated.

C. Water: Clean, non-staining, and non-detrimental.

D. Grout Aggregate: ASTM C 144, standard masonry type.

2.02 PORTLAND CEMENT GROUT

A. Proportions by volume shall be 1 part Portland cement, and sand two and one-half (2-½) to three (3) times sum of volumes of cement and lime.

B. Mix for five (5) minutes maximum with sufficient water to form a stiff plastic putty. Add water as required for workability.

C. Compressive Strength: ASTM C 109, two thousand eight hundred (2,800) psi in twenty-eight (28) days.

2.03 GYPSUM PLASTER GROUT

A. Pre-mixed, pre-packaged, wood fiber gypsum plaster with an ASTM C 472 minimum average dry compressive strength of two thousand (2,000) psi in twenty-eight (28) days. Mix with water in accordance with manufacturer's instructions for intended use to form a stiff plastic mix required for workability.

2.04 NON-METALLIC, SHRINKAGE RESISTANT GROUT

A. Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cements, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C-621.

B. Compressive Strength: ASTM C 109, six thousand five hundred (6,500) to nine thousand (9,000) psi in twenty eight (28) days.

C. Non-shrink Percentage: ASTM C 827 and ASTM C 157, five tenths (0.5) percent.

2.05 EPOXY ADHESIVE GROUT

A. Two component material suitable for use on dry or damp surfaces, 100 percent solids, high, moisture insensitive, complying with ASTM C 881.

1. Tensile Strength: ASTM D 638, five thousand (5,000) psi, minimum in fourteen (14) days.

2. Tensile Elongation: ASTM D 638, two percent (2%) minimum.

3. Compressive Strength: ASTM D 695, six thousand five hundred (6,500) psi minimum in twenty-four (24) hours at seventy degrees Fahrenheit (70°F), twelve thousand five hundred (12,500) psi in twenty-eight (28) days at seventy degrees Fahrenheit (70°F).

4. Water Absorption: ASTM D 570, one percent (1%) maximum.

5. Bond Strength:

a. Direct Shear: Four hundred (400) psi

b. Direct Tension: Two hundred (250) psi

c. Beam Break: Eight (800) psi

6. Pot Life: Five (5) minutes maximum at seventy degrees Fahrenheit (70°F)

2.06 BONDING GROUT

A. Of approximately one (1) part cement to one (1) part fine sand passing a No. 30 sieve with approved latex bonding agent when allowed.

2.07 PNEUMATICALLY PLACED PLASTER ("GUNITE" OR "SHOTCRETE")

A. Materials: Portland Cement, lime, water, and sand.

B. Compressive Strength: ASTM C 109, two thousand eight hundred (2,800) psi in twenty-eight (28) days.

C. Proportioning: one (1) part cement to not more than five (5) parts sand.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fill joints, voids, and pockets completely.

B. Comply with manufacturer's instruction and UBC Chapter 47.

C. Finish surfaces exposed to view smooth.

D. Pneumatically Placed Plaster: Screened and reused rebound material in an amount not greater than twenty five percent (25%) of the total sand in any batch.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Grouting for leveling structural plates, sealing joints and gaps, filling voids and pockets and masonry cells shall not be measured for payment.

B. Pneumatically placed plaster ("Gunite" or "Shotcrete") will be measured by the actual areas in the plane of work.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items included in A. above. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

B. Payment for Pneumatically placed plaster ("Gunite" or "Shotcrete") will be based on the Contract Unit Price and shall include full compensation for preparing the foundation, setting all formwork, and grounds, furnishings and placing reinforcement, placing the concrete, finishing surfaces, curing and structural backfill as shown on the Plans. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

SECTION 16000

ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of the requirements for electrical improvements including, but not limited to, trenching, conduit, luminaires, vaults, pull boxes, and transformer pads.

1.02 REFERENCES

The following codes and standards are included by reference as an integral part of this document and are included as amended. While these codes are named specifically, the applicable regulations are not limited solely to those listed.

A. National Electrical Code – Currently Adopted by City of Gillette
B. National Electrical Safety Code – Currently Adopted by City of Gillette
C. City of Gillette Electrical – Line Extension Policy – Currently Adopted by City of Gillette

PART 2 PRODUCTS

2.01 MATERIALS

A. Conduit

1. All conduit shall be polyvinyl chloride (PVC) Schedule 40 electrical conduit

2. All required bends and sweeps for conduits shall be in accordance with the City of Gillette Electrical Line Extension Policy.

B. Conductor

1. The street light conductor with ground shall be suitable for installation in electrical conduit.

C. The CONTRACTOR shall purchase the following materials from the City of Gillette for the CONTRACTOR to use. The materials will be available at the City of Gillette Warehouse for the CONTRACTOR to transport to the site.

1. Pull Boxes

2. Distribution Pedestals

3. Transformer Pads (Single and Three Phase)

4. Switch Bases

5. Junction Boxes

6. Residential Street Lights (Poles and luminaires)

7. Highway Street Lights (Poles, arms, luminaires and anchor bolts)

D. Portland Cement Concrete – Air-entrained Portland Cement Concrete shall conform to the requirements of Section 03304, Subsection 2.08, Class B.

E. Reinforcing Steel – Reinforcing steel shall conform to the requirements of Section 03200, Concrete Reinforcement.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Trenching

The trenches for the installation of the electrical conduit shall be compacted to the following minimum standards as determined by the ENGINEER where applicable:

1. One-half (1/2) of the excavated material shall be placed into the trench after the installation of the pipe. This material shall be compacted with the use of a "wheel" with a width between fifty and ninety percent (50-90%) of the trench width. The "wheel" shall either be "smooth faced" or have "pads" with a depth no greater than three inches (3").

2. A second lift with a loose depth of no more than twelve inches (12") shall be placed into the trench and be compacted with the use of the same "wheel".
3. The remaining excavated material shall be placed into the trench and be compacted by wheel rolling

4. The CONTRACTOR shall perform the above operation and shall meet all requirements of Section 02210.

5. For trenches less than 8” wide, top soil preservation can be excluded.

6. Topsoil, seeding and surface restoration in accordance to Section 02280 and Section 02900.
7. For trenches 8” wide and greater, the trenching requirements of Section 02220 shall apply.
8. Controlled backfill can be permitted in place of soil compaction as approved by ENGINEER.

B. Conduit

1. All conduit shall be installed in accordance with the Design Drawings. The installation of a two hundred pound (200#) tensile strength nylon pull string **is required**.

2. PVC conduit shall be joined using a solvent welded slipfitter coupling to make a watertight joint.

3. Where conduit runs are placed parallel to other conduit runs or cross over one another they shall be separated by a minimum of three inches (3”) of sand or soil cushion. All bending of conduit shall be carefully done to avoid damage. Free ends of conduit shall be capped to prevent the entry of moisture, dirt or rocks. Caps shall be solvent welded.

4. Conduit shall terminate in accordance to current Electrical Line Extension Policy.

5. Cleaning of conduit in place shall be subsidiary to other items.

C. Conductors

1. CONTRACTOR shall furnish and install conductor with ground for the street lighting.

2. Developer to purchase primary and secondary cable from City of Gillette Warehouse and to be installed by City of Gillette Electrical Services.

3. Responsibility of service drops as per current City of Gillette Electrical Line Extension Policy.

D. Highway Street Light Foundations

1. CONTRACTOR shall provide materials necessary for installation of breakaway bases and anchor bolts. CONTRACTOR shall be responsible for all materials as shown on the Design Drawings. Top of concrete shall be six inches (6”) above final established grade, as determined by ENGINEER.

2. Ground rods are not required with the highway street light foundations.

E. Pull Boxes

1. Pull boxes shall be installed by the CONTRACTOR at the locations shown on the Design Drawings.

2. Conduit entering the pull boxes shall be bonded and the metal frame of the pull box shall be grounded.

3. Pull boxes shall be placed on four inches (4") of base material consisting of 1-1/2” minus crushed limestone.

4. This item includes excavation, placing of the pull box, electrical bond, backfill, and repair of surface to the original condition.

F. Distribution Pedestals

1. Distribution pedestals shall be installed by the CONTRACTOR at the locations shown on the Design Drawings.

2. This item includes excavation, subgrade preparation, placing of the pedestal, backfill and repair of surface to the original condition.

G. Transformer Pads

1. Transformer pads shall be installed by the CONTRACTOR at the locations shown on the Design Drawings.

2. Transformer pads shall be placed in accordance to current City of Gillette Electrical Line Extension Policy.

3. This item includes excavation, subgrade preparation, placing of the pad, backfill, and repair of surface to the original condition.

H. Switch Bases

1. Switch bases shall be installed by the CONTRACTOR at the locations shown on the Design Drawings.

2. Switch bases shall be installed in accordance to the current City of Gillette Electrical Line Extension Policy.

3. This item includes excavation, placing of the switch base backfill, and repair of surface to the original condition.

I. Junction Boxes

1. Junction boxes shall be installed by the CONTRACTOR at the locations shown on the Design Drawings.

2. Junction boxes shall be installed in accordance to the current City of Gillette Electrical Line Extension Policy

3. This item includes excavation, subgrade preparation, placing of the junction box, backfill and repair of surface to the original condition.

J. Residential Street Lights

1. The CONTRACTOR shall install residential street light poles, luminaires and street light pedestals. CONTRACTOR shall install conductor with ground from luminaire to the hand hole and from the hand hole to the street light pedestal. CONTRACTOR shall provide connection point at hand hole.

2. Poles are to be installed and checked for plumb during installation. The pole's vertical centerline will be used as the reference for plumb.

K. Highway Street Lights

1. The CONTRACTOR shall install highway street light poles, arms and luminaires. CONTRACTOR shall install conductor with ground from luminaire to the hand hole and from the hand hole to conduit sweep in foundation. CONTRACTOR shall provide connection point at hand hole.

2. Poles are to be installed and checked for plumb during installation. The pole's vertical centerline will be used as the reference for plumb.

L. Loop Detectors

1. Detector loops shall be installed as shown on the Design Drawings.

2. All detector loops are to be wired in series or parallel as indicated on the Loop Schedule.

3. All detector loops shall be the size and type (quadrapole or bipole) as indicated and installed in conformance with the drawings and as described herein. One continuous length of No. 14 THHN stranded wire shall be used from the pull box around the loop area, with the specified number of turns, and back to the pull box. The loop wire shall have approximately four (4) turns per foot in the run between the loop and the pull box.

4. Connections of the loop wire to the lead-in wire shall be made in the future and then only in the adjacent pull box using a soldered waterproof splice. A future contract will address this connection and the installation of the lead-in wire.

5. The loop wires in the pull box shall be tagged with a permanent type marker indicating loop number (see Loop Schedule) and loop wire starting tape. Tag all loops, indicating the loop numbers, as shown on the Loop Schedule.

6. Each loop placed shall be tested before placing pavement over it. Perform a resistance test between each circuit and ground. Insulation resistance should exceed one hundred (100) megohms.

7. The results of the test shall be made on the form sheet "Loop Test Recording," and copies given to the ENGINEER and OWNER.

8. A “clean out” shall be constructed over the condulet at the corner of each loop so that access can be provided to the wiring in each condulet. Details of these “clean outs” are shown on the Design Drawings.

9. This item includes the trenching, PVC conduit, data recording, loop wire, condulet “clean out”, and installation.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. STANDARD ITEMS

1. 16000.01X X" DEEP TRENCHING

   This item shall be measured by the lineal foot of _____ inch (__") deep trench completed.

2. 16000.02X INSTALL X" ELECTRICAL PVC CONDUIT

This item shall be measured by the lineal foot of _____ inch (_") electrical PVC conduit installed along the centerline of conduit through all street light foundations, pull boxes, switch bases and transformers.

3. 16000.03X INSTALL X/2 ELECTRICAL CONDUCTOR WITH GROUND

This item shall be measured by the lineal foot of X/2 electrical conductor with ground installed.

4. 16000.04X INSTALL X/3 ELECTRICAL CONDUCTOR WITH GROUND

This item shall be measured by the lineal foot of X/3 electrical conductor with ground installed.

5. 16000.05 INSTALL HIGHWAY STREET LIGHT FOUNDATION

This item shall be measured by the numerical count of highway street light foundations installed.

6. 16000.06 INSTALL TRAFFIC SIGNAL FOUNDATION

This item shall be measured by the numerical count of traffic signal foundations installed.

7. 16000.07 INSTALL PAD FOR TRANSFORMER (SINGLE PHASE)

This item shall be measured by the numerical count of prefabricated transformer pads (single phase) installed.

8. 16000.08 INSTALL PAD FOR TRANSFORMER (THREE PHASE)

This item shall be measured by the numerical count of prefabricated transformer pads (three phase) installed.

9. 16000.09 INSTALL ELECTRICAL PULL BOX

This item shall be measured by the numerical count of electrical pull boxes installed.

10. 16000.10 INSTALL DISTRIBUTION PEDESTAL

This item shall be measured by the numerical count of distribution pedestals installed.

11. 16000.11 INSTALL SWITCH BASES

This item shall be measured by the numerical count of switch bases installed.

12. 16000.12 INSTALL JUNCTION BOX

This item shall be measured by the numerical count of junction boxes installed.

13. 16000.13 INSTALL POLE RISER W/WEATHERHEAD

This item shall be measured by the numerical count of pole risers with weatherheads installed.

14. 16000.14 INSTALL POLE RISER W/O WEATHERHEAD

This item shall be measured by the numerical count of pole risers installed without weatherheads.

15. 16000.15 REMOVE RESIDENTIAL STREET LIGHT

This item shall be measured by the numerical count of residential street lights removed.

16. 16000.16 REMOVE HIGHWAY STREET LIGHT

This item shall be measured by the numerical count of highway street lights removed.

17. 16000.17 INSTALL RESIDENTIAL STREET LIGHT

This item shall be measured by the numerical count of residential street lights installed.

18. 16000.18 INSTALL HIGHWAY STREET LIGHT

This item shall be measured by the numerical count of highway street lights installed.

19. 16000.19X INSTALL TRAFFIC LIGHT POLE (X' MAST ARM)

This item shall be measured by the numerical count of traffic poles (X' mast arm) installed.

20. 16000.20XY INSTALL LOOP DETECTOR (X'xY')

This item shall be measured by the numerical count of ____ foot by _____ foot (_'x_') fabricated traffic loop detectors installed.

21. 16000.21 INSTALL LOOP LEAD-IN CABLE

This item shall be measured by the lineal foot of loop lead-in cable installed.

22. 16000.22X INSTALL NO. X AWG, CONDUCTOR

This item shall be measured by the lineal foot of No. X AWG electrical conductor installed.

23. 16000.23X INSTALL XC NO. 14 AWG, CABLE

This item shall be measured by the lineal foot of XC No. 14 AWG electrical cable installed.

24. 16000.24 INSTALL TRAFFIC CONTROLLER W/BASE & EQUIPMENT

This item shall be measured by the numerical count of traffic controllers installed complete and operable.

25. 16000-25 INSTALL PEDESTRIAN SIGNAL (ICC UNIT)

This item shall be measured by the numerical count of pedestrian signals installed complete.

26. 16000-26 INSTALL PEDESTRIAN PUSHBUTTON W/SIGN

This item shall be measured by the numerical count of pedestrian pushbuttons with signs installed complete.

27. 16000-27 TRAFFIC SIGNAL (3 COLOR/1 WAY/12"-12"-12")

This item shall be measured by the numerical count of traffic signals (3 color/1 way/12"-12"-12") installed complete.

28. 16000-28 TRAFFIC SIGNAL (3 COLOR/1 WAY/12"-12"-12"/w/BP)

This item shall be measured by the numerical count of traffic signals (3 color/1 way/12"-12"-12") with backplates installed complete.

29. 16000-29 TRAFFIC SIGNAL (3 COLOR/1WAY/12"-12"-12"(ARROW)/w/BP)

This item shall be measured by the numerical count of traffic signals (3 color/1 way/12"-12"-12"(Arrow)) with backplates installed complete.

4.02 BASIS OF PAYMENT

A. STANDARD ITEMS

1. 16000.01X X" DEEP TRENCHING

Payment will be made for trench excavation, backfill, and all other items, equipment, tolls and labor necessary to complete this item.

2. 16000.02X INSTALL X" ELECTRICAL PVC CONDUIT

Payment shall include; furnishing and installing conduit, sweeps, and specials; and all other work necessary or incidental for completion of the item.

3. 16000.03X INSTALL X/2 ELECTRICAL CONDUCTOR WITH GROUND

Payment shall include furnishing and installing the conductor, and all other items, equipment, tools and labor necessary for the completion of this item.

4. 16000.04X INSTALL X/3 ELECTRICAL CONDUCTOR WITH GROUND

Payment shall include furnishing and installing the conductor, and all other items, equipment, tools and labor necessary for the completion of this item.

5. 16000.05 INSTALL HIGHWAY STREET LIGHT FOUNDATION

Payment will be for furnishing and installing all materials including concrete and reinforcing steel; installation of anchor bolts; excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

6. 16000.06 INSTALL TRAFFIC SIGNAL FOUNDATION

Payment will be for furnishing and installing all materials including concrete and reinforcing steel; installation of OWNER supplied anchor bolts; excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

7. 16000.07 INSTALL PAD FOR TRANSFORMER (SINGLE PHASE)

Payment will be made for installing the prefabricated pad (single phase), excavation below the pad, and all equipment, tools and labor necessary for the completion of this item.

8. 16000.08 INSTALL PAD FOR TRANSFORMER (THREE PHASE)

Payment will be made for installing the prefabricated pad (three phase), excavation below the pad, backfill and compaction, and all equipment, tools and labor necessary for the completion of this item.

9. 16000.09 INSTALL ELECTRICAL PULL BOX

Payment will be for furnishing and installing all materials including pull box and cover, gravel base, and conduit bushing; excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

10. 16000.10 INSTALL DISTRIBUTION PEDESTAL

Payment will be for furnishing and installing; wiring the service to the secondary power cable; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

11. 16000.11 INSTALL SWITCH BASES

Payment will be for installing all materials, excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

12. 16000.12 INSTALL JUNCTION BOX

Payment will be for installing all materials, excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

13. 16000.13 INSTALL POLE RISER W/WEATHERHEAD

Payment will be made for furnishing and installing all materials, including conduit, and all equipment, tools and labor necessary for the completion of this item.

14. 16000.14 INSTALL POLE RISER W/O WEATHERHEAD

Payment will be made for furnishing and installing all materials, including conduit, and all equipment, tools and labor necessary for the completion of this item.

15. 16000.15 REMOVE RESIDENTIAL STREET LIGHT

Payment will be for removing the residential street light; backfill; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

16. 16000.16 REMOVE HIGHWAY STREET LIGHT

Payment will be for removing the highway street light and foundation; backfill; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

17. 16000.17 INSTALL RESIDENTIAL STREET LIGHT

Payment will be for installing all materials, including the residential street light pole, luminaire and street light pedestal; wiring the luminaire to the secondary power cable within the street light pedestal; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

18. 16000.18 INSTALL HIGHWAY STREET LIGHT

Payment will be for installing all materials, including highway street light pole, luminaire; wiring the luminaire to the secondary power cable; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

19. 16000.19X INSTALL TRAFFIC LIGHT POLE (X' MAST ARM)

Payment will be furnishing and installing all materials except for the luminaire, which is supplied by the OWNER; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

20. 16000.20XY INSTALL LOOP DETECTOR (X'xY')

Payment will be for furnishing and installing all materials including the conduit, loop wire and sealant; excavation, backfill and special compaction; testing and data recording; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

21. 16000.21 INSTALL LOOP LEAD-IN CABLE

Payment shall include furnishing and installing the cable and connecting devices; and all other items, equipment, tools and labor necessary for the completion of this item.

22. 16000.22X INSTALL NO. X AWG, CONDUCTOR

Payment shall include furnishing and installing the conductor, fuses and fuse housings; and all other items, equipment, tools and labor necessary for the completion of this item.

23. 16000.23X INSTALL XC NO. 14 AWG, CABLE

Payment shall include furnishing and installing the cable and connecting devices; and all other items, equipment, tools and labor necessary for the completion of this item.

24. 16000.24 INSTALL TRAFFIC CONTROLLER W/BASE & EQUIPMENT

Payment will be for furnishing and installing all materials including the concrete base, cabinet, controller, meter socket w/disconnect and related equipment; excavation, backfill and special compaction; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

25. 16000.25 INSTALL PEDESTRIAN SIGNAL (ICC UNIT)

Payment will be for furnishing and installing all materials including the signal, visor and mounting hardware; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

26. 16000.26 INSTALL PEDESTRIAN PUSHBUTTON W/SIGN

Payment will be for furnishing and installing all materials including the pushbutton with sign and mounting hardware; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

27. 16000.27 TRAFFIC SIGNAL (3 COLOR/1 WAY/12"-12"-12")

Payment will be for furnishing and installing all materials including the signal, lights, tunnel visors and mounting hardware; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

28. 16000.28 TRAFFIC SIGNAL (3 COLOR/1 WAY/12"-12"-12"/w/BP)

Payment will be for furnishing and installing all materials including the signal, lights, tunnel visors, backplate and mounting hardware; and all tools

and labor for the performance of the work and incidentals necessary to complete the item.

29. 16000.29 TRAFFIC SIGNAL (3 COLOR/1 WAY/12"-12"-12"(ARROW)/w/BP)

Payment will be for furnishing and installing all materials including the signal, lights, tunnel visors, backplate and mounting hardware; and all tools and labor for the performance of the work and incidentals necessary to complete the item.

SECTION 16010

FIBER SYSTEM CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. The rules and guidelines offered in Section 16010 are applicable to any entity constructing a fiber system within the corporate city limits of Gillette, Wyoming. These guidelines are necessary to ensure the proper use of City right-of way (R.O.W.) and to ensure compatibility with existing and future City-owned fiber networks. The sections of this category have been split between private and public construction. Private construction relates to any construction being performed by (or for) entities other than the City. Public construction relates to any construction being performed by (or for) the City. The requirements in Section 16010 provide the minimum fiber construction requirements by the City and are not intended to supersede any other City of Gillette, state, or federal laws/requirements that may be more stringent than what is listed in Section 16010.

1.02 QUALITY ASSURANCE

A. The City reserves the right to inspect construction to ensure compliance with Section 16010. This inspection may occur during construction or after construction is complete (but prior to construction permit closure).

1.03 REFERENCES

A. The following are references or standards that are referenced in Section 16010.

1. Institute of Electrical and Electronics Engineers (IEEE) National Electrical Safety Code (most recent published edition)
2. National Fire Protection Association (NFPA) 70 National Electrical Code (most recent published edition)
3. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) 607-C
4. American National Standards Institute/Insulated Cables Engineers Association (ANSI/ICEA) S-87-64
5. Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA) 455 (International Electrotechnical Commission (IEC) 60794)
6. Telcordia GR-20-CORE Issue 2

PART 2 PRODUCTS

2.01 EXISTING MUNICIPAL NETWORK

A. The City operates a fiber optic system for its own use. The City utilizes multi-path MicroDuct product and intends to continue to use this system in the future. Information regarding this product

is provided so that future public construction can seamlessly integrate with the existing system where necessary.

2.02 MATERIALS

A. MICRODUCT

The City utilizes the Duraline Future Path MicroDuct product. Per the manufacturer, this product is installed using the same tools and equipment that is utilized for traditional conduit or innerduct. The City allows for the use of the 7-way and 2-way configurations.

B. FIBER OPTIC CABLE

The City utilizes the OFS MiDia® FX PLUS fiber cable product and allows for the use of the 96-count and 12-count configurations.

2.03 PROPOSED NEW CONSTRUCTION (PUBLIC)

A. APPROVED MATERIALS

The following sections detail the approved product for new public construction projects. The City of Gillette typically warehouses these products and offers to sell them to the construction contractor at the City's cost for public projects.

1. MICRODUCT

All duct shall be Duraline Future Path MicroDuct or City-approved equivalent. Unless specified otherwise by the City, 7-way configurations shall be used for all backbone and distribution fiber routes, and all drops shall use 2-way configurations. All MicroDuct shall be installed with metallic components and shall be locatable using standard radio frequency (RF) locator equipment.

2. FIBER OPTIC CABLE

All fiber optic cable shall be OFS MiDia® FX Loose Tube cable or City-approved equivalent. The cable shall be tested per applicable requirements of ANSI/ICEA S-87-64, TIA/EIA 455 (IEC 60794), and Telcordia GR-20-CORE Issue 2. The fiber shall be rated for 1310/1550 nm transmission. The cable transmission performance loss shall not exceed the values specified in the following table.

Wavelength	Maximum Loss
1310 nm	0.35 dB/km
1385 nm	0.31 dB/km
1490 nm	0.27 dB/km
1550 nm	0.25 dB/km

1625 nm	0.27 dB/km

The cable shall be zero water peak fiber. The cable sheath construction shall be OFS MiDia® FX Plus construction or better. Tensile load rating of the cable shall be 300 lb. or better. Crush resistance shall be 300 220 N/cm or better. The core type of the fiber shall be 1.7 mm with gel-filled buffer tubes with 12 fibers per buffer tube.

3. VAULTS

The City will specify which vault manufacturer and models are acceptable for the particular project. All vaults shall have a minimum rating of Tier 15. The Tier rating of the vault shall be adjusted depending upon the specifics of the actual vault placement and use. Manufacturer guidelines shall be followed when selecting vaults for a particular application. The Tier rating shall be stamped on the lid of the vault.

4. SPLICE CASES

The City will specify which splice case manufacturer and models are acceptable for the particular project.

5. REMOTE TERMINATION CABINETS

The City will provide information on which remote termination cabinet manufacturer and models are acceptable for the particular project by either providing make/model or by reviewing and approving the contractor's proposed solution.

6. LOCATE STATION (VAULTS)

Locate stations for all vault locations shall be required. The City Warehouse will provide the required equipment for the locate station.

Part 3 EXECUTION

3.01 INSTALLATION (PUBLIC)

A. CONSTRUCTION HOURS

The City allows construction hours as referenced in the City's Standard Construction Specifications, General Conditions, Article 6, section 6.02 and Supplementary Conditions, SC-1.01. For work along Wyoming state roads, the contractor shall follow the Wyoming Department of Transportation (WYDOT) construction hours and rules. In cases where WYDOT and City of Gillette construction hours conflict, the contractor shall adhere to the most stringent operating hours.

B. EXISTING UTILITY HIT MITIGATION

From a safety and service disruption perspective, certain steps are required prior to construction that involves disturbing the earth. The contractor shall follow Wyoming state law as indicated in Title 37

Chapter 12, Article 3. Before any construction begins, a line locate request shall be made with One Call of Wyoming (Call 811 locally or 800-849-2476 if out of state). The contractor shall contact One Call at least two (2) full business days prior to excavation. The contractor shall verify that all utility locates have been completed prior to disturbing the earth. The City requires that no mechanical excavation be performed within two (2) feet of existing City-owned vaults, pedestals, or other above ground structures where underground utilities converge. Within this two (2) foot boundary, vac equipment shall be used to expose utilities.

C. MICRODUCT

All MicroDuct manufacturer's requirements shall be followed during the installation. The contractor shall ensure that the rated allowable bend radius is not exceeded and that the pulling force on the conduit does not exceed the rated Safe Working Pull Strength.

D. CABLE

All fiber manufacturer's requirements shall be followed during the installation. The contractor shall ensure that the rated allowable bend radius, crush resistance, and tensile rating is not exceeded during the installation. The contractor shall ensure that both short-term and long-term maximum microcable loads are not exceeded. Installation should only be performed when the outside temperature is within the manufacturer's recommended installation temperatures for the specific product. Microcables are less robust than traditional cables and should only be installed into duct using the air-blown method. As per manufacturer recommendations, microcables are not designed for aggressive handling scenarios including shared and undersized hand-holes/vaults.

E. CONDUIT/CABLE DEPTH

Any main line conduit placement in the right of way shall be a minimum of 48 inches deep as measured to the top of the conduit.

F. SPLICE CASES

Only City-approved splice cases shall be used for the construction. All splice cases shall be flash tested upon splicing completion to ensure a water-tight seal.

G. SEPARATION OF UTILITIES

The City has established minimum utility separation requirements to be maintained from existing utilities during new underground communication facility construction within the City limits. Where other state or federal rules apply, the contractor shall follow the most stringent requirements. The Contractor shall maintain the following minimum separations from existing utilities:

- Gas Lines - Minimum of 12" radial separation (as specified in NESC 320B)
- Electric Lines - Minimum of 12" radial separation (as specified in NESC 320B)
- Communication Lines - Minimum of 12" radial separation
- City Sewer Lines - Minimum of 12" radial separation
- City Water Lines - Minimum of 12" radial separation

H. DROP CONSTRUCTION

All drops within the public right of way (R.O.W.) or on private property shall be a minimum of 48 inches deep, as measured to the top of conduit. To conserve R.O.W., all drop conduit placed in the same routes as the mainline cable shall utilize the same bore hole as the mainline conduit.

I. APPROVED CONSTRUCTION METHODS

In general, the City will not dictate construction methods. The City does require that any construction under roads be performed via a directional boring method to avoid damage to the road where feasible. Any construction methods that meet fiber and duct manufacturer requirements will be acceptable unless specified differently for special cases called out in the construction permit.

3.02 INSTALLATION (PRIVATE)

A. CONSTRUCTION HOURS

The City allows construction hours as referenced in the City's Standard Construction Specifications, General Conditions, Article 6, section 6.02, and Supplemental Conditions, SC-1.01. For work along Wyoming state roads, the contractor shall follow WYDOT construction hours and rules. In cases where WYDOT and City of Gillette construction hours conflict, the contractor shall adhere to the most stringent operating hours.

B. EXISTING UTILITY HIT MITIGATION

From a safety and service disruption perspective, certain steps are required prior to construction that involves disturbing the earth. The contractor shall follow Wyoming state law as indicated in Title 37 Chapter 12, Article 3. Before any construction begins, a line locate request shall be made with One Call of Wyoming (Call 811 locally or 800-849-2476 if out of state). The contractor shall contact One Call at least two (2) full business days prior to excavation. The contractor shall verify that all utility locates have been completed prior to disturbing the earth. The City requires that no mechanical excavation be performed within two (2) feet of existing City owned vaults, pedestals, or other above ground structures where underground utilities converge. Within this two (2) feet boundary, vac equipment shall be used to expose utilities.

C. CONDUIT / CABLE DEPTH

Any mainline conduit placement in the right of way shall be a minimum of 48 inches deep as measured to the top of the conduit.

D. SEPARATION OF UTILITIES

The City has established minimum utility separation requirements to be maintained from existing utilities during new underground communication facility construction within the City limits. Where other state or federal rules apply, the contractor shall follow the most stringent requirements. The Contractor shall maintain the following minimum separations from existing utilities:

- Gas Lines - Minimum of 12" radial separation (as specified in NESC 320B)

● Electric Lines - Minimum of 12” radial separation (as specified in NESC 320B)
● Communication Lines - Minimum of 12” radial separation
● City Sewer Lines - Minimum of 12” radial separation for utility crossing and 36” horizontal separation for installs parallel to lines
● City Water Lines - Minimum of 12” radial separation for utility crossing and 36” horizontal separation for installs parallel to lines

E. DROP CONSTRUCTION

All drops within the public right of way or on private property shall be a minimum of 48-inches deep as measured to the top of conduit. Drops within private property shall be a minimum of 24-inches to the top of conduit or cable.

F. APPROVED CONSTRUCTION METHODS

In general, the City will not dictate construction methods. The City does require that any construction under roads be performed via a directional boring method to avoid damage to the road where feasible, or performed as otherwise approved by the City Engineer. Any construction methods that meet fiber and duct manufacturer requirements will be acceptable unless specified differently for special cases called out in the construction permit.

3.03 CONTRACTOR IDENTIFICATION

All contractors working on either private or public projects shall have vehicle and equipment signage that clearly states the name of their company. This signage shall be clearly visible from either the right or left side of the equipment.

3.04 CONSTRUCTION AREA NOTIFICATION

The contractor shall notify the City a minimum of 24 hours prior to commencement of construction in each construction area. For any street closures, the contractor shall meet the procedures and notification requirements of Section 01041 Part 1.06.

3.05 EXCAVATION / ROAD REPAIR

Damage to roads or rights-of-way due to construction or equipment use shall be repaired to acceptable conditions as detailed in the City-issued right-of-way permit, or as otherwise required by the City Engineer to restore the roadway to its pre-construction condition.

3.06 VERIFICATION OF LOCATABILITY OF NEW FACILITIES (PUBLIC CONSTRUCTION ONLY)

The contractor shall ensure that all new construction can be located after installation. This should be done by physically testing each segment’s tracer wire to ensure locatability. Each segment that is tested shall be recorded and provided to the City in a summary. The City reserves the right to audit these contractor test results prior to final acceptance. Should a segment fail, the contractor shall rework the area to correct the problem.

3.07 SAFETY (PUBLIC AND PRIVATE CONSTRUCTION)

The contractor shall meet the job site safety and conduct requirements as specified in the General Conditions and in Section 01041 Part 1.05. For work along Wyoming state roads, the contractor shall follow WYDOT safety requirements. In cases where WYDOT and City of Gillette safety rules conflict, the contractor shall adhere to the most stringent regulations.

The contractor shall also provide all measures necessary to delineate and provide separation between work areas and publically accessible areas.

3.08 TRAFFIC CONTROL (PUBLIC AND PRIVATE CONSTRUCTION)

The contractor shall meet the traffic control requirements as specified in Section 01510 Parts 1-3. For work along Wyoming state roads, the contractor shall follow WYDOT traffic control requirements. In cases where WYDOT and City of Gillette traffic control rules conflict, the contractor shall adhere to the most stringent regulations.

3.09 RESTORATION (PUBLIC AND PRIVATE CONSTRUCTION)

The contractor shall perform ongoing, daily site cleanup to ensure that no trash, debris, or other construction waste materials remain in/near the work areas at the completion of each work day. To preserve lawns, tarps shall be put down prior to placing spoils on grass areas. The contractor shall replace topsoil and replant any disturbed grass with seed that matches the species of existing lawn area. To prevent erosion of topsoil, straw or equivalent shall be crimped into the soil after seeding. The contractor shall clean mud, dirt, and other debris from sidewalks, curbs, gutters, and streets. The contractor shall warranty all restoration for a period of one year from the date of city acceptance of the project.

3.10 INSPECTION (PUBLIC AND PRIVATE CONSTRUCTION)

The contractor is responsible for quality control including appropriate inspections and work controls. However, the City will perform periodic in process and final inspections to ensure compliance with City requirements.

3.11 PROJECT RECORDS (PUBLIC AND PRIVATE CONSTRUCTION)

A. PROJECT AS-BUILTS

Prior to project completion, the contractor shall submit project as-built drawings that clearly show what assets were placed in the areas of construction. The City may require that GPS coordinates of all cable routes and vaults be taken and provided digitally to the city in KMZ format. These records shall be submitted digitally in a format that the City agrees to prior to issuing construction permits.

B. ASSET LABELING

All placed infrastructure that is visible above ground shall be clearly labeled to identify the owner of the asset. This would include pedestals, vaults, cabinets, or huts. For private construction, the specifics of the labeling shall be left to builder as long as ownership of the asset can be distinguished

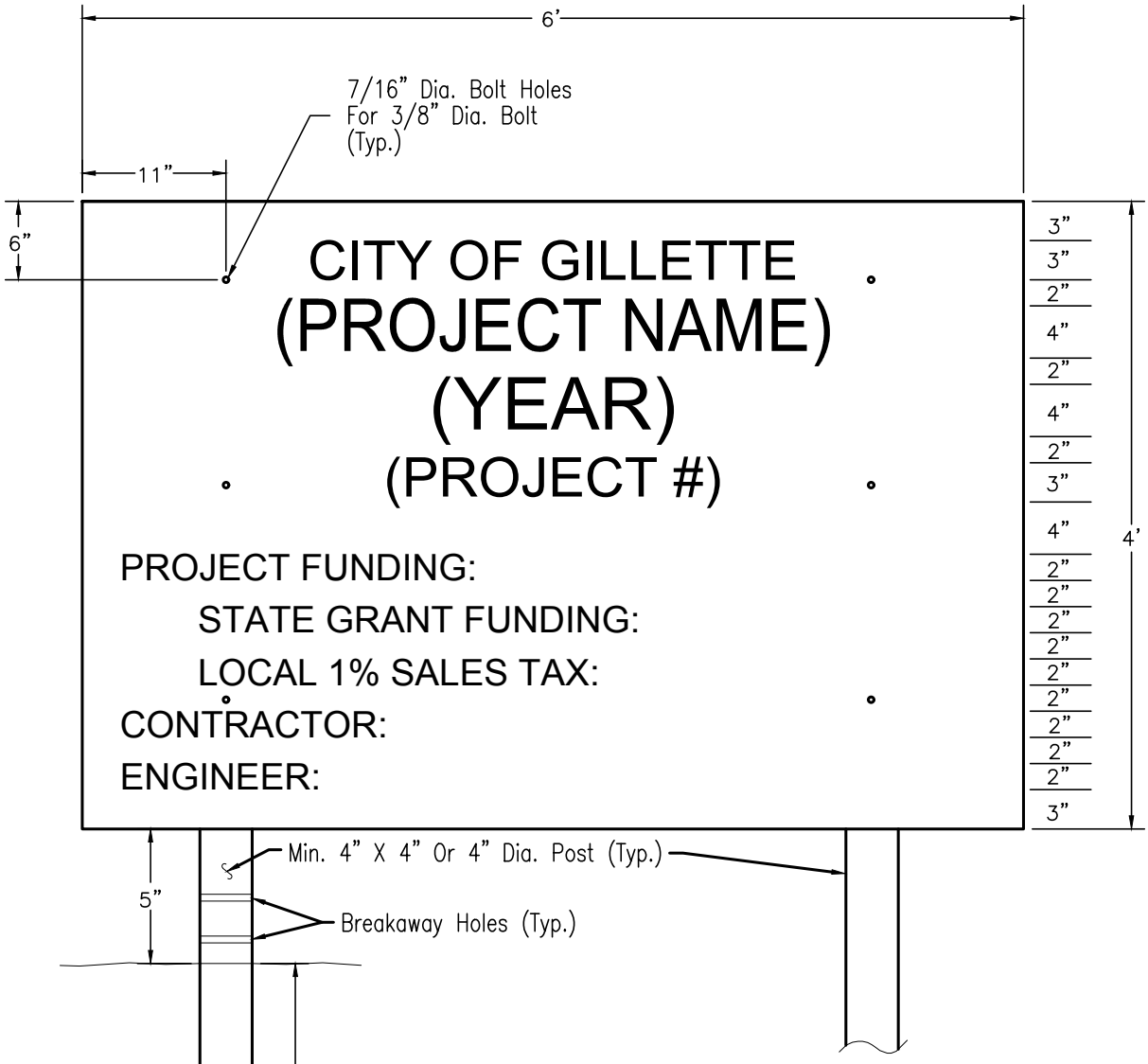
without the need to open the structure. For public construction, the labeling shall include 1) an identifier marking it as a city asset and 2) the structure ID that corresponds to labeling on the as-built maps.

STANDARD DRAWING INDEX

DRAWING NAME	NO.		DRAWING NAME	NO.
Project ID Sign	01015-01		Stationary Lane Closure - Multi-Lane Highway	01510-13
Stabilized Construction Entrance	01500-01		Road Closure - Temporary	01510-14
Storm Drain Inlet Protection	01500-02		Channelizing Devices	01510-15
Stormwater Inlet & Outlet Protection	01500-03		Sidewalk Closure	01510-16
Check Dam	01500-04		Full Block Closure	01510-17
Sediment Control Wattle	01500-05		Water/Sewer Trench & Bedding	02220-01
Silt Fence	01500-06		Cement Treated Fill Pipe Saddle	02225-01
Silt Fence - Winter/Frozen Ground	01500-07		Typical Cut Permit Street Repair	02511-01
Silt Fence - Gravel Filter	01500-08		Typical Arterial Street Cross Section	02512-01
Filter Berm	01500-09		Typical Collector and Local Street Section	02512-02
Sediment Basin - Temporary	01500-10		Typical Alley Section	02512-03
Sediment Trap & Dam	01500-11		Typical Type 'A' and 'C' Curb and Gutter - Attached Sidewalk	02528-01
Sediment Trap - Straw Bale Dike	01500-12		Street Corner With & Without Valley Gutter	02530-01
Sediment Trap - Concentrated Flow	01500-13		Residential Access Control & Offsets	02530-02
Sediment Trap - Excavated	01500-14		Commercial & Industrial Access Control	02530-03
Sediment Trap - Earth Berm	01500-15		Standard Residential Driveways	02530-04
Sediment Trap - Ditch	01500-16		Curb Ramp for Arterial & Collector Detached Sidewalk	02530-05
Sediment Trap - Silt Fence	01500-17		Curb Ramp for Arterial & Collector -Attached Sidewalk	02530-06A
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3" Air Vacuum Air Release Valve	02665-08		POC Assembly (3” and Larger) w/Parallel Backflow (2” & Smaller)	02920-03
4" Air Vacuum Air Release Valve	02665-09		Typical Layout – Water Tap, Meter, and POC Assembly (2” and Smaller)	02920-04
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Typical Meter Installation for 1" & Smaller Meters	02665-13		Trenching	02920-08
Thermal-Coil Meter Box	02665-14		Sleeving	02920-09
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Typical Meter Installation for 1.5" - 2" Meters	02665-16		Control Wire Junction Box	02920-11
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Manhole Channel Details	02700-05		Two Station Decoder Schematic	02920-22
Sanitary Sewer Service Line	02700-06		Decoder Grounding Schematic	02920-23
Sanitary Sewer Manhole Ring & Cover	02700-07		Pedestal Mounted Controller Assembly	02920-24
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Typical Street Sign Installation	02805-01		Longitudinal Joint Details	03251-02
Barricade Installation Type III	02805-02			



GENERAL NOTES:

1. 4" Radius On Each Corner Is Optional
2. Sign Face, Back and Edges Shall Receive One Coat Primer And Two Coats Of White Paint.
2. Letters Shall Be Black Enamel.
3. Posts Shall Receive One Coat Of Cedar Stain.
4. *Dollar Amounts To Be Determined After Contract Award.

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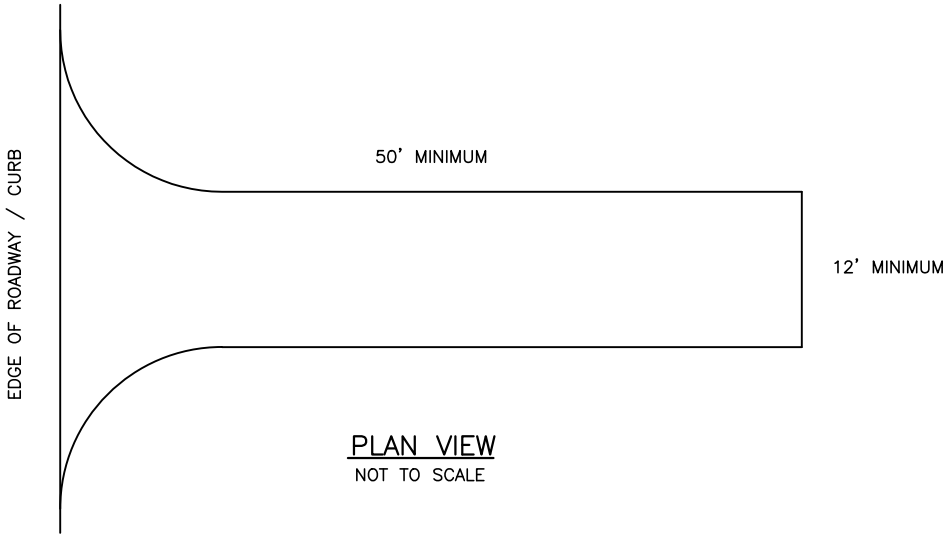
PROJECT ID SIGN

DATE: MARCH 2012

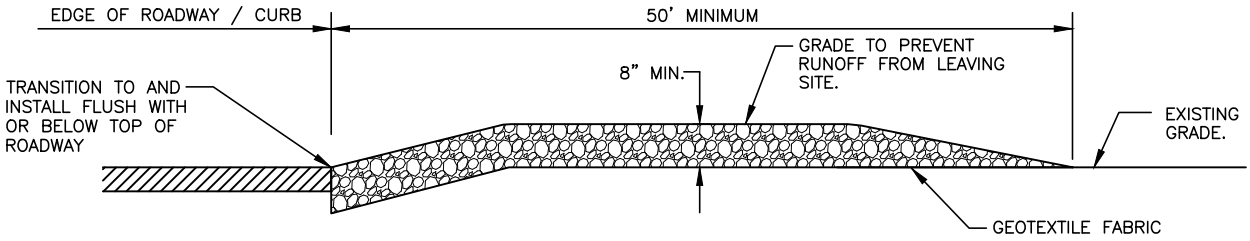
DRAWING NO. 01015-01

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PLAN VIEW
NOT TO SCALE



STABILIZED CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE

NOTES:

1. TO BE INSTALLED PRIOR TO CONSTRUCTION ACTIVITIES.
2. STONE SIZE SHALL BE 2" – 4" OPEN GRADED ROCK.
3. THICKNESS OF CRUSHED STONE PAD TO BE NOT LESS THAN 8".
4. LENGTH SHALL BE A MINIMUM OF 50' FROM ACTUAL ROADWAY, AND WIDTH NOT LESS THAN FULL WIDTH OF INGRESS/EGRESS. (12' MINIMUM)
5. ENTRANCE SHALL BE PROPERLY GRADED TO PREVENT RUNOFF FROM LEAVING THE CONSTRUCTION SITE.
   THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS OF WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS OF WAY MUST BE REMOVED IMMEDIATELY BY CONTRACTOR.
   AS NECESSARY, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH OR WATERCOURSE USING APPROVED METHODS.
6. ALL ROCK AND FABRIC TO BE REMOVED UPON COMPLETION OF CONSTRUCTION, AND THE AREA BACKFILLED AND RECLAIMED, OR RE–SEEDED, APPROPRIATE TO THE SITE.

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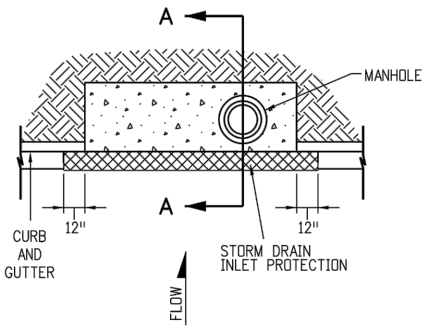
STABILIZED CONSTRUCTION ENTRANCE

DATE: MARCH 2012

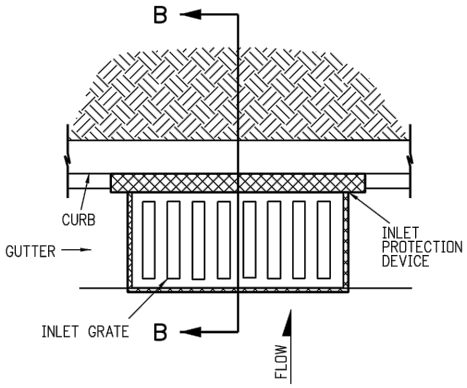
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DRAWN BY: KEB

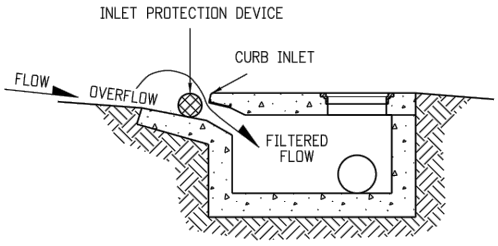
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PLAN VIEW



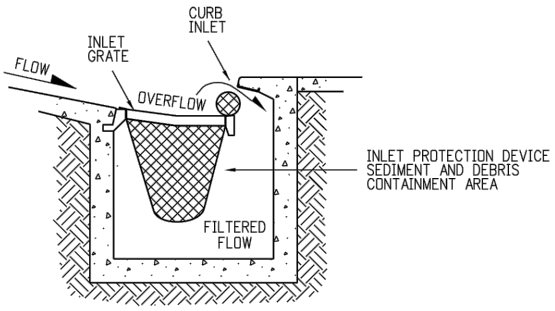
PLAN VIEW



SECTION A-A

STORM DRAIN INLET PROTECTION (CURB OPENING)

INLET PROTECTION SHALL EXTEND 12 IN. PAST EACH END OF THE INLET.



SECTION B-B

STORM DRAIN INLET PROTECTION (COMBINATION)

INLET PROTECTION SHALL EXTEND 12 IN. PAST EACH END OF THE INLET.

NOTES:

1. INLET PROTECTION BMP SHALL BE INSTALLED BEFORE CONSTRUCTION BEGINS.
2. INLET PROTECTION SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
3. INLET PROTECTION SHALL BE REMOVED ONCE CONSTRUCTION IS COMPLETED.

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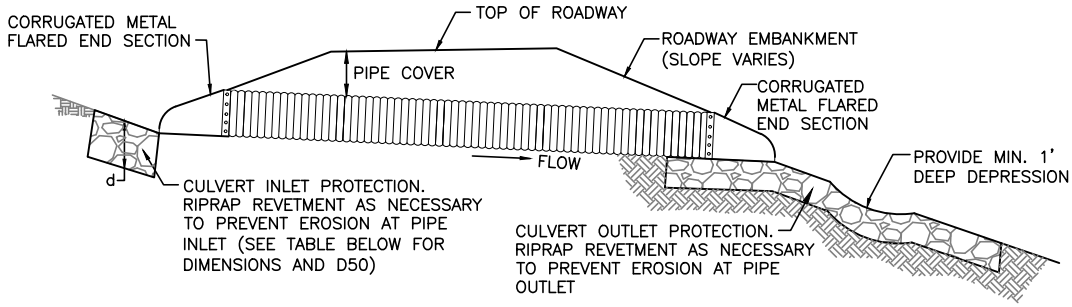
STORM DRAIN INLET PROTECTION

DATE: MARCH 2012

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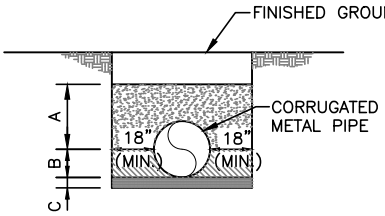
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METAL PIPE INSTALLATION PROFILE

NOT TO SCALE



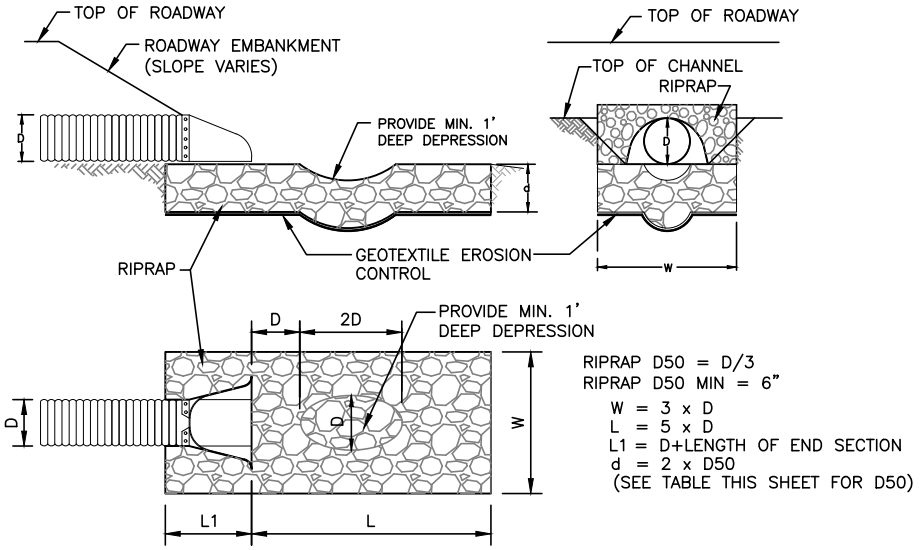
A = ON SITE STRUCTURAL BACKFILL, PLACED TO AT LEAST 12 INCHES ABOVE TOP OF PIPE.

B = COMPACTED STRUCTURAL BACK FILL PLACED TO AT LEAST THE CULVERT SPRING LINE

C = 3 INCHES (IN SOIL) OR 12 INCHES (IN ROCK) BELOW THE BOTTOM OF THE PIPE OF LOOSE STRUCTURAL BACK FILL.

PIPE TRENCHING DETAIL

NOT TO SCALE



RIPRAP D50 = D/3
RIPRAP D50 MIN = 6"
W = 3 x D
L = 5 x D
L1 = D+LENGTH OF END SECTION
d = 2 x D50
(SEE TABLE THIS SHEET FOR D50)

CULVERT OUTLET PROTECTION DETAIL

NOT TO SCALE

RIP–RAP APRON SIZING DIMENSIONS – INLET AND OUTLET							
PIPE DIA. (D)	RIP–RAP D50 (D/3)	END SECTION LENGTH	L1	LENGTH (L)	WIDTH (W)	d (2 x D50)	DEPRESSION DIM.
24"	8"	78"	102"	120"	72"	16"	24"x48"x12"
30"	10"	96"	126"	150"	90"	20"	30"x60"x12"
36"	12"	96"	132"	180"	108"	24"	36"x72"x12"

CONSTRUCTION SPECIFICATIONS:

1. CORRUGATED METAL PIPE SIZING VARIES, SEE PLANS FOR LENGTH AND DIAMETER.
2. PIPE SLOPE: MINIMUM SLOPE => 0.5%, MAXIMUM SLOPE => 10%.
3. MINIMUM PIPE COVER IS TWO FEET. MAXIMUM PIPE COVER IS FIFTEEN FEET OR MANUFACTURER'S RECOMMENDED VALUES.
4. STRUCTURE BACKFILL SHALL BE COMPOSED OF SUITABLE MATERIALS DEVELOPED ON THE PROJECT. TO BE SUITABLE FOR USE UNDER THIS CLASSIFICATION, BACKFILL SHALL BE FREE OF FROZEN LUMPS, WOOD, OR OTHER ORGANIC MATERIAL. IF THE MATERIAL CONTAINS ROCK FRAGMENTS THAT, IN THE OPINION OF THE ENGINEER, WILL BE INJURIOUS TO THE STRUCTURE, THE NATIVE MATERIAL SHALL NOT BE USED FOR BACKFILLING AND IMPORTED STRUCTURE BACKFILL SHALL BE USED.
5. CONNECT END SECTION TO PIPE AS RECOMMENDED BY THE MANUFACTURER.

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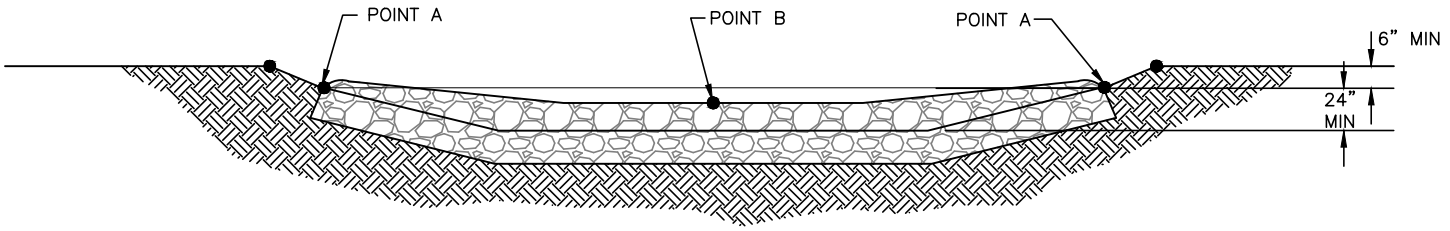
STORMWATER INLET & OUTLET PROTECTION

DATE: MARCH 2012

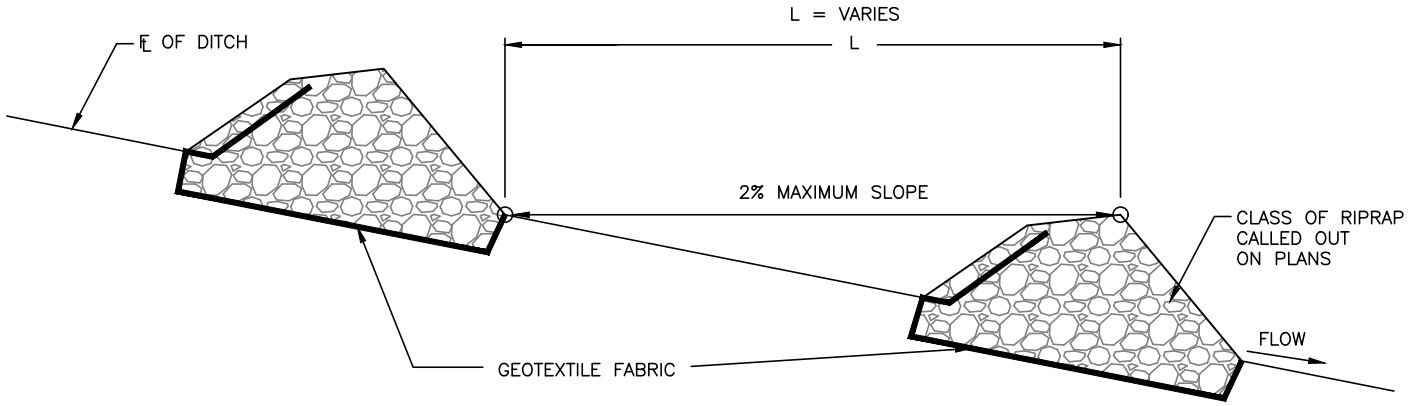
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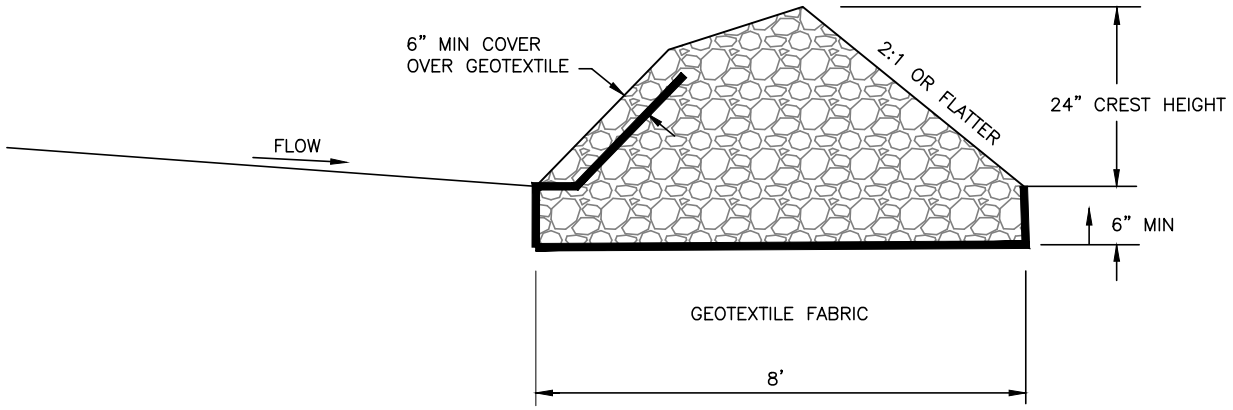
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TYPICAL SECTION VIEW



SECTION VIEW ALONG DITCH FLOWLINE



SECTION DETAIL

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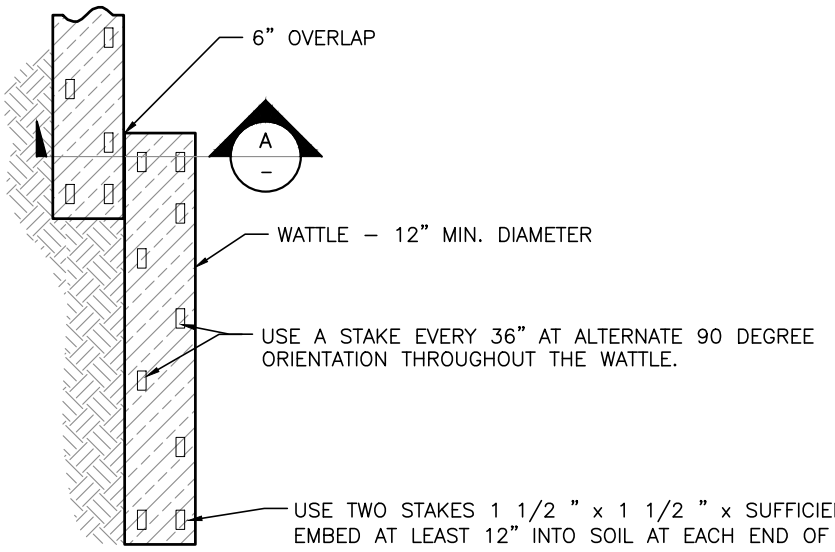
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DATE: MARCH 2012

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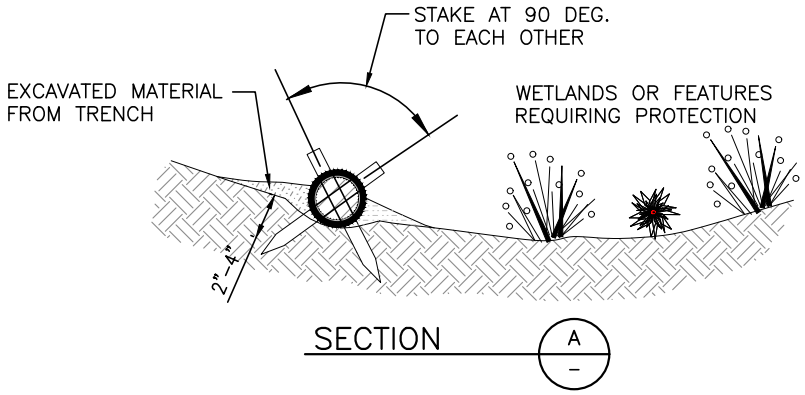
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DITCH INSTALLATION	
GRADE	SPACING (FT)
2%	150
3%	100
4%	75
5%	50

CUT OR FILL SLOPE INSTALLATION	
SLOPE	SPACING (FT)
1:1	10
2:1	20
3:1	30
4:1	40



WATTLE INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF WATTLE.
2. WATTLES INDICATED ON INITIAL SWMP PLAN SHALL BE INSTALLED PRIOR TO ANY LAND–DISTURBING ACTIVITIES.
3. WATTLES SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR, OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED HIGH FLOW AREAS.
5. THE WATTLE SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".
6. EXTEND END OF WATTLE UPSLOPE TO AVOID FLOW AROUND END.

WATTLE MAINTENANCE NOTES

1. SEDIMENT ACCUMULATED UPSTREAM WATTLE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST OF WATTLE.

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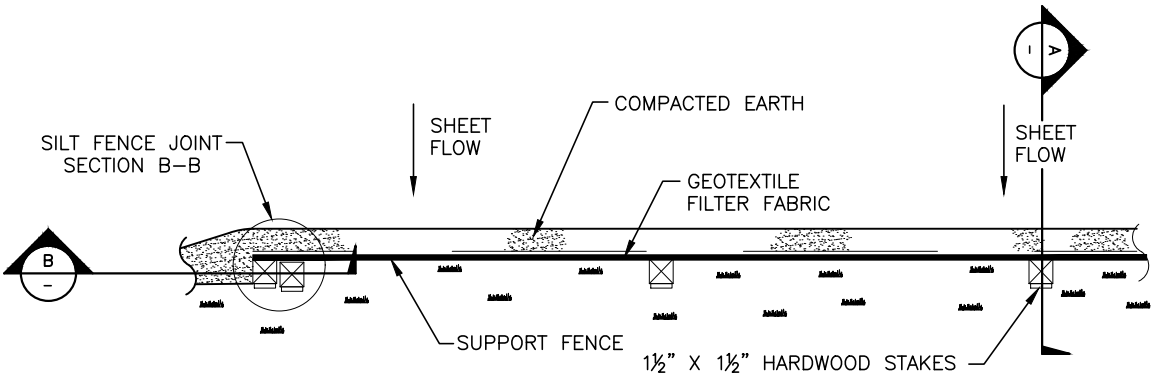
SEDIMENT CONTROL WATTLE

DATE: MARCH 2012

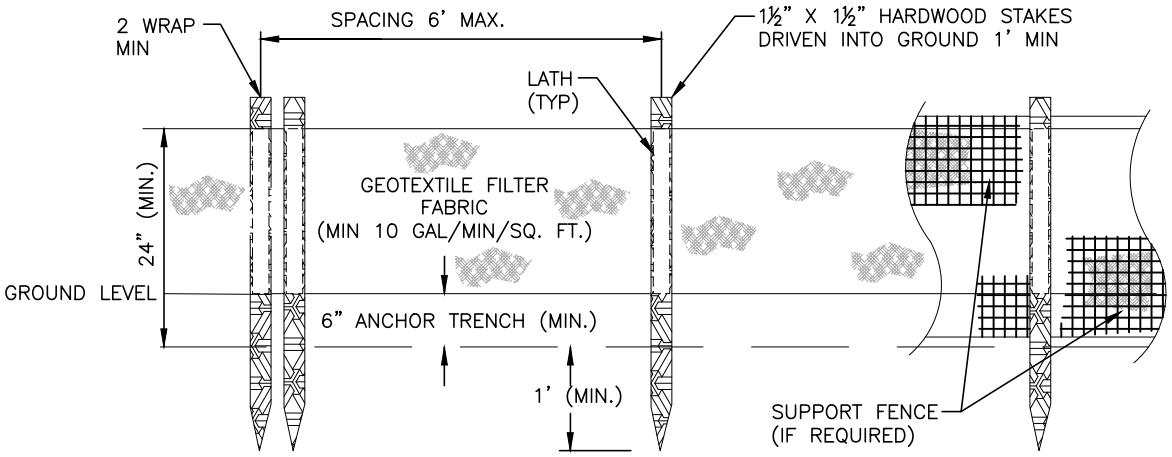
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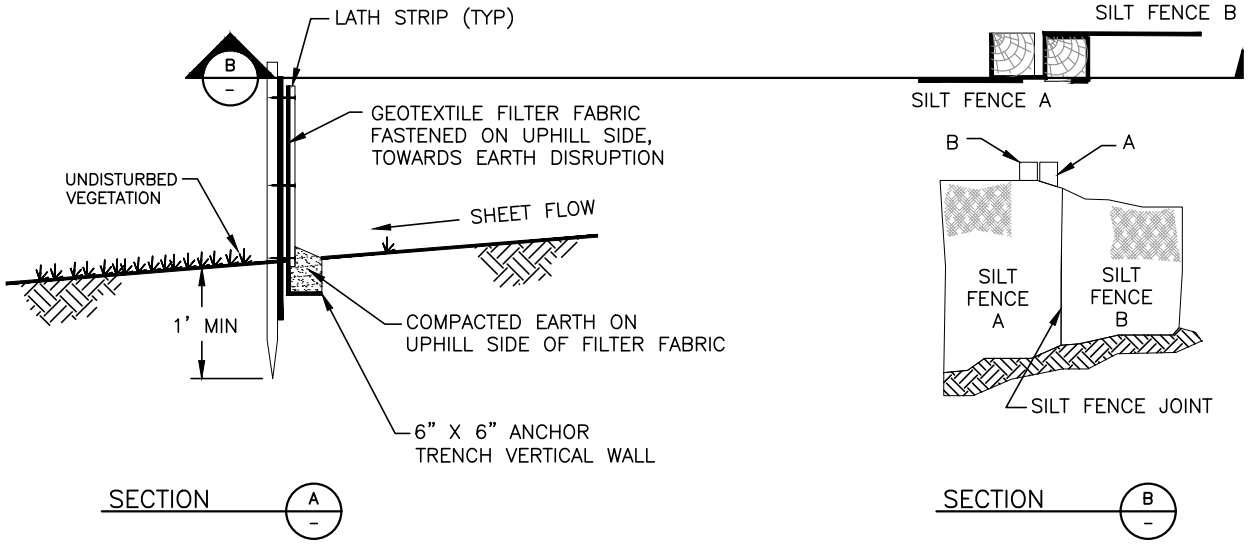
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PLAN VIEW



FRONT VIEW



SECTION A

SECTION B

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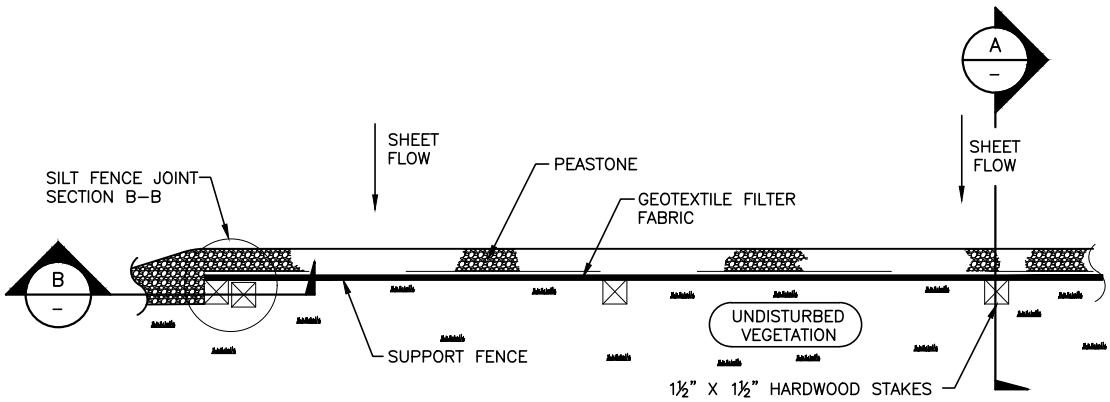
SILT FENCE

DATE: MARCH 2012

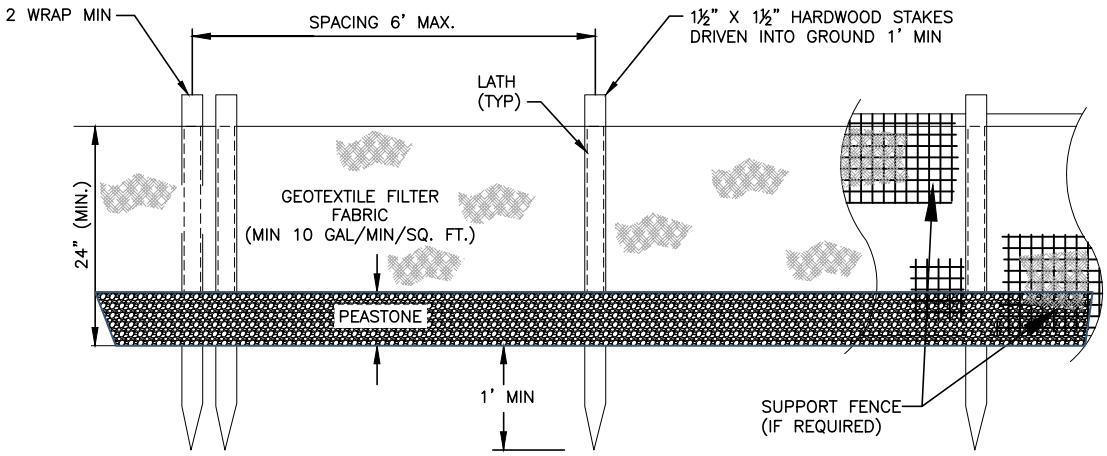
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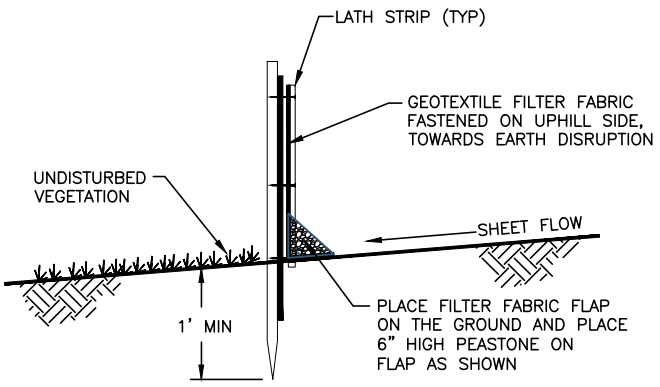
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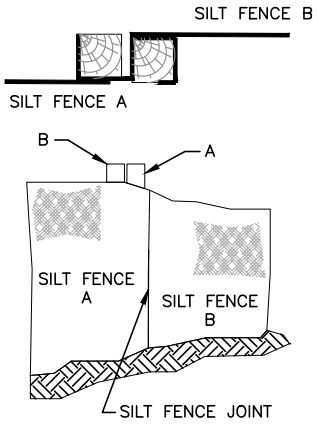
PLAN VIEW



FRONT VIEW



SECTION A



SECTION B

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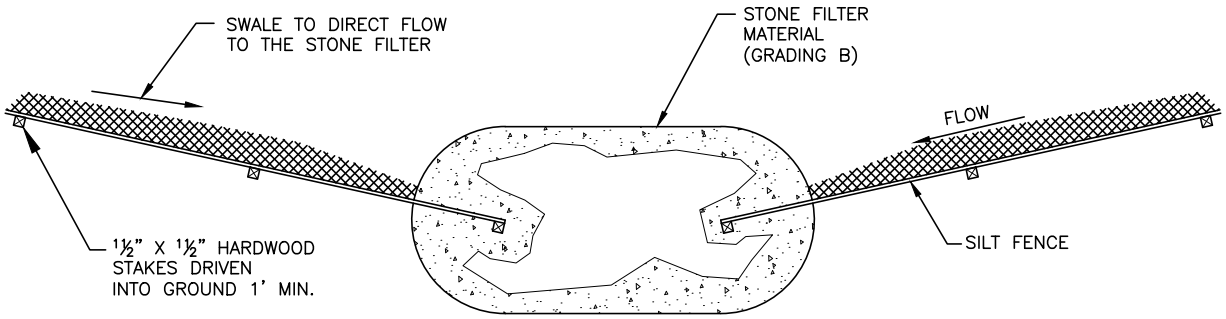
WINTER/FROZEN GROUND SILT FENCE

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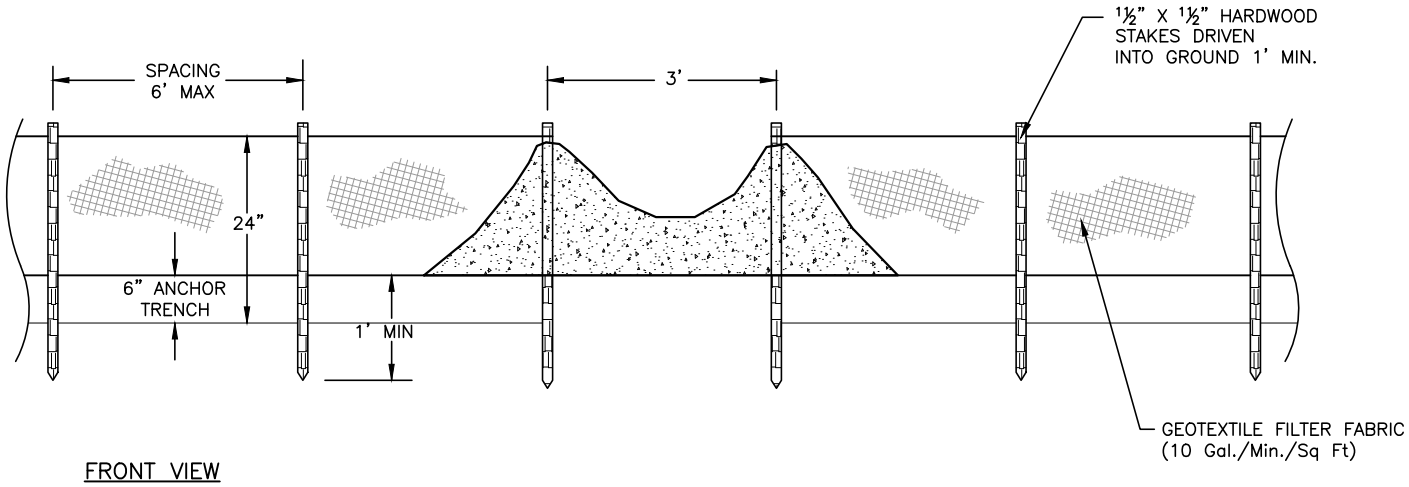
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DATE: MARCH 2012

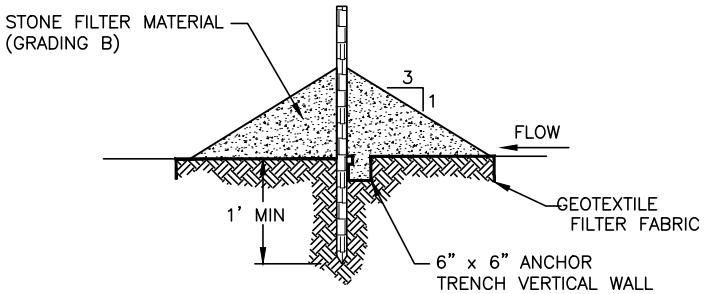
DRAWING NO. 01500-07



PLAN VIEW



FRONT VIEW



CROSS SECTION

PLACE GEOTEXTILE FABRIC UNDER STONE WITH 6 INCH MIN. OVERLAP AND TRENCHED IN 6 INCH MIN.

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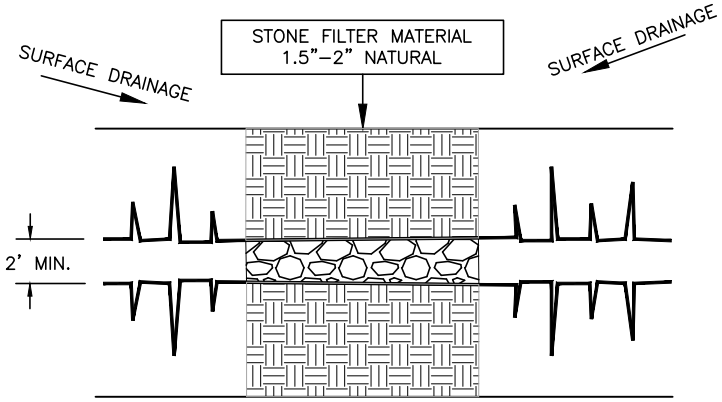
GRAVEL FILTER FOR SILT FENCE

DATE: MARCH 2012

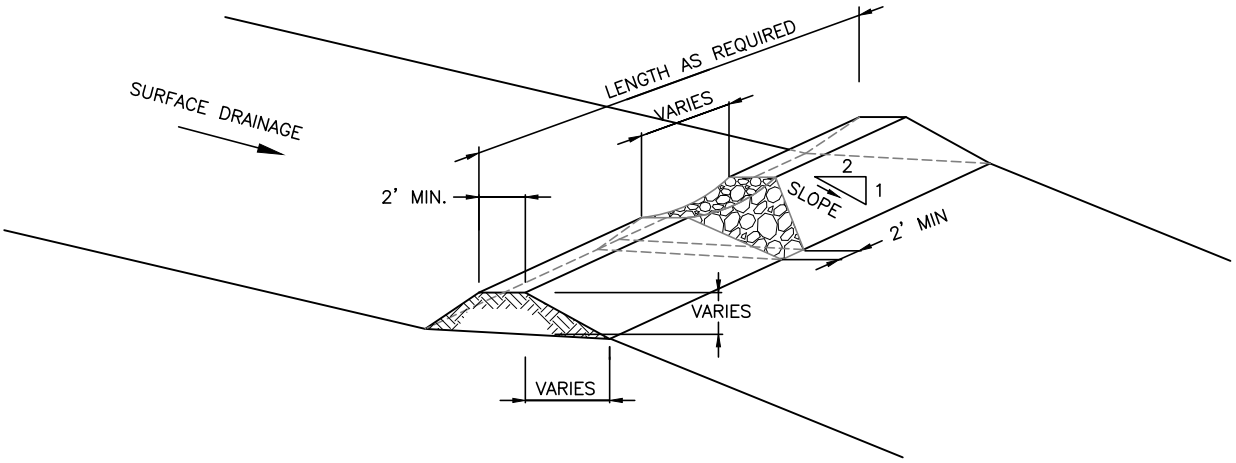
DRAWING NO. 01500-08

DRAWN BY: KEB

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PLAN VIEW



ISOMETRIC VIEW

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GILLETTE, WYOMING 82717
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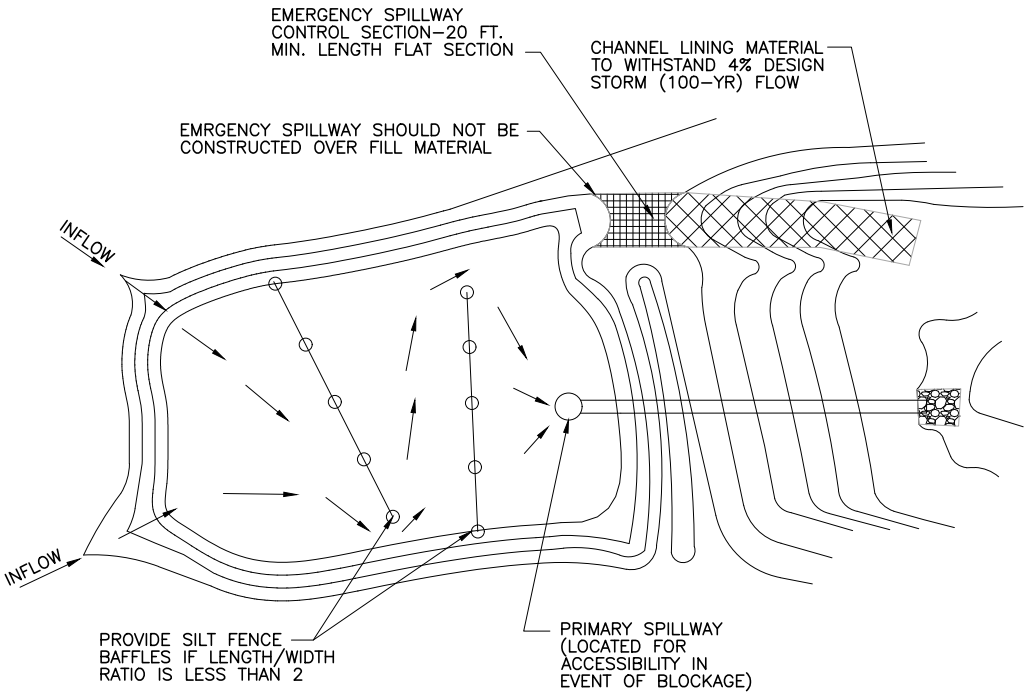
FILTER BERM

DATE: MARCH 2012

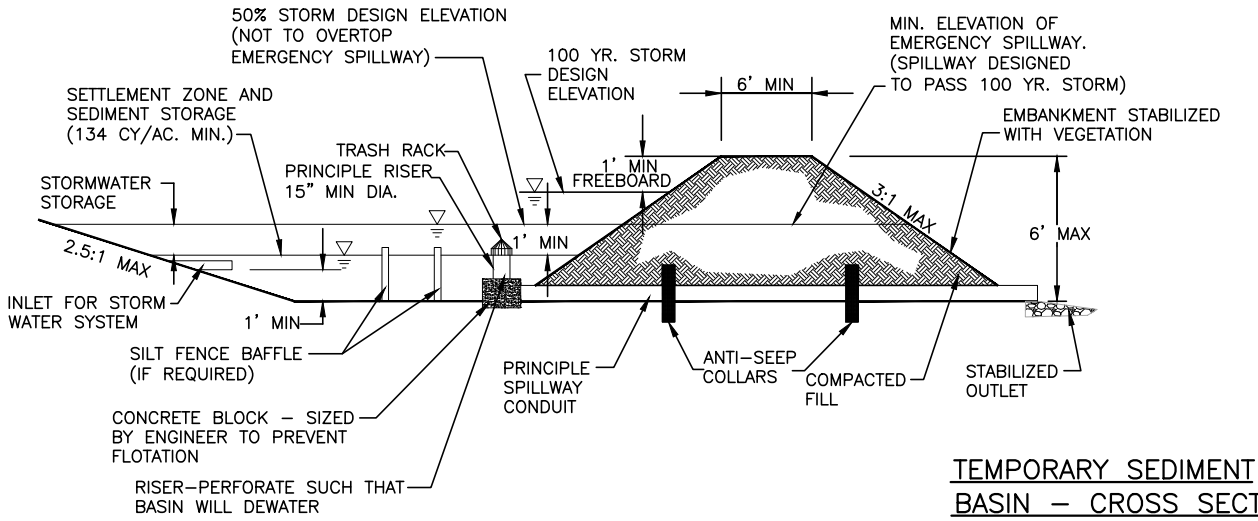
DRAWING NO. 01500-09

DRAWN BY: KEB

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PLAN VIEW



TEMPORARY SEDIMENT
BASIN – CROSS SECTION

SEDIMENT BASIN NOTES

DESIGN REQUIREMENTS:

1. THE PLAN AND PROFILES ARE SCHEMATIC IN NATURE. CONSTRUCTION PLANS MUST PROVIDE SPECIFIC SITE CONSTRUCTION ARRANGEMENTS. DETAILS GIVEN IN THIS DRAWING SHALL BE USED UNLESS ALTERNATE DETAILS ARE SHOWN IN PLAN AND APPROVED BY THE CITY OF GILLETTE.

2. IF THE LENGTH TO WIDTH RATIO IS LESS THAN 2, INTERIOR SEDIMENT FENCE BAFFLES SHALL BE PROVIDED TO REDUCE SHORT–CIRCUITING OF THE BASIN.

3. EMERGENCY SPILLWAYS TO BE LOCATED IN A NON–FILL LOCATION WHEN FEASIBLE AND SHALL BE LINED WITH A NON–ERODIBLE MATERIAL SUCH AS RIP–RAP OR TURF REINFORCEMENT MATERIAL.

MANTENANCE/SAFETY REQUIREMENTS:

4. CLEAN OUT DEPOSITED SEDIMENT WHEN SEDIMENT STORAGE HAS BEEN REDUCED BY 50% OF THE ORIGINAL DESIGN STORAGE VOLUME. THE CLEANOUT LEVEL SHALL BE INDICATED ON THE RISER PIPE WITH PAINTED RED HORIZONTAL LINE.

5. SEDIMENT BASINS SHALL BE FENCED USING CONSTRUCTION FENCE OR OTHER MATERIAL FOR SAFETY REASONS AND INCLUDE SIGNS READING: "DANGER – KEEP OUT"

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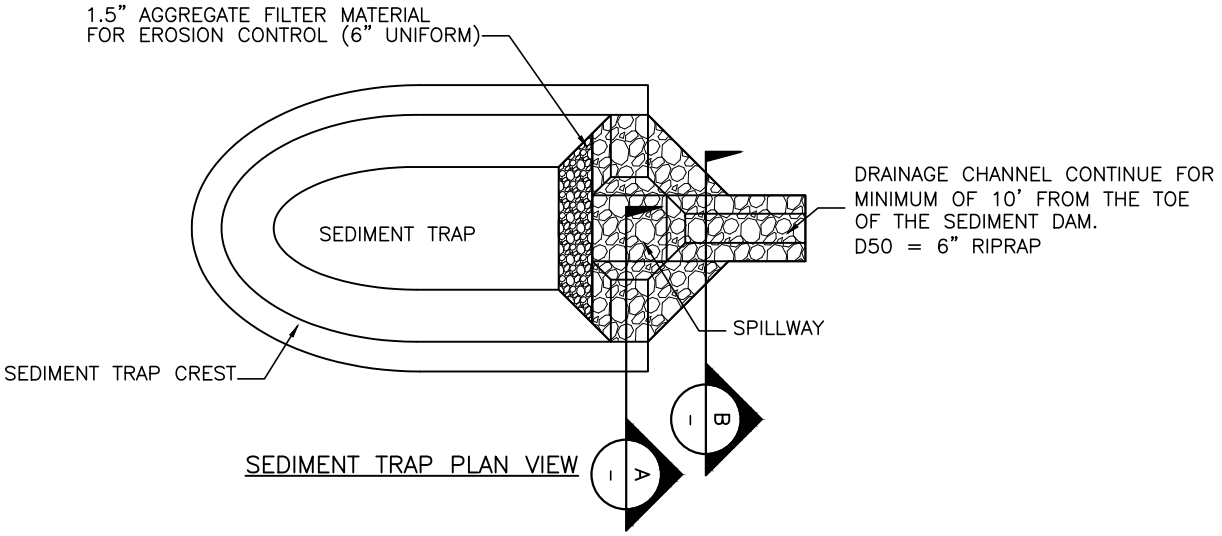
TEMPORARY SEDIMENT BASIN

DATE: MARCH 2012

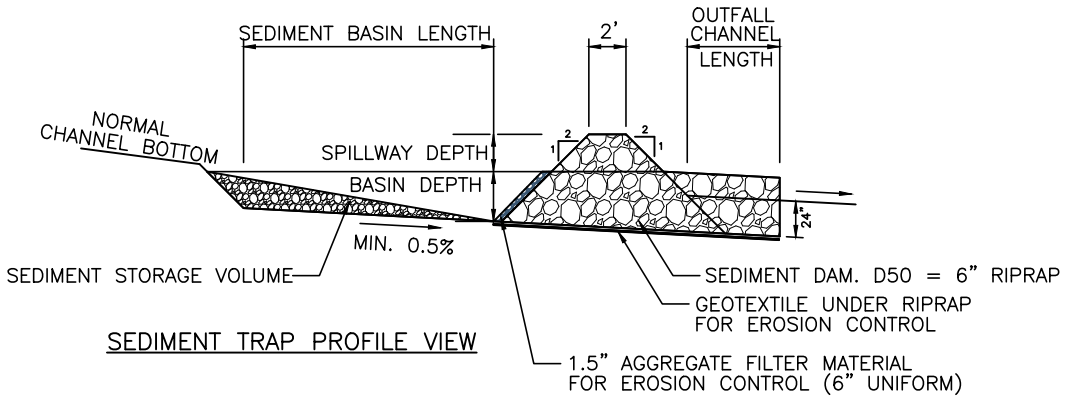
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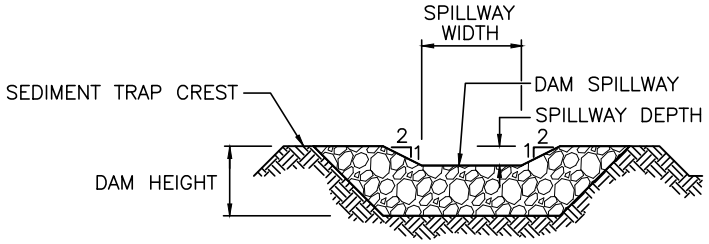
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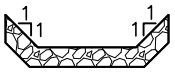
SEDIMENT TRAP PLAN VIEW



SEDIMENT TRAP PROFILE VIEW



SECTION A: SEDIMENT DAM SPILLWAY



SECTION B: DRAINAGE DITCH DETAIL

CONSTRUCTION SPECIFICATIONS:

1. RIPRAP SHOULD BE MECHANICALLY PLACED AND SHAPED.
2. SEDIMENT TRAP MUST BE CLEANED OUT WHEN SEDIMENT STORAGE VOLUME IS HALF FULL.
3. ALL AREAS OF THE SEDIMENT TRAP SHALL BE TEMPORARILY SEEDED EXCEPT FOR THE BOTTOM OF THE BASIN.
4. FOLLOW–UP INSPECTION AND ANY NEEDED MAINTENANCE SHALL BE PERFORMED EVERY 14 DAYS AND AFTER EACH STORM.

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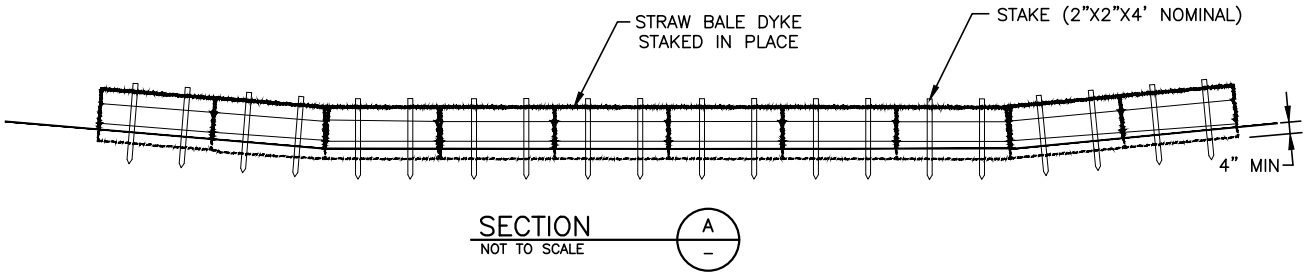
SEDIMENT TRAP & DAM

DATE: MARCH 2012

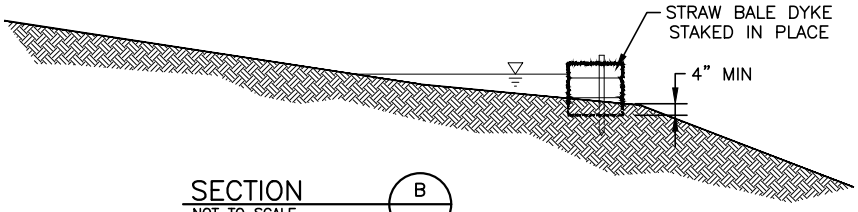
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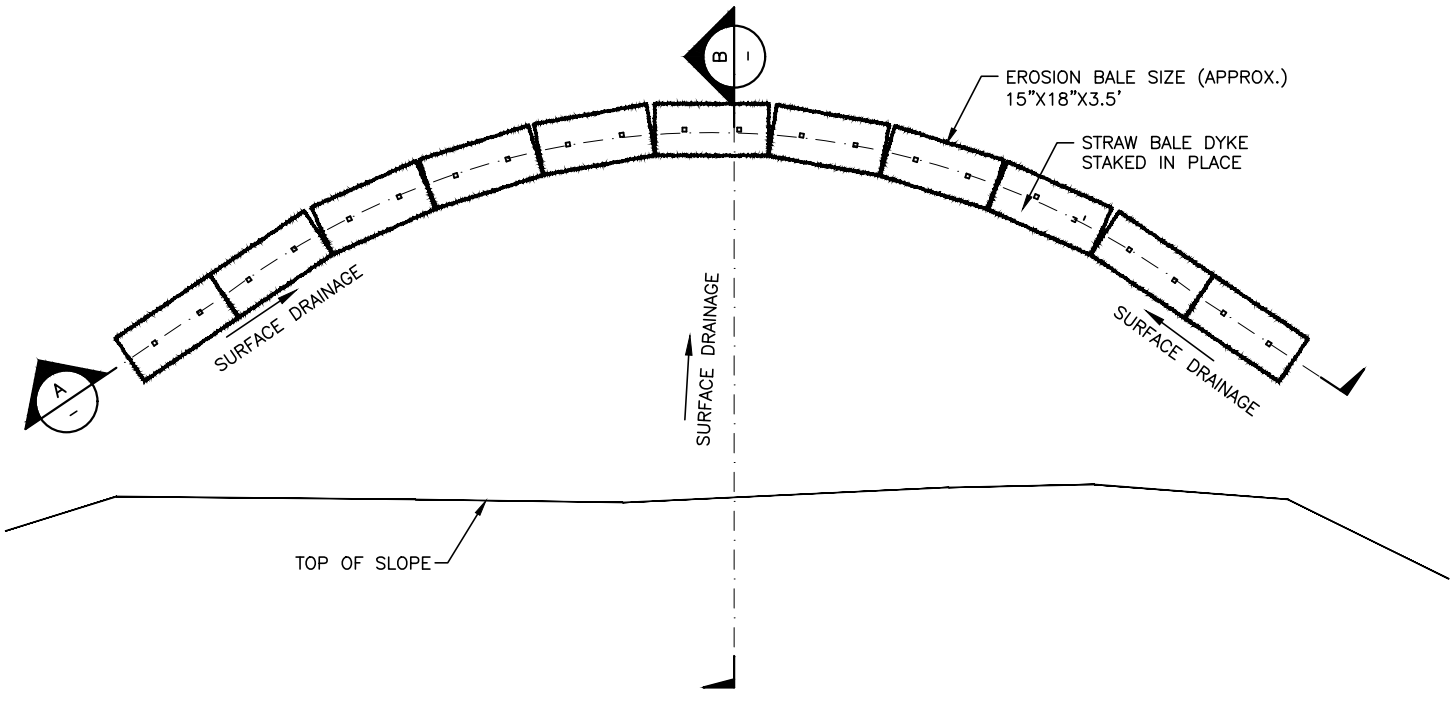
APPROVED BY: CITY ENGINEER HV/KDS



SECTION A
NOT TO SCALE



SECTION B
NOT TO SCALE



EROSION BALE INSTALLATION

1. EROSION BALES SHALL BE ENTRENCHED 4" MIN. INTO SOIL, TIGHTLY ABUTTED WITH NO GAPS, STAKED AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.
2. IT IS RECOMMENDED THAT STRAW BALES SHALL BE USED IN CONJUNCTION WITH SILT FENCE IN ORDER TO BE AN EFFECTIVE BMP.

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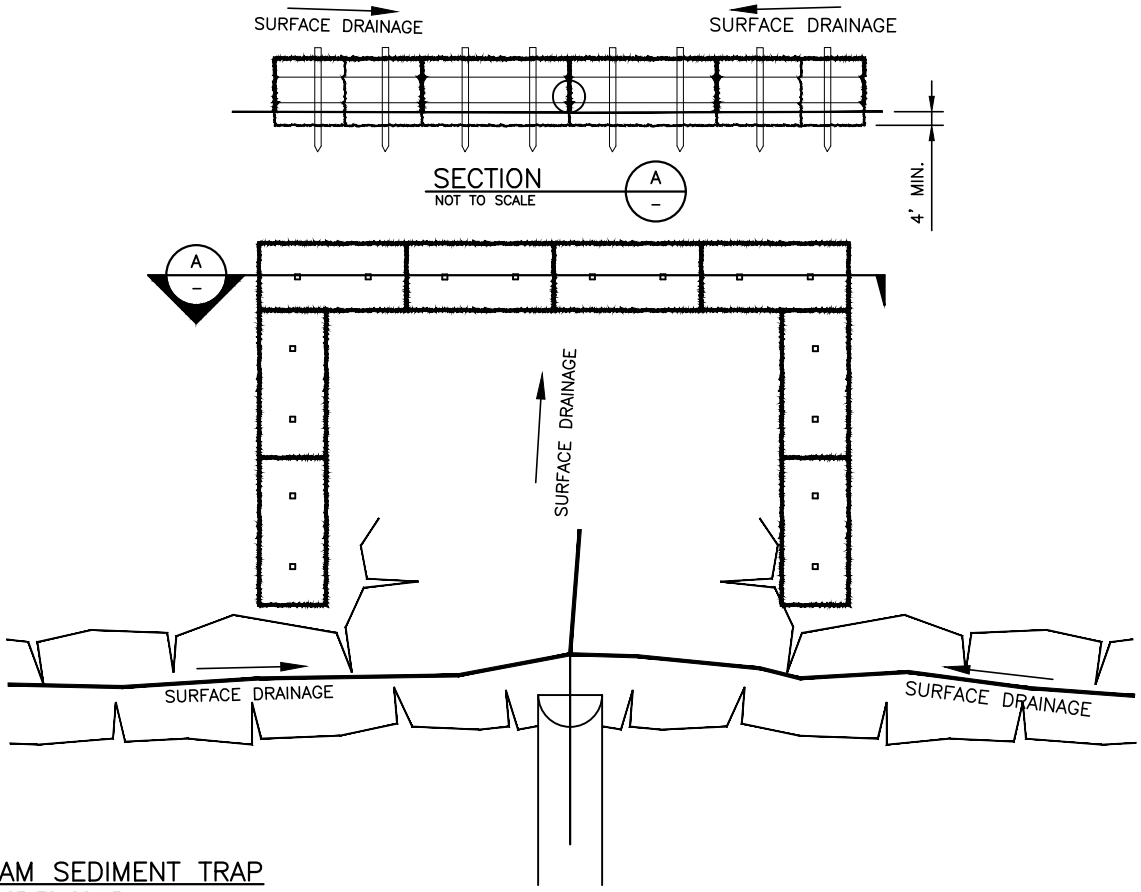
SEDIMENT TRAP WITH STRAW BALE DIKE

DATE: MARCH 2012

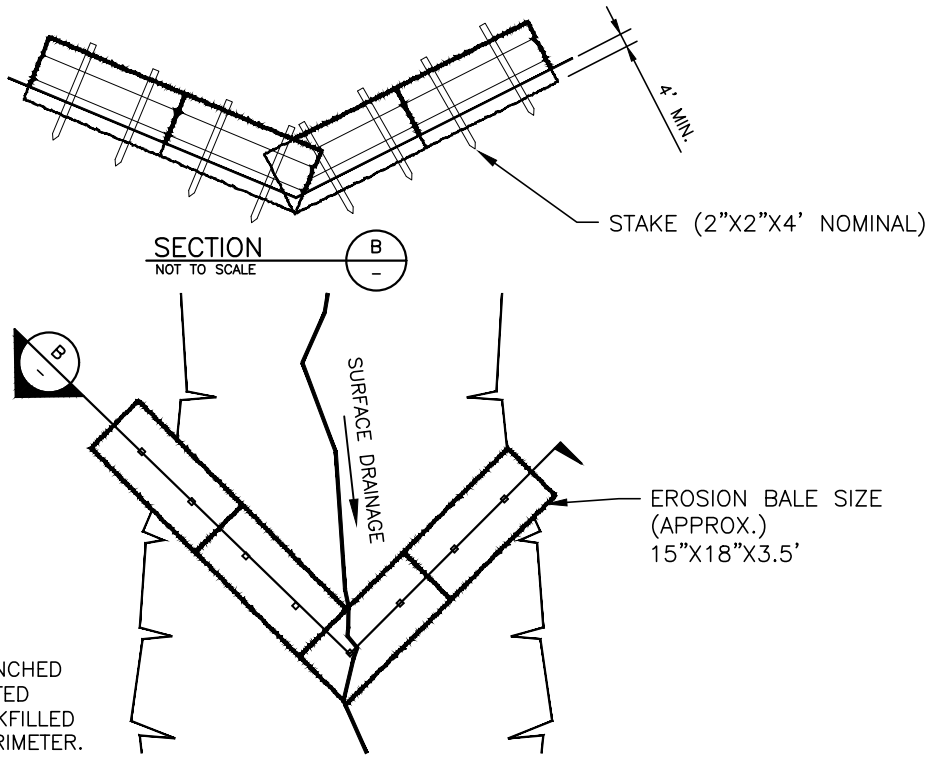
DRAWING NO. 01500-12

DRAWN BY: KEB

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DOWNSTREAM SEDIMENT TRAP
NOT TO SCALE



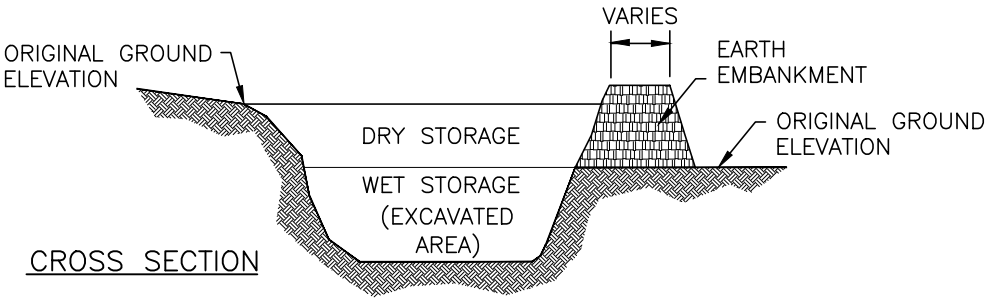
EROSION BALE INSTALLATION

1. EROSION BALES SHALL BE ENTRENCHED 4" MIN. INTO SOIL, TIGHTLY ABUTTED WITH NO GAPS, STAKED AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.

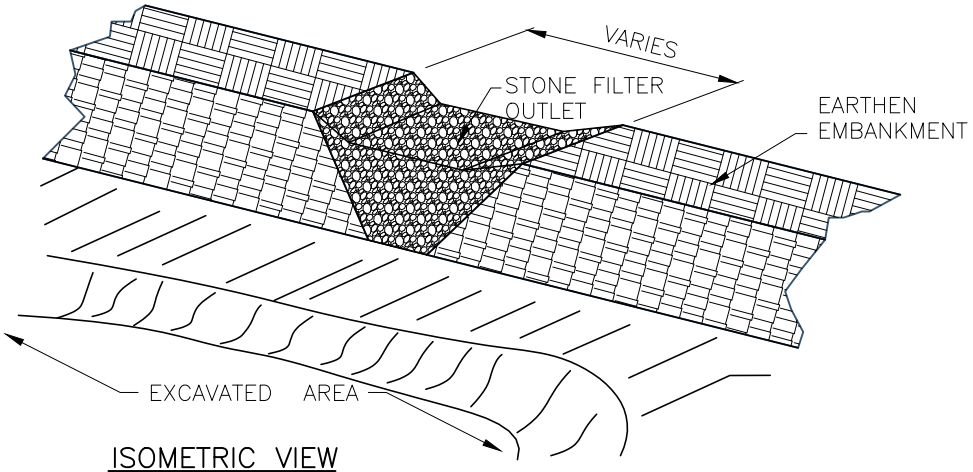
City Of Gillette
ENGINEERING DIVISION
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SEDIMENT TRAP FOR CONCENTRATED FLOW

DRAWN BY: KEB	APPROVED BY: CITY ENGINEER HV/KDS	DATE: MARCH 2012
		DRAWING NO. 01500-13



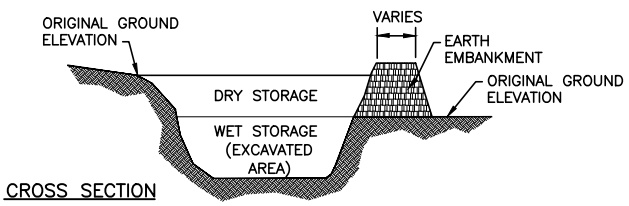
CROSS SECTION



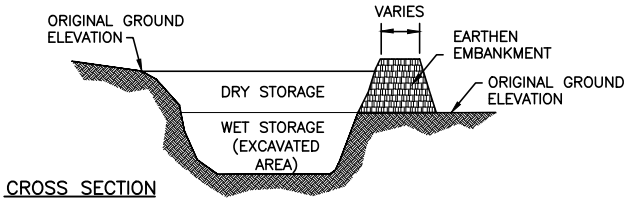
ISOMETRIC VIEW

EXCAVATED SEDIMENT TRAP
STONE FILTER OUTLET

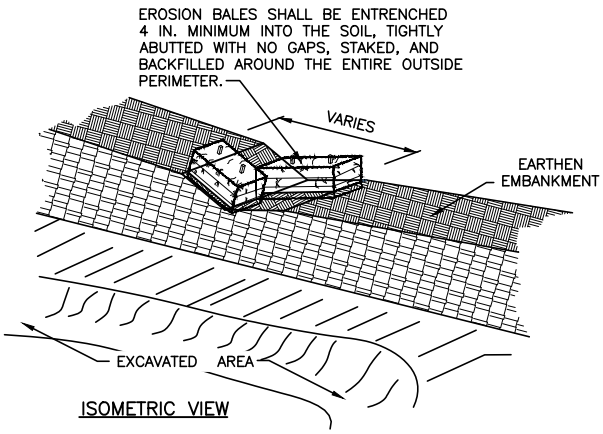
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CROSS SECTION



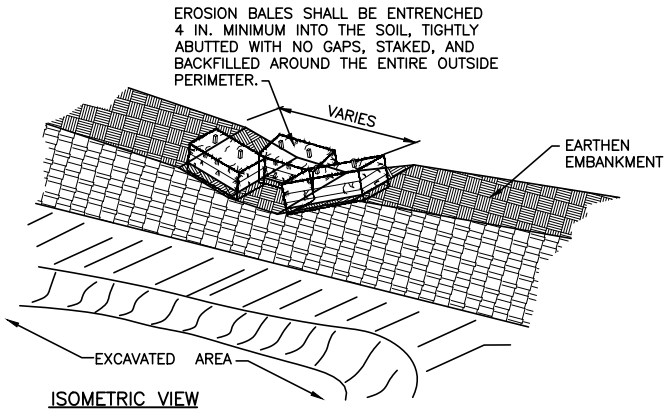
CROSS SECTION



ISOMETRIC VIEW

EXCAVATED SEDIMENT TRAP
STRAW BALE OUTLET–TYPE A

NOT TO SCALE



ISOMETRIC VIEW

EXCAVATED SEDIMENT TRAP
STRAW BALE OUTLET–TYPE B

NOT TO SCALE

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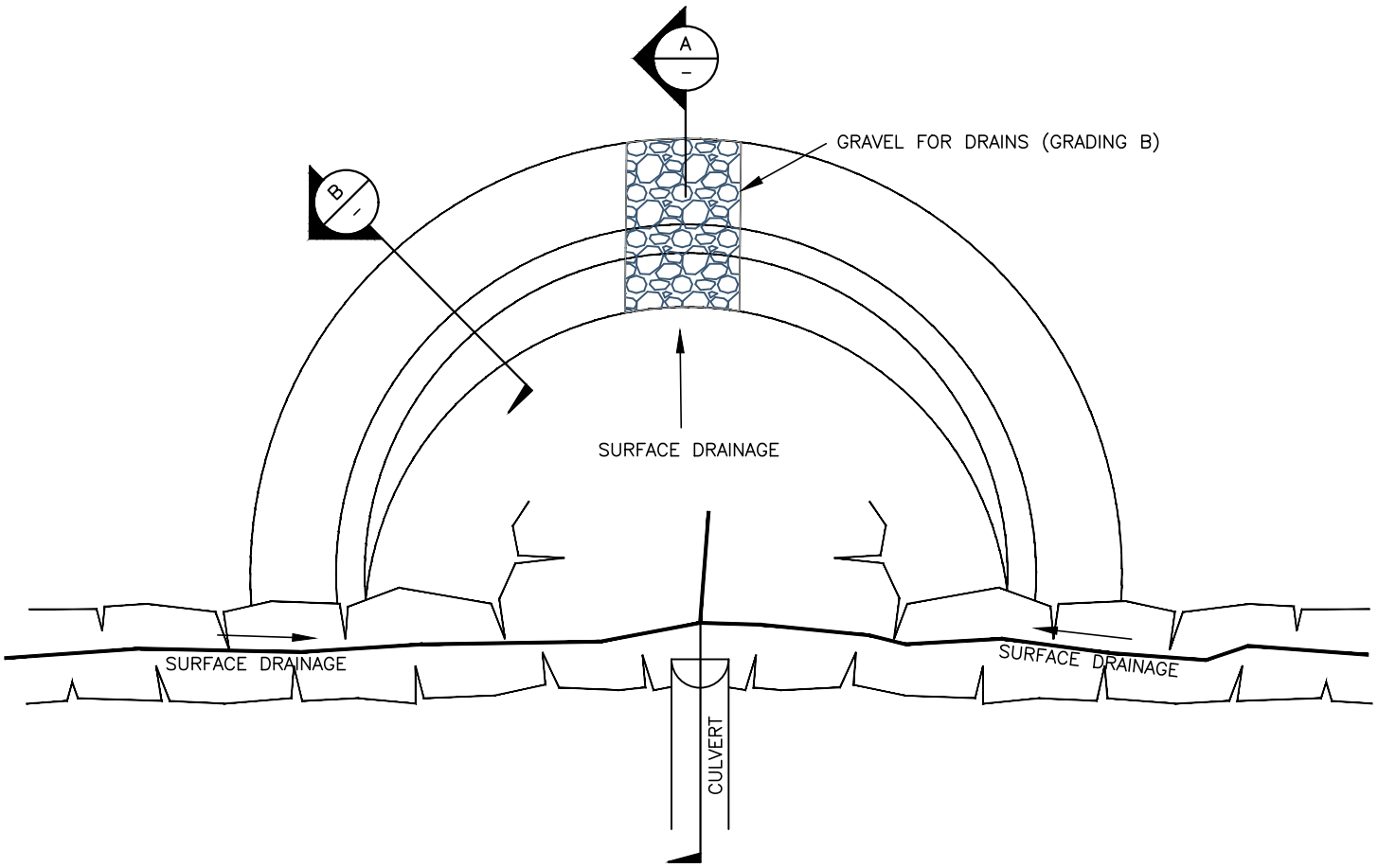
SEDIMENT TRAP - EXCAVATED

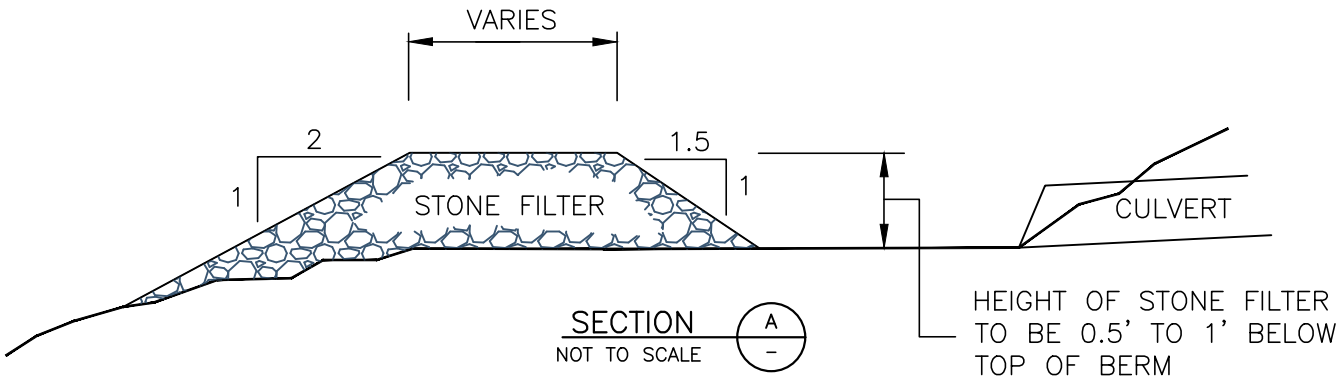
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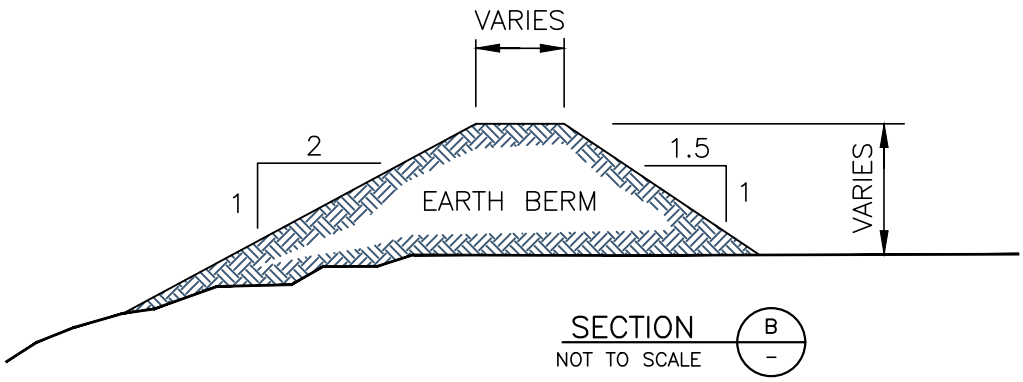
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DRAWING NO. 01500-14







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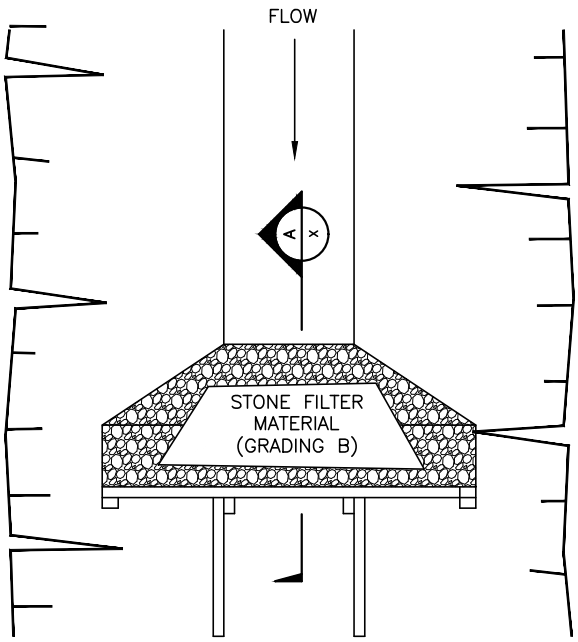
SEDIMENT TRAP - EARTH BERM

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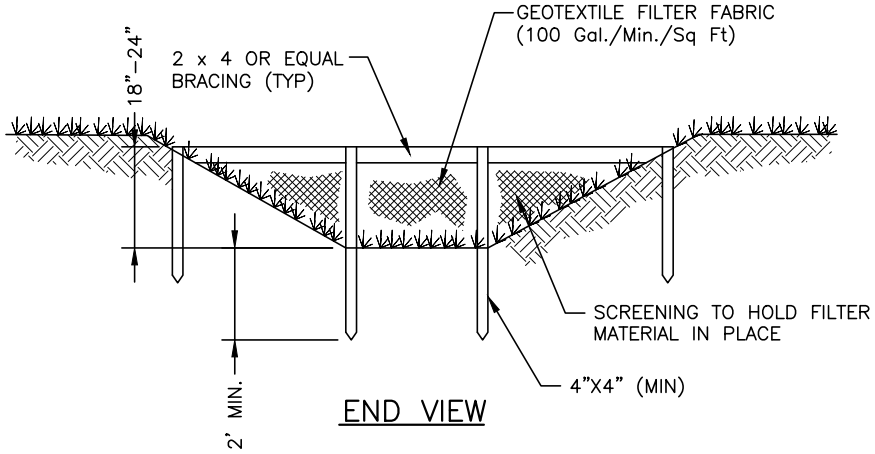
APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

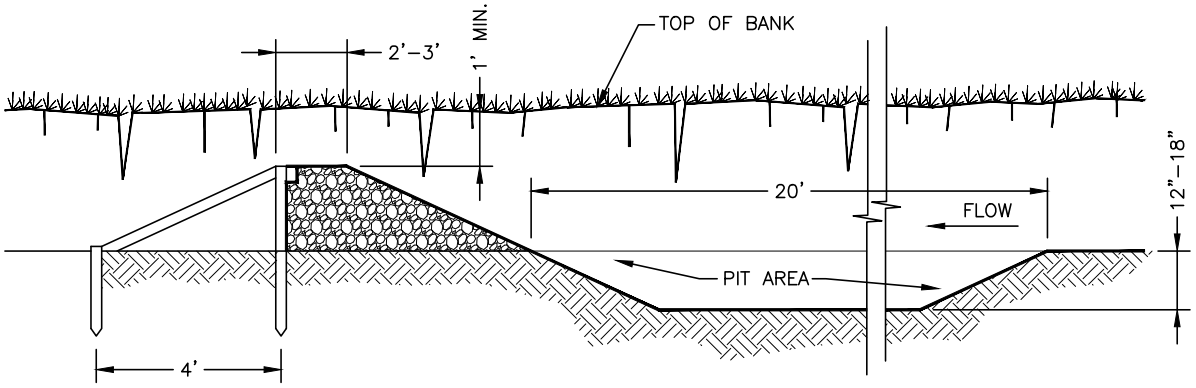
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PLAN VIEW



END VIEW

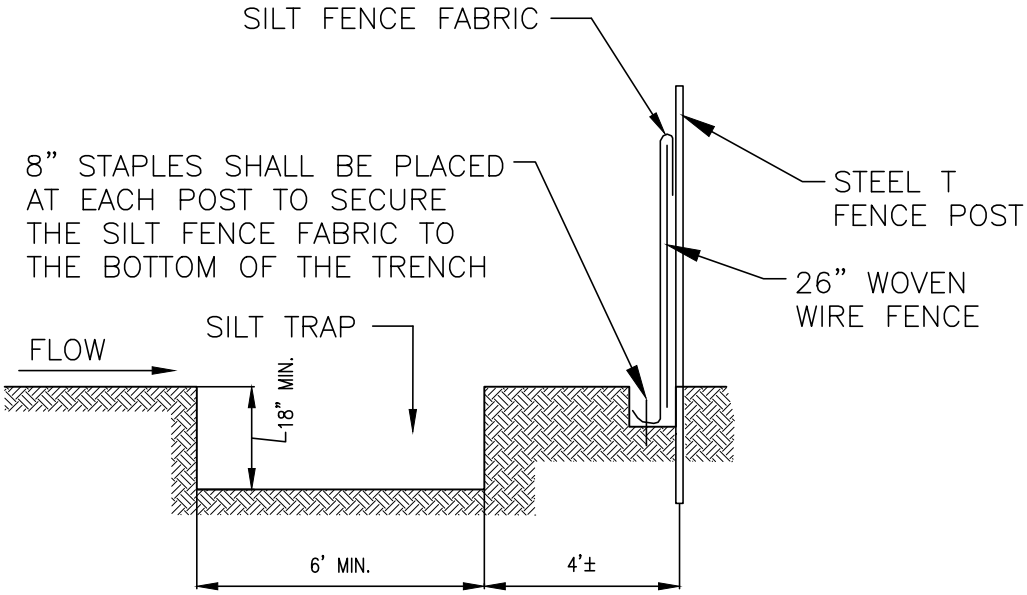


SECTION A

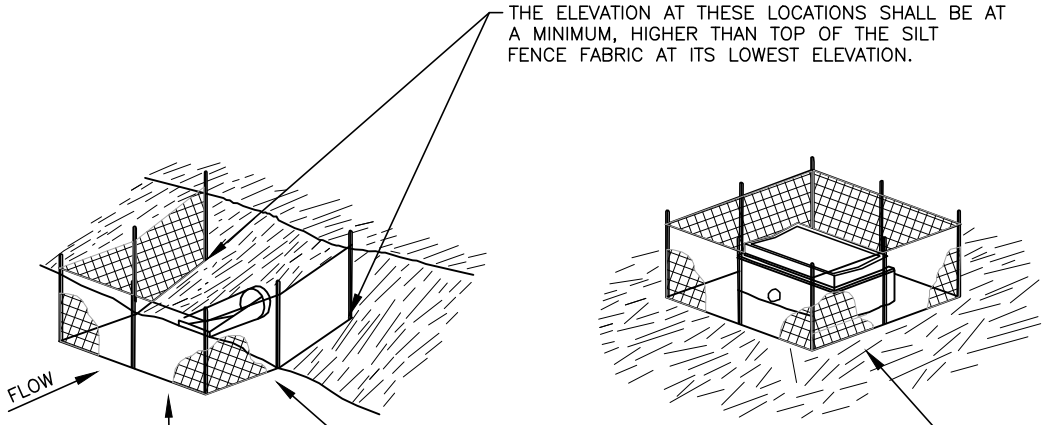
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SEDIMENT TRAP - DITCH

DATE:	MARCH 2012
DRAWING NO.	01500-16
DRAWN BY:	KEB
APPROVED BY: CITY ENGINEER	HV/KDS



CROSS–SECTION



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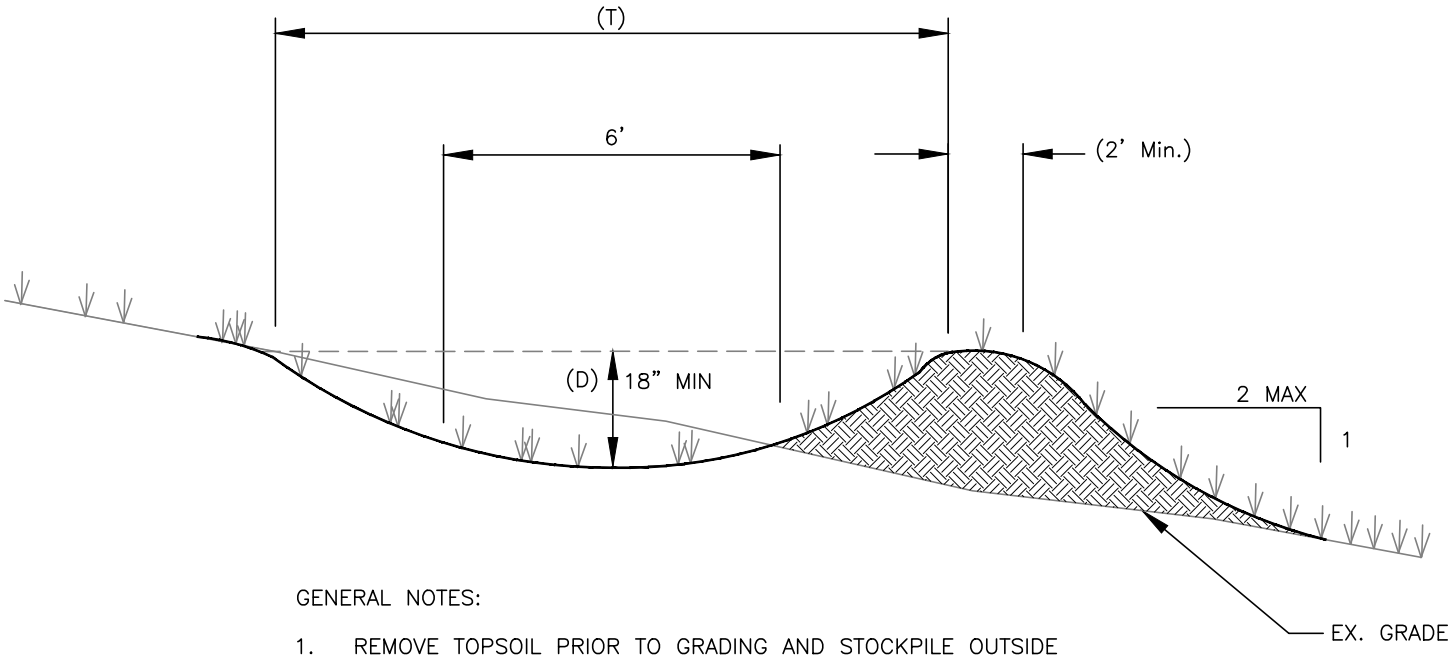
SEDIMENT TRAP - SILT FENCE

DATE: MARCH 2012

DRAWING NO. 01500-17

DRAWN BY: KEB

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GENERAL NOTES:

1. REMOVE TOPSOIL PRIOR TO GRADING AND STOCKPILE OUTSIDE
2. PROVIDE MINIMUM 4" OF TOPSOIL TO FACILITATE REVEGETATION.
3. IF THE EXPECTED LIFE SPAN OF THE DIVERSION STRUCTURE IS GREATER THAN 15 DAYS, BOTH THE BERM AND DITCH MUST BE SEEDED.

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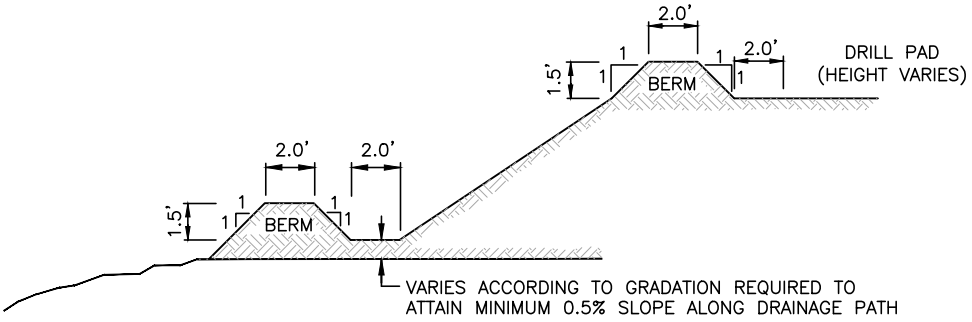
DIVERSION SWALE / BERM

DATE: MARCH 2012

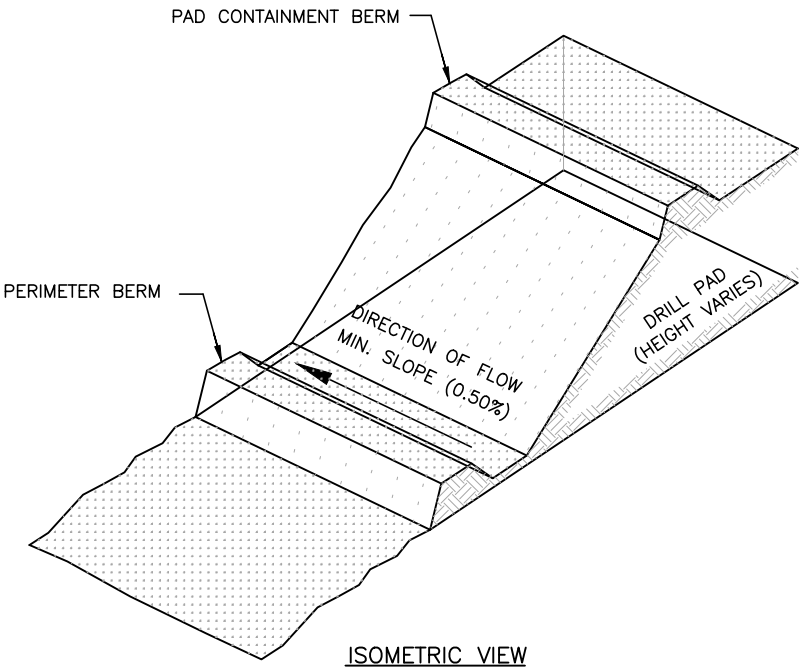
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PROFILE VIEW



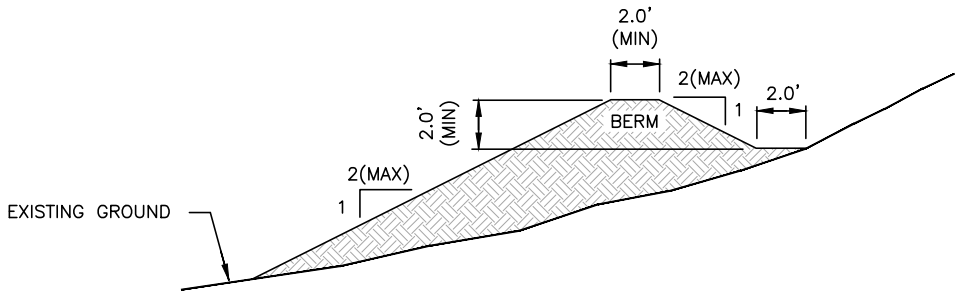
ISOMETRIC VIEW

CONSTRUCTION SPECIFICATIONS:

1. THE AREA UP-SLOPE OF THE BERM AT THE BASE OF INITIAL FILL SLOPE SHALL HAVE A MINIMUM SLOPE OF 0.5%.
2. COMPACT BERMS WITH HAND HELD COMPACTION DEVICE, TRACKHOE BUCKET OR OTHER METHOD CAPABLE OF ATTAINING 85% DENSITY.
3. FOLLOW-UP INSPECTION AND ANY NEEDED MAINTENANCE SHALL BE PERFORMED EVERY 14 DAYS AND AFTER EACH STORM.
4. SEE PLAN FOR BERM WIDTH, DEPTH AND LOCATIONS.

PERIMETER BERM DETAIL

NOT TO SCALE



DIVERSION BERM/DITCH DETAIL

NOT TO SCALE

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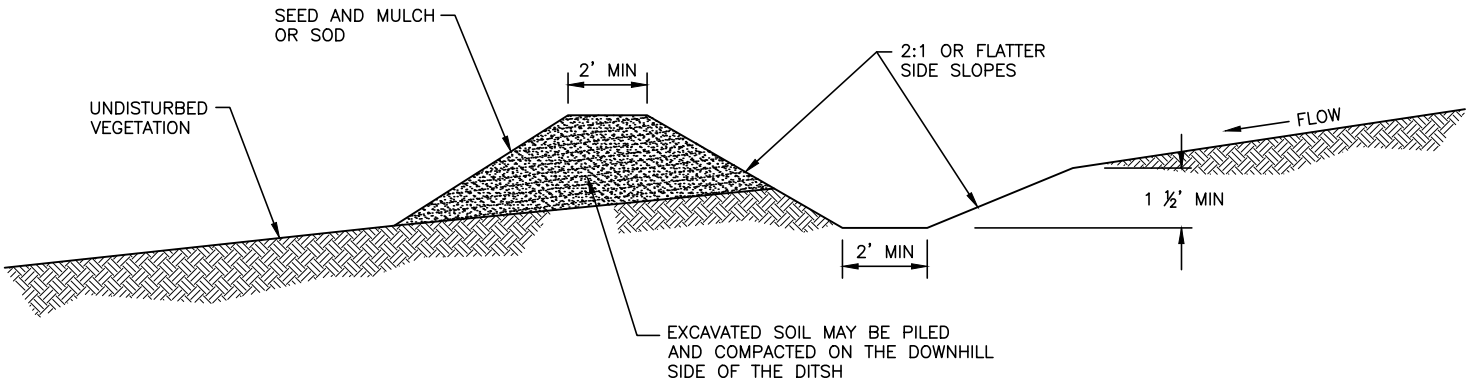
DIVERSION BERM & DITCH

DATE: MARCH 2012

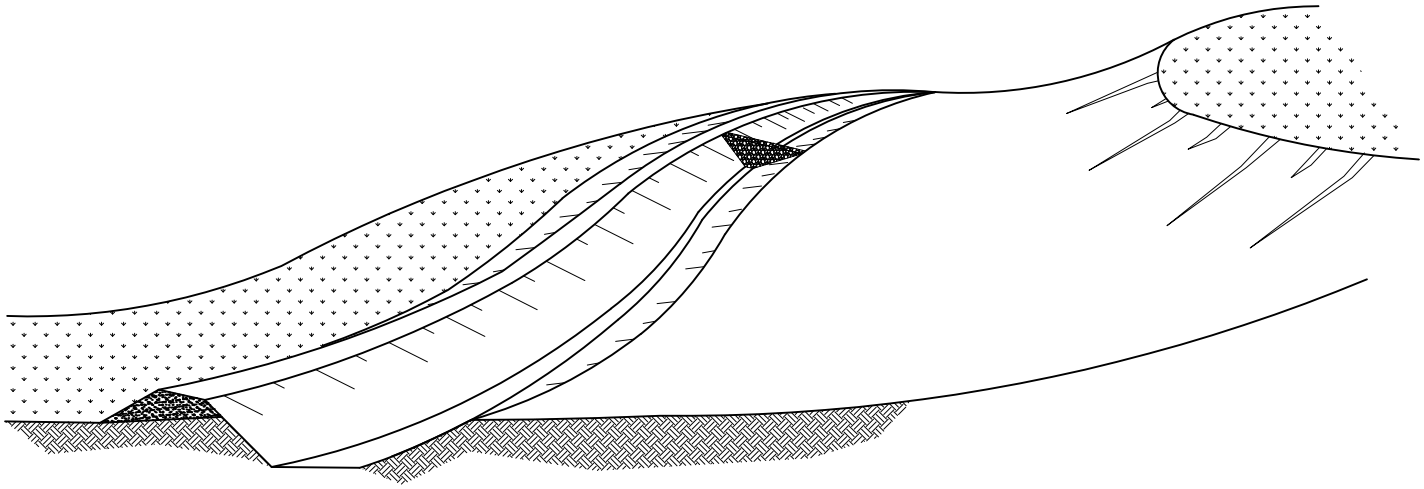
DRAWING NO. 01500-19

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CROSS–SECTION



ISOMETRIC VIEW

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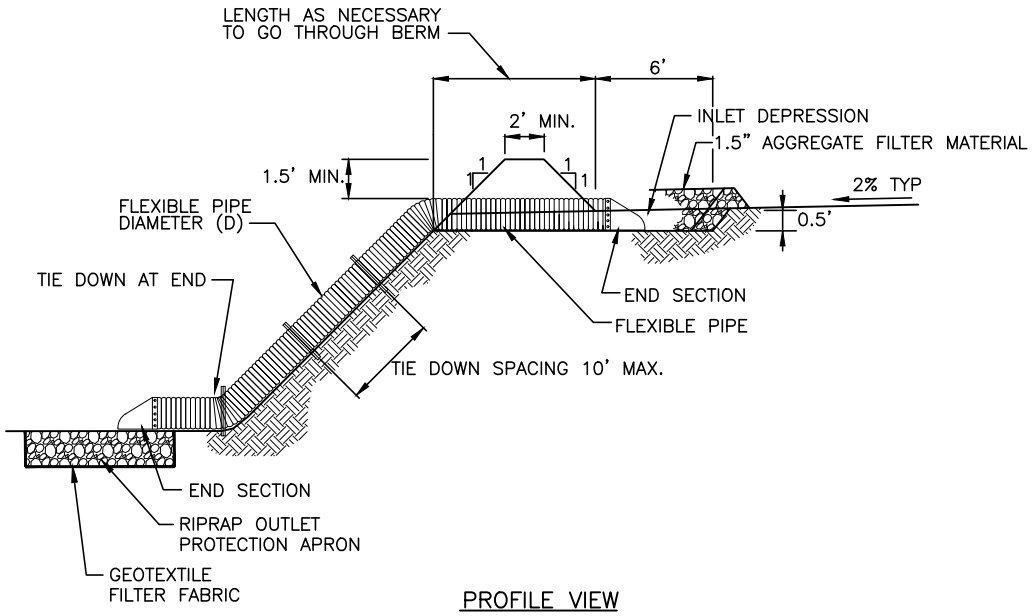
DIVERSION DITCH

DATE: MARCH 2012

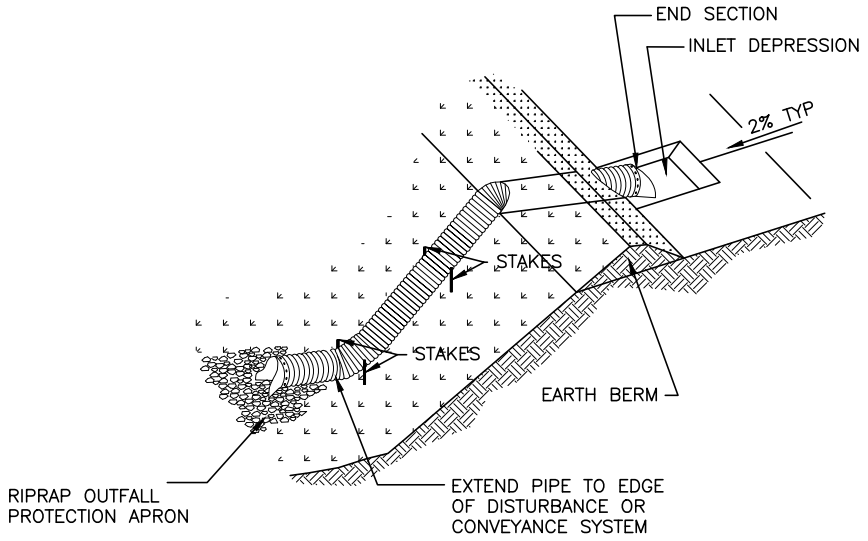
DRAWING NO. 01500-20

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PROFILE VIEW



ISOMETRIC VIEW

CONSTRUCTION SPECIFICATIONS:

1. THE SLOPE DRAIN SHALL HAVE A MINIMUM SLOPE OF 5%.
2. THE TOP OF THE EARTH BERM OVER THE INLET PIPE AND THOSE BERMS CARRYING WATER TO THE PIPE SHALL BE AT LEAST 1.5 FEET HIGHER THAN THE TOP OF THE INLET PIPE.
3. THE PIPE SHALL BE FLEXIBLE WITH WATER TIGHT CONNECTING BANDS. FLEXIBLE PIPE SHOULD BE STAKED ON EITHER SIDE.
4. A RIPRAP APRON SHALL BE PROVIDED AT THE OUTLET.
5. THE SOIL AROUND AND UNDER THE INLET PIPE AT THE ENTRANCE SECTION SHALL BE HAND TAMPED IN 4" LIFTS TO THE TOP OF THE EARTH BERM.
6. FOLLOW-UP INSPECTION AND ANY NEEDED MAINTENANCE SHALL BE PERFORMED EVERY 14 DAYS AND AFTER EACH RAINFALL EVENT.
7. SEE PLAN FOR PIPE DIAMETER, LENGTH AND LOCATIONS.

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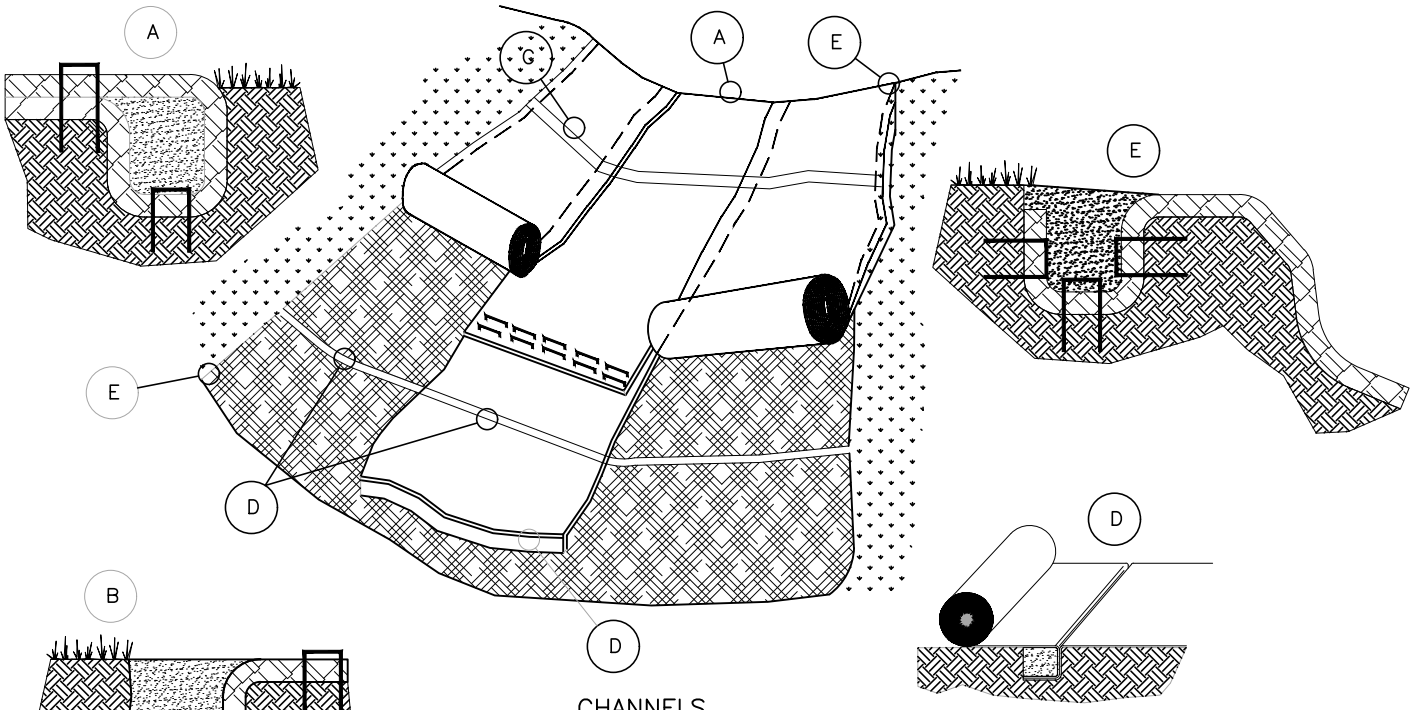
TEMPORARY SLOPE DRAIN

DATE: MARCH 2012

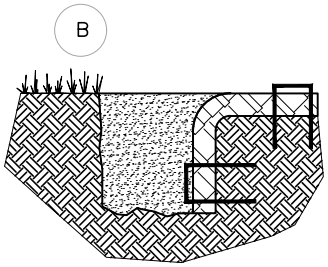
DRAWING NO. 01500-21

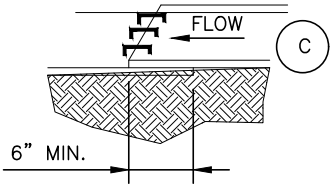
DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



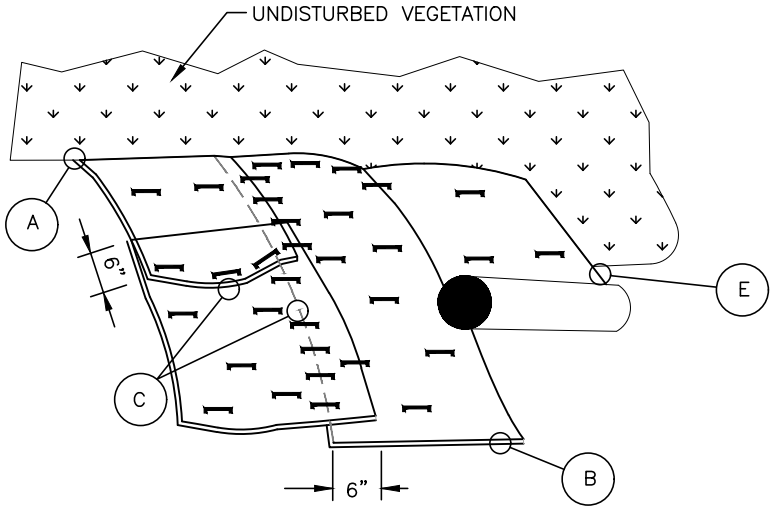
CHANNELS





OVERLAPS ARE A MINIMUM OF 6" OR PER MANUFACTURERS SPECS.

SECURE BY USING AN APPROPRIATE PINNING PATTERN PER MANUFACTURERS SPECIFICATIONS



SLOPES

NOTES:

1. ALL FABRIC TRENCHING (A, B, D, E) ARE TO BE 6" D X 6" W MINIMUM.
2. DEPENDING ON THE VELOCITY, SLOPE, SOILS, USE PROPER BLANKET OR TURF MAT LINING PER MANUFACTURES SPECIFICATIONS TO HANDLE SHEER STRESSES OF THE SLOPE/CHANNEL.

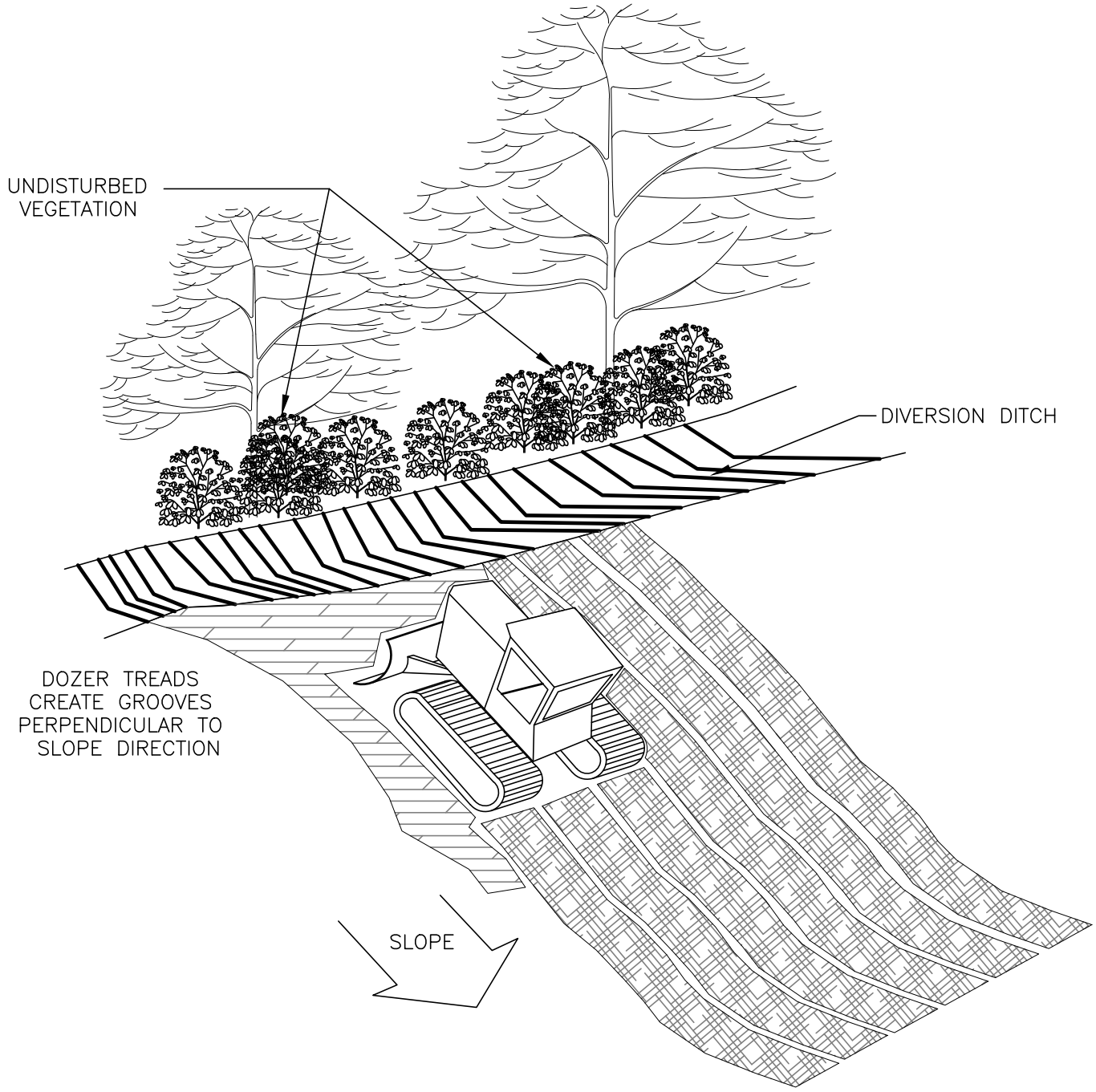
City Of Gillette
ENGINEERING DIVISION
P.O. BOX 3003, 201 E. 5TH STREET
GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

EROSION CONTROL BLANKET & TURF MAT

DATE:	MARCH 2012
DRAWING NO.	01500-22

DRAWN BY: KEB

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UNVEGETATED SLOPES SHOULD BE TEMPORARILY
SCARIFIED TO MINIMIZE RUNOFF VELOCITIES

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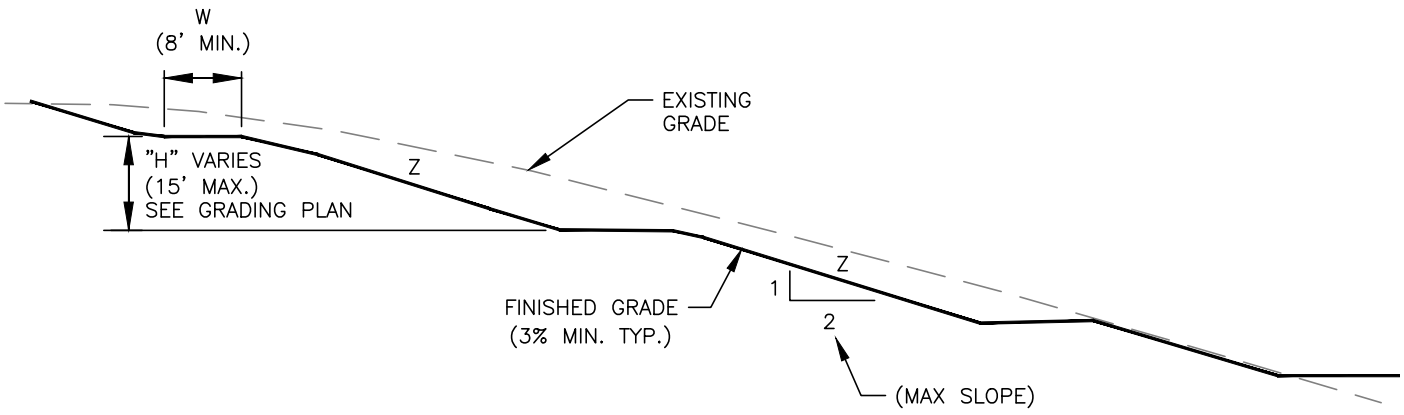
SURFACE ROUGHENING & SCARIFICATION

DATE: MARCH 2012

DRAWING NO. 01500-23

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



INSTALLATION NOTES:

1. SEE GRADING PLAN VIEW FOR LOCATION OF TERRACING, WIDTH (W), AND SLOPE (Z).

2. TERRACING IS TYPICALLY NOT REQUIRED FOR SLOPES OF 4:1 OR FLATTER.

3. GRADE TERRACES TO DRAIN BACK TO SLOPE AT A MINIMUM OF 3% GRADE.

MAINTENANCE NOTES:

1. RILL EROSION OCCURRING ON TERRACED SLOPES SHALL BE REPAIRED, RESEEDED, MULCHED OR STABILIZED IN A MANNER APPROVED BY THE CITY.

2. TERRACING MAY NEED TO BE RE-GRADED TO RETURN THE SLOPE TO THE FINAL DESIGN GRADE. THE SLOPE SHALL THEN BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED AS APPROVED BY THE CITY.

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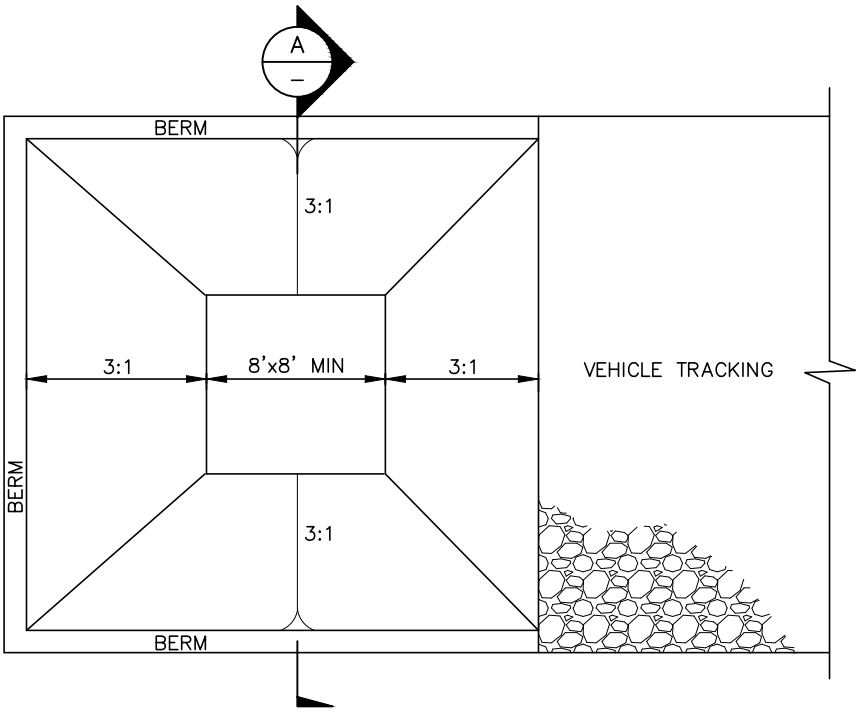
TEMPORARY TERRACING

DATE: MARCH 2012

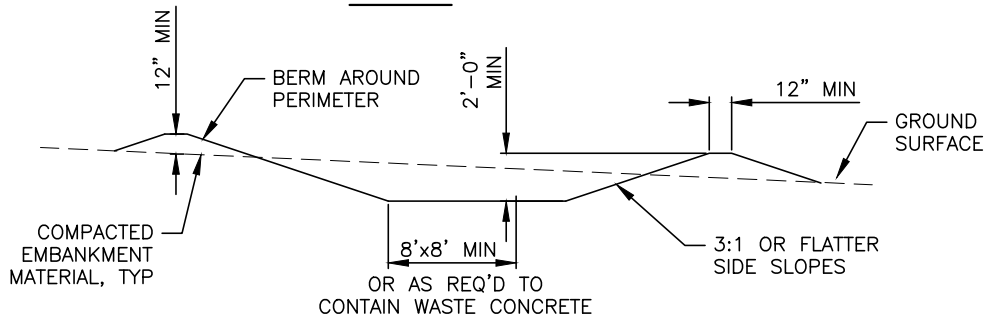
DRAWING NO. 01500-24

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



PLAN



SECTION A

CONCRETE WASHOUT AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATIONS OF WASHOUT AREA
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL IS REQUIRED AT ACCESS POINT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

CONCRETE WASHOUT MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASHED CONCRETE.
2. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE STABILIZED.
4. INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.

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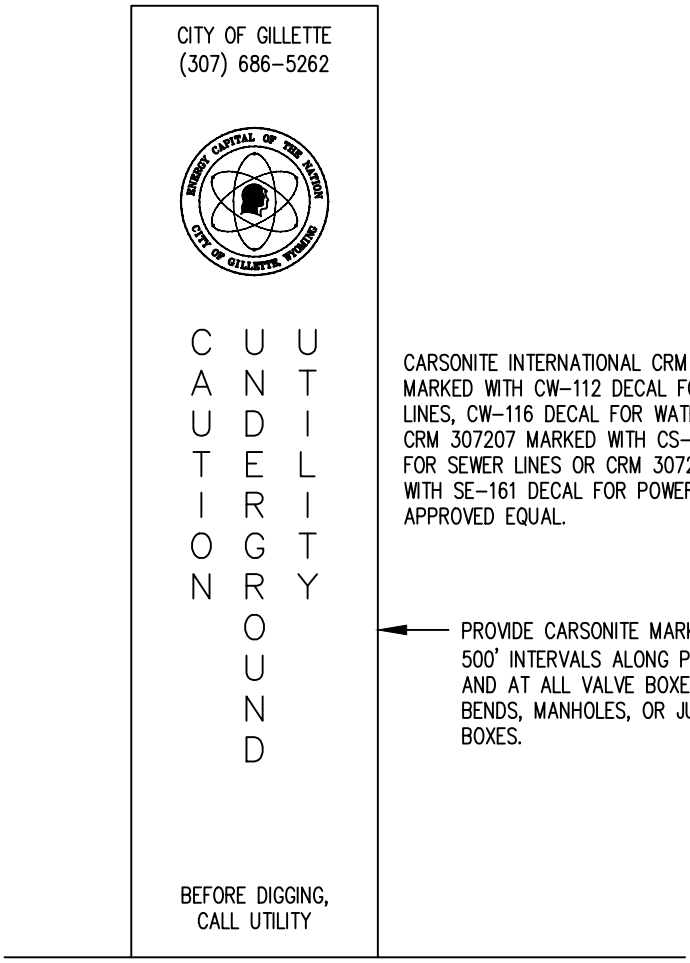
EXCAVATED CONCRETE WASHOUT AREA

DATE: MARCH 2012

DRAWING NO. 01500-25

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS

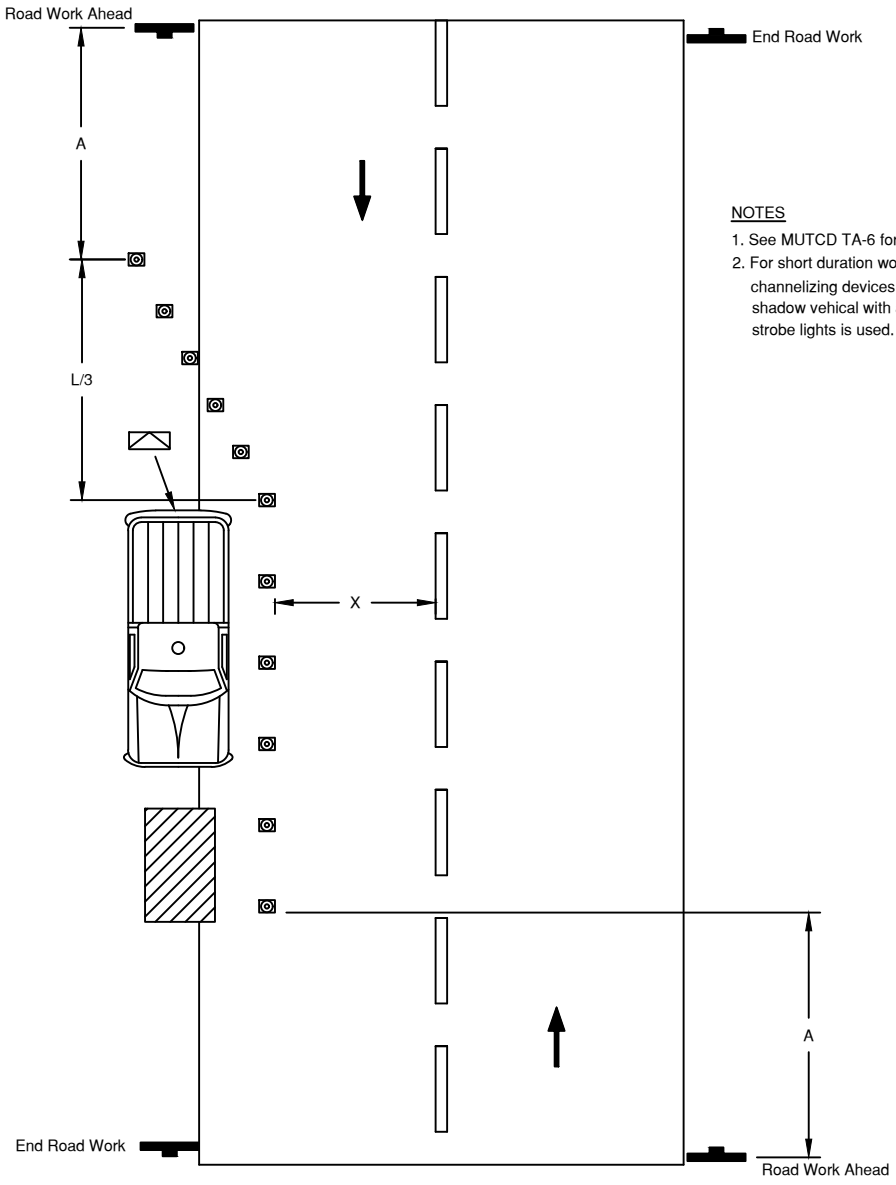


UTILITY MARKER

NOTE:
1. UTILITY MARKERS WILL BE PROVIDED BY THE CITY OF GILLETTE AT COST.
2. INSTALLATION OF UTILITY MARKERS ARE THE RESPONSIBILITY OF THE CONTRACTOR/DEVELOPER.

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UTILITY (CARSONITE) MARKER	DATE: MAY 2009
	DRAWING NO. 01510-01
DRAWN BY: JAC	APPROVED BY: CITY ENGINEER DLH/KDS



NOTES

1. See MUTCD TA-6 for additional guidance.
2. For short duration work, the taper and channelizing devices may be omitted if a shadow vehical with activated rotating or strobe lights is used.

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

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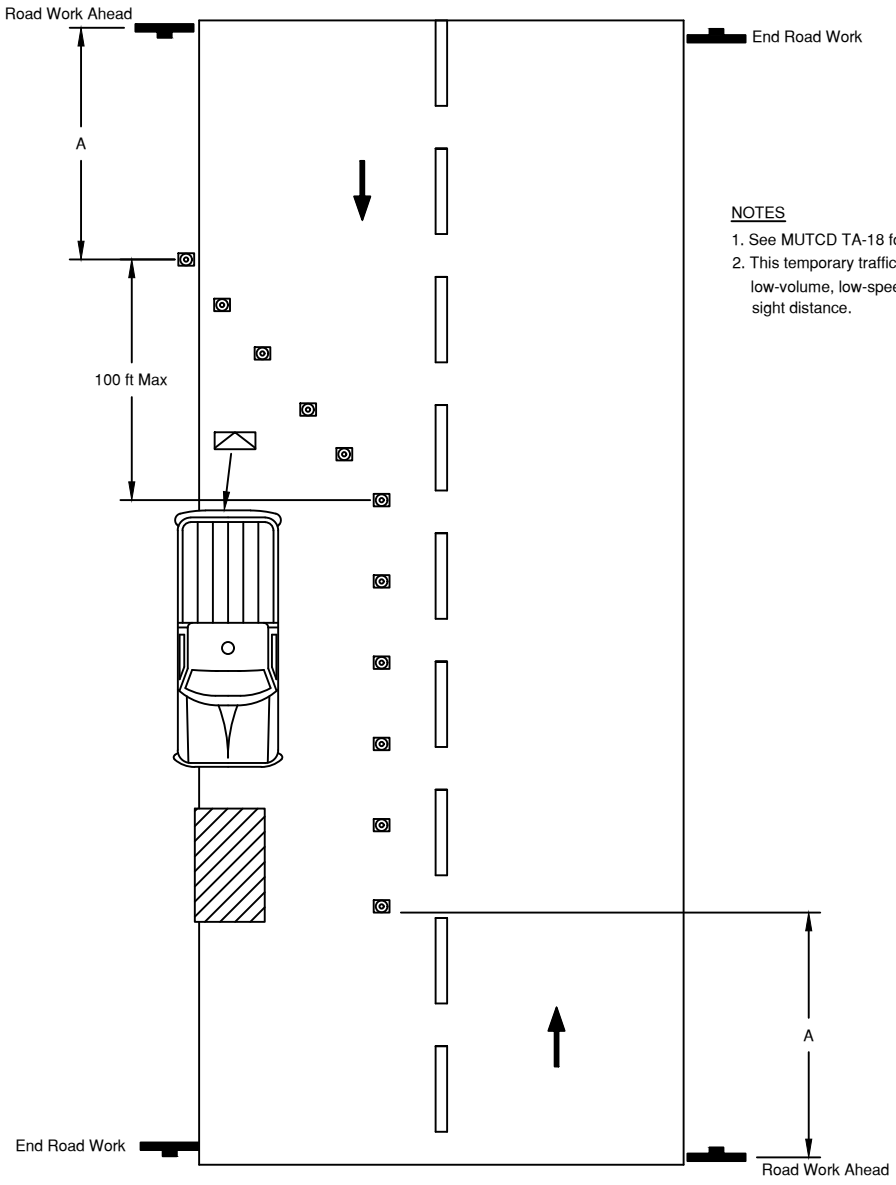
MINOR LOW SPEED ROADS SHOULDER WORK

DATE: MAY 2009

DRAWING NO. 01510–02

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



NOTES

1. See MUTCD TA-18 for additional guidance.
2. This temporary traffic control is only used for low-volume, low-speed facilities with adequate sight distance.

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where L = $WS^2/60$ for 40 mph or less and
L = WS for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

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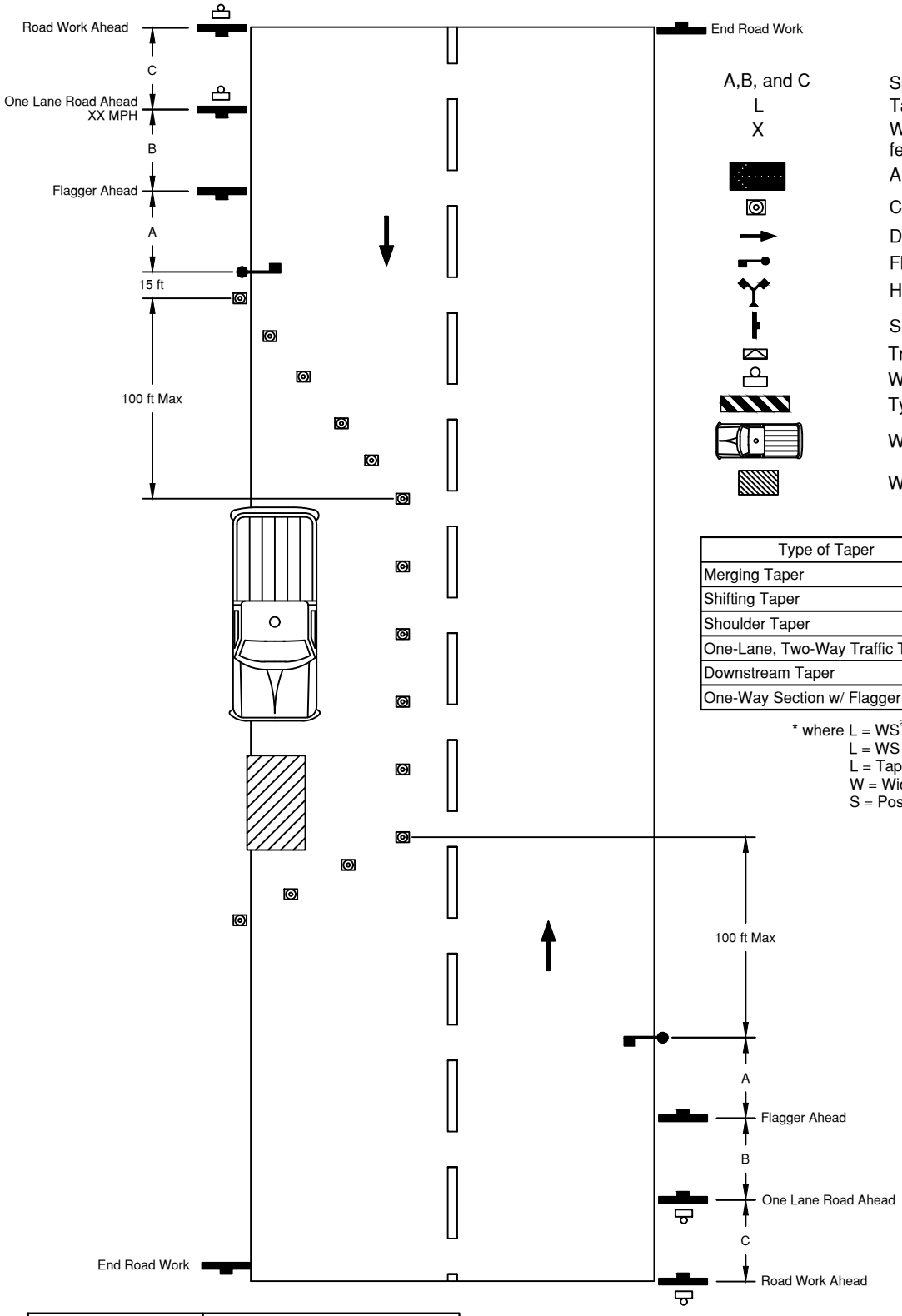
LANE CLOSURE (MINOR STREET)

DATE: MAY 2009

DRAWING NO. 01510–03

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

NOTES

1. See MUTCD TA-10 for additional guidance.

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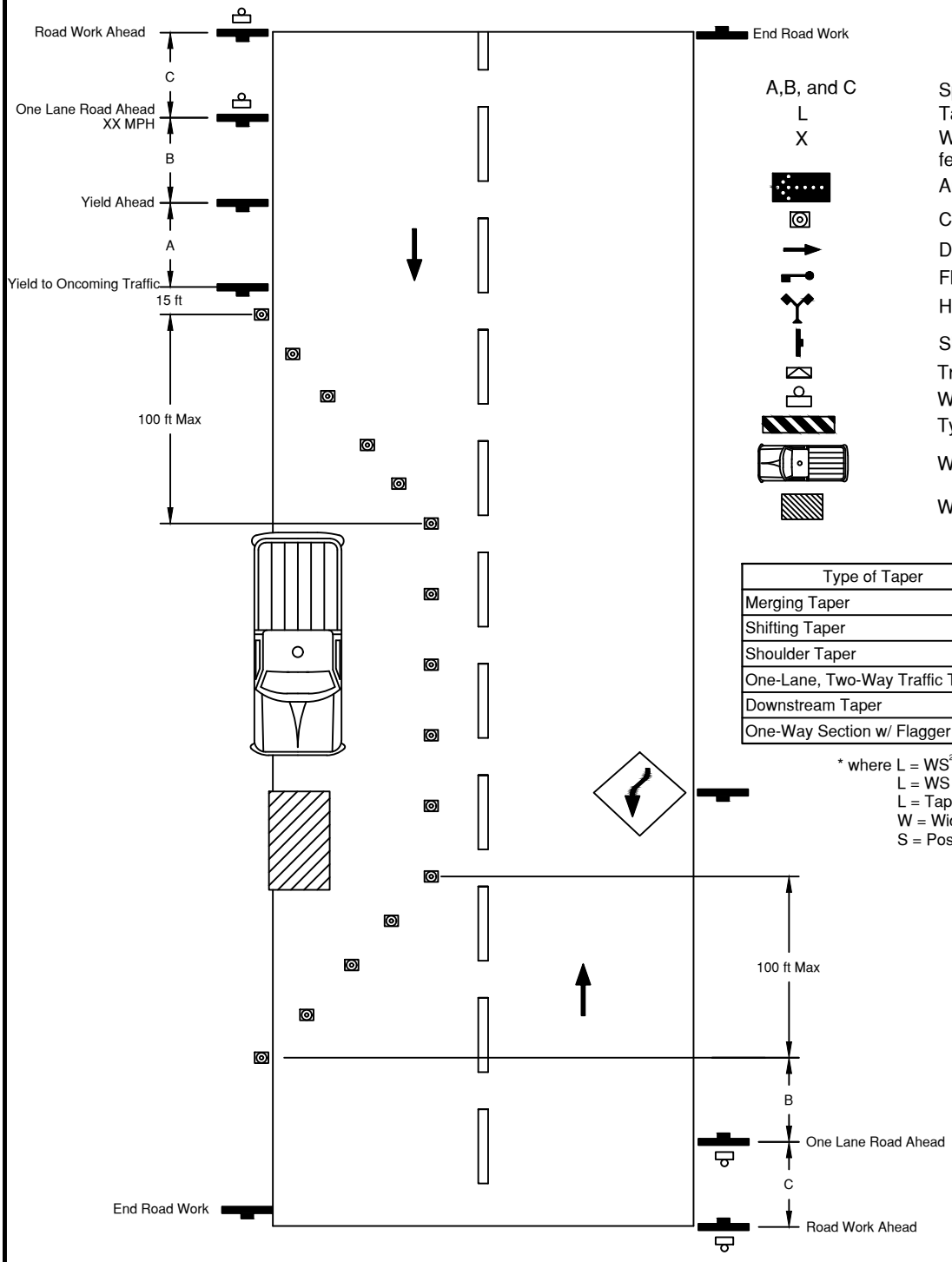
LANE CLOSURE USING FLAGGERS (LOW-VOLUME TWO-LANE ROAD)

DATE: MAY 2009

DRAWING NO. 01510–04

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

NOTES

1. See MUTCD TA-11 for additional guidance.
2. This temporary traffic control may be used as an alternate plan to the lane closure with flaggers if:
   a. the volume of traffic is low enough that the yielding traffic has sufficient gaps.
   b. Drivers from both directions are able to see approaching motor vehicles through and beyond the work site.

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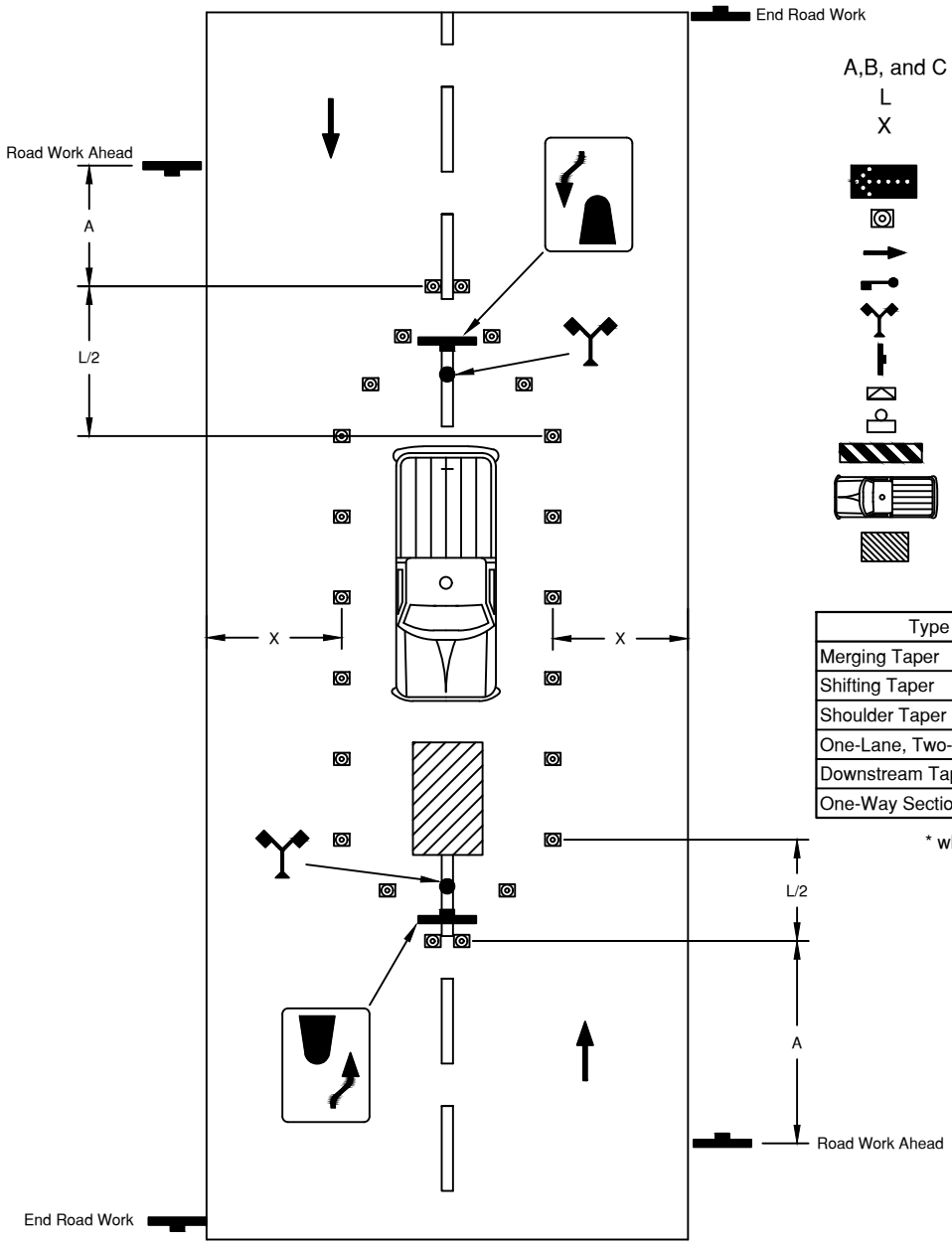
LANE CLOSURE (LOW-VOLUME TWO-LANE ROAD)

DATE: MAY 2009

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

DRAWING NO. 01510–05



Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

NOTES

1. See MUTCD TA-15 for additional guidance.

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

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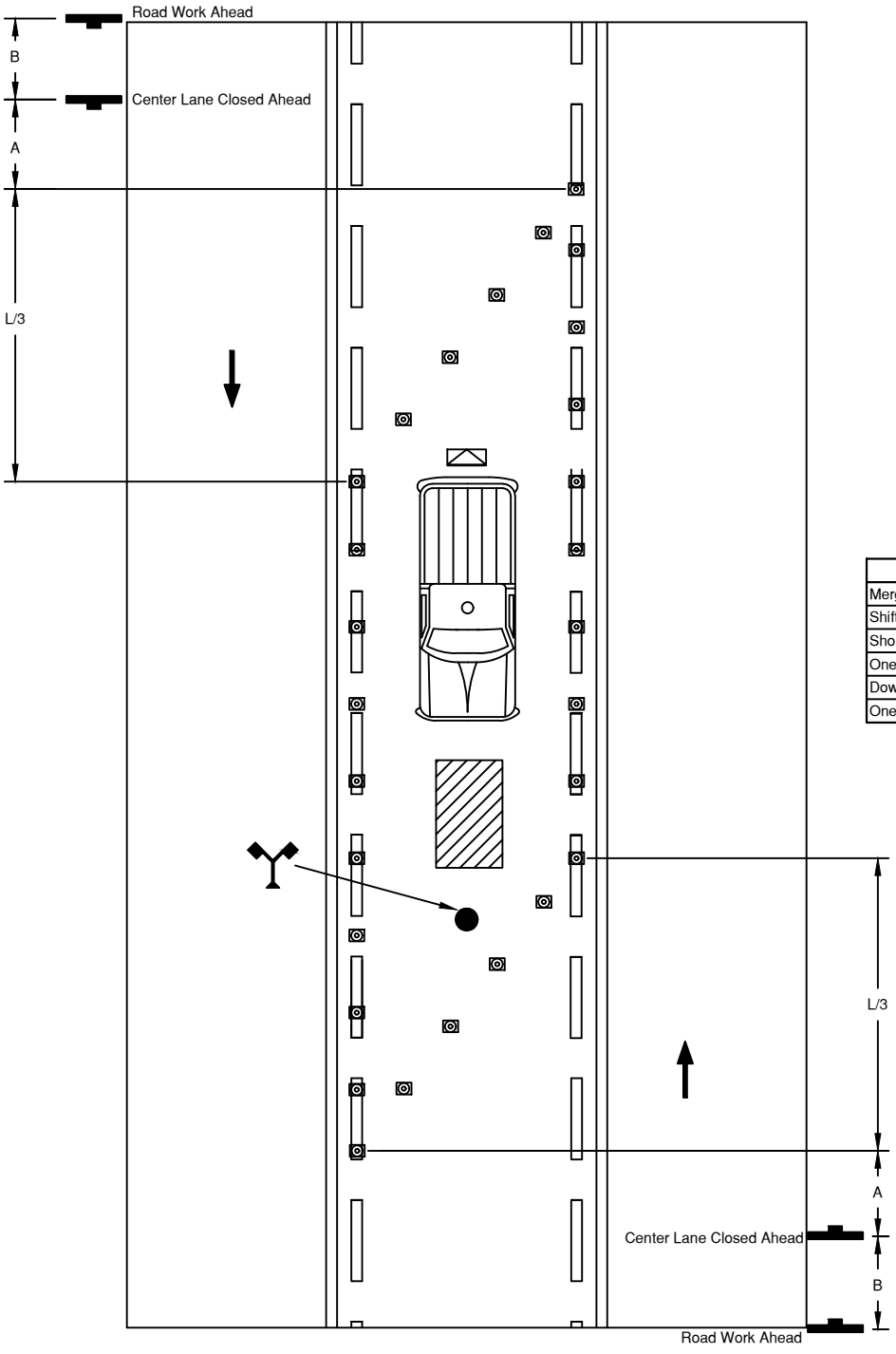
CENTER WORK (LOW-VOLUME ROAD)

DATE: MAY 2009

DRAWING NO. 01510–06

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

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LANE CLOSURE (CENTER TURN LANE)

DATE: MAY 2009

DRAWING NO. 01510–07

DRAWN BY: JAC

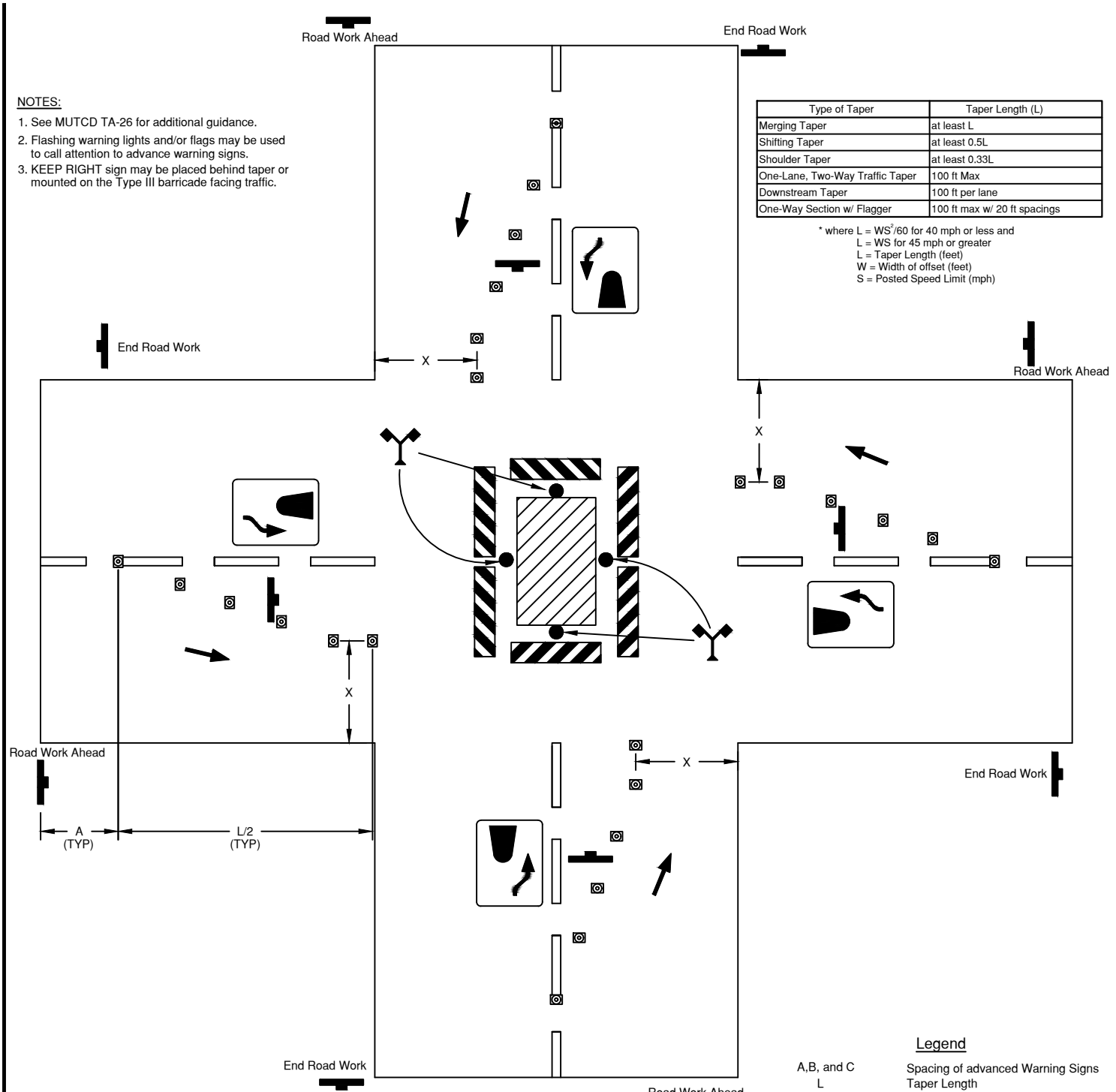
APPROVED BY: CITY ENGINEER DLH/KDS

NOTES:

1. See MUTCD TA-26 for additional guidance.
2. Flashing warning lights and/or flags may be used to call attention to advance warning signs.
3. KEEP RIGHT sign may be placed behind taper or mounted on the Type III barricade facing traffic.

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)



Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

- A,B, and C — Spacing of advanced Warning Signs
- L — Taper Length
- X — Width of Travel Way (10' min, 9' if few trucks & low volume)
- Arrow Panel
- Channelizing Device
- Direction of Traffic
- Flagger Station
- High-Level Warning Device (Flag Tree)
- Sign (Shown Facing Left)
- Truck Mounted Attenuator
- Warning Light (or Flags)
- Type III Barricade
- Work Vehicle
- Work Area

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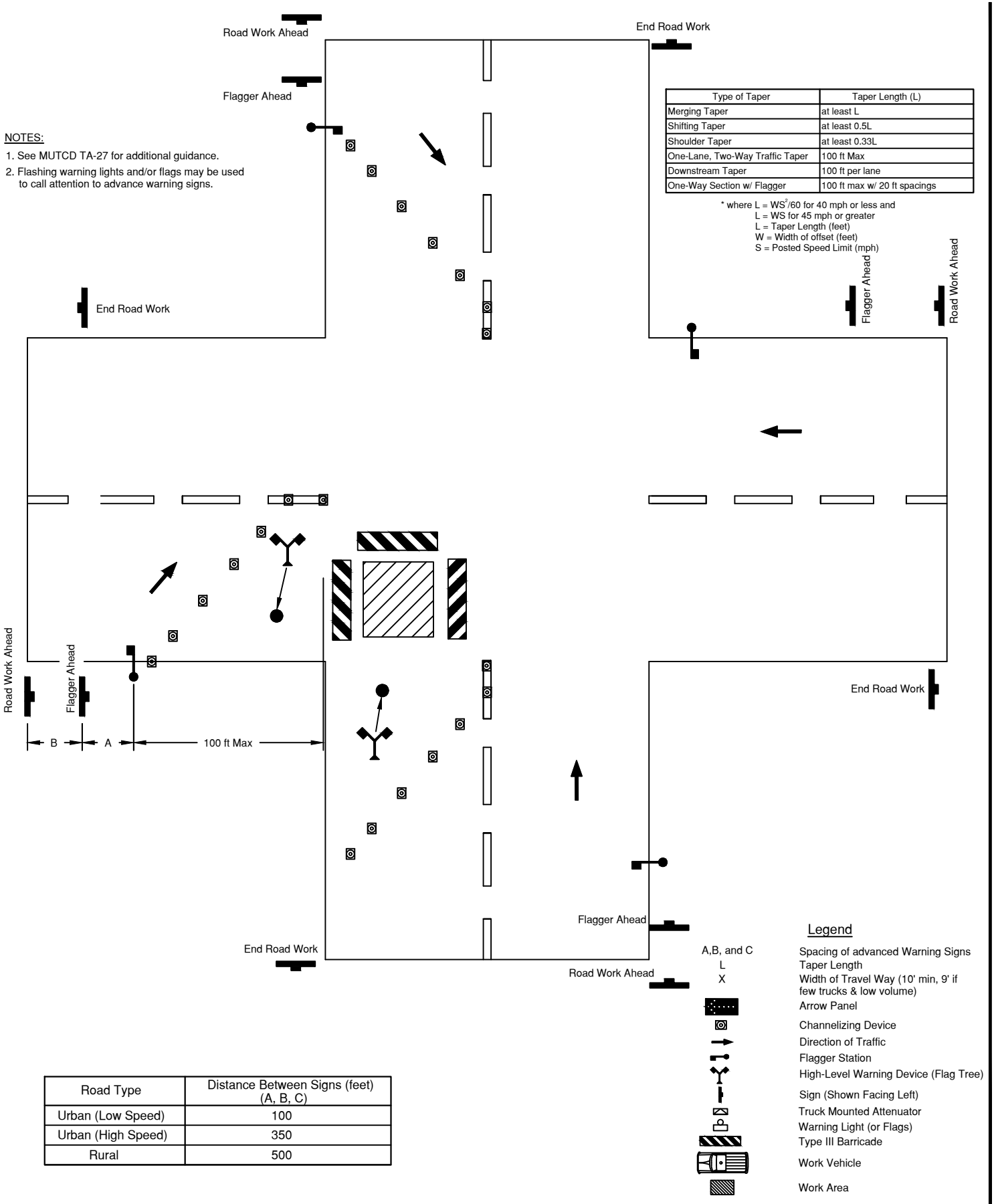
INTERSECTION CLOSURE (CENTER LOCATION)

DATE: MAY 2009

DRAWING NO. 01510–08

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



NOTES:

1. See MUTCD TA-27 for additional guidance.
2. Flashing warning lights and/or flags may be used to call attention to advance warning signs.

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

- A,B, and C — Spacing of advanced Warning Signs
- L — Taper Length
- X — Width of Travel Way (10' min, 9' if few trucks & low volume)
- Arrow Panel
- Channelizing Device
- Direction of Traffic
- Flagger Station
- High-Level Warning Device (Flag Tree)
- Sign (Shown Facing Left)
- Truck Mounted Attenuator
- Warning Light (or Flags)
- Type III Barricade
- Work Vehicle
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PHONE: (307) 686-5311

INTERSECTION CLOSURE (SIDE LOCATION)

DATE: MAY 2009

DRAWING NO. 01510–09

DRAWN BY: JAC

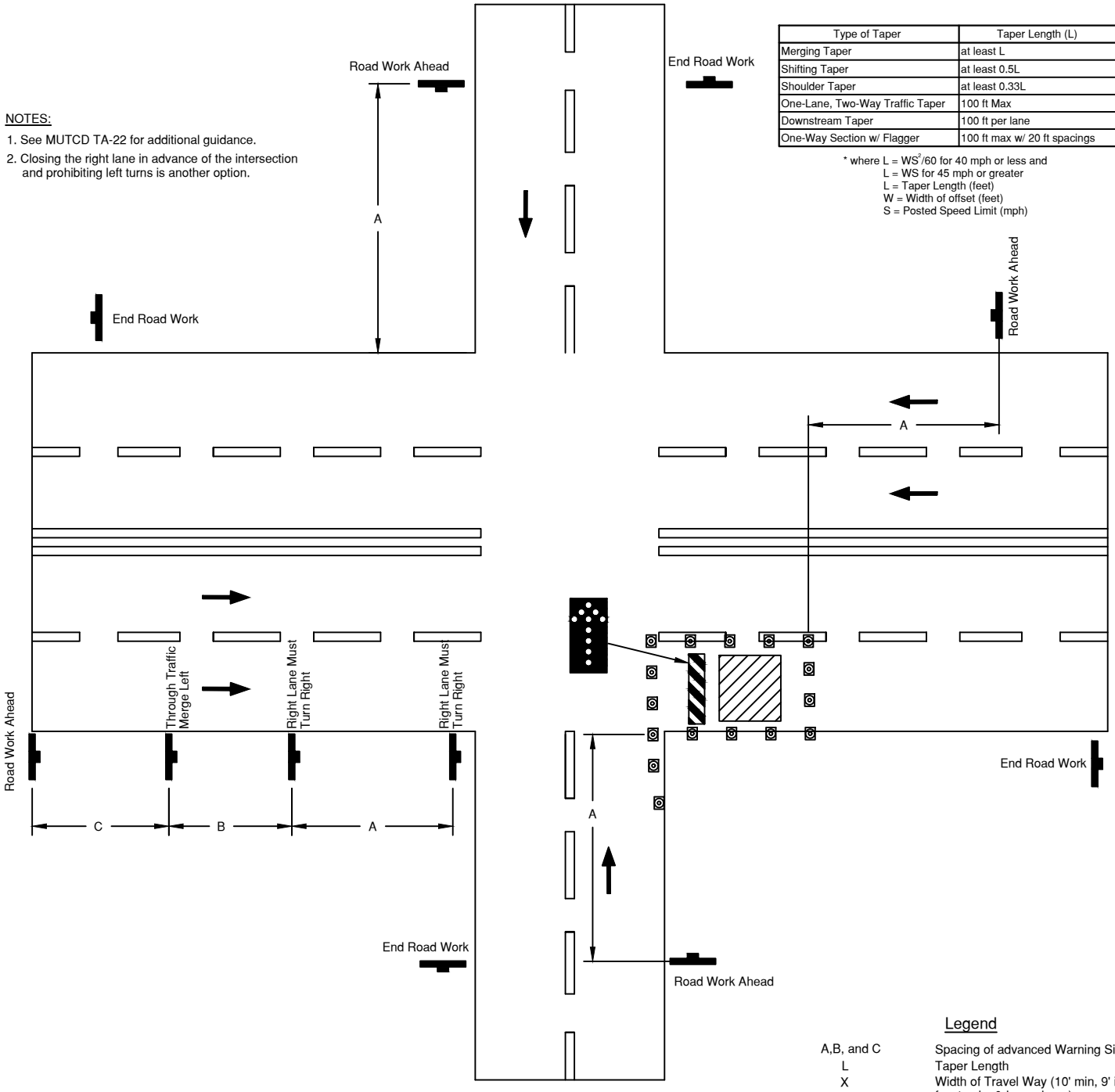
APPROVED BY: CITY ENGINEER DLH/KDS

NOTES:

1. See MUTCD TA-22 for additional guidance.
2. Closing the right lane in advance of the intersection and prohibiting left turns is another option.

Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)



Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

City Of Gillette
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GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

INTERSECTION CLOSURE (FAR SIDE, RIGHT LANE)

DATE: MAY 2009

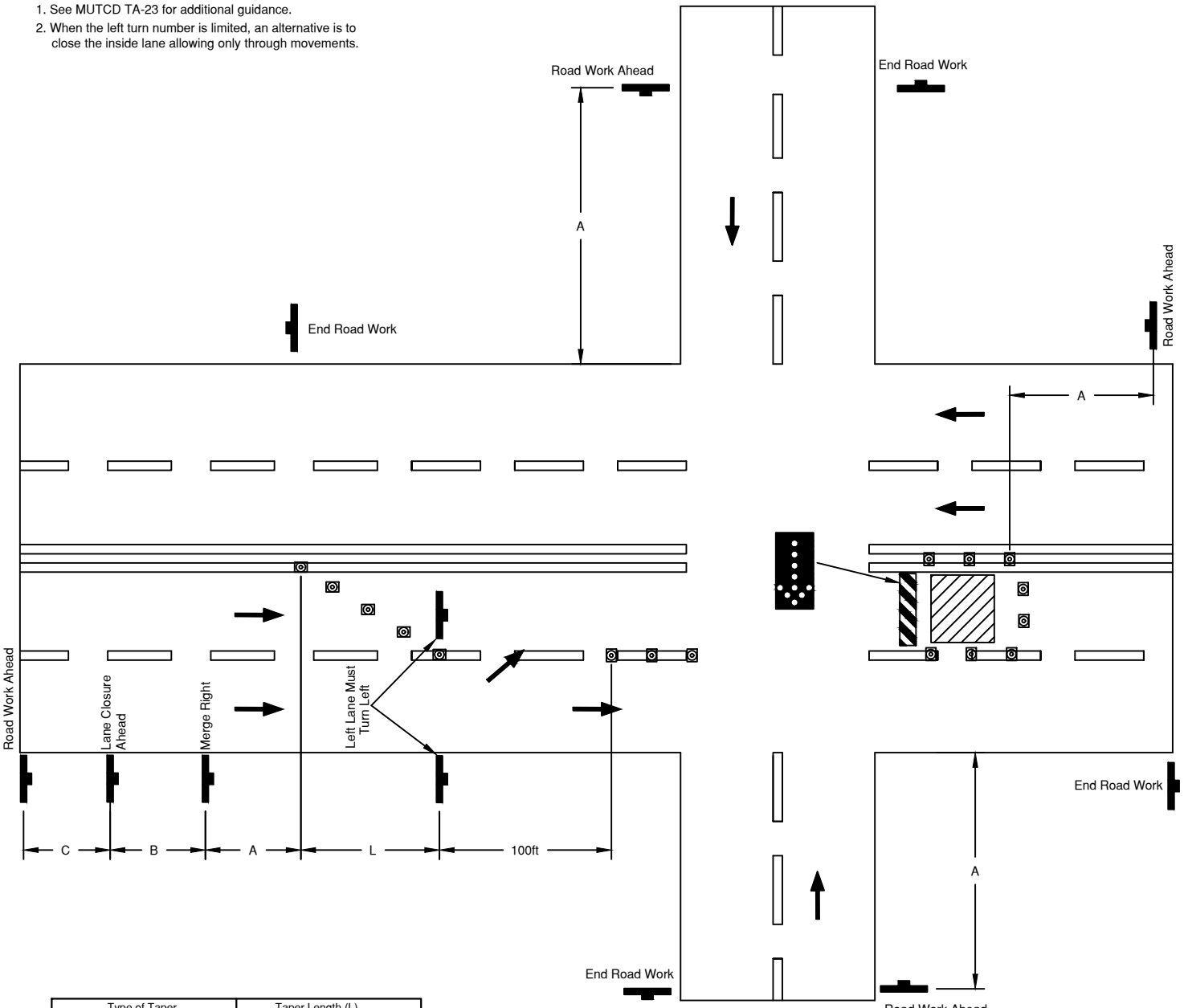
DRAWING NO. 01510–10

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

NOTES:

1. See MUTCD TA-23 for additional guidance.
2. When the left turn number is limited, an alternative is to close the inside lane allowing only through movements.



Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
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INTERSECTION CLOSURE (FAR SIDE, LEFT LANE)

DRAWN BY: JAC

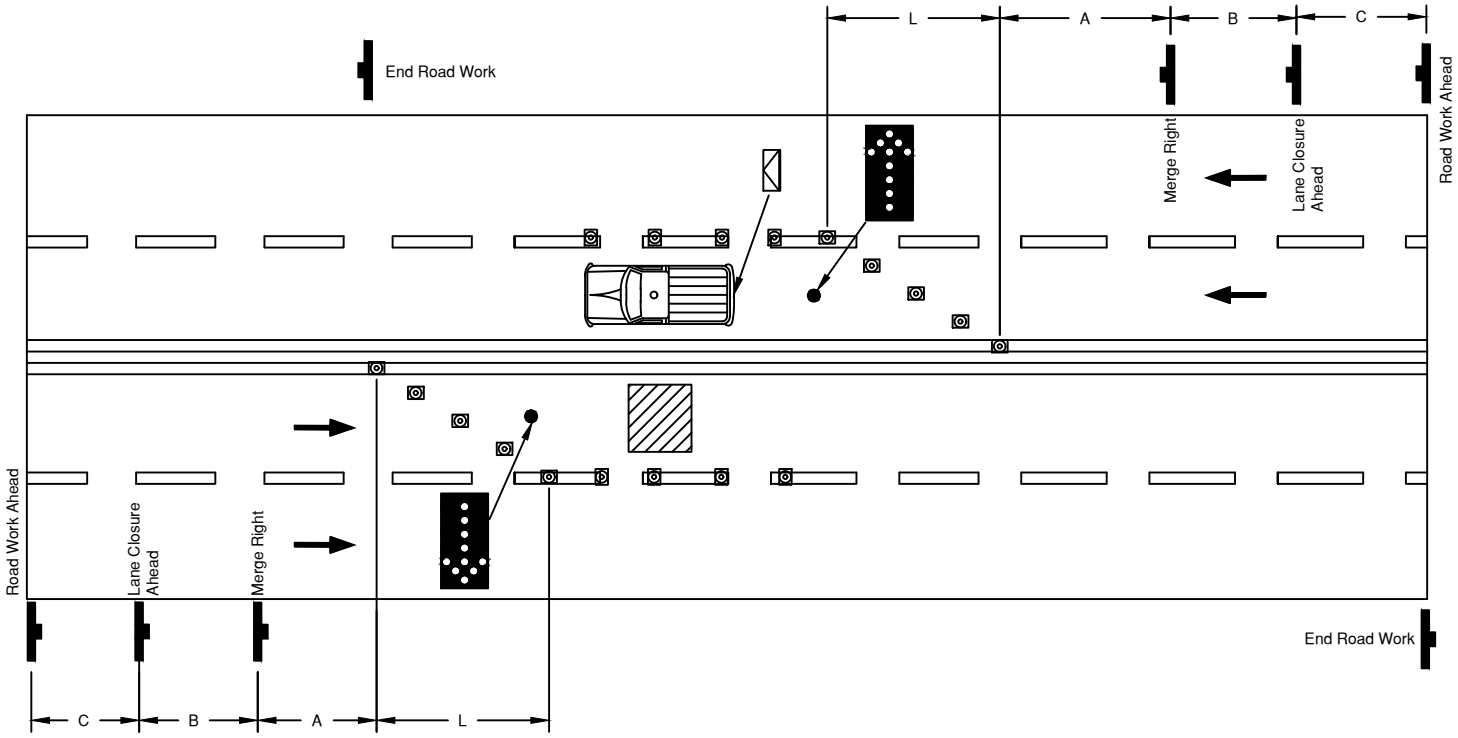
APPROVED BY: CITY ENGINEER DLH/KDS

DATE: MAY 2009

DRAWING NO. 01510–11

NOTES:

1. See MUTCD TA-30 for additional guidance.



Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where $L = WS^2/60$ for 40 mph or less and
$L = WS$ for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

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LANE CLOSURE (INTERIOR OF MULTI-LANE)

DATE: MAY 2009

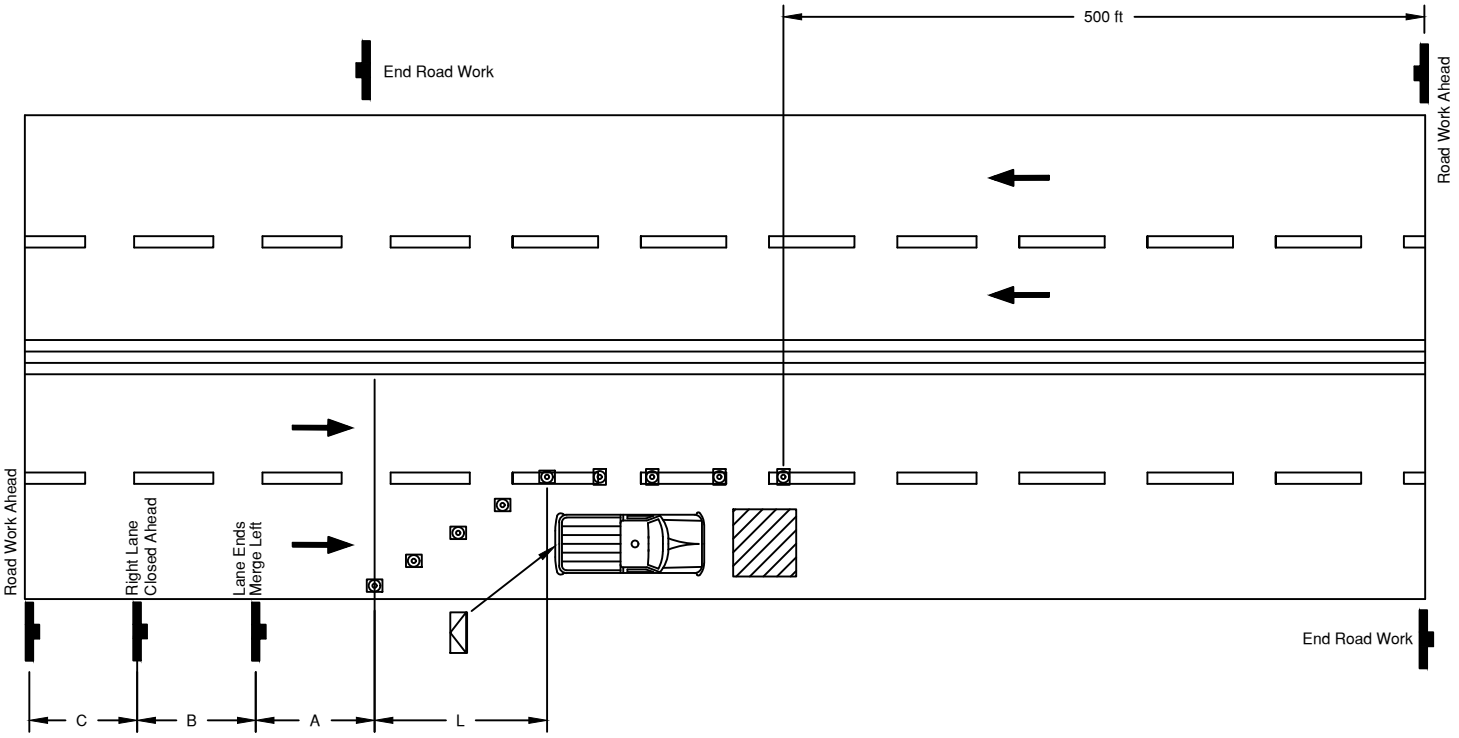
DRAWING NO. 01510–12

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

NOTES:

1. See MUTCD TA-6 for additional guidance.



Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where L = $WS^2/60$ for 40 mph or less and
L = WS for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
	Truck Mounted Attenuator
	Warning Light (or Flags)
	Type III Barricade
	Work Vehicle
	Work Area

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STATIONARY LANE CLOSURE (MULTI-LANE HIGHWAY)

DATE: MAY 2009

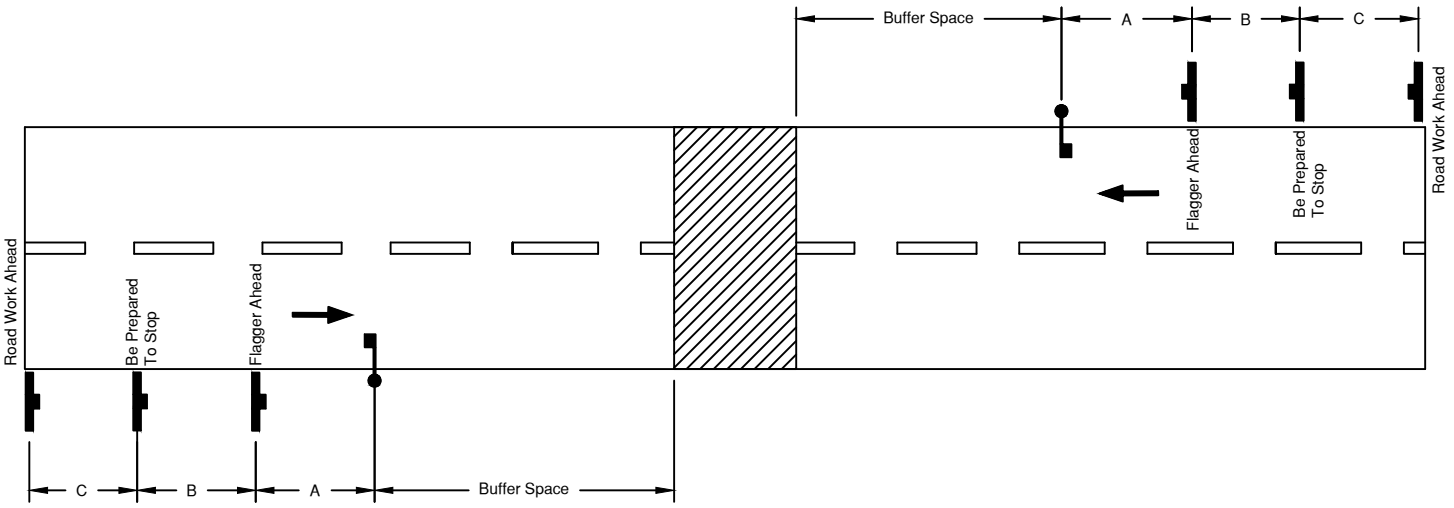
DRAWING NO. 01510–13

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

NOTES:

1. See MUTCD TA-13 for additional guidance.
2. This temporary traffic control is only used for daylight work where the closure is not more than 20 minutes.



Type of Taper	Taper Length (L)
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	100 ft Max
Downstream Taper	100 ft per lane
One-Way Section w/ Flagger	100 ft max w/ 20 ft spacings

* where L = $WS^2/60$ for 40 mph or less and
L = WS for 45 mph or greater
L = Taper Length (feet)
W = Width of offset (feet)
S = Posted Speed Limit (mph)

Road Type	Distance Between Signs (feet) (A, B, C)
Urban (Low Speed)	100
Urban (High Speed)	350
Rural	500

Legend

A,B, and C	Spacing of advanced Warning Signs
L	Taper Length
X	Width of Travel Way (10' min, 9' if few trucks & low volume)
	Arrow Panel
	Channelizing Device
	Direction of Traffic
	Flagger Station
	High-Level Warning Device (Flag Tree)
	Sign (Shown Facing Left)
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	Warning Light (or Flags)
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	Work Vehicle
	Work Area

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ROAD CLOSURE (TEMPORARY)

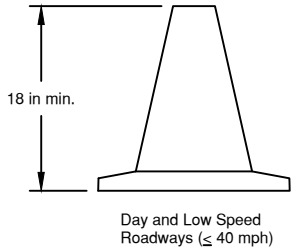
DATE: MAY 2009

DRAWING NO. 01510–14

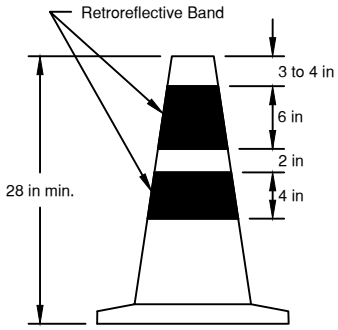
DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

CONES

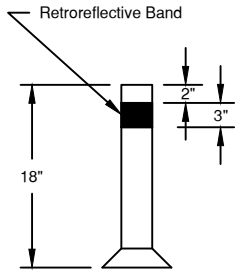


Day and Low Speed
Roadways (≤ 40 mph)

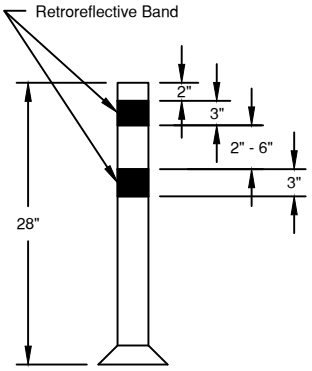


Night and /or Freeway
High Speed Roadways
(> 45 mph)

TUBULAR MARKERS

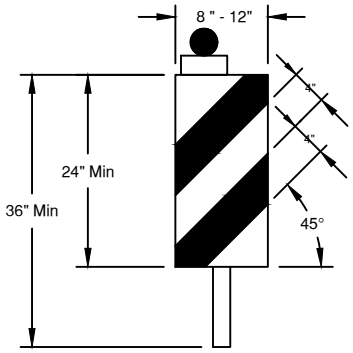


Day and Low Speed
Roadways (≤ 40 mph)

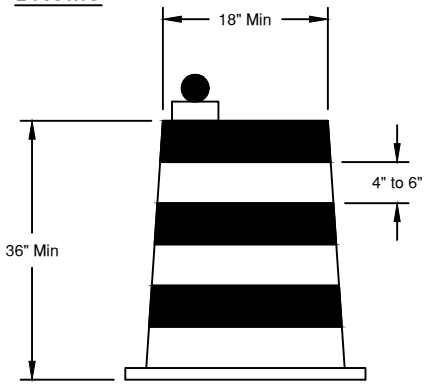


Night and /or Freeway
High Speed Roadways
(> 45 mph)

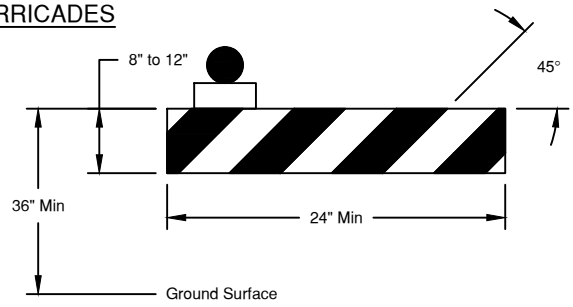
VERTICAL PANELS



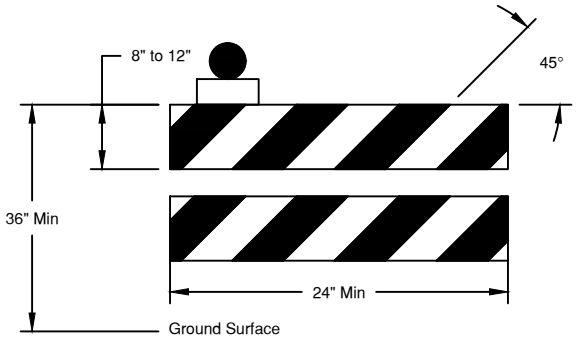
DRUMS



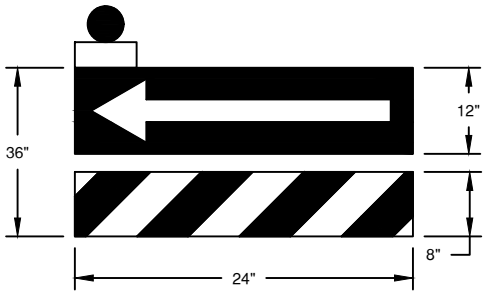
BARRICADES



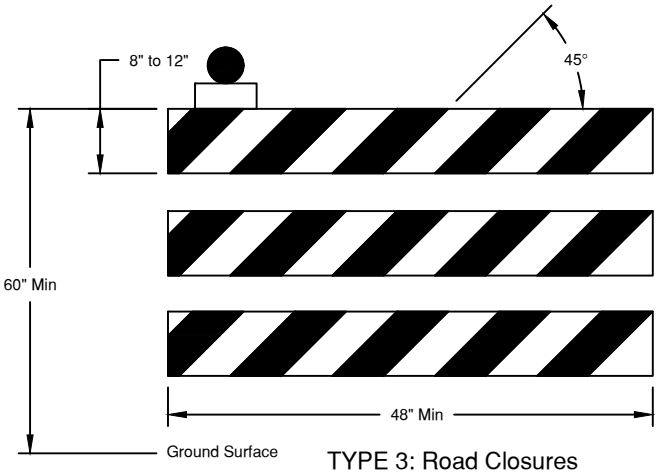
TYPE 1: Low Speed Roads



TYPE 2: Higher Speed Roads



Direction Indicater



TYPE 3: Road Closures

NOTE:
THESE EXHIBITS ARE FOR GENERAL INFORMATION ONLY. ALL TRAFFIC CONTROL COMPONENTS SHALL BE DESIGNED ACCORDING TO THE LATEST EDITION OF THE MUTCD.

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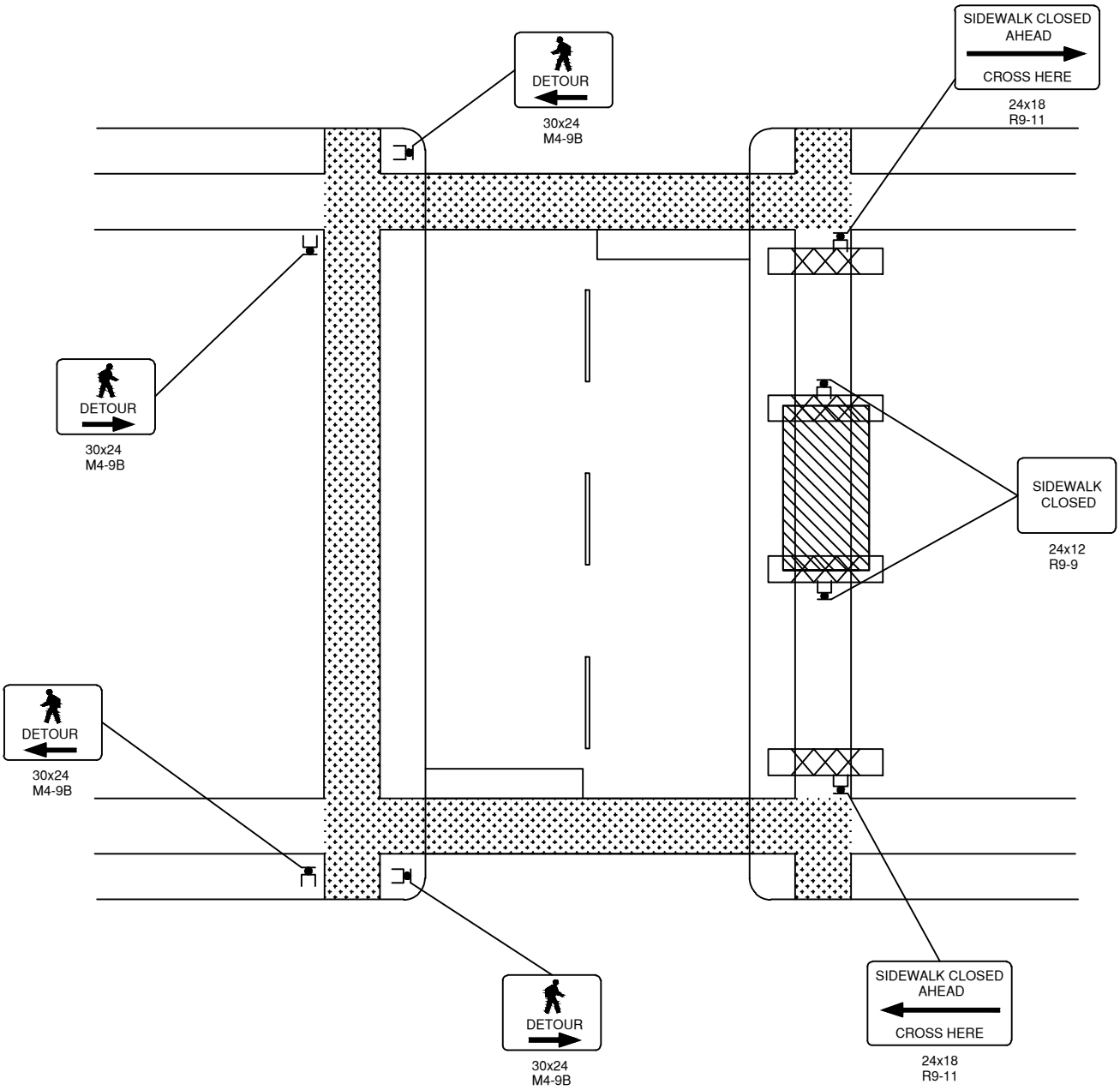
CHANNELIZING DEVICES

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS

DATE: JULY 2012

DRAWING NO. 01510-15



Legend

- PORTABLE BARRIER RAIL
- PEDESTRIAN TRAFFIC
- UNDER CONSTRUCTION

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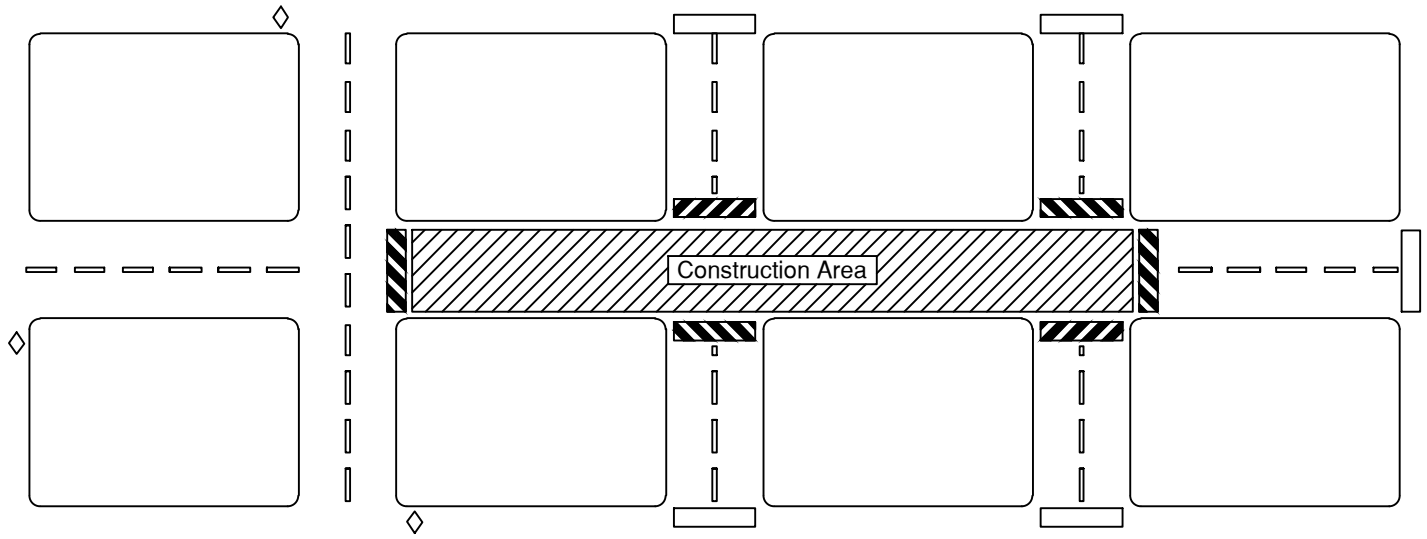
SIDEWALK CLOSURE

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

DATE: SEPT 2020

DRAWING NO. 01510-16



Legend

Type III Barricade
Road Closed

Type III Barricade
Road Closed to
Thru Traffic

Road Work Ahead

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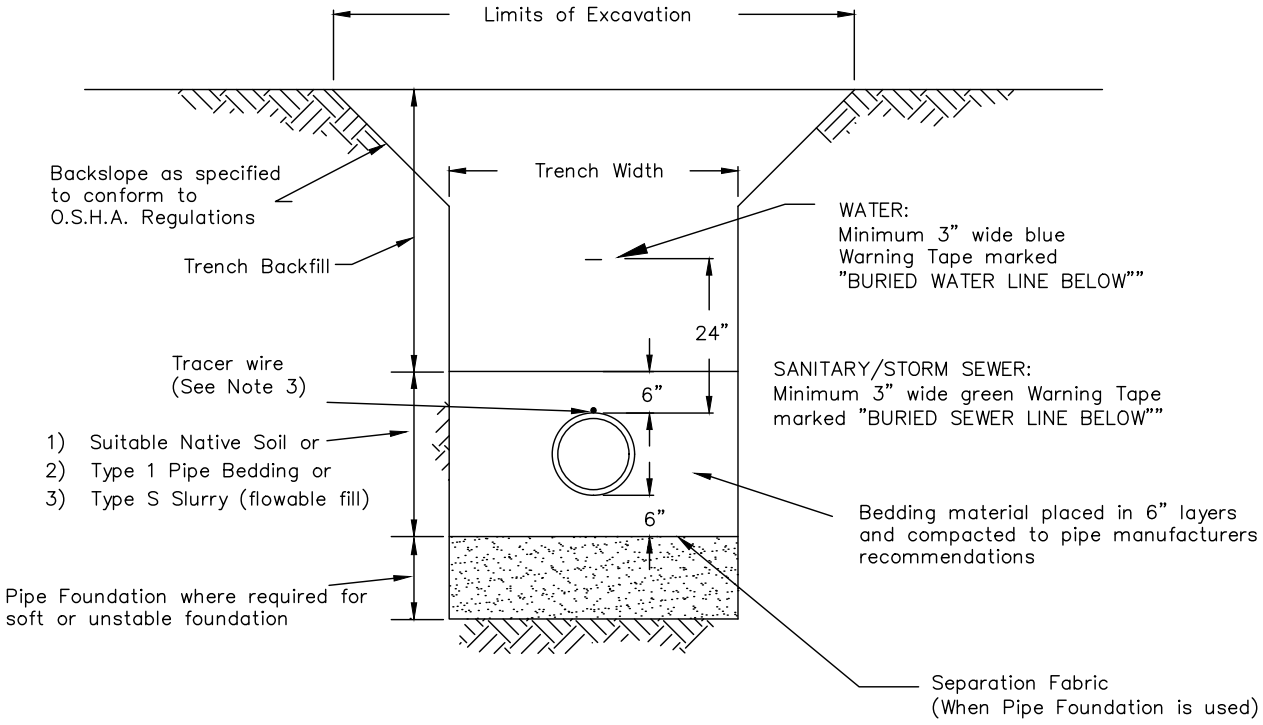
FULL-BLOCK CLOSURE

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS

DATE: SEPT 2020

DRAWING NO. 01510-17



NOTES:

1. Comply with Specification Section 02220 and 02225 for trench excavation & backfill.

2. Tracer wire and/or warning tape will be provided as shown on the plans and/or where applicable.

3. Tracer wire is required on all water lines and may be required on sanitary and storm sewer lines on a case by case basis or as specified on the plans.Wire type shall be as specified in Section 02665.

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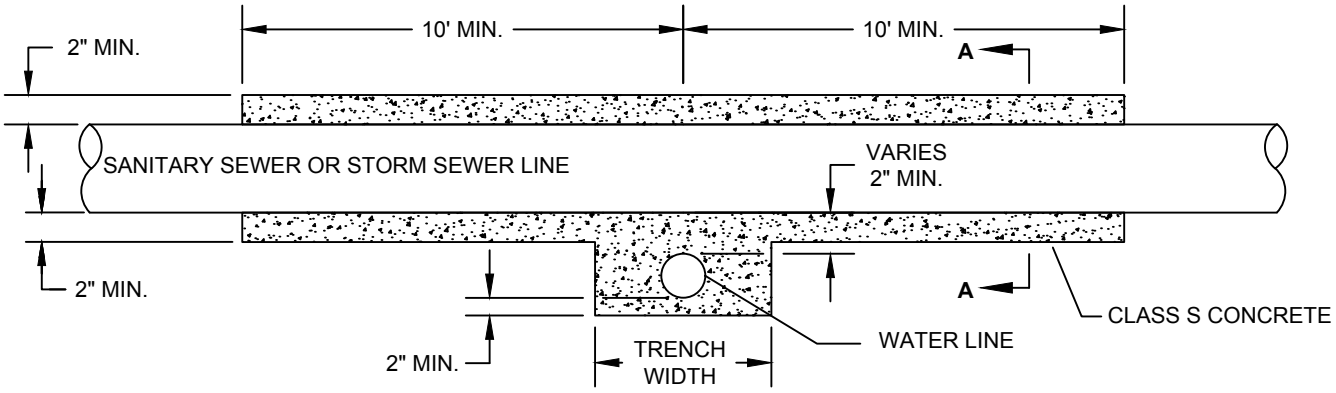
WATER/SANITARY SEWER/STORM SEWER TRENCH & BEDDING

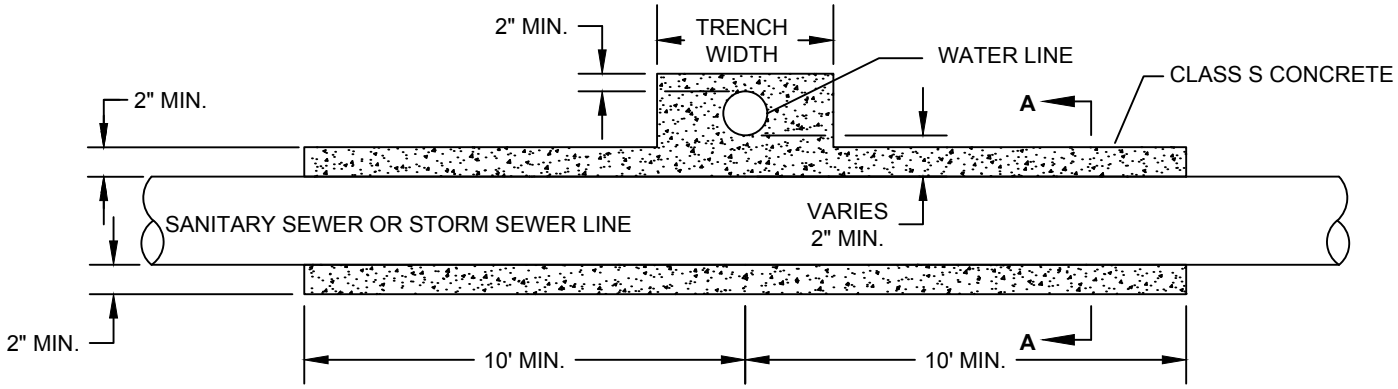
DRAWN BY: KEB

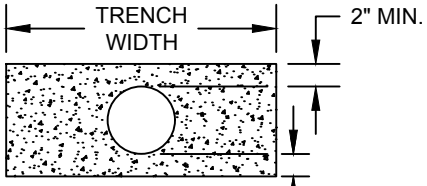
APPROVED BY: CITY ENGINEER HV/KDS

DATE: MAY 2017

DRAWING NO. 02220-01







SECTION A-A

City Of Gillette
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CEMENT TREATED FILL PIPE SADDLE

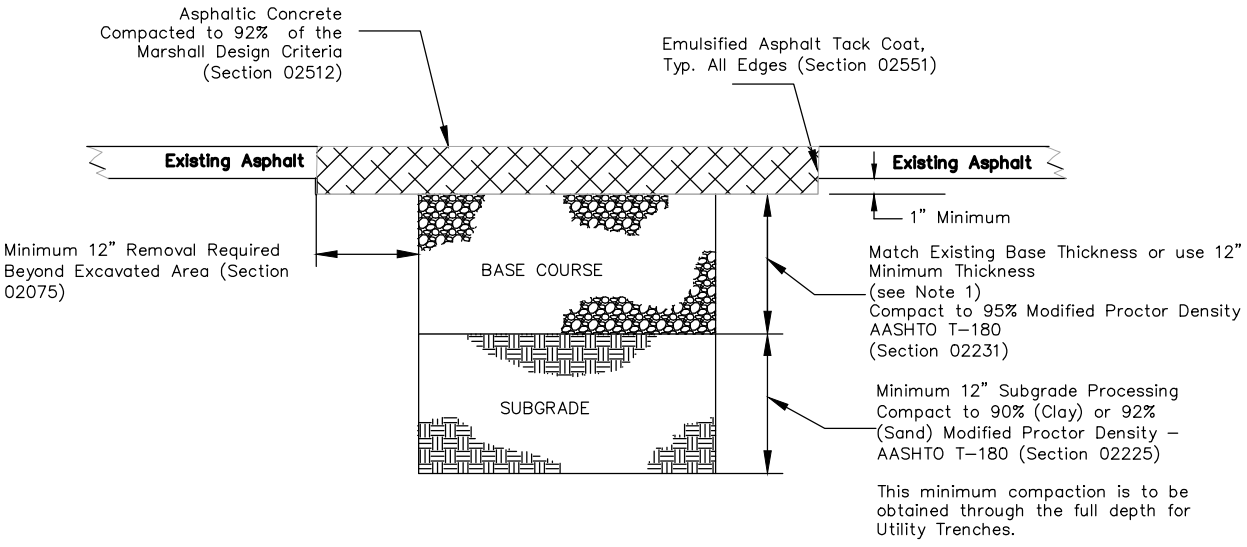
DRAWN BY: SLP

APPROVED BY: CITY ENGINEER DLH/KDS

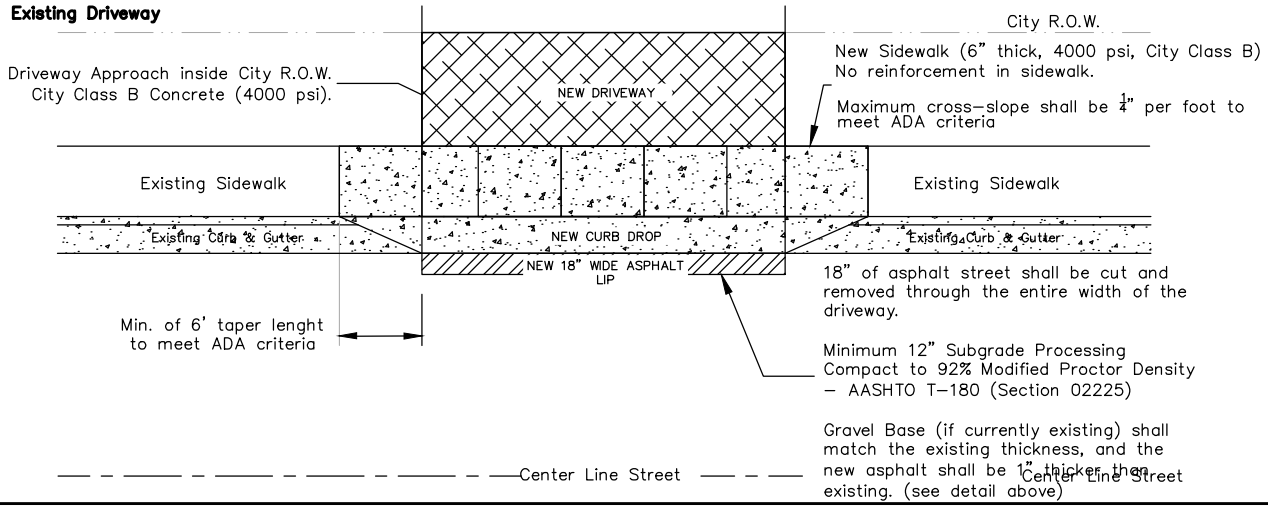
DATE: JANUARY 2009

DRAWING NO. 02225–01

PAVEMENT REPAIR AND TRENCH BACKFILL DETAIL



DRIVEWAY/CURB & GUTTER REPLACEMENT DETAIL



NOTES:

1. For pavement failure areasa minimum of 12" of base course shall be used. Alternatively, in areas where no failures have occurred (i.e. "Cut Permit" patch over new water or sewer service), the same depth of base course as existing can be used.
2. All repair areas shall be cut in a square or rectangular shape. Irregular shapes are not allowed.
3. All Section numbers referenced correspond with the current City of Gillette Standard Construction Specifications.
4. Compaction requirements on concrete street repairs shall be the same as asphalt streets.
5. When the saw cut on a concrete street repair is within 10' of the joint, the concrete shall be removed to the joint.
6. All joints on concrete street repairs shall be resealed.
7. The thickness of a Portland Cement Concrete Pavement (PCCP) patch shall match the existing PCCP pavement thickness.

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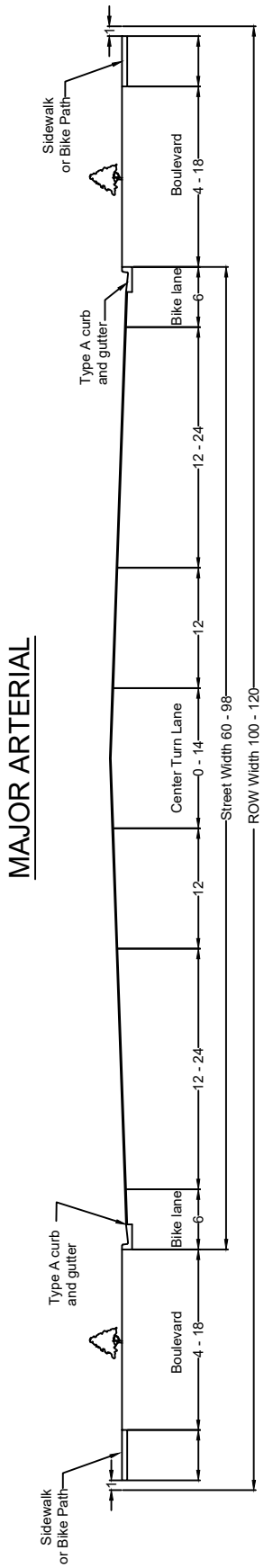
TYPICAL STREET REPAIR

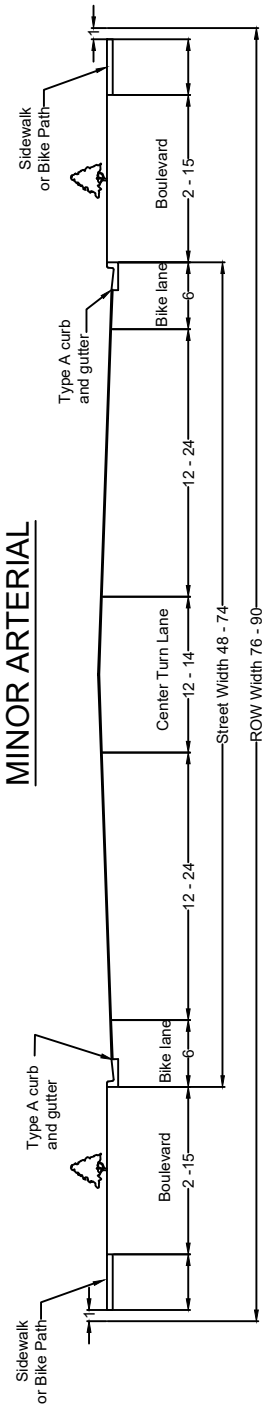
DATE: MAY 2017

DRAWING NO. 02511-01

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER JTB





City Of Gillette
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TYPICAL ARTERIAL STREET CROSS SECTION

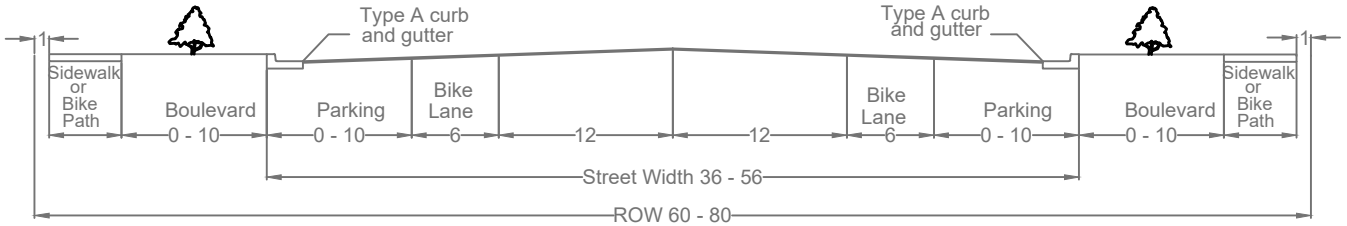
DRAWN BY: CS

APPROVED BY: CITY ENGINEER JS

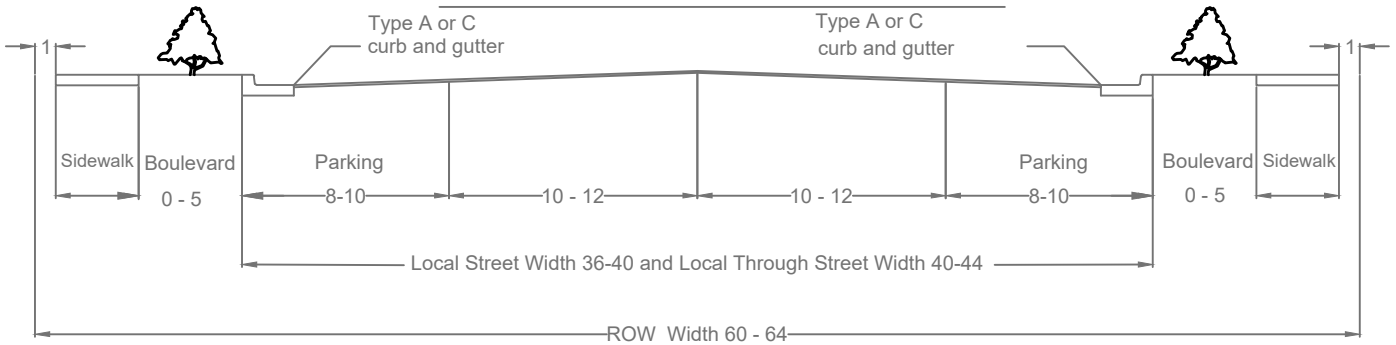
DATE: OCT 2025

DRAWING NO. 02512–01

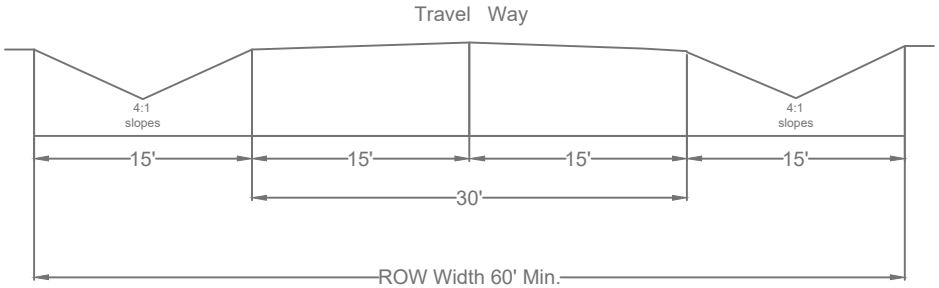
COLLECTOR



LOCAL OR LOCAL THROUGH



Local Residential Street
R-S and R-R Zones*



*Local street option where streets have no, or limited, continuity and serving properties in an R-S and R-R Zone.

NOTES: 1. Sidewalks shall meet the minimum width restrictions called out in Section 504 in the current adopted City of Gillette Design Standards.

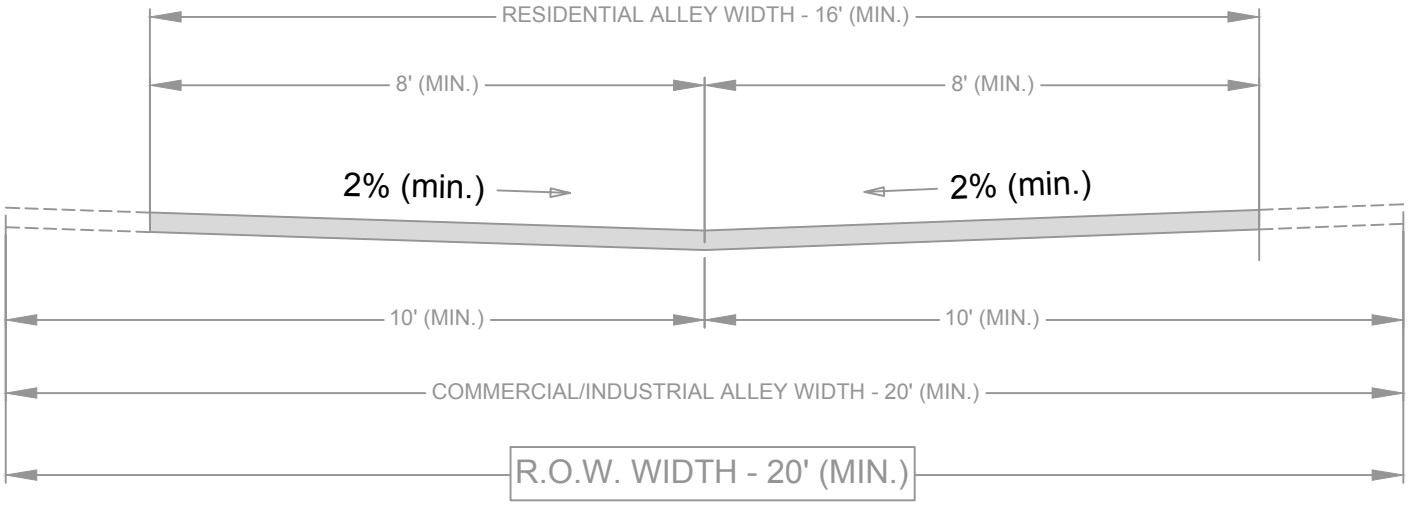
2. C & G shall be Type A in commercial/industrial areas

3. C & G shall be Type A or C in residential areas

City Of Gillette
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PHONE: (307) 686-5311

TYPICAL COLLECTOR AND LOCAL STREET SECTION	DATE: OCT 2025
	DRAWING NO. 02512–02
DRAWN BY: CS	APPROVED BY: CITY ENGINEER JS

INVERTED CROWN-STYLE ALLEY
RESIDENTIAL &
COMMERCIAL / INDUSTRIAL

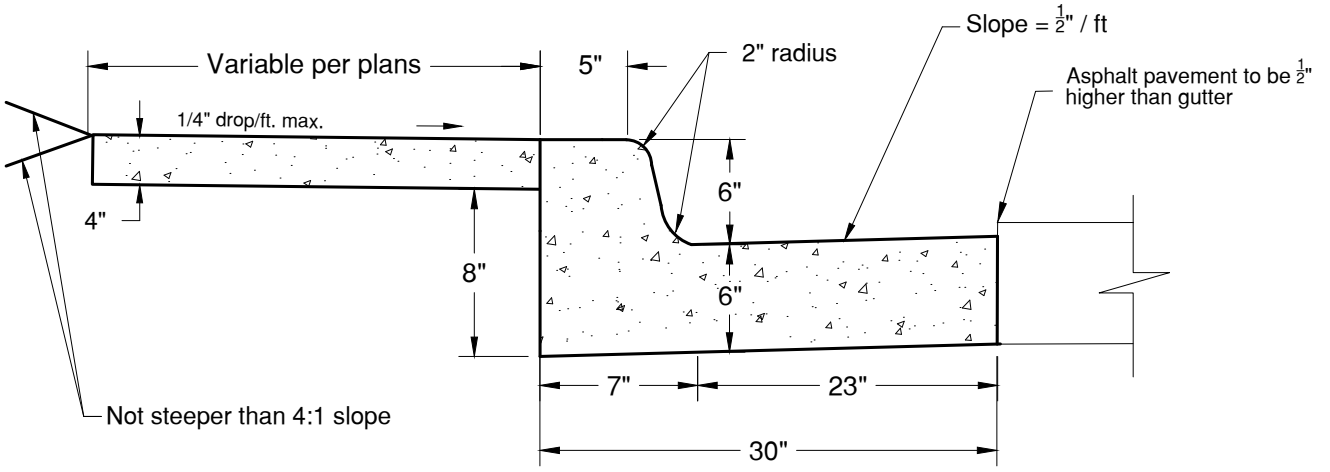


NOTE:

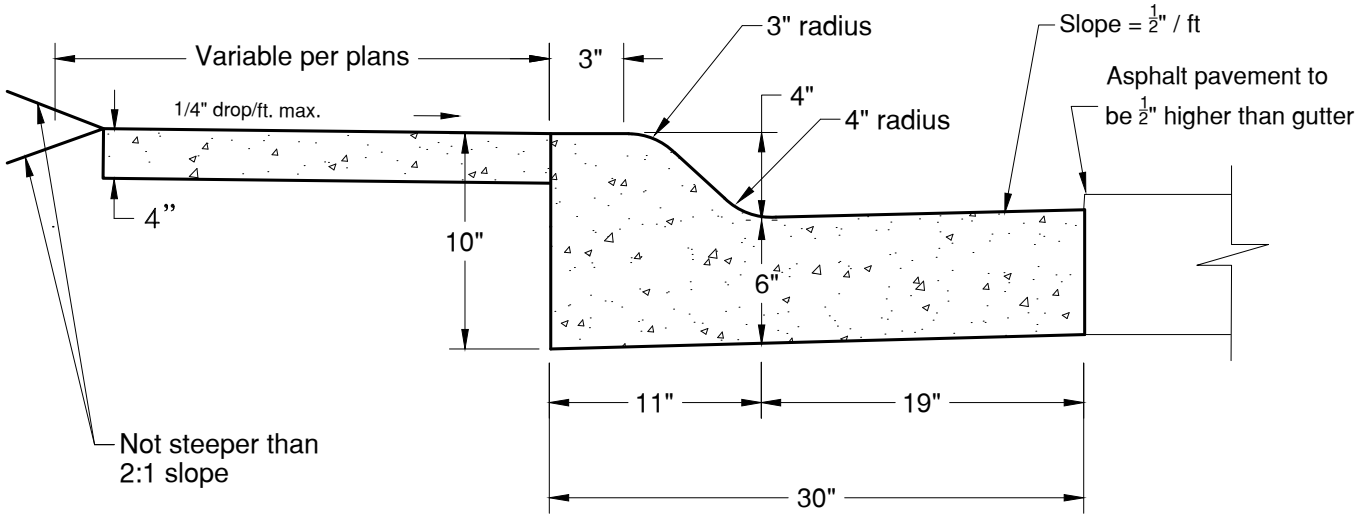
1. The invert location may be offset from the centerline if conditions warrant and with approval by the City Engineer.

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TYPICAL ALLEY SECTION	DATE: SEPTEMBER 2011
DRAWN BY: CJS / APPROVED BY: CITY ENGINEER TLW	DRAWING NO. 02512–03



TYPE "A" HIGH BACK CURB & GUTTER WITH SIDEWALK



TYPE "C" ROLLOVER CURB & GUTTER WITH SIDEWALK

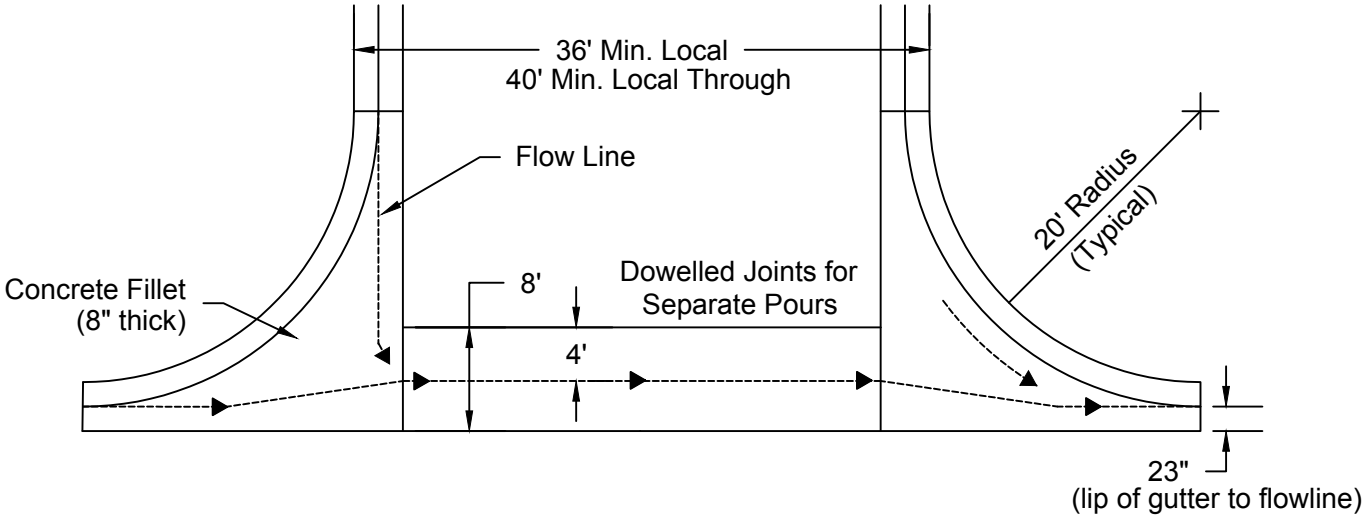
NOTES:

1. Subgrade compaction shall conform to SECTION 02528.
2. 3/4" expansion joint material shall be placed at P.C., P.T, curb returns and straight run at 150' maximum.
3. Jointing shall comply with SECTION 02528 and 03251.
4. No curb and gutter shall be placed without a final form or stringline inspection by the ENGINEER.
5. Curb and gutter shall be Class B concrete used unless otherwise specified.
6. Contraction joints shall be constructed by sawing or scoring. When scoring, a tool shall be used which will leave corners rounded and destroy aggregate interlock for specified minimum depth.
7. Detached sidewalk must be installed within 1' of the property boundary.
8. The sidewalk shall be 6" in depth through all driveway areas.

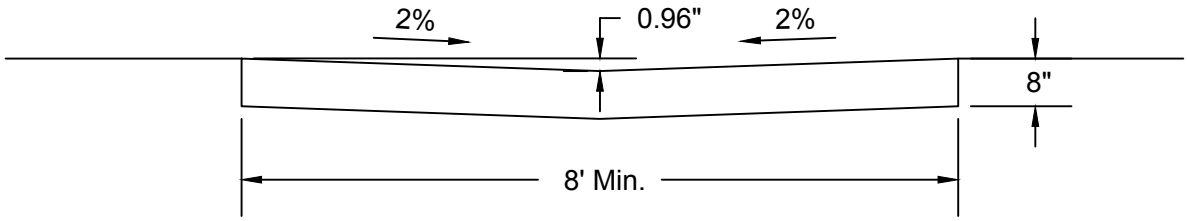
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PHONE: (307) 686-5311

TYPICAL TYPE "A" AND TYPE "C" CURB & GUTTER WITH ATTACHED SIDEWALK

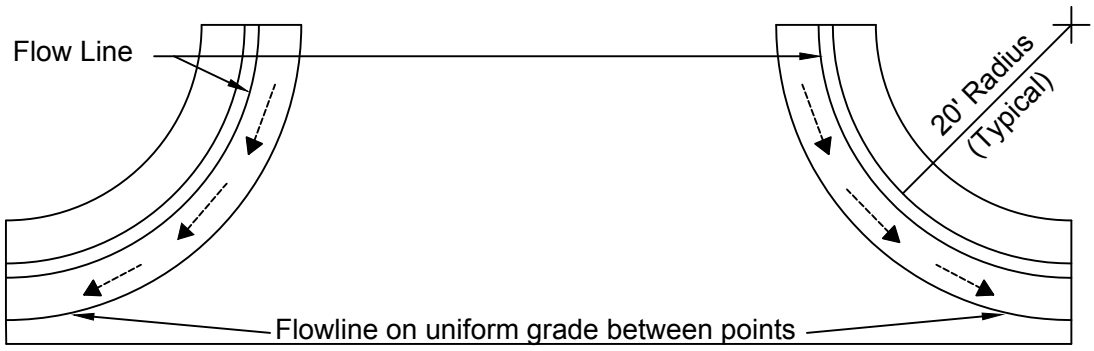
DRAWN BY: CJS	APPROVED BY: CITY ENGINEER HV/KDS	DATE: OCTOBER 2012
		DRAWING NO. 02528-01



PLAN OF CORNER WITH VALLEY GUTTER



VALLEY GUTTER DETAIL



PLAN OF CORNER WITHOUT VALLEY GUTTER

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STREET CORNER WITH / WITHOUT VALLEY GUTTER

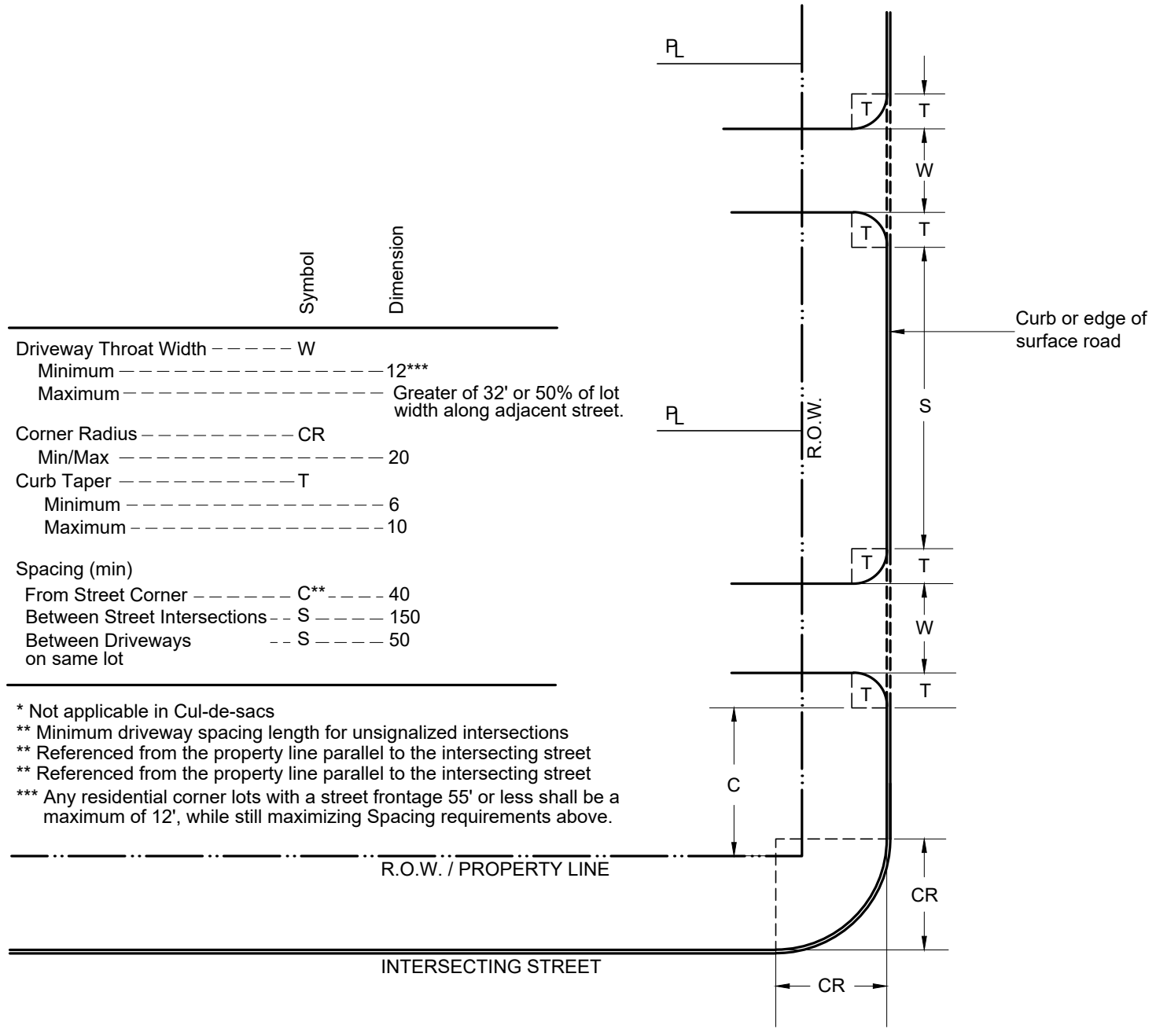
DRAWN BY: CJS	APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 02530–01

	Symbol	Dimension
Driveway Throat Width	W	
Minimum		12***
Maximum		Greater of 32' or 50% of lot width along adjacent street.
Corner Radius	CR	
Min/Max		20
Curb Taper	T	
Minimum		6
Maximum		10
Spacing (min)		
From Street Corner	C**	40
Between Street Intersections	S	150
Between Driveways on same lot	S	50

* Not applicable in Cul-de-sacs
** Minimum driveway spacing length for unsignalized intersections
** Referenced from the property line parallel to the intersecting street
** Referenced from the property line parallel to the intersecting street
*** Any residential corner lots with a street frontage 55' or less shall be a maximum of 12', while still maximizing Spacing requirements above.



NOTES:

1. Driveway spacing length from signalized intersections shall be individually determined taking into consideration signal cycle length, traffic volumes, lane tapers and vehicle stacking lengths.
2. The City Engineer may require larger driveway spacing from what is listed above if the street geometrics and traffic volumes warrant larger spacing.

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RESIDENTIAL ACCESS CONTROL AND OFFSETS

DRAWN BY: CS
APPROVED BY: CITY ENGINEER JS
DATE: APRIL 2025
DRAWING NO. 02530–02

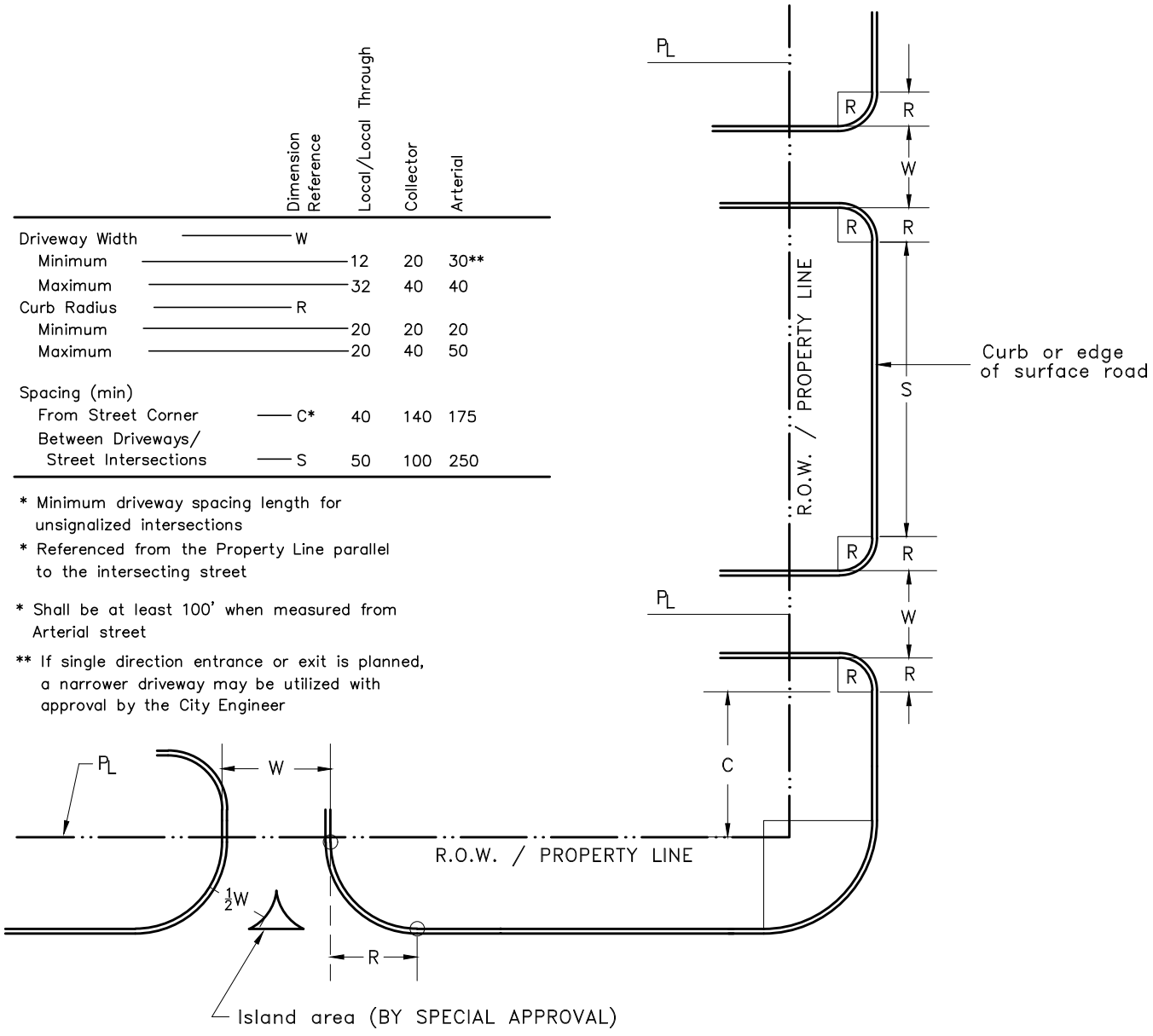
	Dimension Reference	Local/Local Through	Collector	Arterial
Driveway Width	W			
Minimum		12	20	30**
Maximum		32	40	40
Curb Radius	R			
Minimum		20	20	20
Maximum		20	40	50
Spacing (min)				
From Street Corner	C*	40	140	175
Between Driveways/ Street Intersections	S	50	100	250

* Minimum driveway spacing length for unsignalized intersections

* Referenced from the Property Line parallel to the intersecting street

* Shall be at least 100' when measured from Arterial street

** If single direction entrance or exit is planned, a narrower driveway may be utilized with approval by the City Engineer



NOTES:

1. Driveway spacing length from signalized intersections shall be individually determined taking into consideration signal cycle length, traffic volumes, lane tapers and vehicle stacking lengths.
2. The City Engineer may require larger distances from street corners or driveway spacing from what is listed above if the street geometrics, roadway classifications, or traffic volumes warrant larger spacing.

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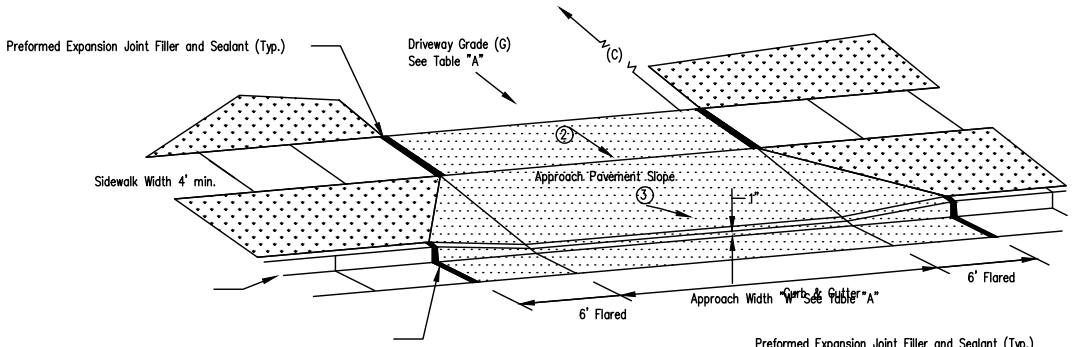
COMMERCIAL & INDUSTRIAL ACCESS CONTROL

DRAWN BY: CS

APPROVED BY: CITY ENGINEER JS

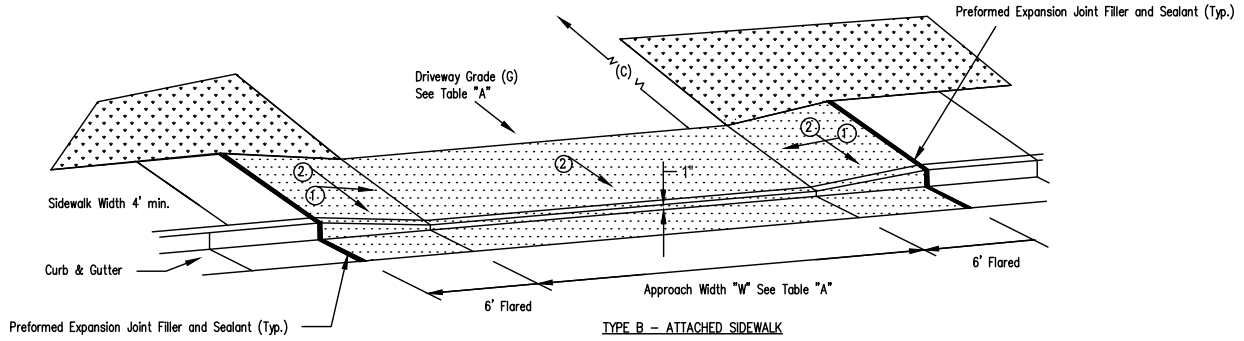
DATE: APRIL 2025

DRAWING NO. 02530–03



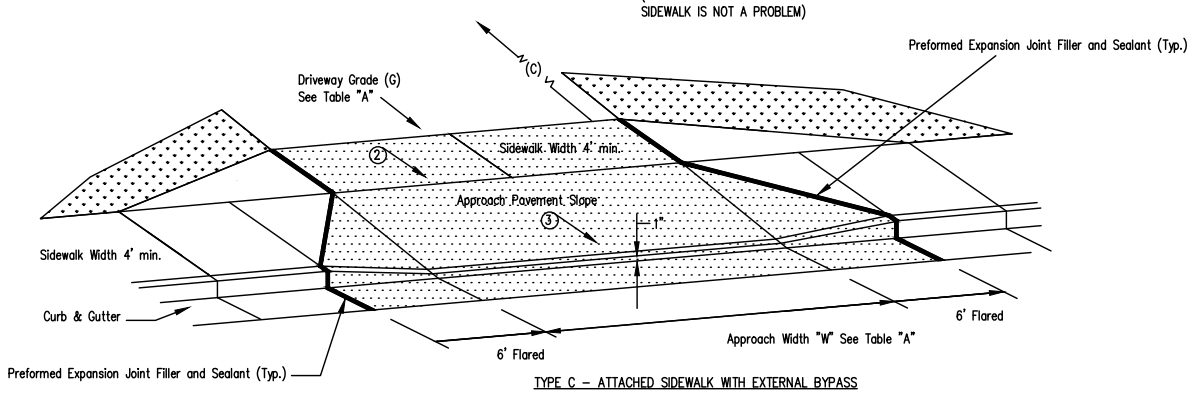
TYPE A – DETACHED SIDEWALK

(MOST DESIRABLE TREATMENT)



TYPE B – ATTACHED SIDEWALK

(CONSIDER USE ONLY WHEN DRAINAGE BEHIND SIDEWALK IS NOT A PROBLEM)



TYPE C – ATTACHED SIDEWALK WITH EXTERNAL BYPASS

(USE FOR SIDEWALK ADJACENT TO CURB WHERE RIGHT-OF-WAY PERMITS CONSTRUCTION)

GENERAL NOTES:

A. All required offstreet parking areas shall be paved. Overflow parkingmaybe gravel, base, crushed asphalt or concrete. All access shall be paved through the ROW, at minimum.
B. Refer to the standard specifications for pavement type and thickness.
C. Where site or other conditions warrant, the City Engineer may require or allow an alternate curb cut design.
D. Residential driveways are generally not allowed on collector or arterial streets.
E. The maximum cross slope for any sidewalk, including through driveways or approach pavement shall be $\frac{1}{4}$ inch/ft.
F. The driveway sidewalk shall be 6" depth through out driveway area.

GENRAL SLOPE REQUIREMENTS:

(1) RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope

(2) CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%)

(3) APPROACH PAVEMENT SLOPE: The approach pavement slope may exceed the slope required for a ramp when it is not used as a combined approach and wheelchair ramp. A by-pass must be provided around approach pavement slopes exceeding 1V:48H (2%) so pedestrians don't encounter steeper cross slopes.

TABLE "A"

Street Type	Width of Throat (W)	Maximum Driveway Grade (G)		
		Desirable	Maximum	Control Dist. (C)
Local and Local Through	12' –32'	6 %	13 %	20' min
Collector	Curb cuts by special approval only	3 %	4 %	50'
Arterial		1 %	4 %	50'

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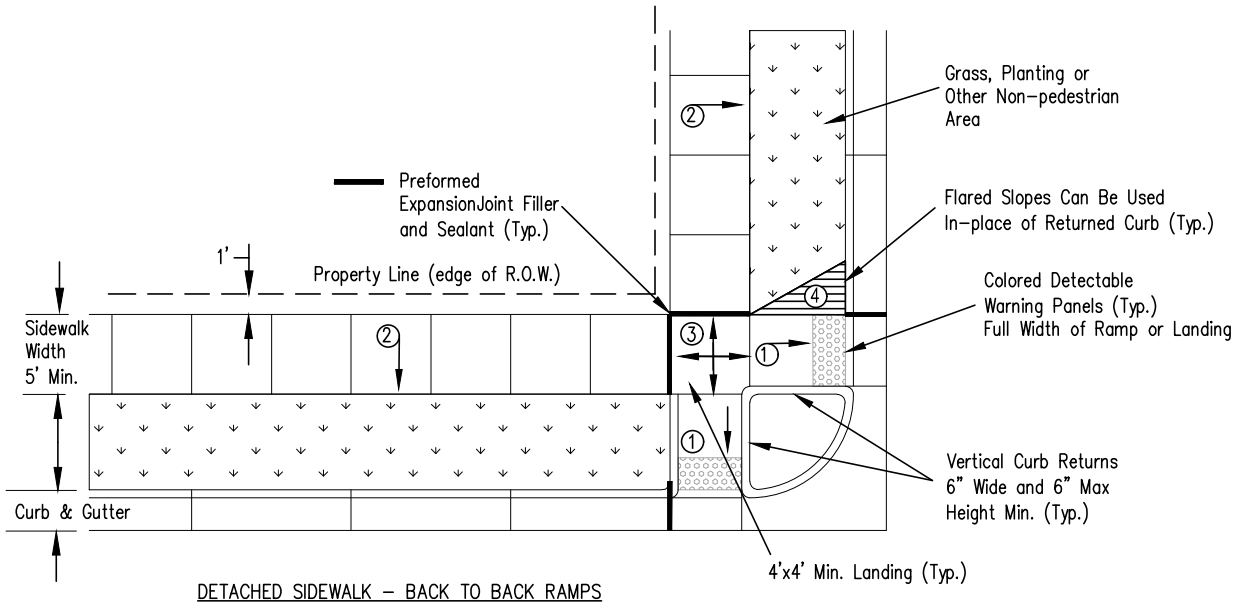
STANDARD RESIDENTIAL DRIVEWAY DETAIL

DRAWN BY: KEB

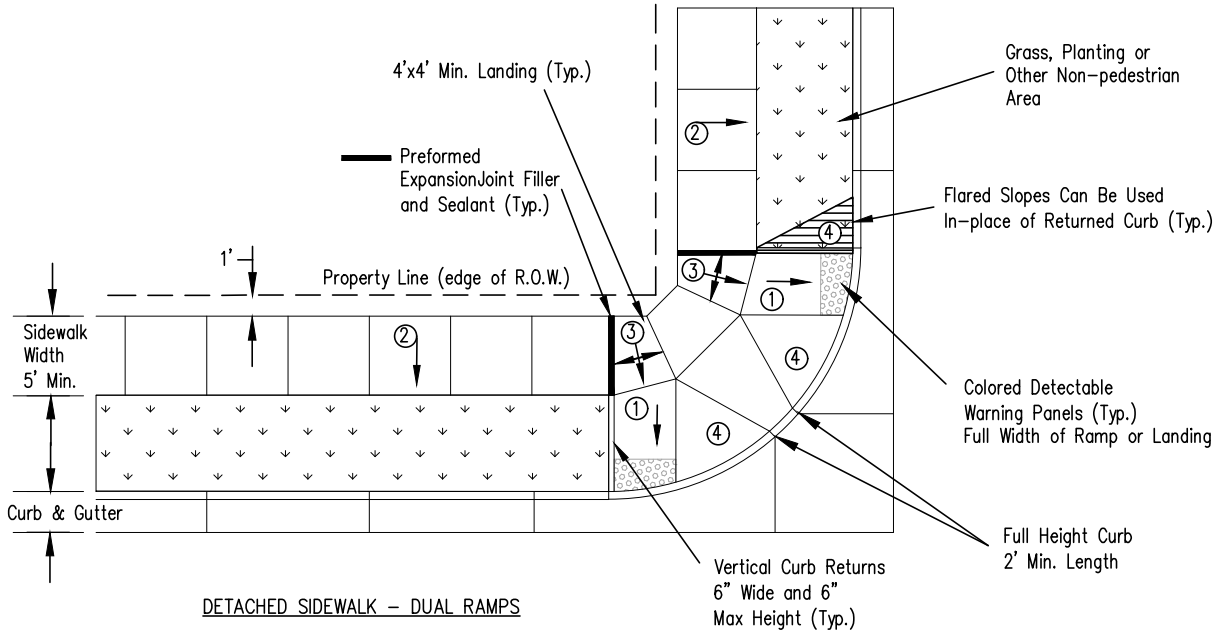
APPROVED BY: CITY ENGINEER HV/KDS

DATE: MAY 2017

DRAWING NO. 02530-04



DETACHED SIDEWALK – BACK TO BACK RAMPS



DETACHED SIDEWALK – DUAL RAMPS

GENERAL NOTES:

A. 5 foot minimum sidewalk width adjacent to Collector and Arterial Streets.
B. 4 Foot minimum for existing infrastructure where it is not feasible to construct 5 foot width. Use 5 foot x 5 foot minimum passing zones every 200 foot maximum.
C. Provide 1V:48H (2%) cross slope for sidewalks and landings for drainage. Slope towards curb and gutter unless otherwise shown.
D. Provide colored detectable warning panels at all curb ramp locations pointing in direction of pedestrian travel.

GENERAL REQUIREMENTS:

1. RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope.
2. CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%).
3. LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)
4. RAMP FLARES: Do not exceed 1V:10H (10%) flared ends.

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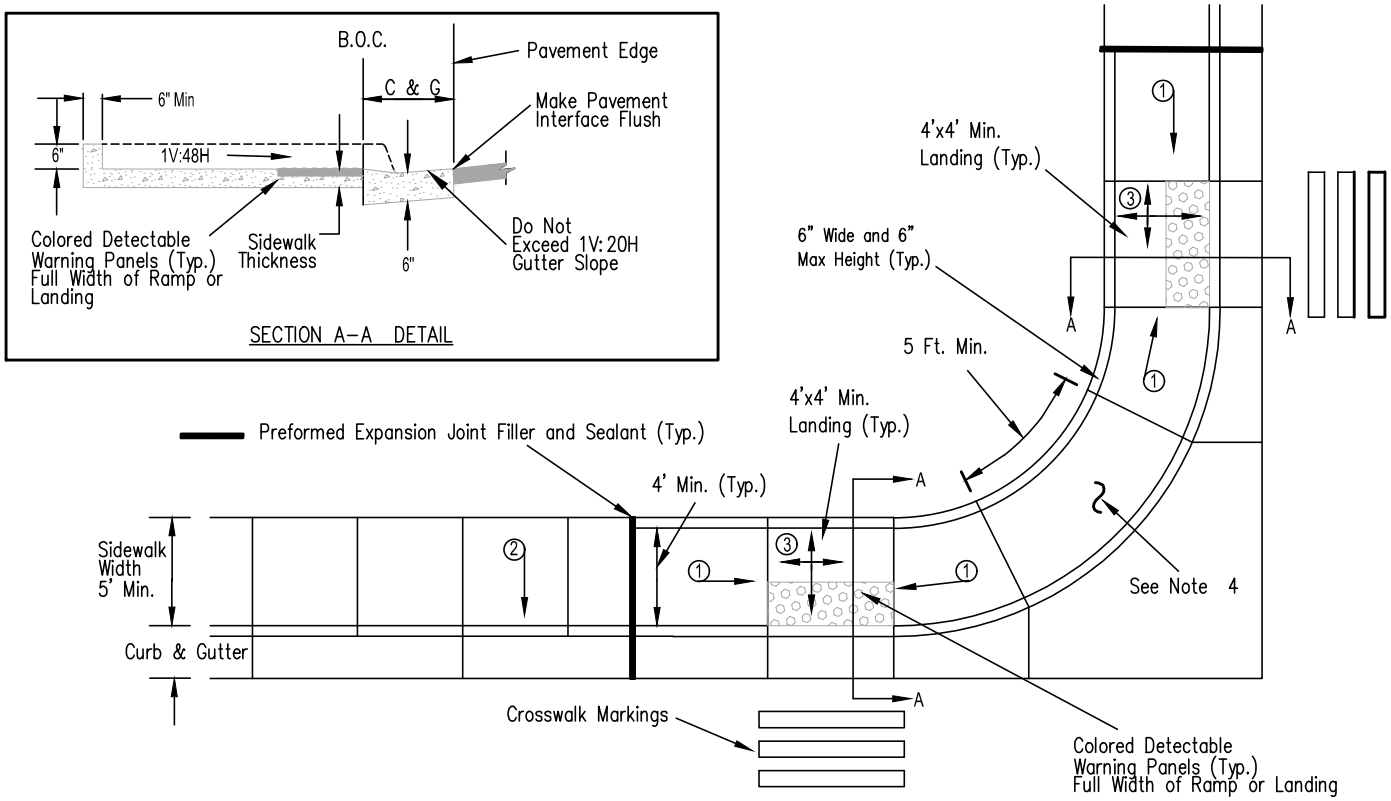
CURB RAMP
ARTERIAL AND COLLECTOR STREETS (Detached Sidewalk)

DATE: JUNE 2020

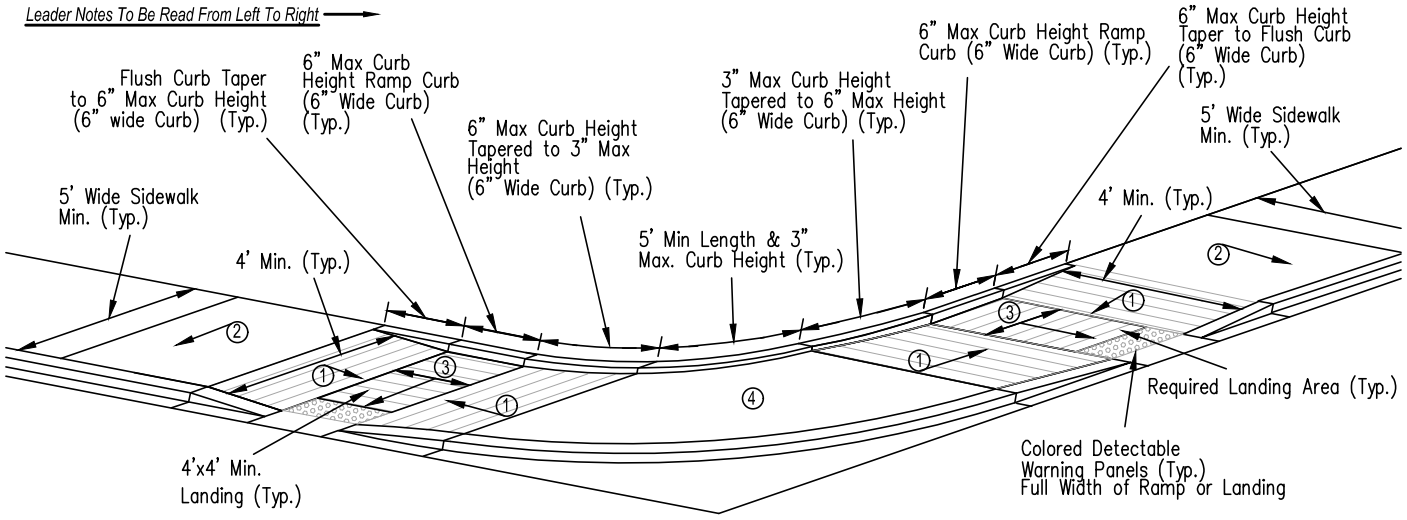
DRAWING NO. 02530-05

DRAWN BY: BMS

APPROVED BY: CITY ENGINEER JS



ATTACHED SIDEWALK – DUAL CURBSIDE SIDEWALK RAMPS



PERSPECTIVE VIEW – DUAL CURBSIDE SIDEWALK RAMPS

GENERAL SLOPE REQUIREMENTS:

1 **RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope**

2 **CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%)**

3 **LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)**

4 **When Necessary Provide 3 Inch High Landing Above Flow Line Between Ramps To Shorten Length And Bring Ramps Closer To Intersection. Provide Rear Curb To Contain High Flows. Joint Spacing Of Radius Sidewalk Determined By Radius Length**

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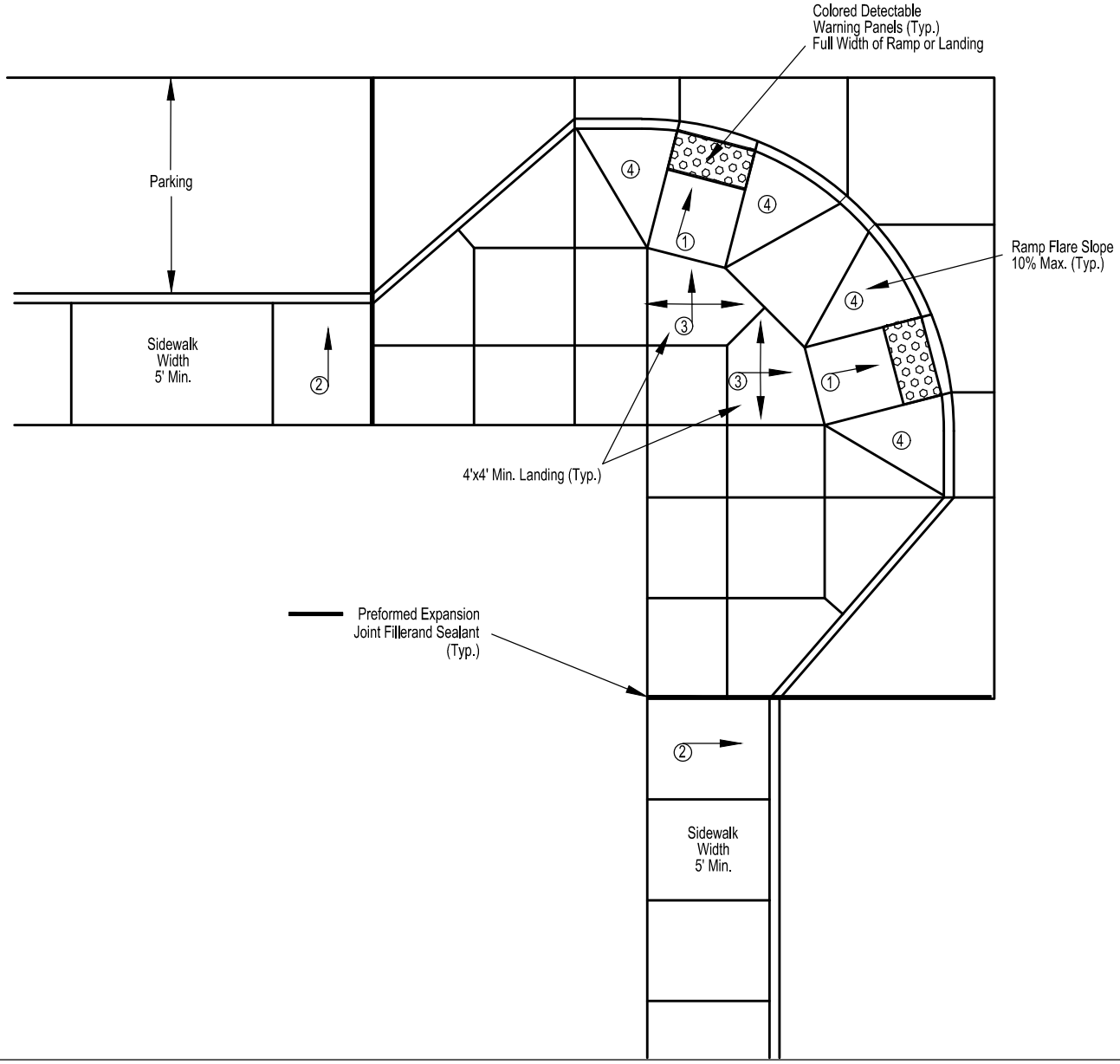
CURB RAMP
ARTERIAL AND COLLECTOR STREETS (Attached Sidewalk)

DATE: JUNE 2020

DRAWING NO. 02530-06A

DRAWN BY: BMS

APPROVED BY: CITY ENGINEER JS



BULB INTERSECTION

GENERAL SLOPE REQUIREMENTS:

① **RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope**

② **CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%)**

③ **LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)**

④ **RAMP FLARES: Do Not Exceed 1V:10H (10%) Flared Slope**

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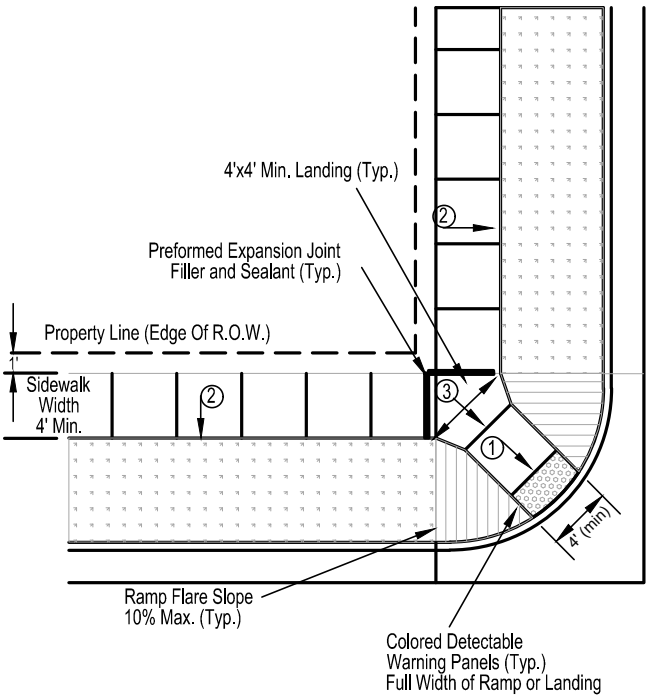
CURB RAMP
ARTERIAL & COLLECTOR STREETS (Bulb Intersection)

DRAWN BY: BMS

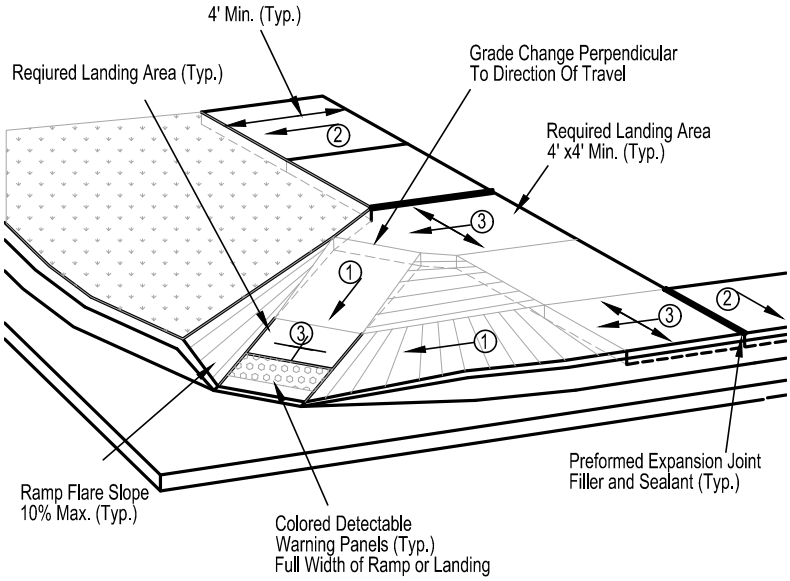
APPROVED BY: CITY ENGINEER JS

DATE: JUNE 2020

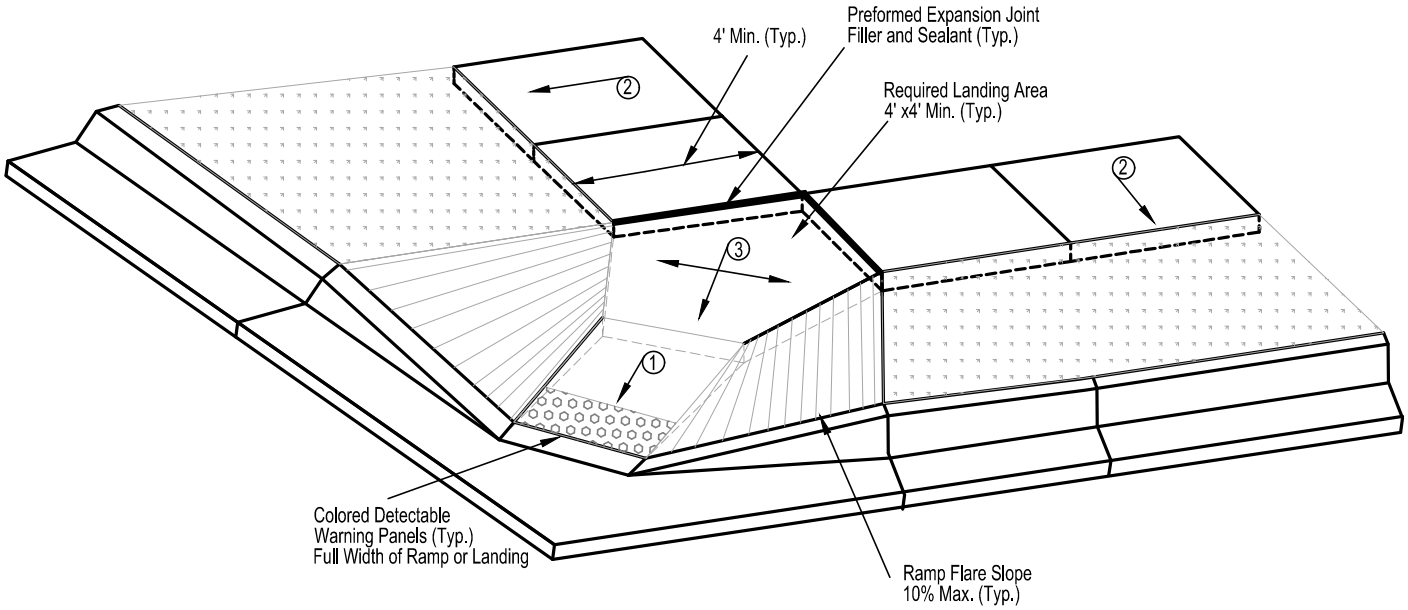
DRAWING NO. 02530-06B



PLAN VIEW - DIAGONAL CURB RAMP



PERSPECTIVE VIEW - BOULEVARD AND CURBSIDE COMBO SIDEWALK



PERSPECTIVE VIEW - DIAGONAL CURB RAMP

GENERAL SLOPE REQUIREMENTS:

① Ramp Slope: Do Not Exceed1V:12H (8.33 %)

② Cross Slope: Do Not Exceed 1V:48H (2%)

③ Landing Slope: Do Not Exceed 1V:48H (2%) In Any Direction (4'x4' Min. Landing)

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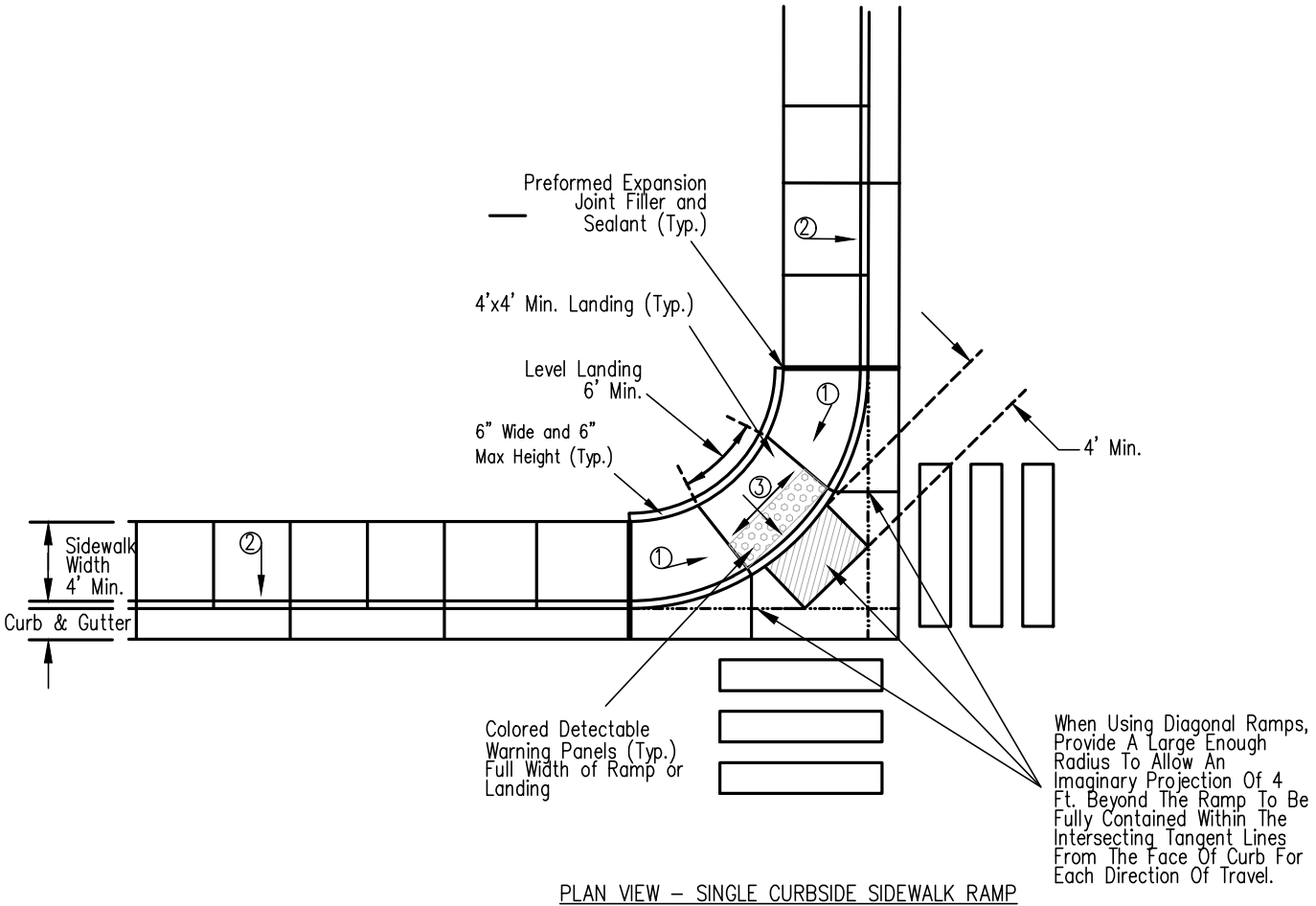
CURB RAMP
LOCAL/LOCAL THROUGH STREETS (Detached Sidewalk)

DATE: JUNE 2020

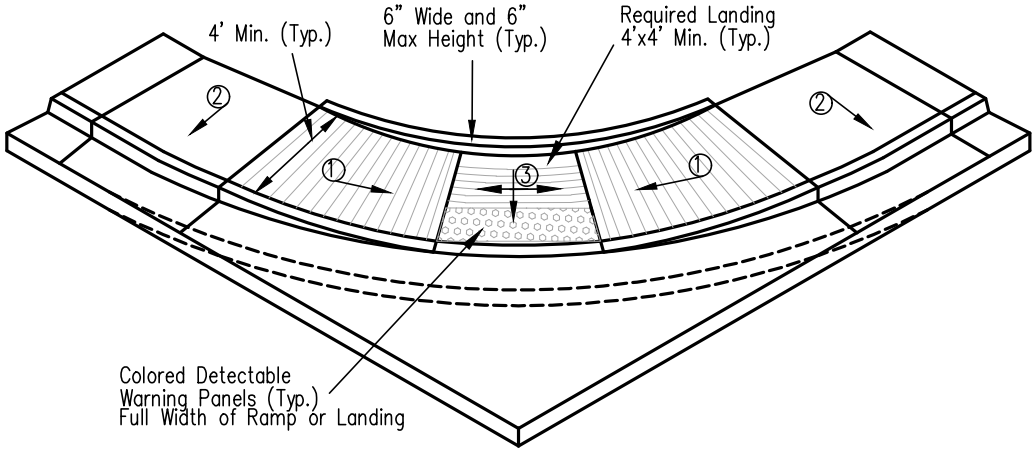
DRAWING NO. 02530-07

DRAWN BY: BMS

APPROVED BY: CITY ENGINEER JS



PLAN VIEW – SINGLE CURBSIDE SIDEWALK RAMP



PERSPECTIVE VIEW – SINGLE CURBSIDE SIDEWALK RAMP

GENERAL SLOPE REQUIREMENTS:

① **RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope**

② **CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%)**

③ **LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)**

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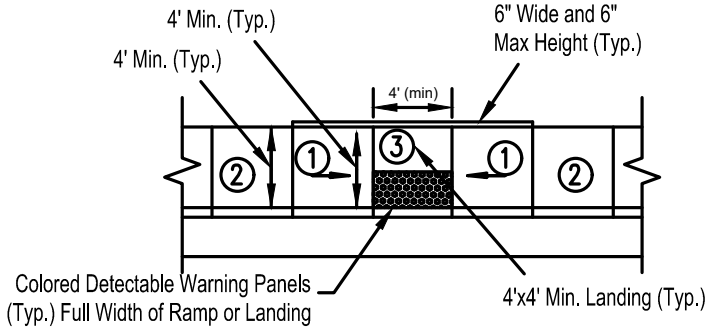
CURB RAMP
LOCAL/LOCAL THROUGH STREETS (Attached Sidewalk)

DATE: JUNE 2020

DRAWING NO. 02530-08

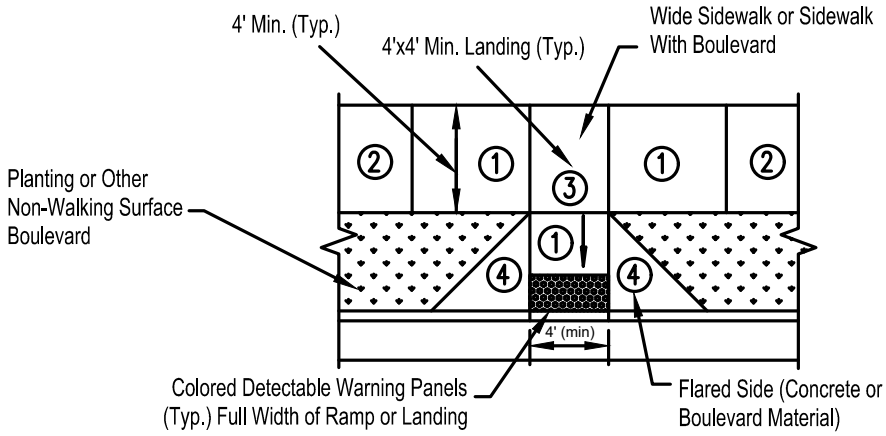
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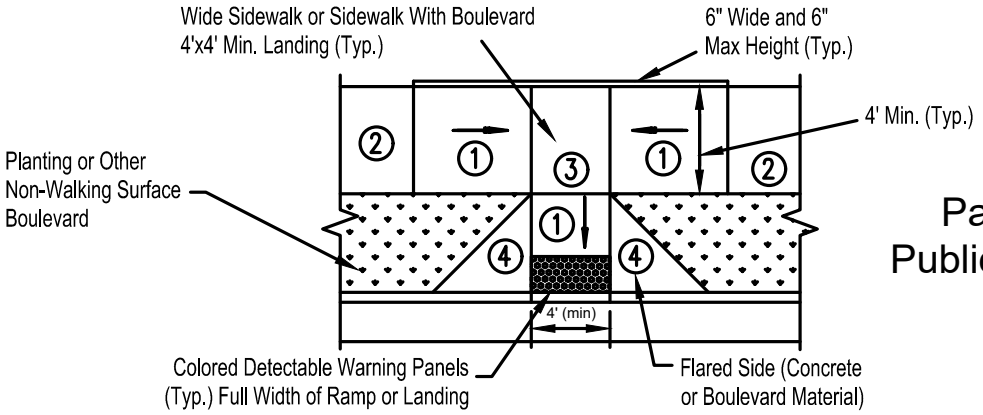
APPROVED BY: CITY ENGINEER JS



Parallel Public Sidewalk Curb Ramp

Perpendicular Public Sidewalk Curb Ramp





Combined Parallel/Perpendicular Public Sidewalk Curb Ramp

GENERAL SLOPE REQUIREMENTS:

1. **RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope**
2. **CROSS SLOPE: Slope sidewalk towards street. Do not exceed 1V:48H (2%)**
3. **LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)**
4. **RAMP FLARES: Do not exceed 1V:10H (10%) flared slope**

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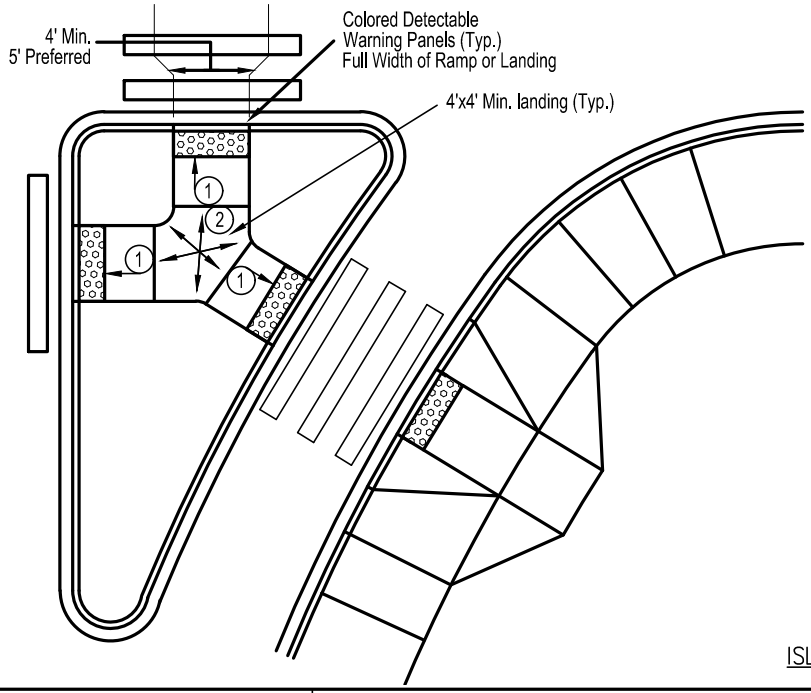
CURB RAMP
Parallel Sidewalk

DATE: JUNE 2020

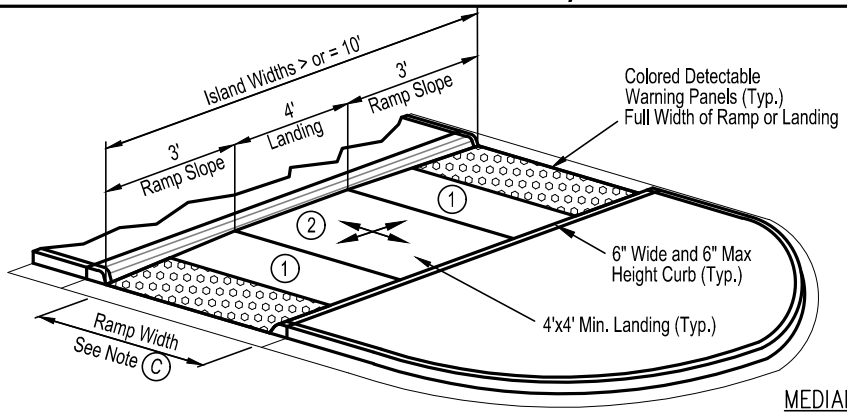
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DRAWN BY: BMS

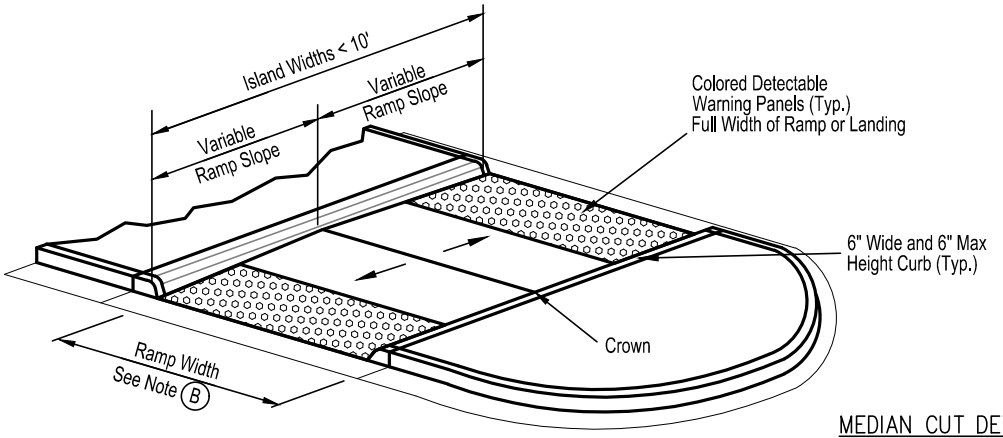
APPROVED BY: CITY ENGINEER JS



ISLAND CUT DETAIL



MEDIAN CUT DETAIL (10' OR WIDER)



MEDIAN CUT DETAIL (LESS THAN 10')

GENERAL NOTES:

A. **Provide Pedestrian Cuts Through Medians That Are Aligned For All Directions Of Travel**

B. **For Median Cuts Less Than 10 Ft. Wide, Provide A Crown At The Center Of The Median. Slope ramps Toward The Street. Do Not Exceed A Slope Of 1V:20H (5%). Use A Ramp Width Of 5 Ft. When possible. If Not, Maintain An Absolute Minimum Ramp Width Of 4 Ft.**

C. **For Median Cuts 10 Ft. Wide And Wider, Provide A Level Landing. Do Not exceed A 1V:12H (8.33%) Ramp Slope. Use A Ramp Width Of 5 Ft. When Possible. If Not, Maintain An Absolute Ramp Width Of 4 Ft.**

GENERAL SLOPE REQUIREMENTS:

(1) **RAMP SLOPE: Do not exceed a 1V:12H (8.33%) ramp slope**

(2) **LANDING SLOPE: Do not exceed 1V:48H (2%) in any direction (4'x4' Min. Landing)**

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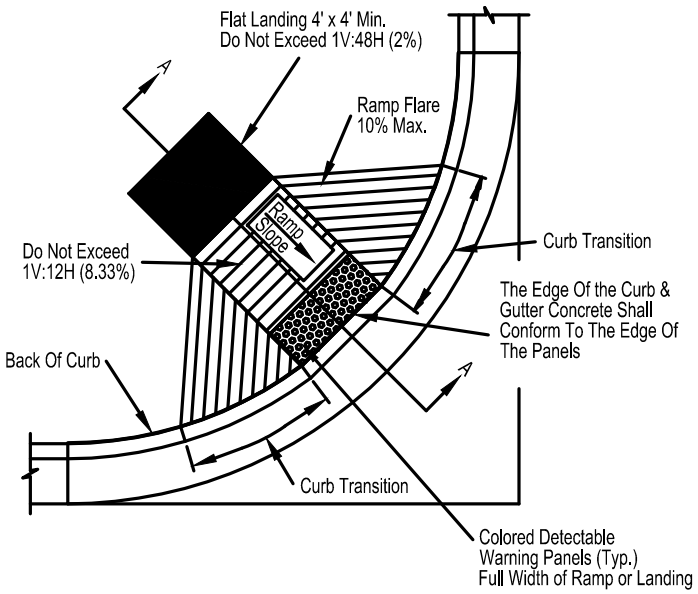
CURB RAMP
MEDIAN OR ISLAND CUTS

DATE: JUNE 2020

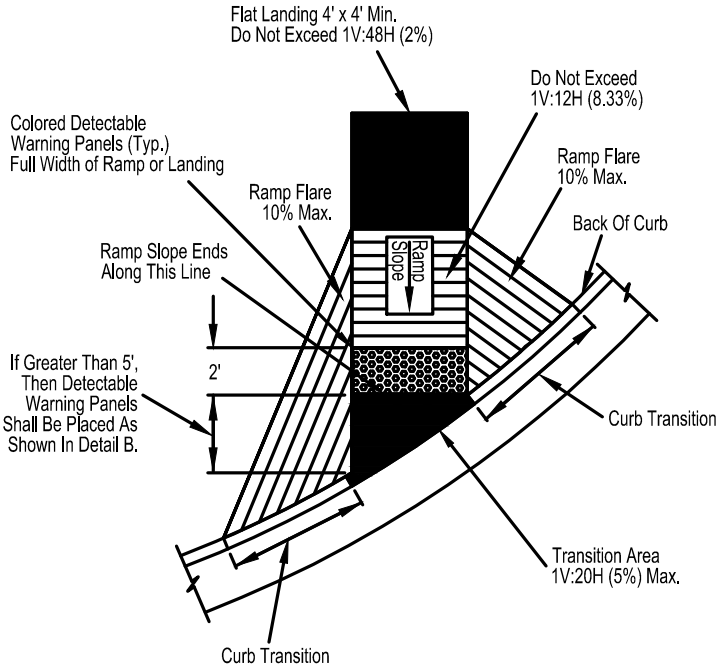
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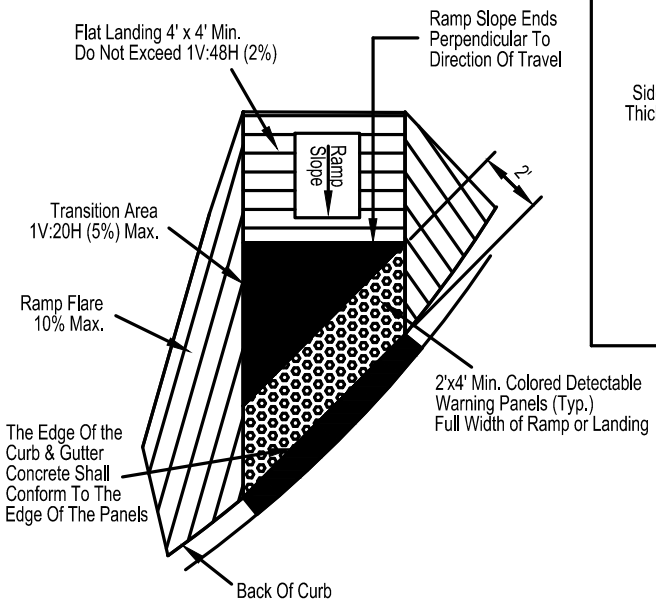
APPROVED BY: CITY ENGINEER JS



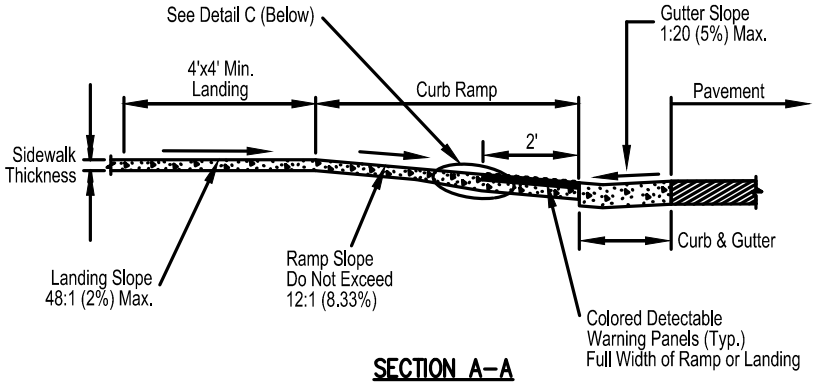
CURB RAMP – PLAN VIEW



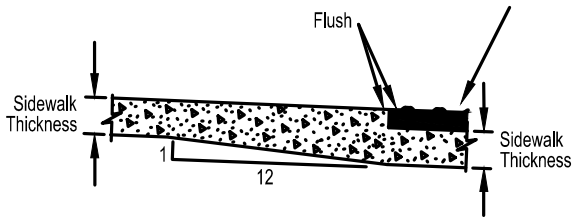
CURB RAMP – PLAN VIEW



DETAIL – B



SECTION A–A



DETAIL – C

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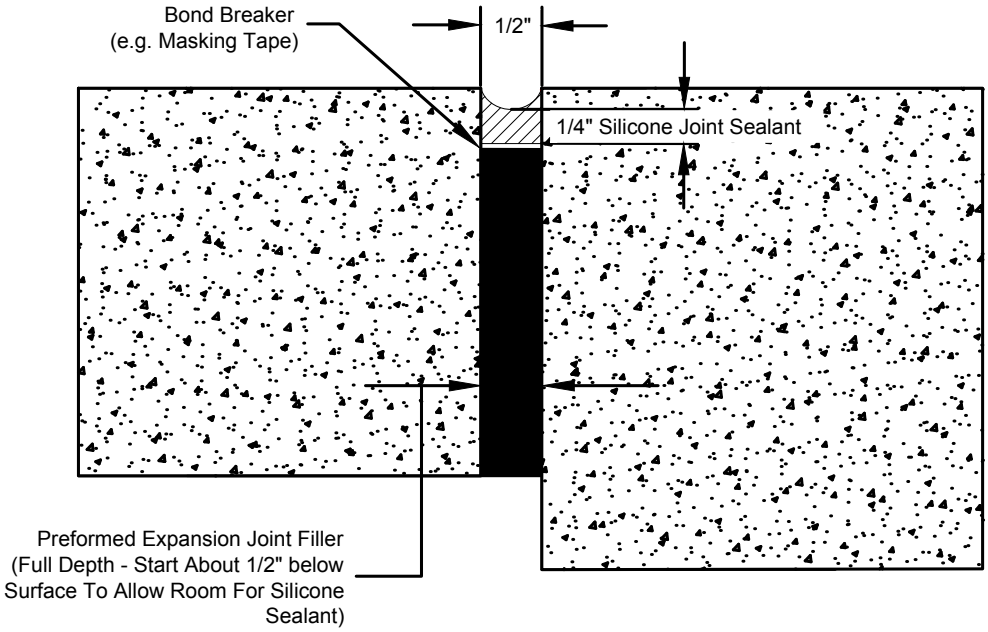
DETECTABLE WARNING PANELS

DATE: JUNE 2020

DRAWING NO. 02530-11

DRAWN BY: BMS

APPROVED BY: CITY ENGINEER JS



TYPICAL PREFORMED EXPANSION JOINT DETAIL

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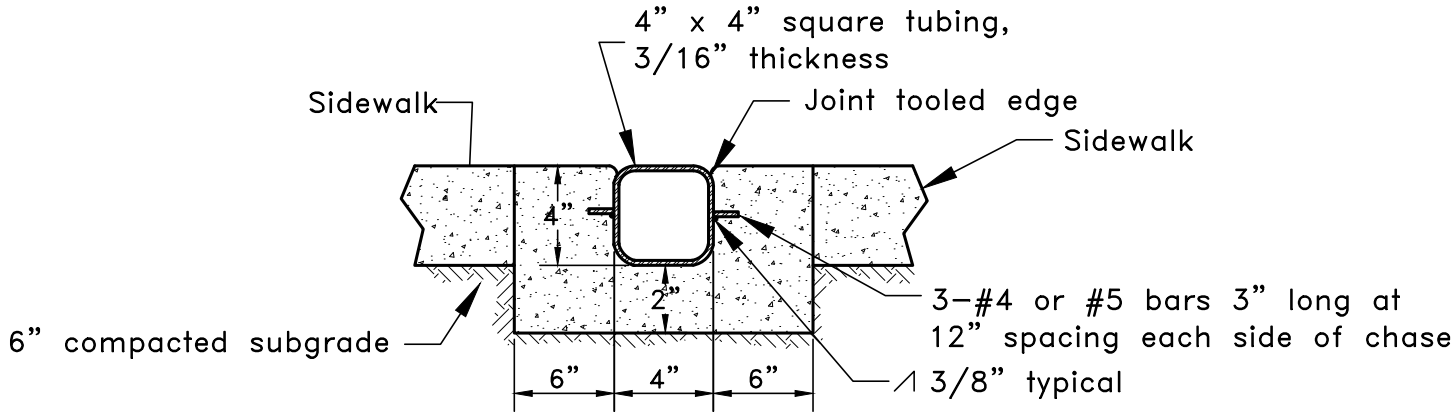
TYPICAL EXPANSION JOINT DETAIL

DATE: FEBRUARY 2012

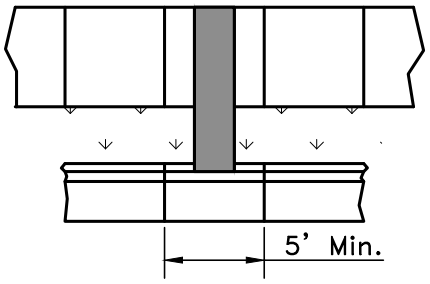
DRAWING NO. 02530-12

DRAWN BY: KEB

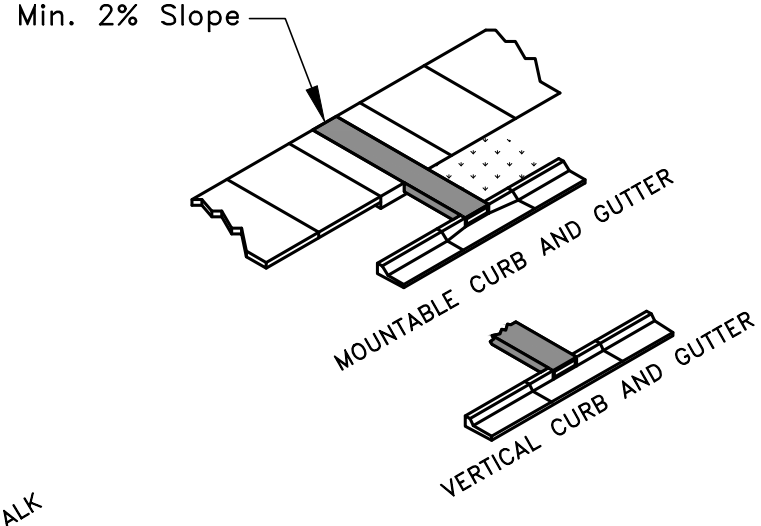
APPROVED BY: CITY ENGINEER HV/KDS



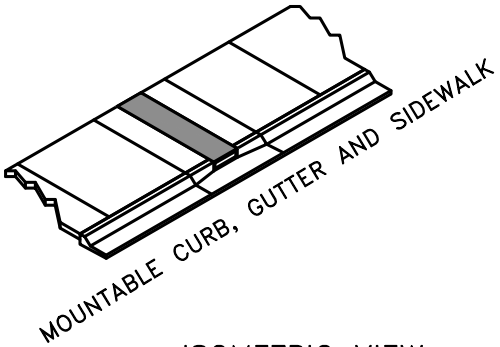
TYPICAL CHASE SECTION



PLAN VIEW
(Detached curb & gutter)



ISOMETRIC VIEW
(Detached curb & gutter)



ISOMETRIC VIEW
(Attached curb & gutter)

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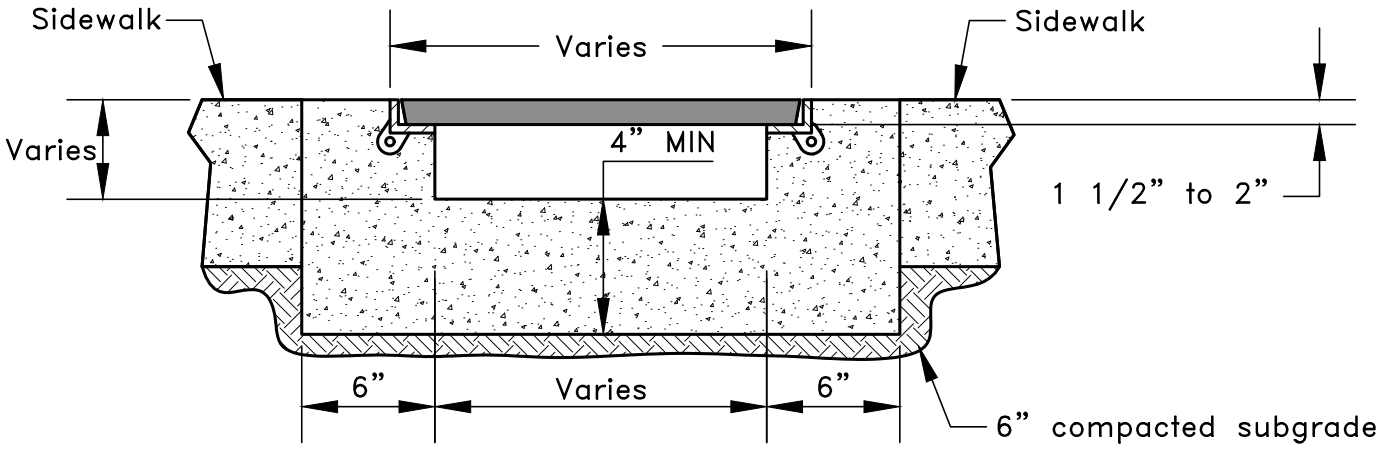
LOW VOLUME SIDEWALK CHASE

DATE: MARCH 2012

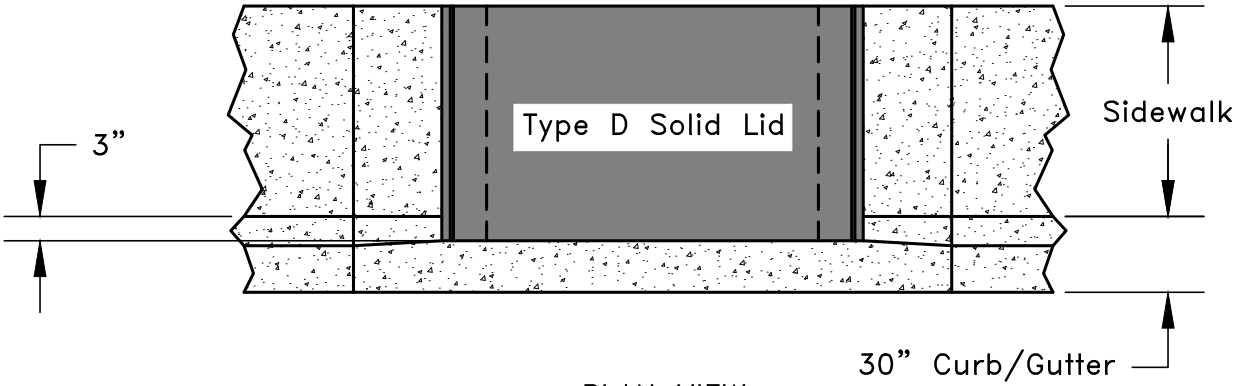
DRAWING NO. 02530–13

DRAWN BY: JAC

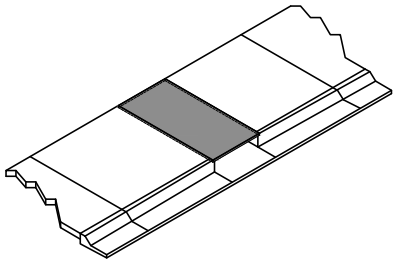
APPROVED BY: CITY ENGINEER DLH/KDS



TYPICAL CHASE SECTION



PLAN VIEW



ISOMETRIC VIEW

NOTE:

1. Neenah Series R-4990 and R-4999, Type D or approved equal.
2. Installation to be per Manufactures Recommendations.
3. Depth of chase channel will vary based on type of curb. Highback curb chase to be 4.5" deep and Roll Over curb chase to be 2.5" deep. Both channels to align with flowline of curb.

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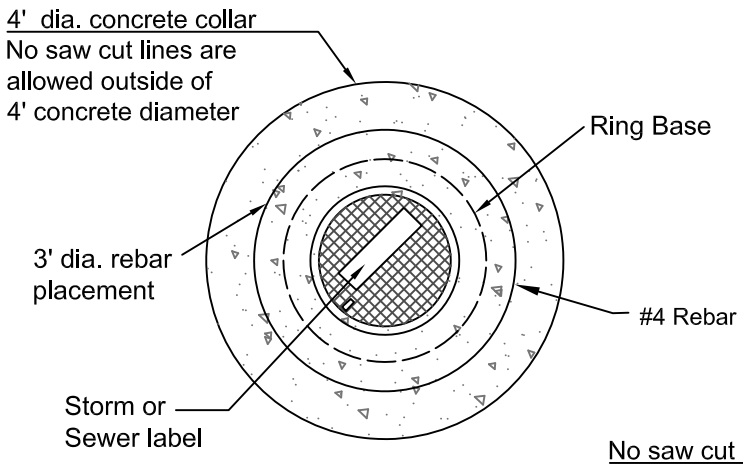
HIGH VOLUME SIDEWALK CHASE

DATE: MARCH 2012

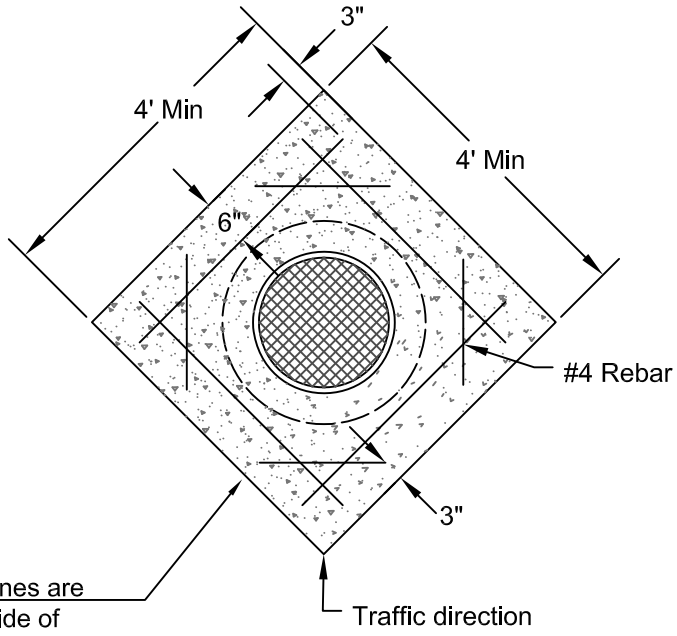
DRAWING NO. 02530-14

DRAWN BY: JAC

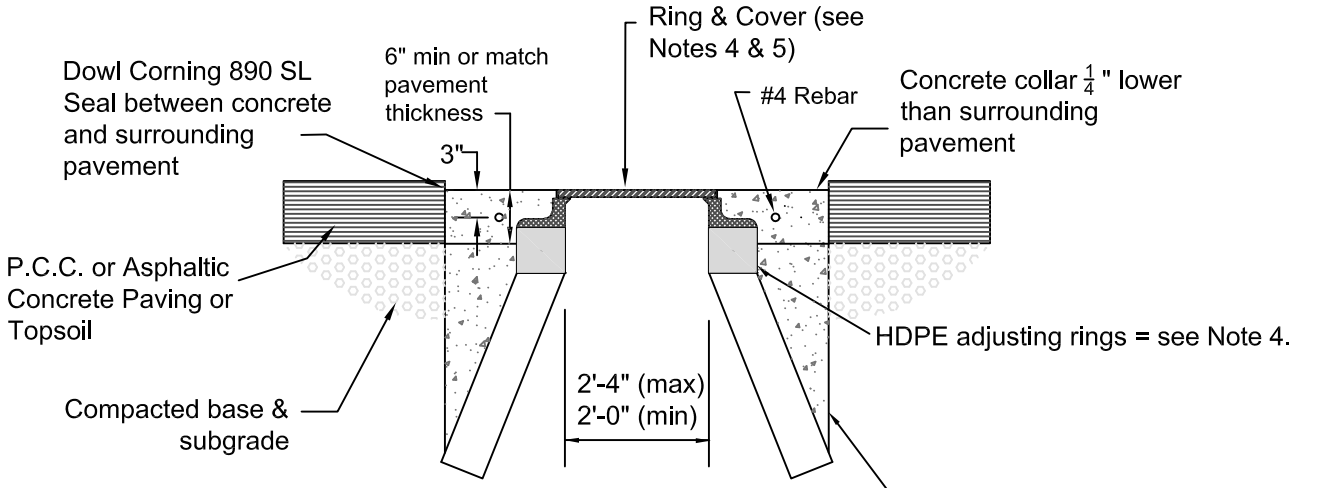
APPROVED BY: CITY ENGINEER DLH/KDS



ROUND CONCRETE COLLAR



DIAMOND CONCRETE COLLAR



CONCRETE MANHOLE COLLAR

NOTES:

1. Grout shall only be used in and around the invert of the pipe and shall not be used around the adjusting rings.
2. HDPE adjusting rings shall be used in increments of 1/4 inch in order to obtain the optimal final grade adjustments.
3. If any shimming of the adjusting rings is used, the shims shall be inserted from the outside of the manhole.
4. All rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer-approved equal. The combined height of manhole ring used and adjusting rings shall not exceed 16" total.
5. The lid (cover) shall be D&L Foundry A-1161 labeled STORM or SEWER (non-ventilated, self-sealing, with closed pick hole).
6. Retrofits, Manhole Adjustments, and other repairs of existing Manhole applications may require diamond collar configuration, and shall only be used as identified on the plans or as approved.
7. Round collars shall be used for all installations in new pavement
8. Precast collars shall not be used.

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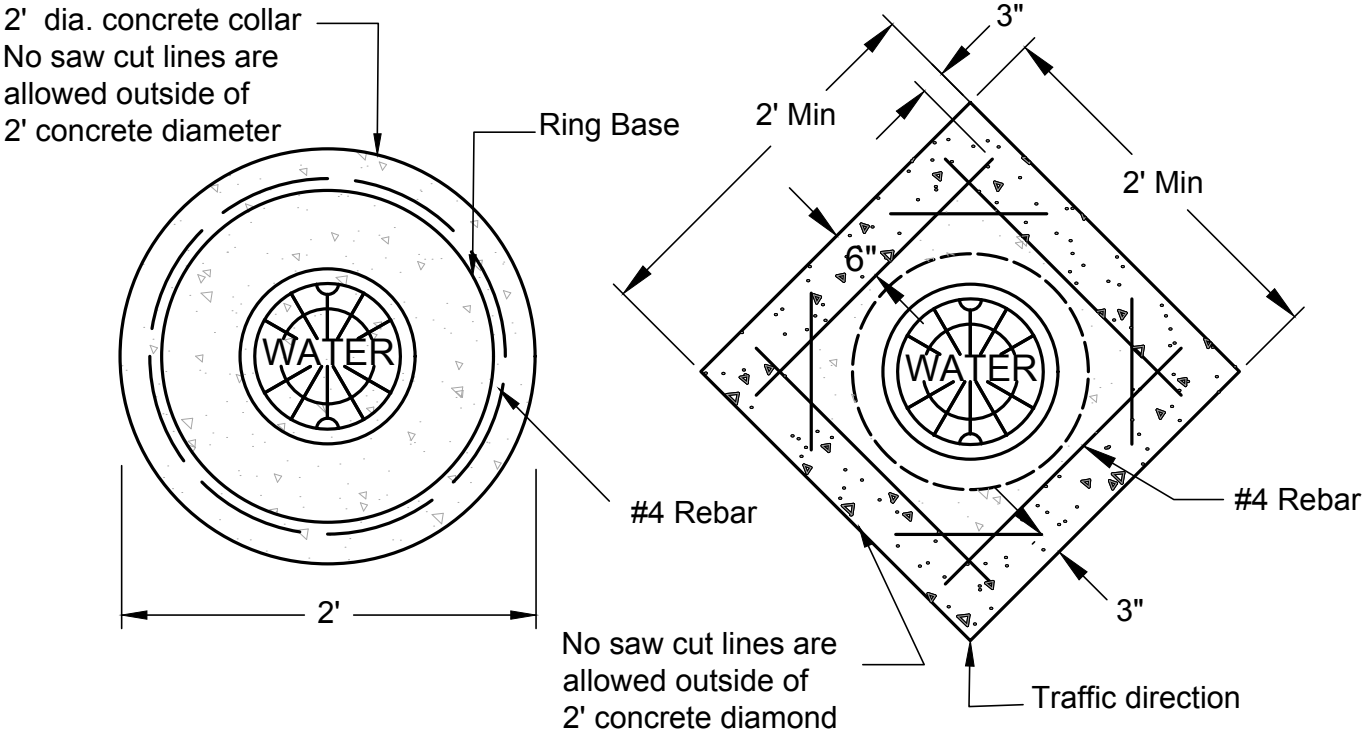
MANHOLE COLLAR DETAIL

DATE: JANUARY 2019

DRAWING NO. 02570–01

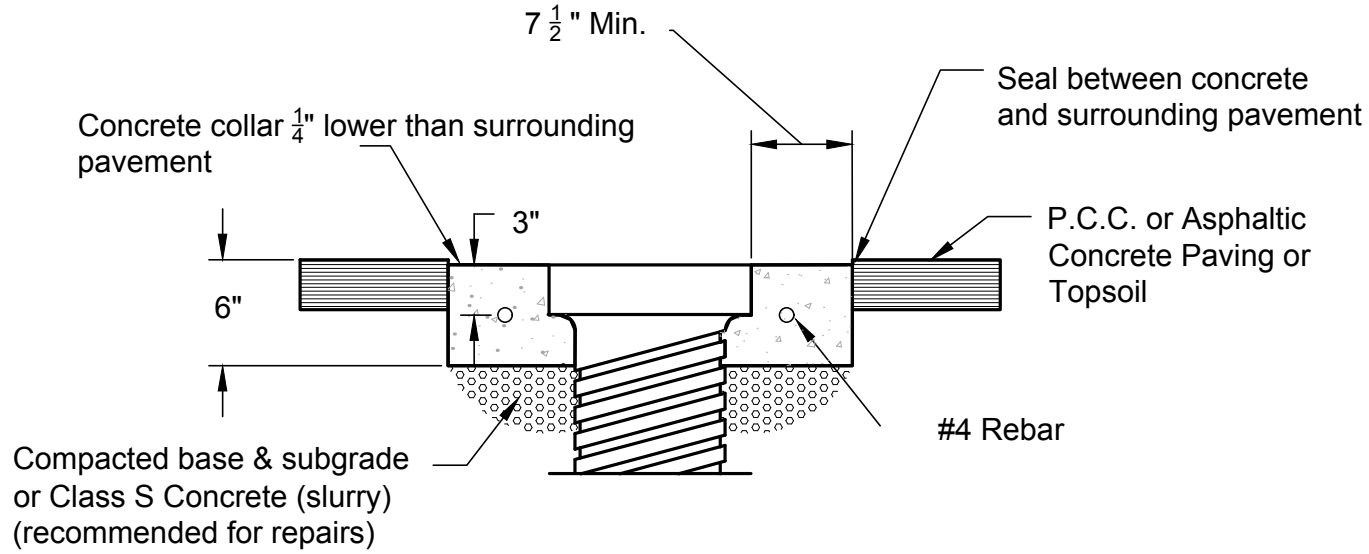
DRAWN BY: KEB

APPROVED BY: CITY ENGINEER JDS



ROUND CONCRETE
VALVE BOX COLLAR

DIAMOND CONCRETE
VALVE BOX COLLAR



NOTE:

1. Retrofits, manhole adjustments and other repairs of existing manhole applications may require diamond collar configuration, and shall only be used as identified on the plans or as approved.
2. Round collars shall be used for all installations in new pavement.
3. Precast collars shall not be used.

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WATER VALVE COLLAR DETAIL

DATE: JANUARY 2019

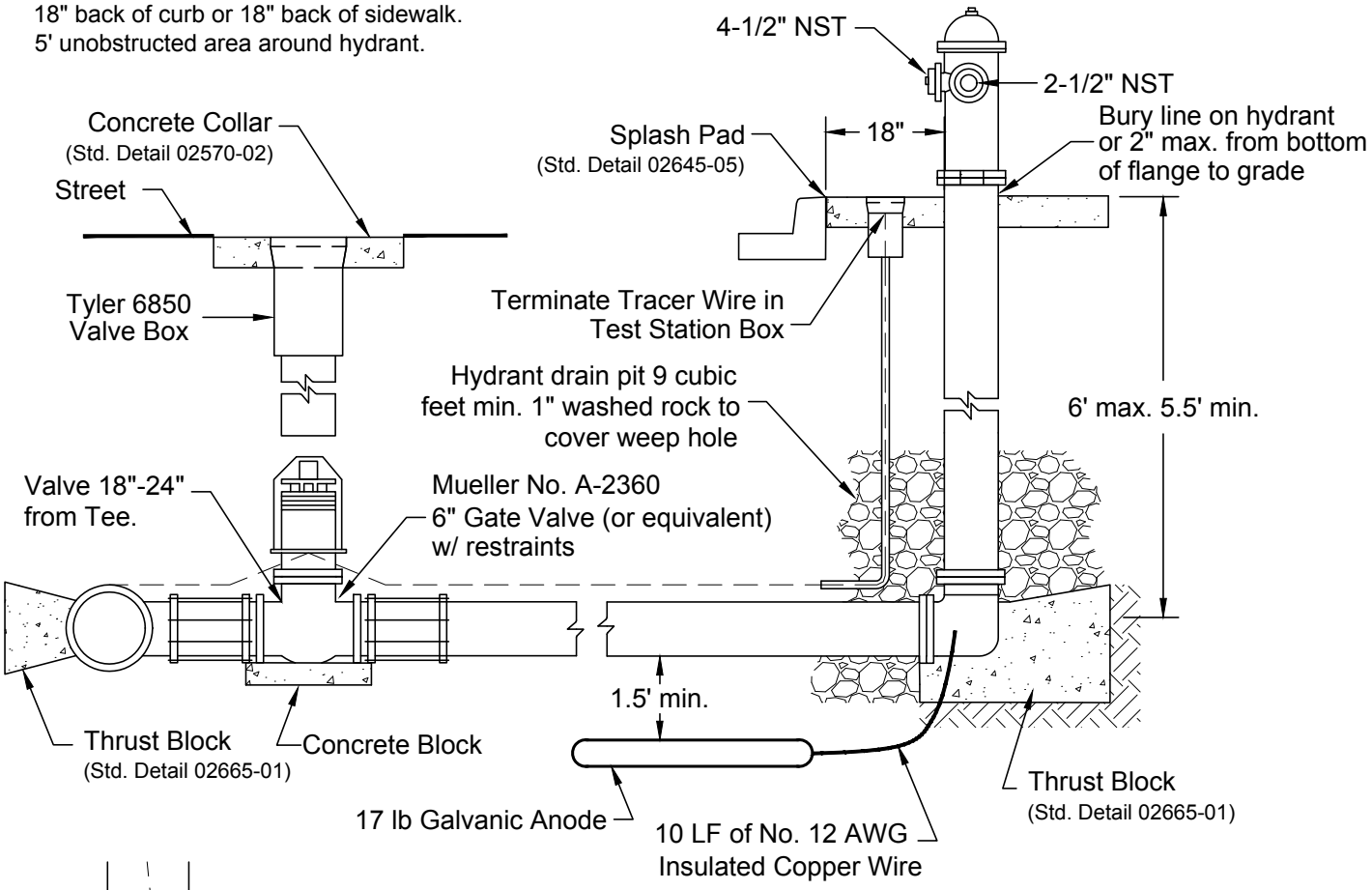
DRAWING NO. 02570–02

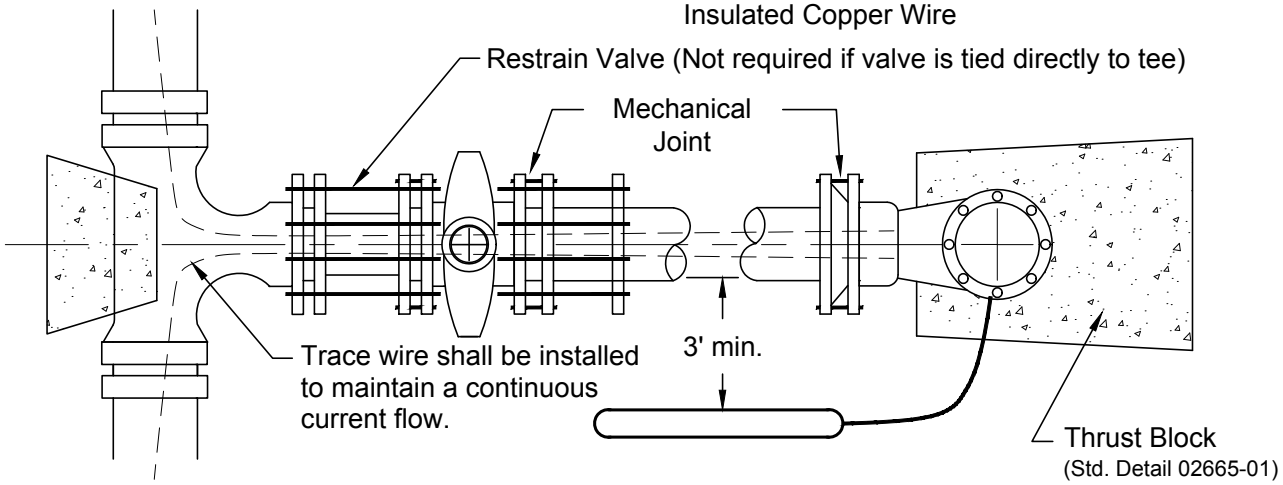
DRAWN BY: KEB

APPROVED BY: CITY ENGINEER JDS

FIRE HYDRANT:

A) Mueller Super Centurion 250 or American AVK 2780 or American Flow Control Waterous Pacer WB-67-250 (5 1/4" barrel).
B) 18" back of curb or 18" back of sidewalk.
C) 5' unobstructed area around hydrant.





NOTES:

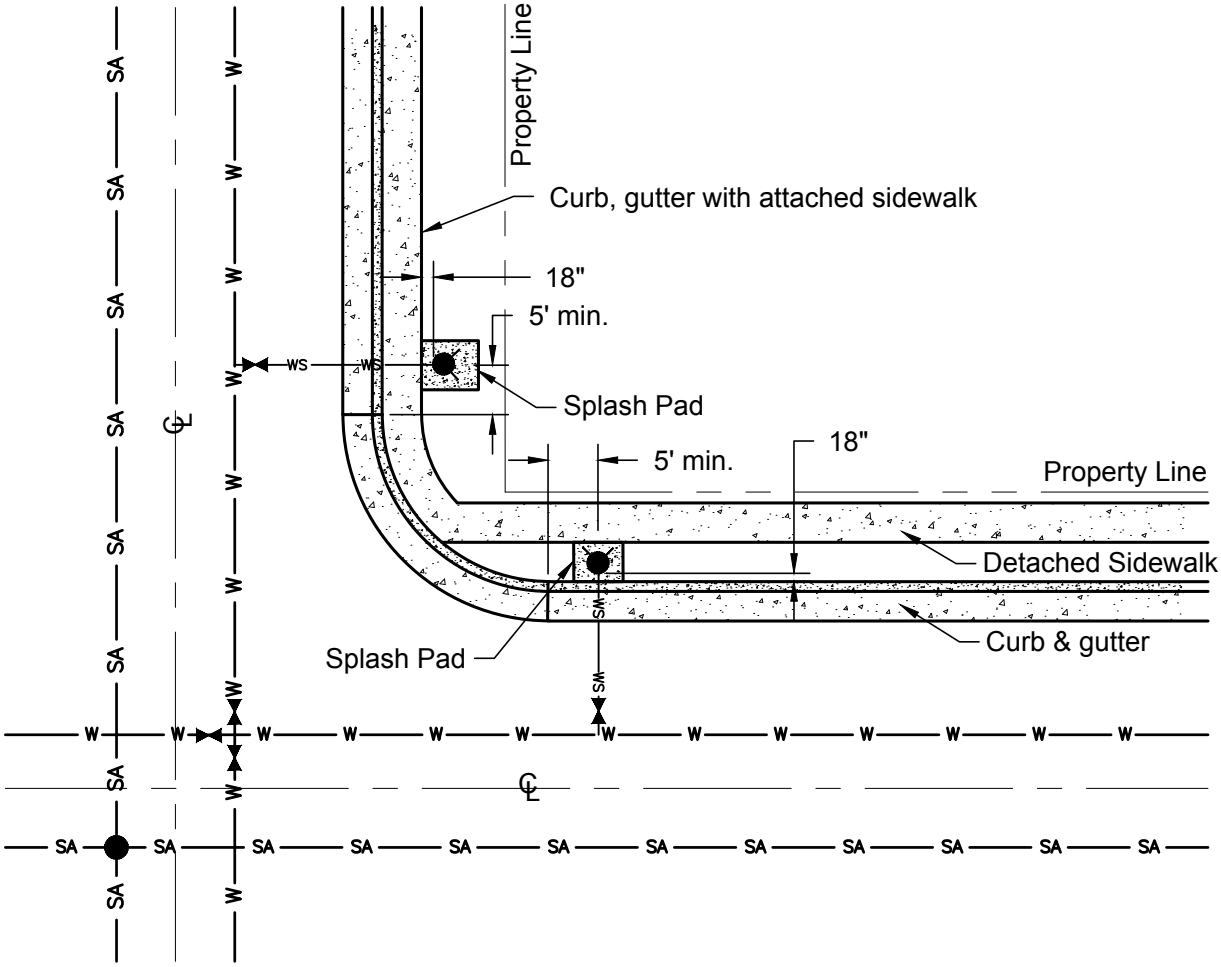
1. Wrap all D.I. fittings with 8 mil. polyethylene in accordance with ANSI/AWWA A21.5/C105.
2. The 6" pipe connection from the water main to the hydrant will be direct. Vertical or horizontal offset using elbows shall not be allowed.
3. Tracer wire shall be installed per Standard Detail 02645-06.
4. Mars Company, Zinc Anode Caps along with a Mechanical Joint Shoe may be used in place of the 17lb Galvanic Anode Bags.
5. Whenever a fire hydrant is taken out of service, it shall immediately be bagged with an orange or black bag that completely covers the hydrant.

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FIRE HYDRANT INSTALLATION

DATE: MARCH 2012
DRAWING NO. 02645-01

DRAWN BY: CJS
APPROVED BY: CITY ENGINEER HV/KDS



NOTE:

1. A minimum 5' 0" unobstructed area is required around Fire Hydrants.

2. Whenever a fire hydrant is taken out of service, it shall immediately be bagged with an orange or black bag that completely covers the hydrant.

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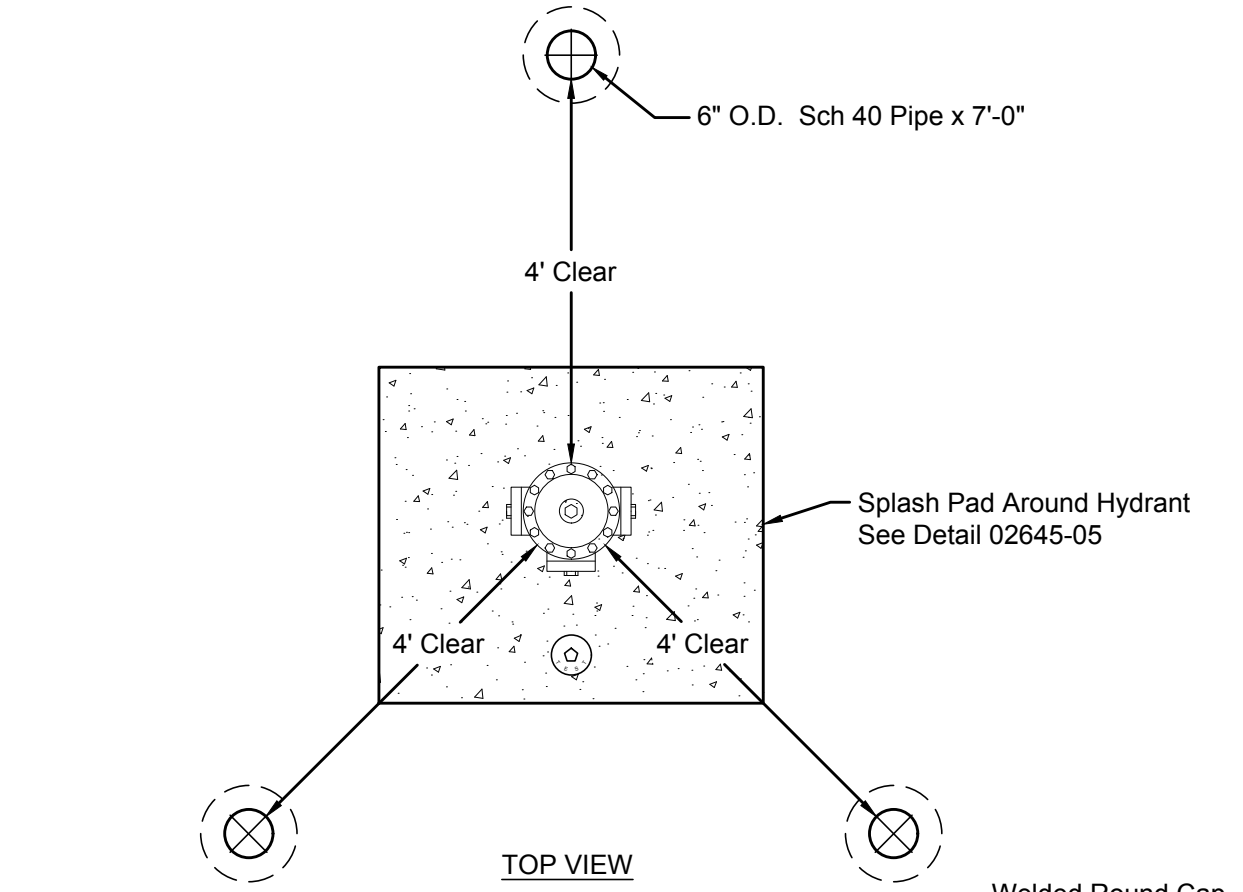
FIRE HYDRANT PLACEMENT

DATE: MARCH 2012

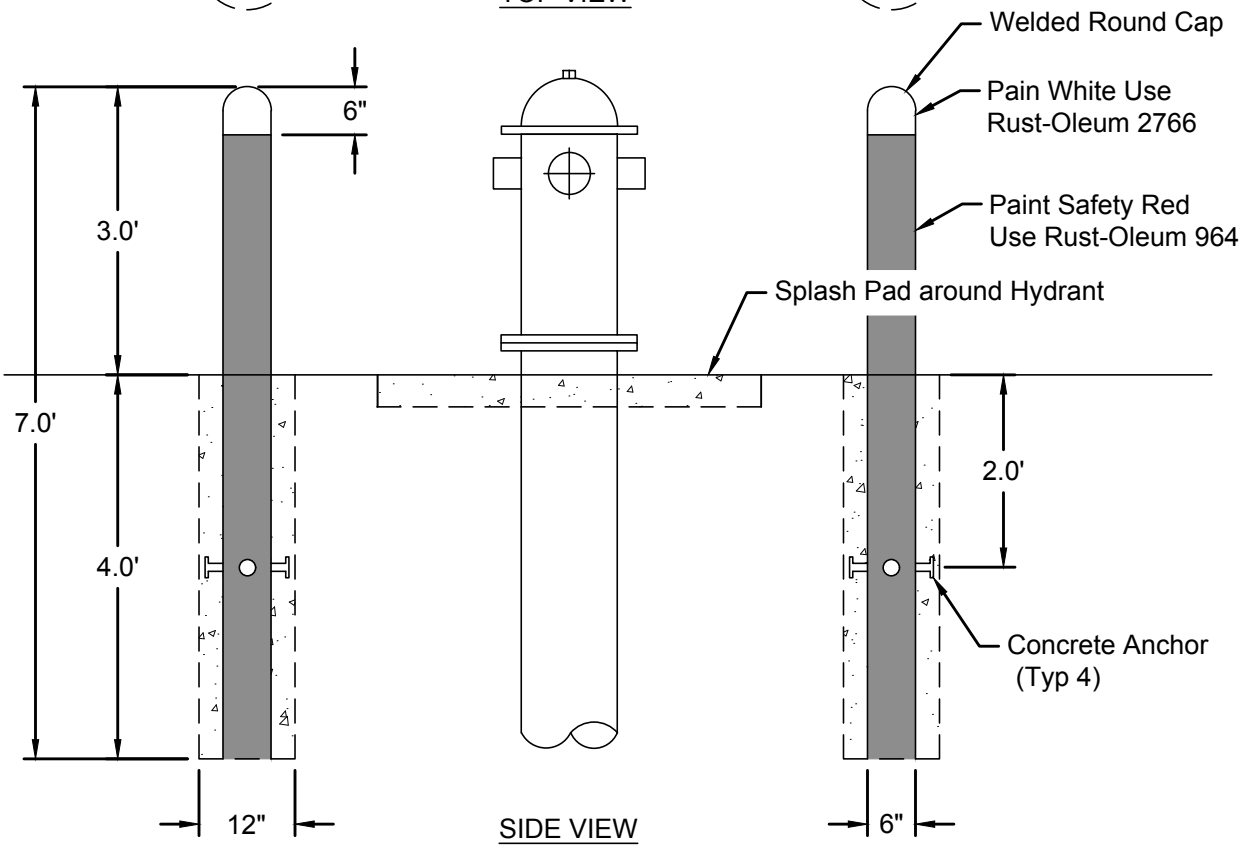
DRAWING NO. 02645–02

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



TOP VIEW



SIDE VIEW

NOTE:

Generally, fire hydrant guards are only installed in areas where there is no curb and gutter.

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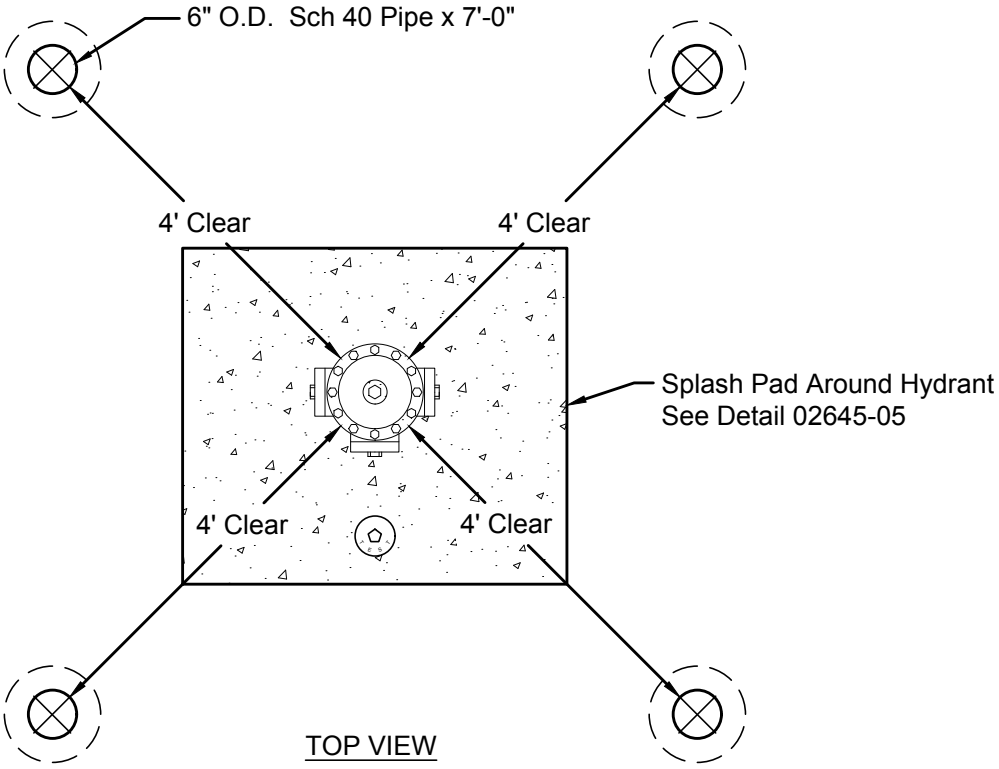
FIRE HYDRANT GUARD (3 POLES)

DATE: JANUARY 2019

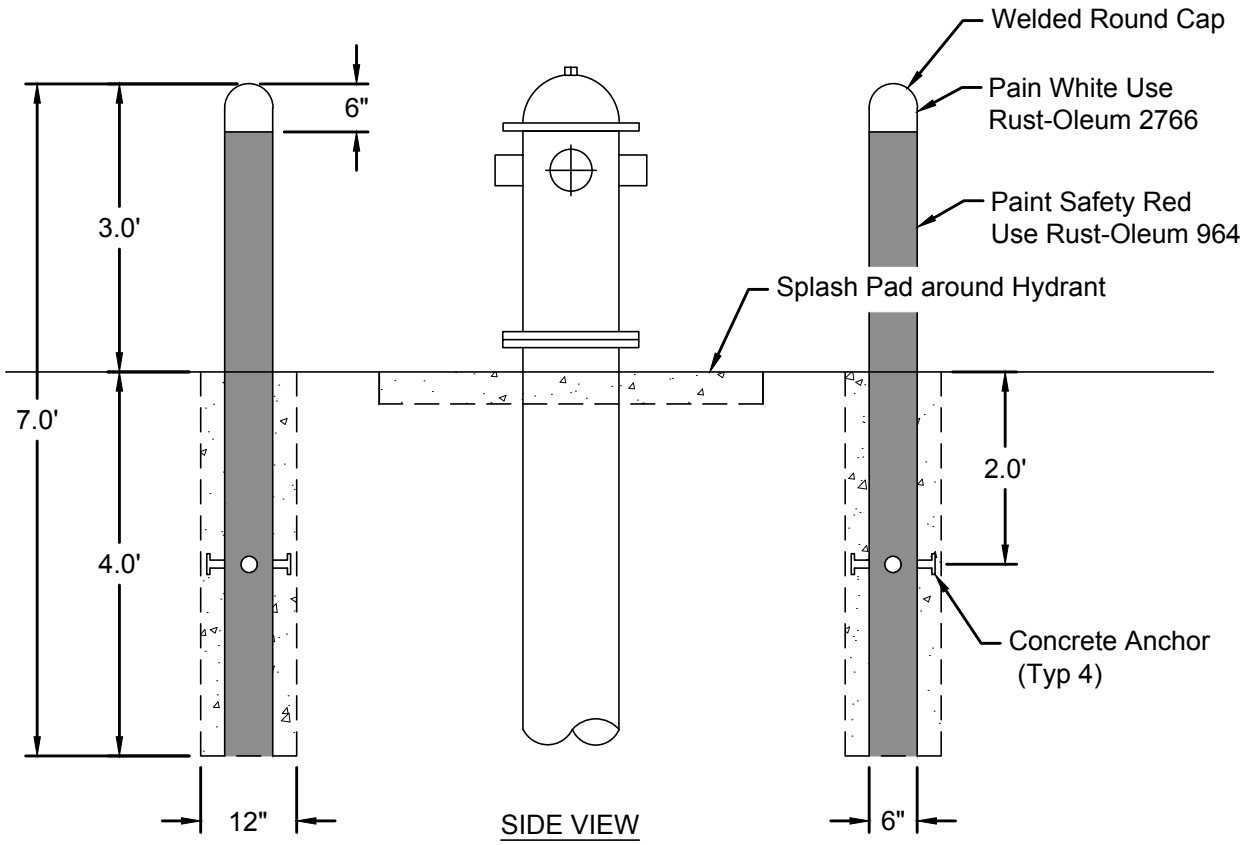
DRAWING NO. 02645-03

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER JDS



TOP VIEW



SIDE VIEW

NOTE:

Generally, fire hydrant guards are only installed in areas where there is no curb and gutter.

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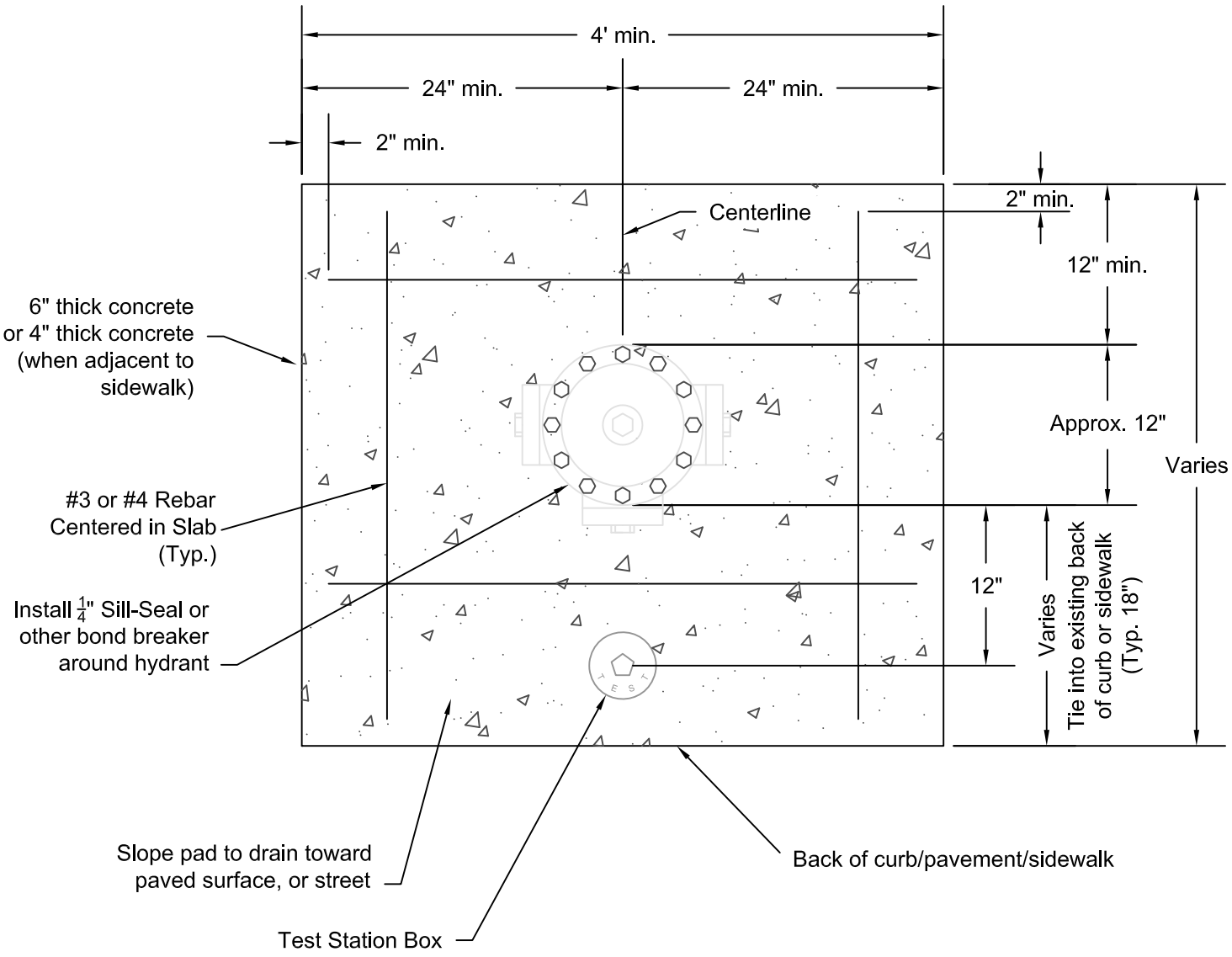
FIRE HYDRANT GUARD (4 POLES)

DATE: JANUARY 2019

DRAWING NO. 02645-04

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER JDS



NOTES:

1. The hydrant is to be located 18" from the back of the curb for detached sidewalk or 18" from the back of attached sidewalk. The splash pad shall be attached to the back of the sidewalk or curb and gutter. A narrow strip will not be allowed between the front edge of the splash pad and the sidewalk or curb and gutter.
2. For hydrants not located immediately adjacent to the street, a larger splash pad with dimensions of 24" (2') behind and 48" (4') in front of the hydrant shall be used.
3. If the fire hydrant and splash pad sit at the back edge of a steep slope, such as a borrow ditch, and there is significant chance for erosion in front of the hydrant, a smaller (4'x4') splash pad may be allowed in addition to the placement of appropriately sized riprap (3" nominal diameter rock) in front of the hydrant and down the slope adjacent to the street.

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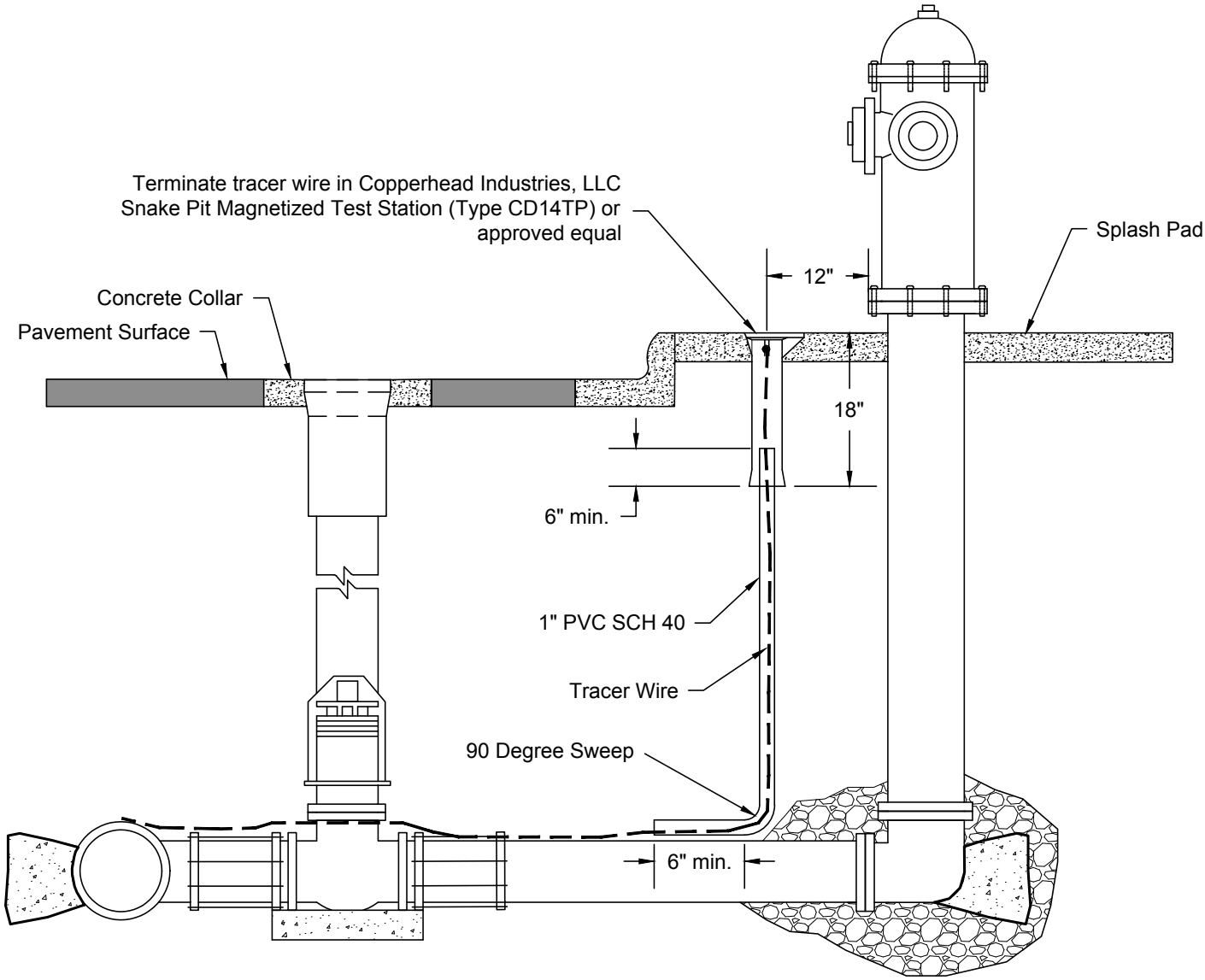
SPLASH PAD FOR FIRE HYDRANT

DATE: JANUARY 2019

DRAWING NO. 02645–05

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER JDS



NOTE:

1. Tracer wire shall be installed to maintain a continuous current flow.

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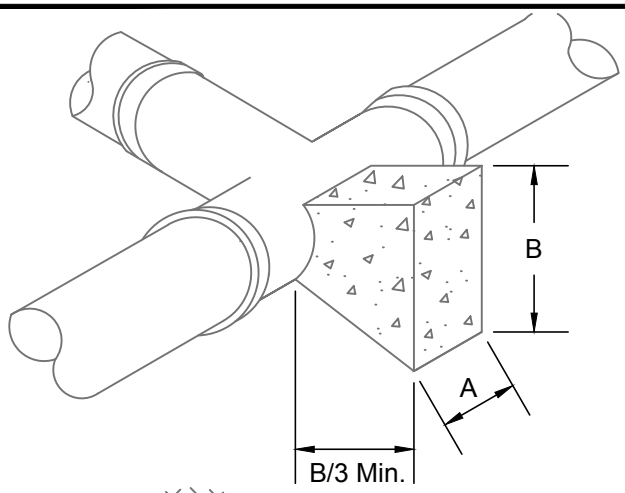
FIRE HYDRANT TRACER WIRE

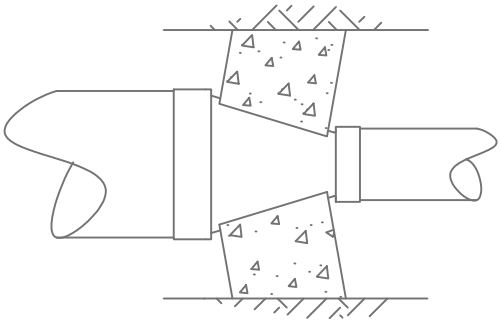
DATE: OCTOBER 2012

DRAWING NO. 02645-06

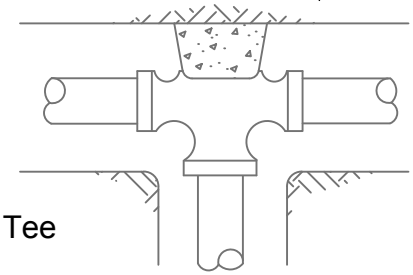
DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

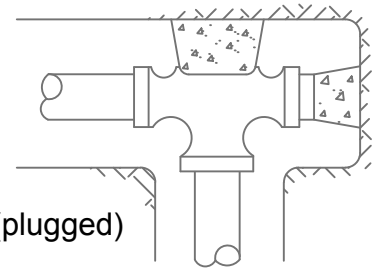




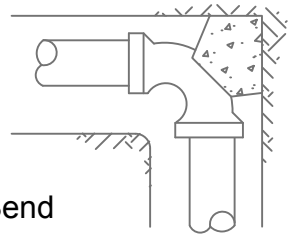
Reducer



Tee



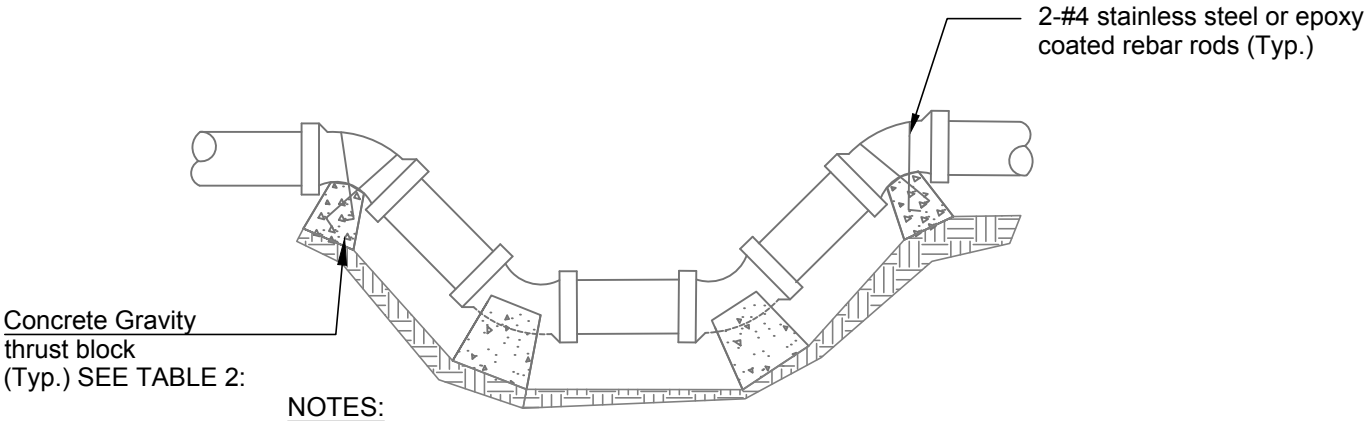
Tee (plugged)



Bend

TABLE 1: DIMENSION FOR THRUST BLOCKING								
FITTING SIZES	TEES & PLUGS		90° BEND		45° BEND & WYES		REDUCERS, 11-1\4° 22-1\2° BENDS	
	A	B	A	B	A	B	A	B
4"	1'-7"	1'-2"	1'-9"	1'-6"	1'-8"	0'-10"	1'-7"	0'-6"
6"	2'-0"	1'-11"	2'-5"	2'-2"	1'-10"	1'-7"	1'-9"	0'-10"
8"	2'-8"	2'-6"	3'-2"	3'-0"	2'-5"	2'-1"	1'-9"	1'-6"
10"	3'-4"	3'-3"	4'-0"	3'-10"	3'-0"	2'-9"	2'-2"	1'-11"
12"	4'-0"	3'-10"	4'-8"	4'-8"	3'-8"	3'-3"	2'-7"	2'-3"
14"	5'-5"	3'-10"	6'-6"	4'-11"	4'-9"	3'-5"	3'-5"	2'-5"

TABLE 2: GRAVITY BLOCK VOLUME (C.Y.)				
SIZES	REBAR TIES	ANGLE OF DOWNTURN		
		11.25°	22.5°	45°
6"	2-# 4	.030	0.60	1.20
8"	2-# 4	0.60	1.10	2.10
10"	2-# 5	0.90	1.70	3.30
12"	2-# 5	1.2	2.50	4.80
FACTOR OF SAFETY = 1.5				



NOTES:

1. Wrap all metallic fittings with 8 mil. polyethylene in accordance with ANSI/AWWA A21.5/C105.
2. Comply with Specification Section 02665 (Pipe installation for water mains)
3. These tables are based on 150 PSI Main Pressure 2000 PSF Soil Bearing Pressure.
4. For other conditions, size of thrust blocks must be computed and approved by Engineer.
5. All thrust blocks must be placed against undisturbed soil. Class "C" or "B" concrete
6. Ensure all bolts are unobstructed by concrete.

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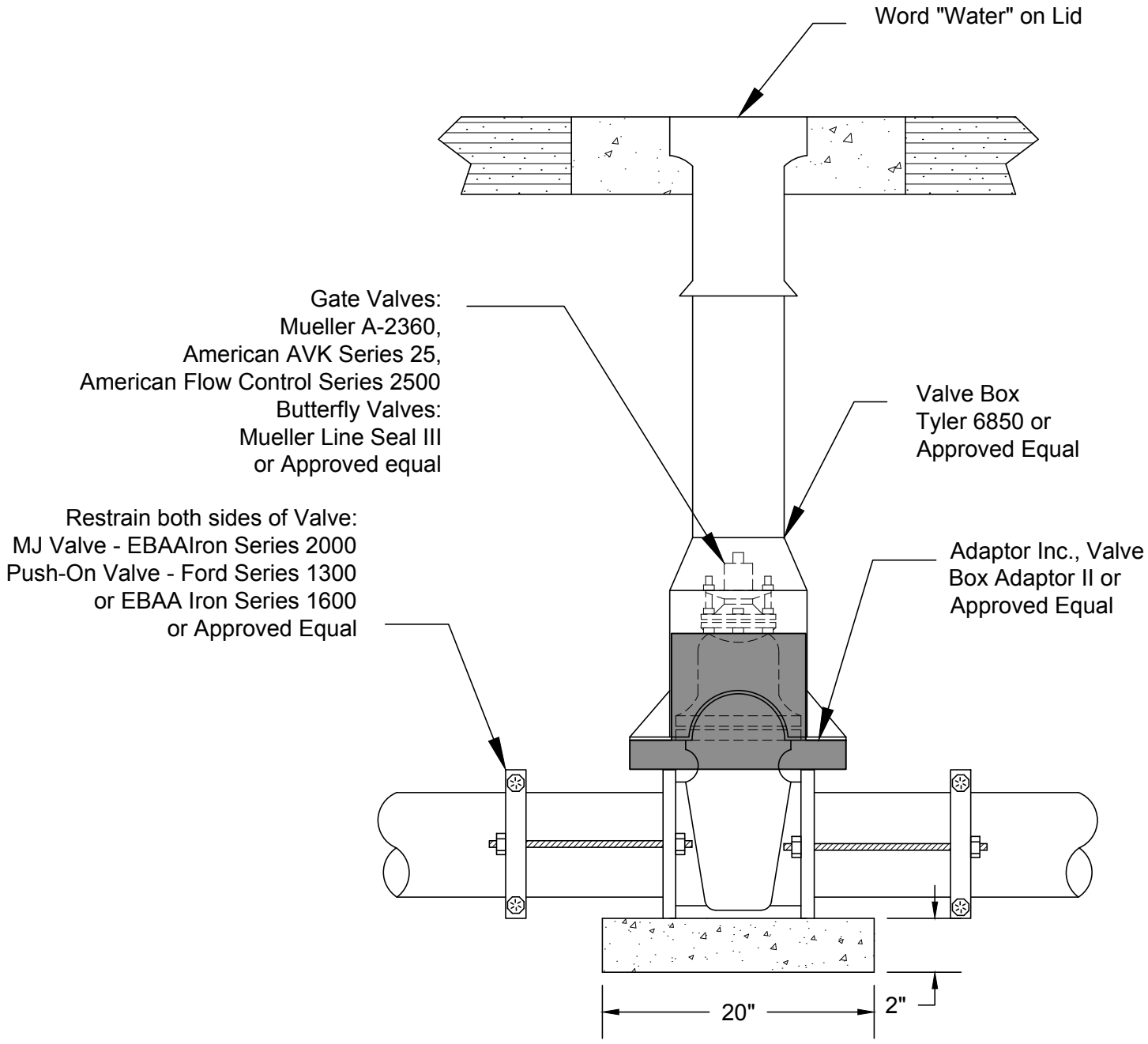
THRUST & GRAVITY BLOCKING FOR WATER MAIN FITTINGS

DATE: MAY 2017

DRAWING NO. 02665–01

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



NOTES:

1. Fire Hydrant Isolation Valves may be restrained directly to the tee.
2. All Valves 14" and larger are required to be Butterfly Valves.
3. When a valve is located at a fitting, (tee, cross's, etc...), it must be installed 18" to 24" away from the fitting.

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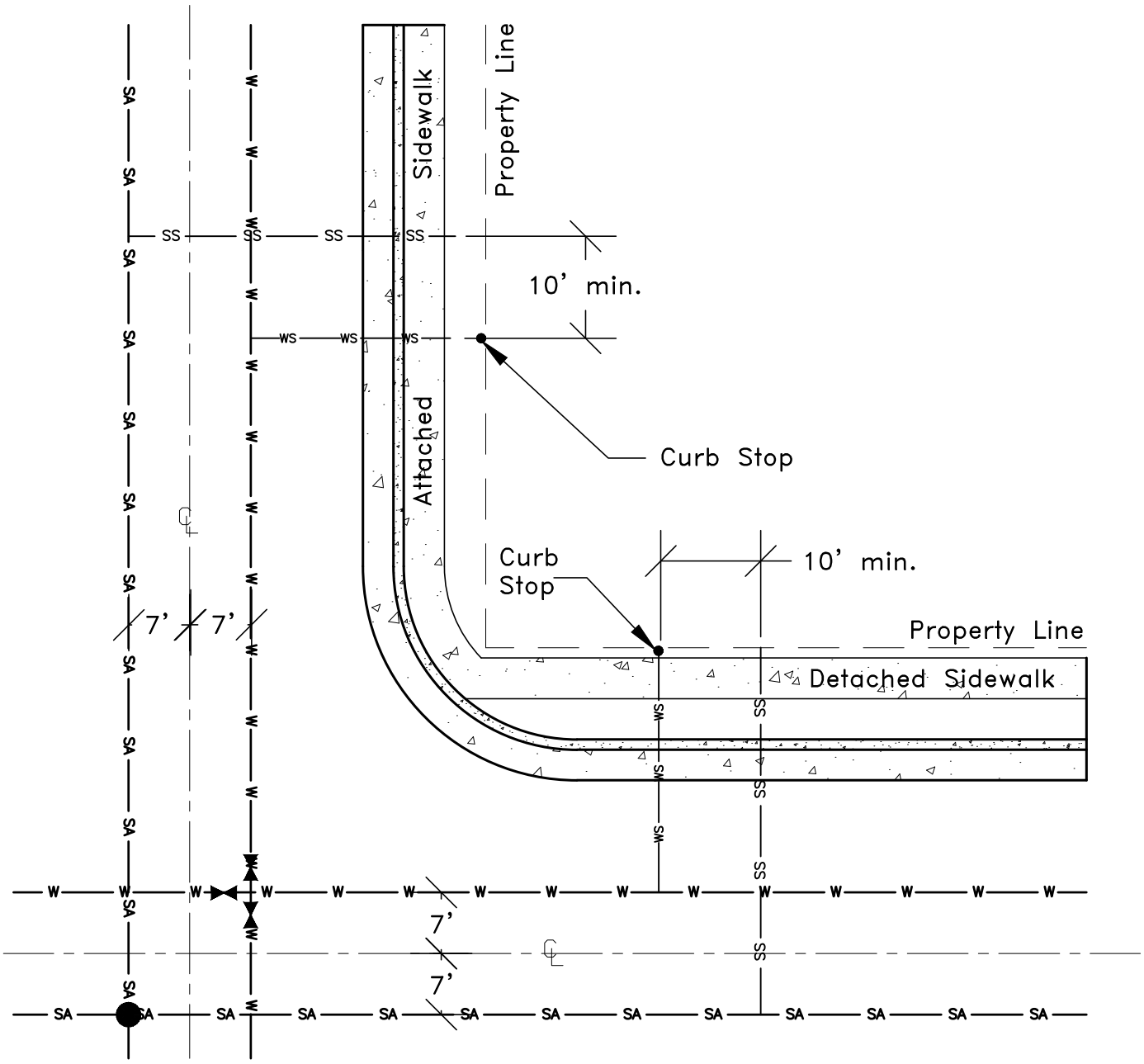
WATER MAIN VALVES

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 02665–02



NOTES:

1. Mark curb where service crosses beneath: A "W" for water, and an "S" for sewer shall be either stamped into newly finished concrete or ground into cured concrete to appropriately mark the utility location.
2. All services to be stubbed to property line.
3. Locate water service uphill from sanitary sewer services.
4. Fire hydrants should be located on the northwest corner of each intersection, where practical.
5. All water lines shall have a 5'–6" to 6'–0" of cover.
6. All sanitary sewer line shall have 8'–0" (minimum) of cover, unless the City Engineer authorizes less cover based on justified design.

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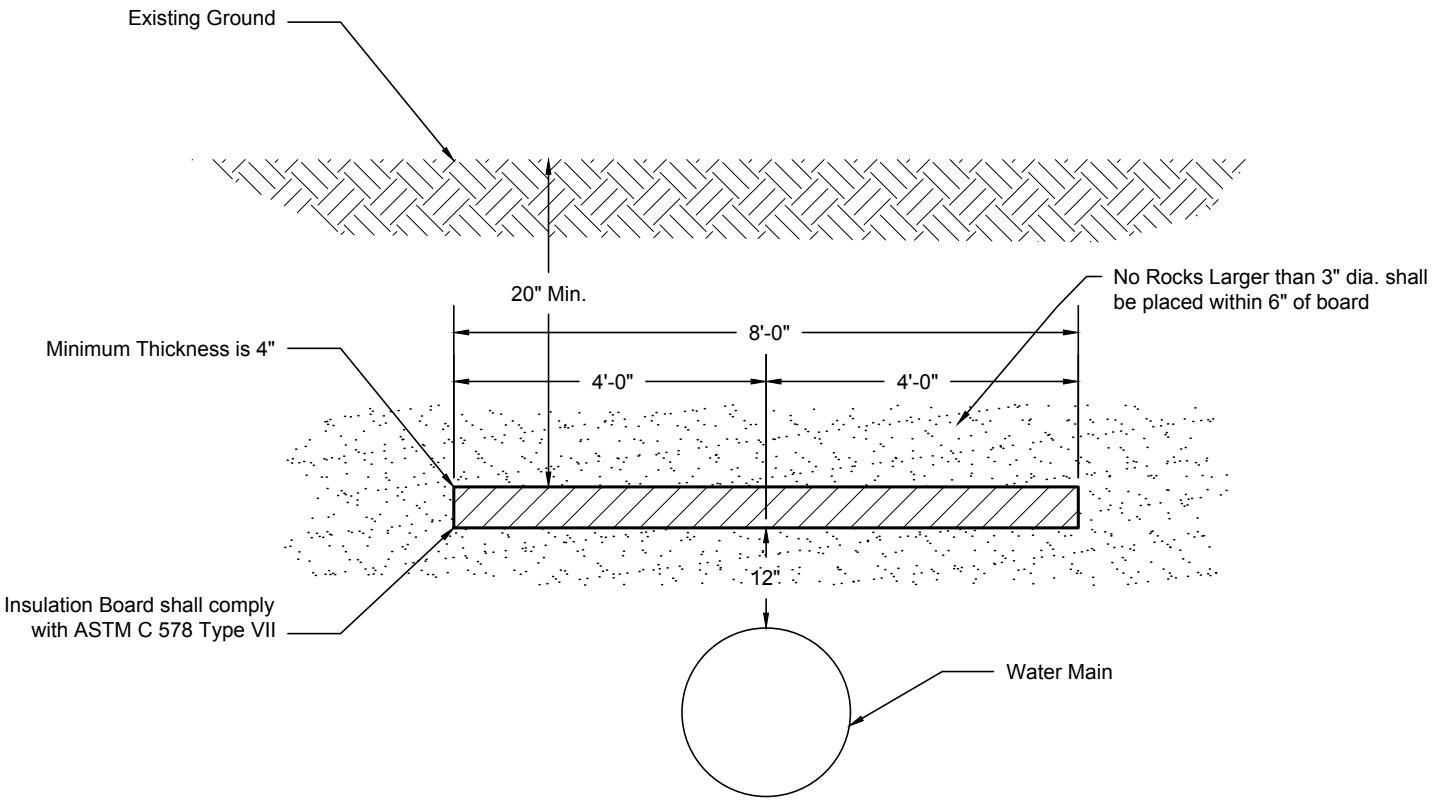
TYPICAL UTILITIES LAYOUT

DATE: MARCH 2012

DRAWING NO. 02665–03

DRAWN BY: JAC

APPROVED BY: CITY ENGINEER DLH/KDS



NOTES:

1. If depth of cover is between 3.0 and 5.0 feet, board shall extend a minimum of four feet either side of pipe.

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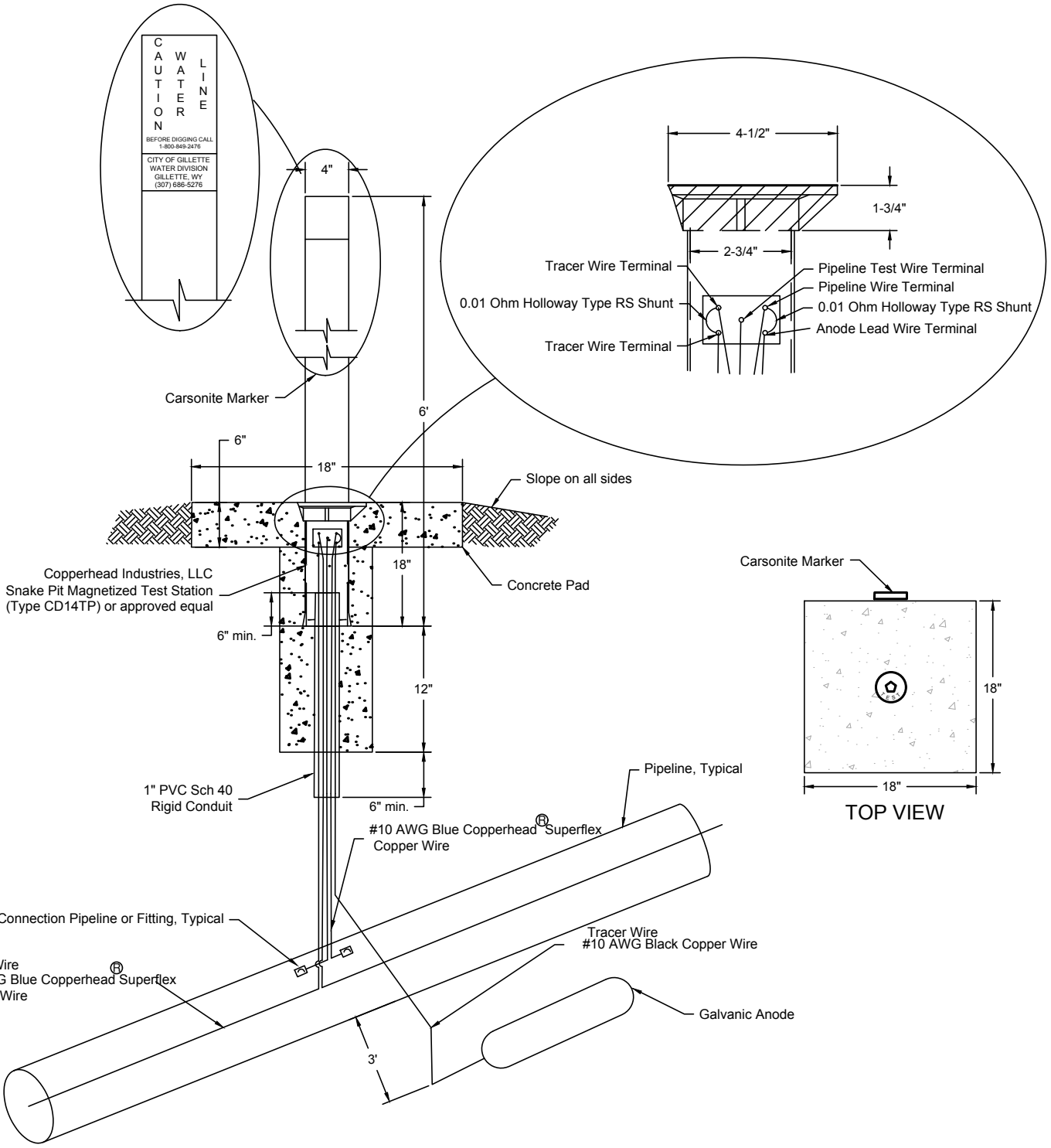
INSULATION BOARD INSTALLATION

DATE: MARCH 2012

DRAWING NO. 02665-04

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



Notes:

1. Install Galvanic Anode 1' below pipeline invert elevation.
2. Provide sufficient slack in test wires/tracer wires to allow terminal block to extend 18" out of test station.
3. Carsonite Markers shall be required only in non-urban areas.
4. If Cathodic protection is not required and a Test Station is provided exclusively for trace wire, a two (2) terminal Test Station is acceptable.

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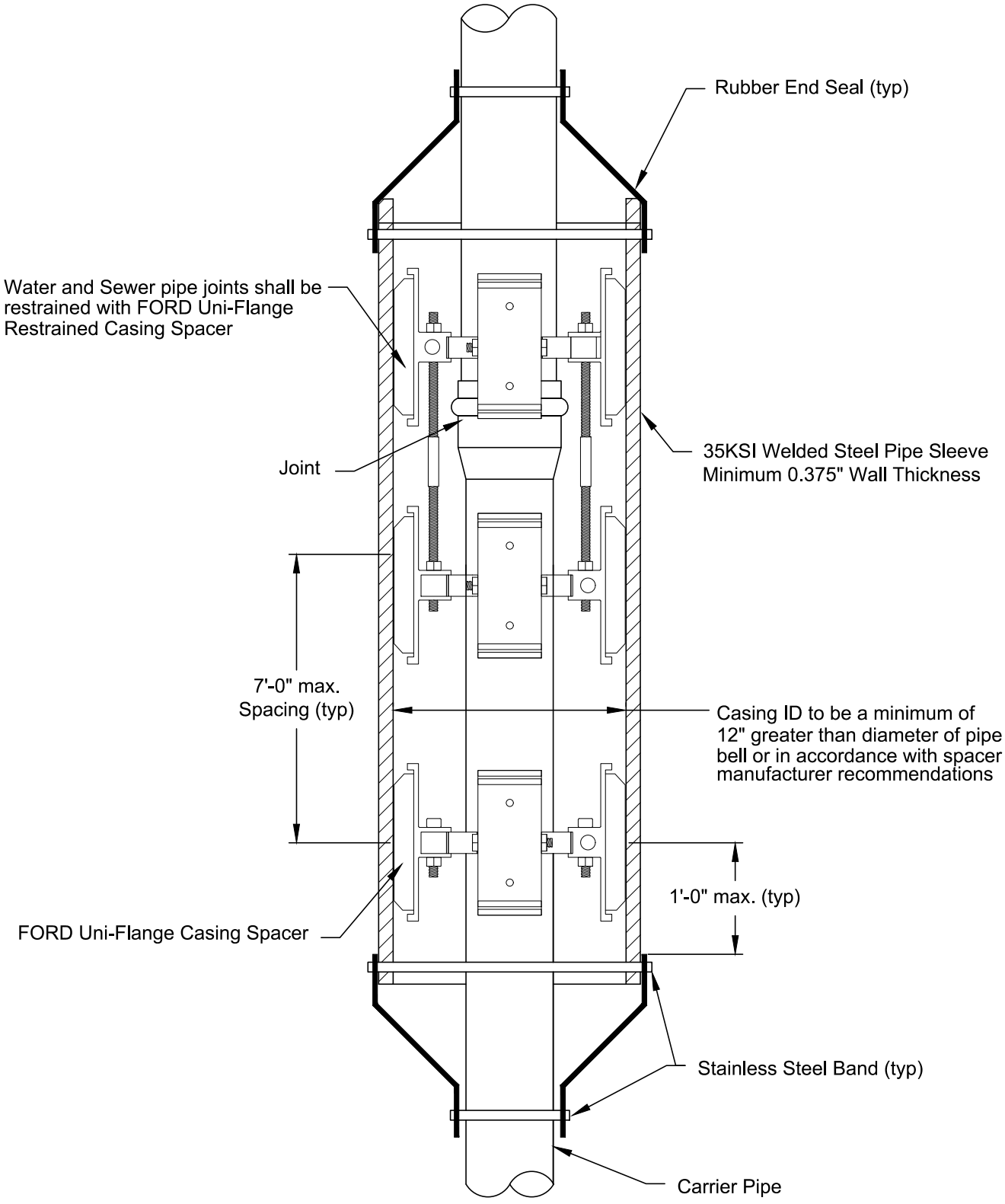
CATHODIC PROTECTION / TRACER WIRE TEST STATIONS

DATE: MAY 2017

DRAWING NO. 02665–05

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



NOTE:

1. Casing pipe that is bored shall have 32 lb. anode bags cad welded to each end.

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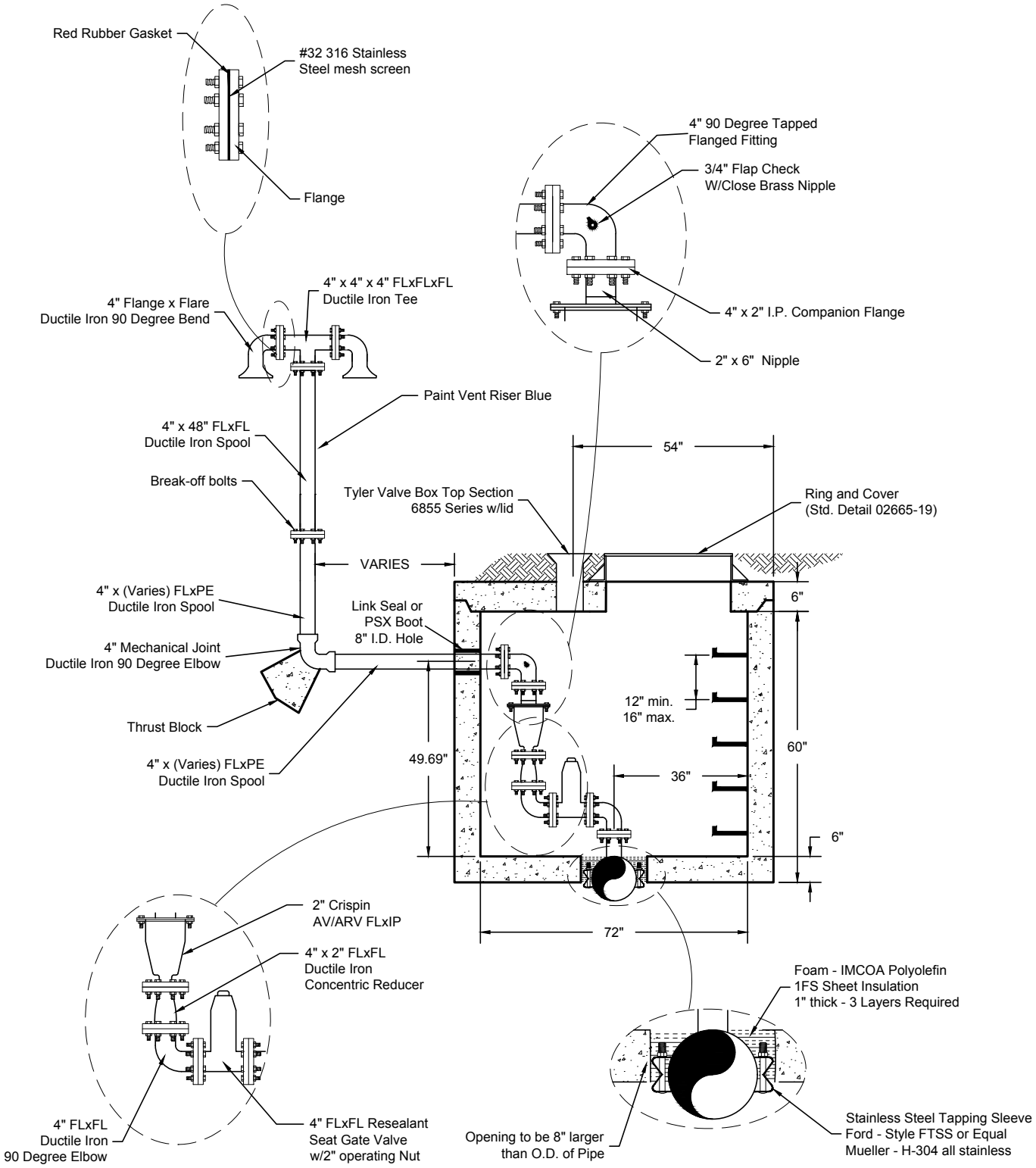
WATER / SANITARY SEWER BORE CASING

DATE: MARCH 2012

DRAWING NO. 02665–06

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



Notes:

1. Concrete - 4000 psi 28 day strength.
2. Reinforcement - ASTM A-615 Grade 60 and A-185 WWF.
3. Cement - Type V or Type II with W/C ratio < 0.45.
4. ASTM C-478 governs.
5. Steps shall be non corrosive rubber coated aluminum or nylon and be supplied with the vault.
6. The vault shall be 72" in diameter.

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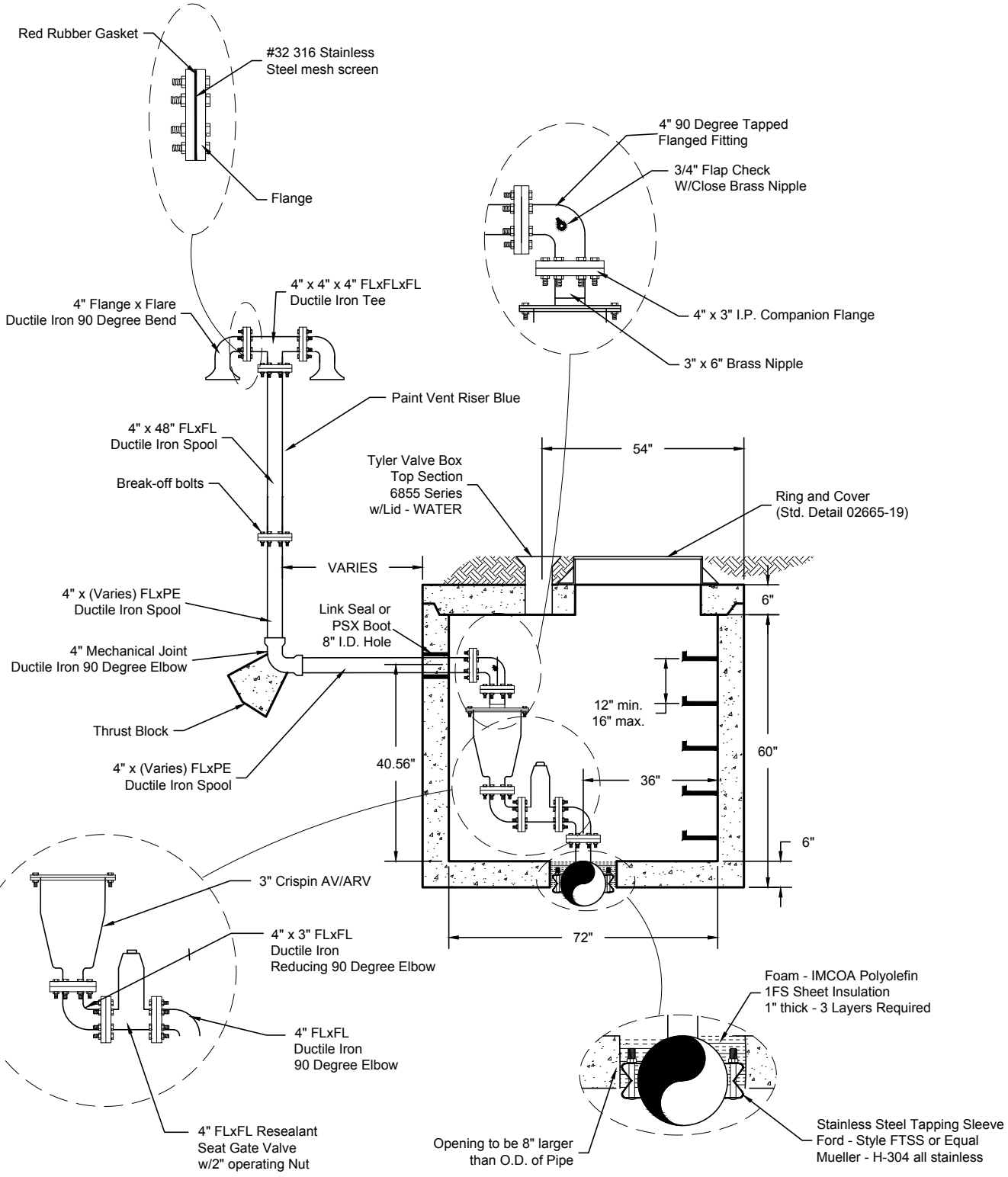
2" AIR VACUUM AIR RELEASE VALVE

DATE: MARCH 2012

DRAWING NO. 02665-07

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



Notes:

1. Concrete - 4000 psi 28 day strength.
2. Reinforcement - ASTM A-615 Grade 60 and A-185 WWF.
3. Cement - Type V or Type II with W/C ratio < 0.45.
4. ASTM C-478 governs.
5. Steps shall be non corrosive rubber coated aluminum or nylon and be supplied with the vault.
6. The vault shall be 72" in diameter.

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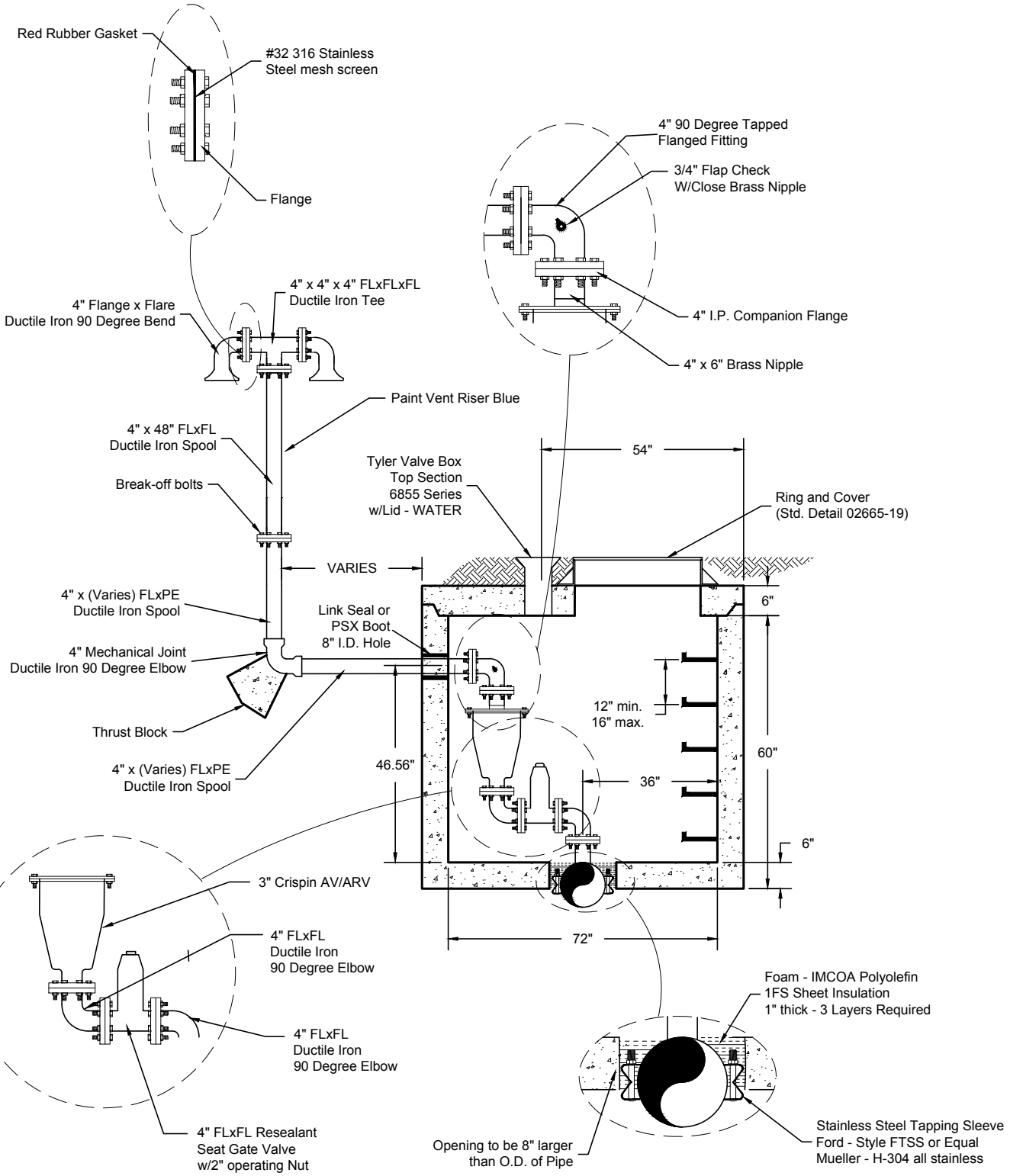
3" AIR VACUUM AIR RELEASE VALVE

DATE: MARCH 2012

DRAWING NO. 02665-08

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



Notes:

1. Concrete - 4000 psi 28 day strength.
2. Reinforcement - ASTM A-615 Grade 60 and A-185 WWF.
3. Cement - Type V or Type II with W/C ratio < 0.45.
4. ASTM C-478 governs.
5. Steps shall be non corrosive rubber coated aluminum or nylon and be supplied with the vault.
6. The vault shall be 72" in diameter.

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PHONE: (307) 686-5311

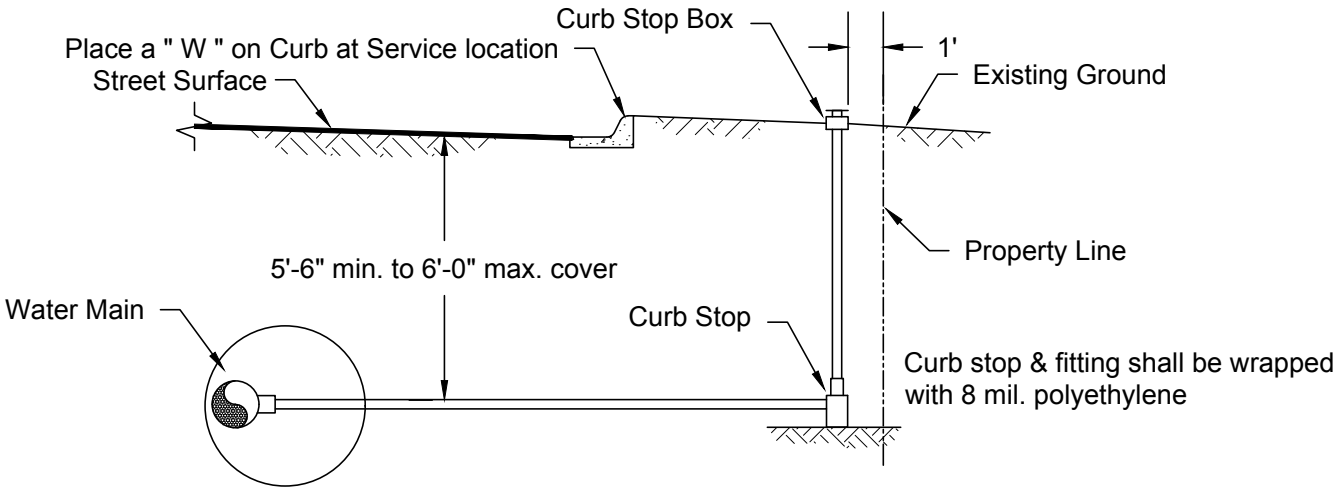
4" AIR VACUUM AIR RELEASE VALVE

DATE: MARCH 2012

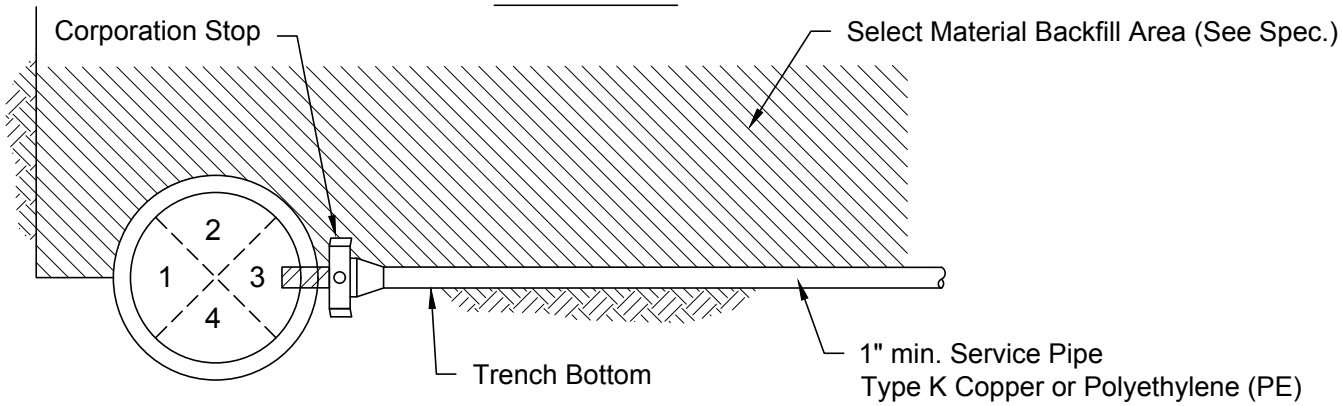
DRAWING NO. 02665–09

DRAWN BY: CJS

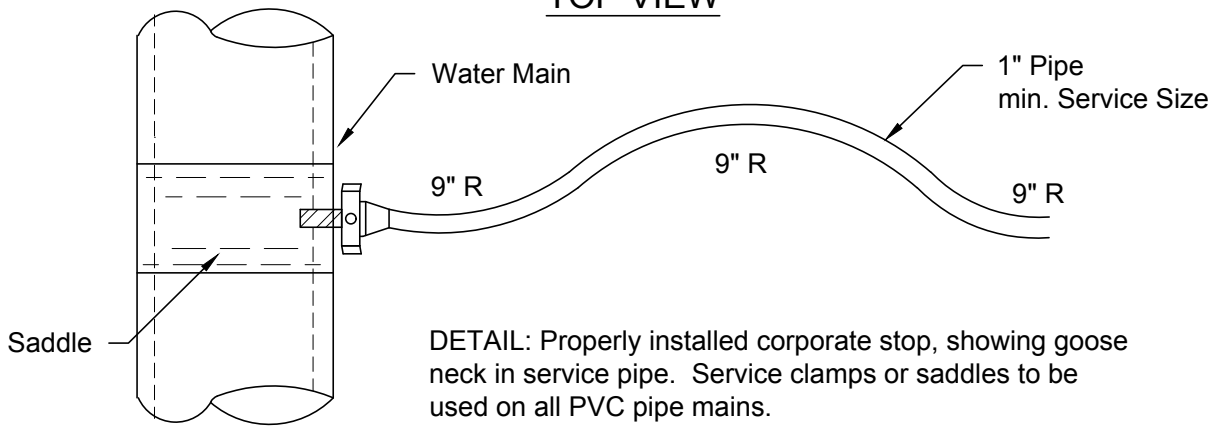
APPROVED BY: CITY ENGINEER HV/KDS



SIDE VIEW



TOP VIEW



DETAIL: Properly installed corporate stop, showing goose neck in service pipe. Service clamps or saddles to be used on all PVC pipe mains.

NOTES:

1. Water Service lines shall have a minimum 5'-6" to 6'-0" maximum cover measured from the existing ground surface, except that cover shall be measured from centerline street grade when service lines are laid to a street side which has an uphill slope.
2. Water Service lines shall be installed EXACTLY where shown on the drawings or as specified.
3. Bedding shall be 1" diameter (maximum) within 6" of service pipe.
4. All brass fittings shall be lead-free.

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TYPICAL WATER SERVICE CONNECTION

DATE: MARCH 2012

DRAWING NO. 02665–10

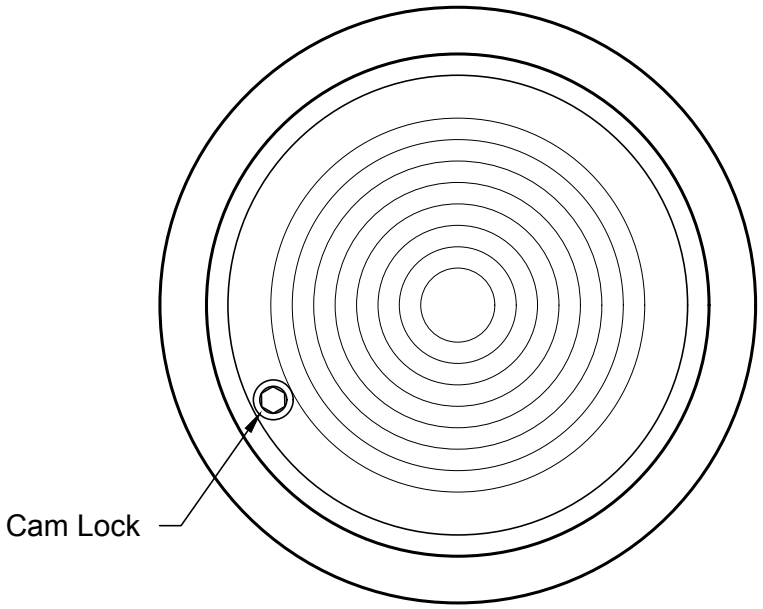
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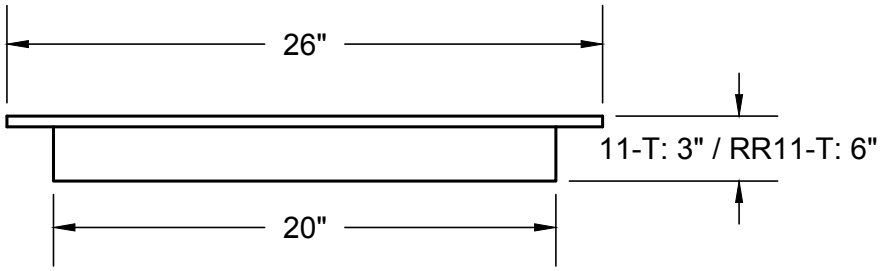
APPROVED BY: CITY ENGINEER HV/KDS

FORD - No. 11-T round pit ring and extra heavy lid (3" height).

FORD - RR11-T ring casting with extra heavy duty top lid (6" height).

MATERIAL: Cast gray iron
ASTM A-48 Class 35B





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WATER METER PIT FRAME COVER

DRAWN BY: CJS

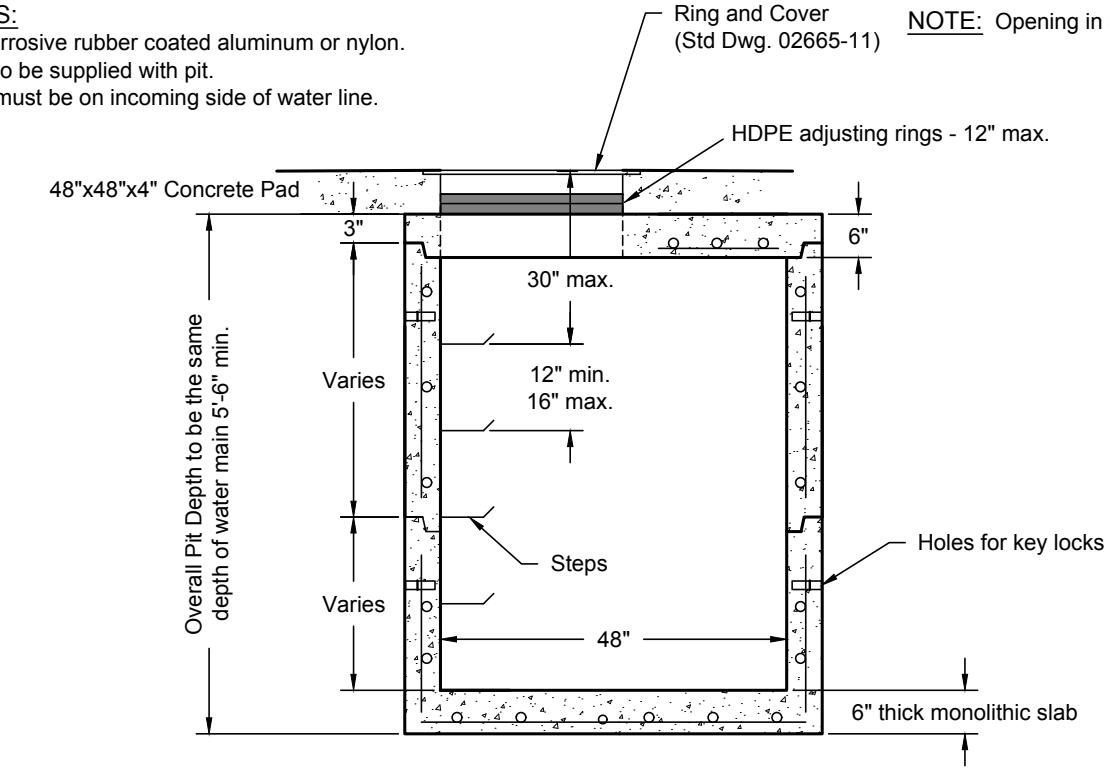
APPROVED BY: CITY ENGINEER HV/KDS

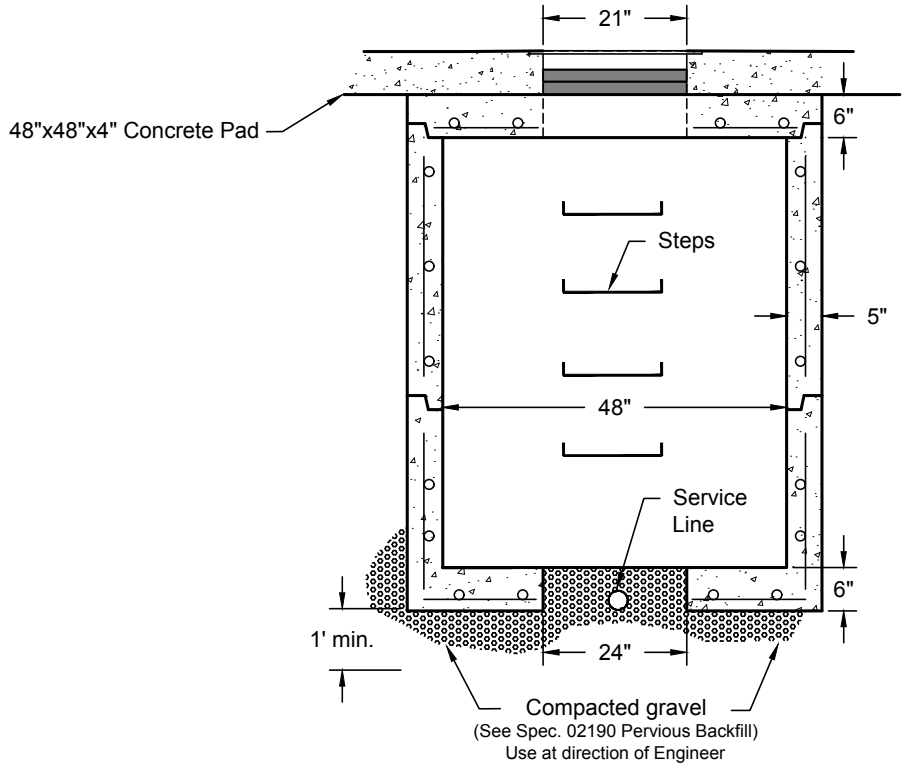
DATE: MARCH 2012

DRAWING NO. 02665–11

STEPS:
Non corrosive rubber coated aluminum or nylon.
Steps to be supplied with pit.
Steps must be on incoming side of water line.

NOTE: Opening in lid to be above steps.





NOTES:
1. Concrete - 4000 PSI 28 day strength.
2. Reinforcement - ASTM A-615 Grade 60 and A-185 WWF.
3. Cement - Type V or Type II with 5.5 bag mix and W/C ratio < 0.45.
4. ASTM C-478 governs.
5. Meter Pit installation to be located outside of sidewalk perimeters.

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METER PIT FOR 1" AND SMALLER METERS

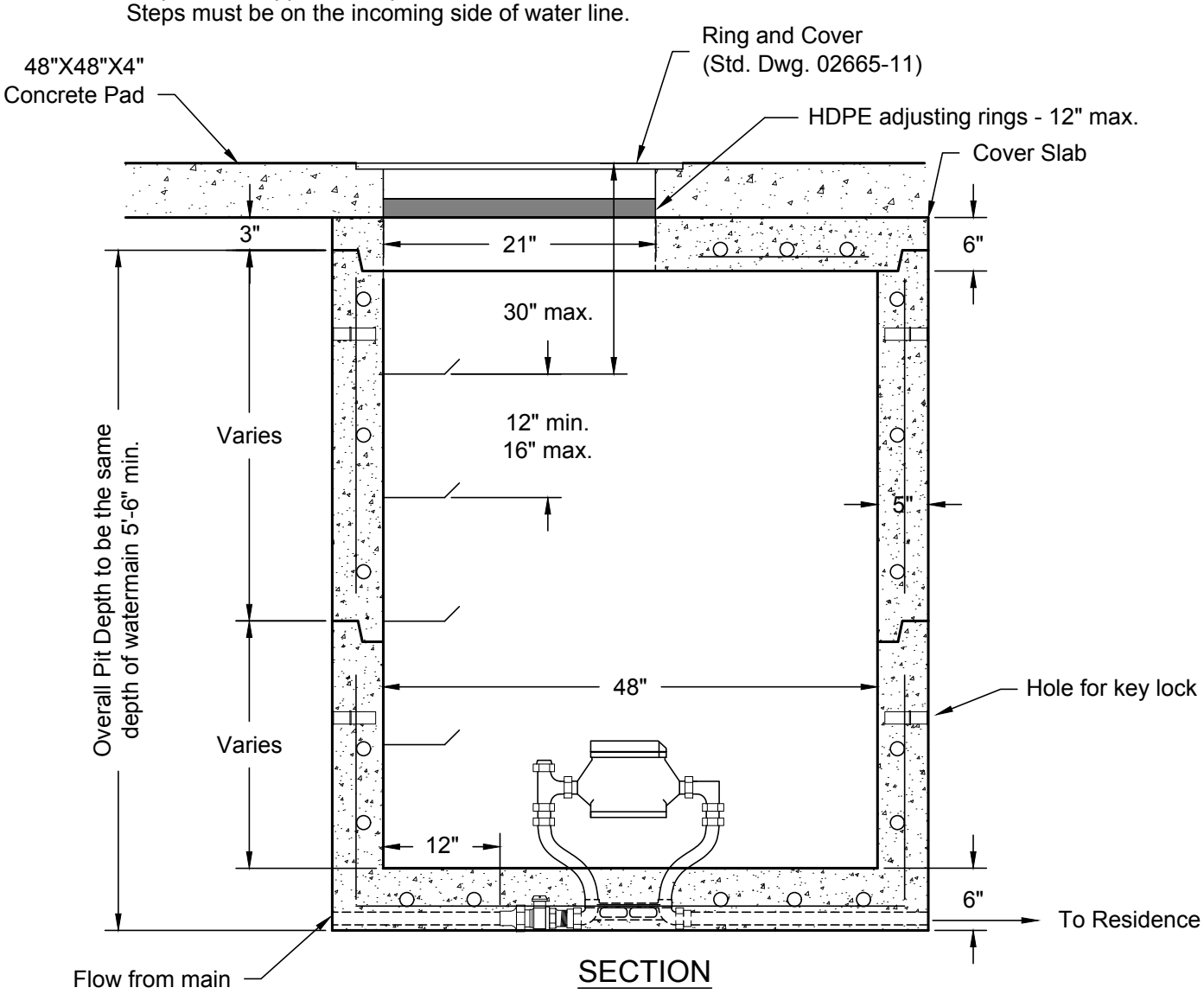
DATE: MARCH 2012

DRAWING NO. 02665–12

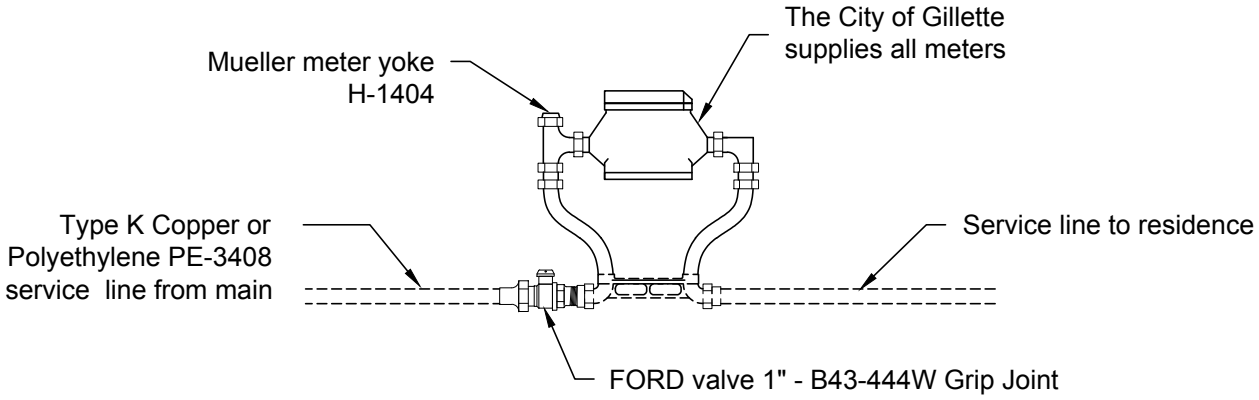
DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

STEPS Non-corrosive rubber coated aluminum or nylon.
Steps to be supplied with pit.
Steps must be on the incoming side of water line.



SECTION



NOTES:

1. Opening in lid to be above steps and valve.
2. 48"x48"x4" Concrete Pad is required when not located within a paved area.
3. Meter Pit Installation not allowed within sidewalk perimeters.

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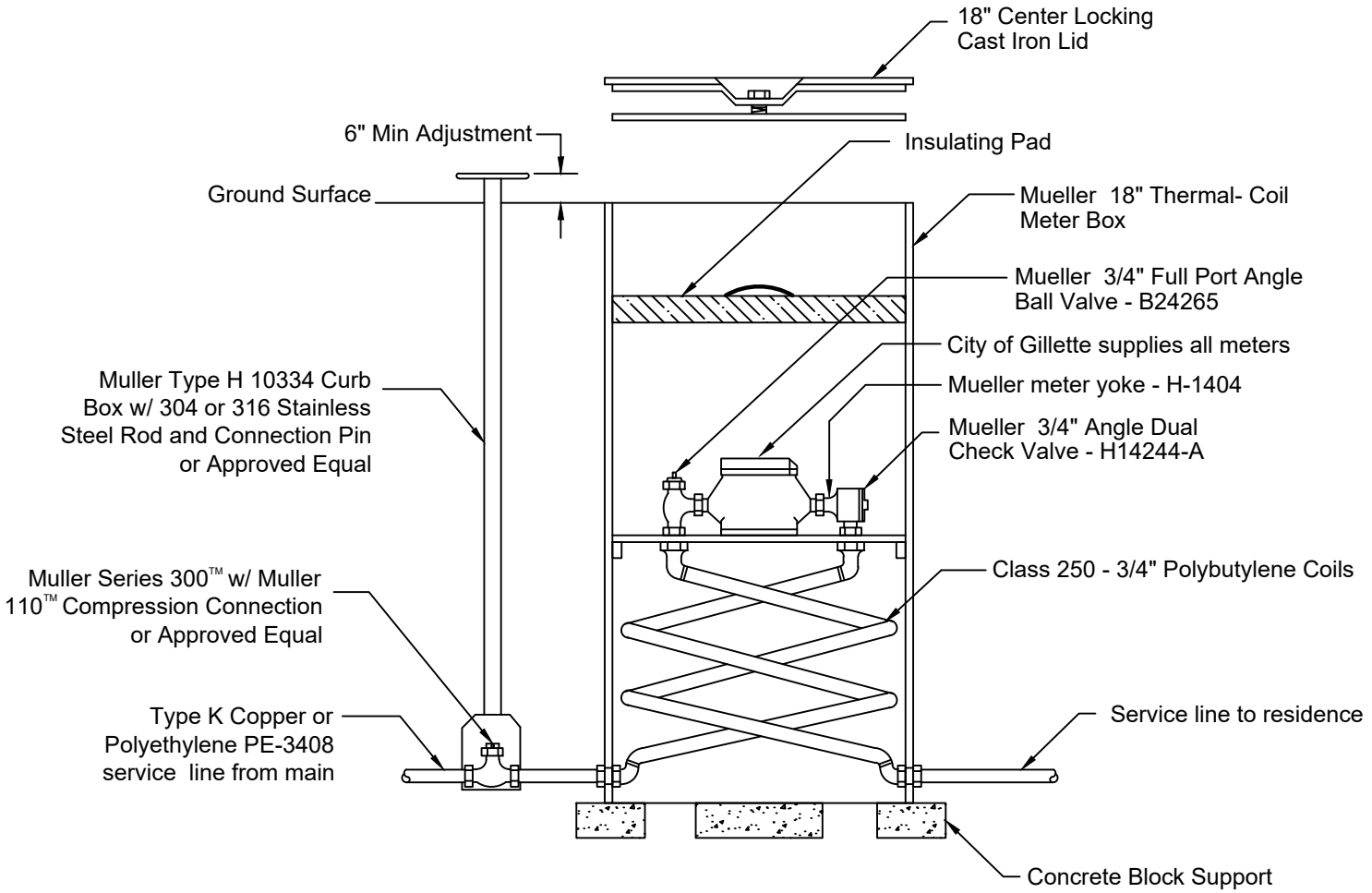
TYPICAL METER INSTALLATION FOR 1" AND SMALLER METERS

DRAWN BY: CJS

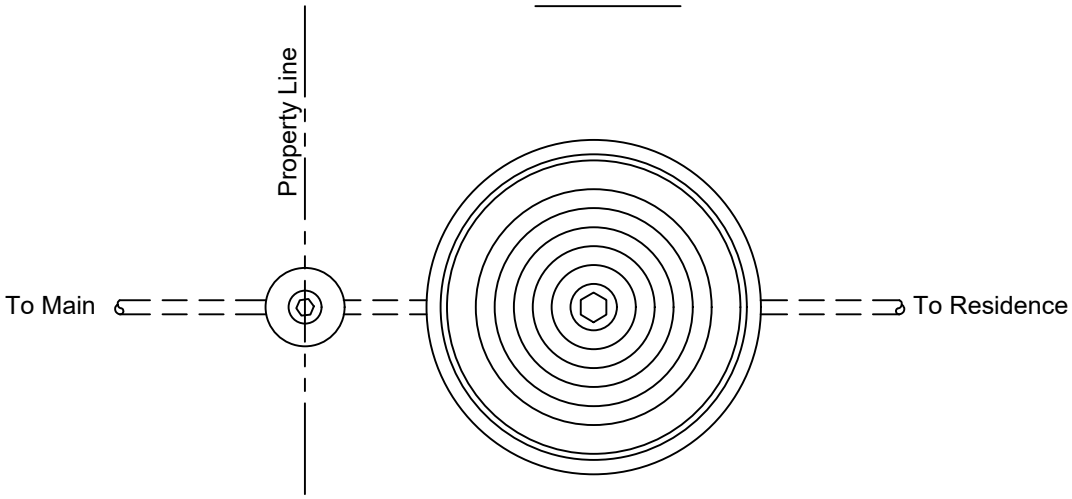
APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 02665–13



SECTION



PLAN VIEW

NOTES:

1. Meter Pit shall not be installed within driveways or sidewalks.
2. All meters are to be supplied by the City of Gillette.

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THERMAL-COIL METER BOX

DATE: NOVEMBER 2020

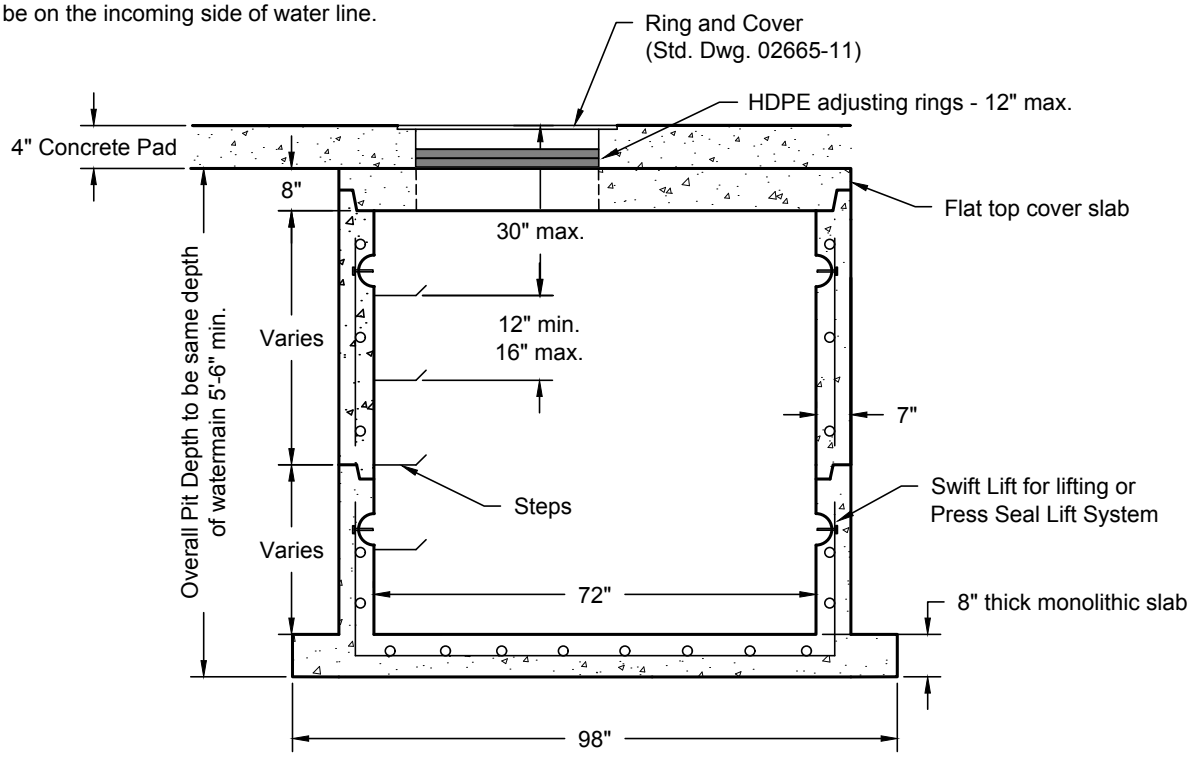
DRAWING NO. 02665–14

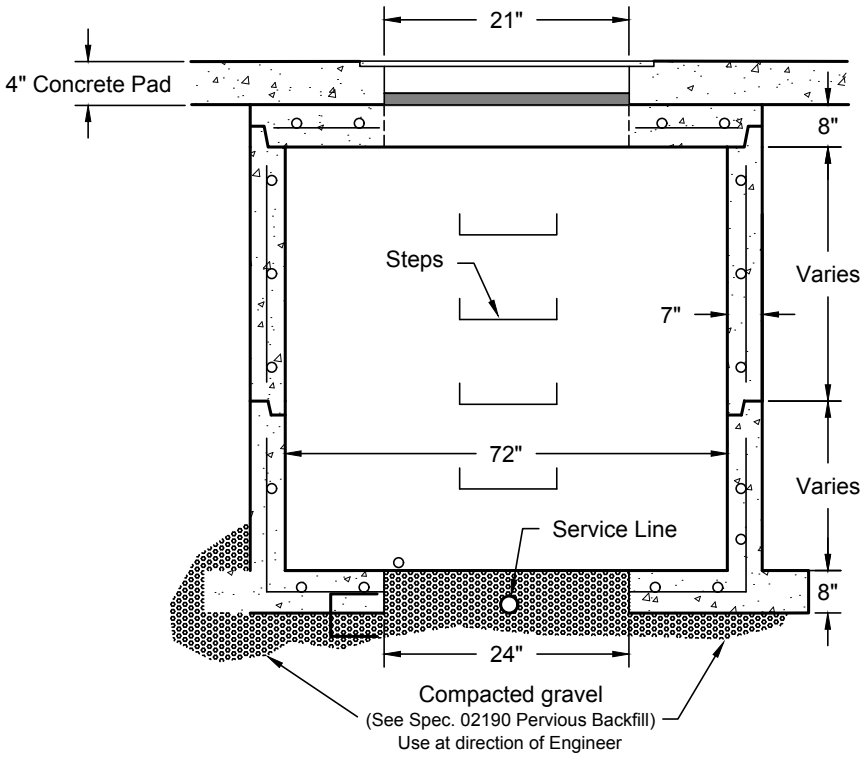
DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

STEPS:
Non corrosive rubber coated aluminum or nylon.
Steps to be supplied with pit.
Steps must be on the incoming side of water line.

NOTE: Opening in lid is to be above steps and Valve.





NOTES:

1. Concrete - 4000 PSI 28 Day strength.
2. Reinforcement - ASTM A-615 Grade 60 and A-185 WWF.
3. Cement - Type V or Type II modified.
4. ASTM C-478 governs.
5. Meter Pit Installation to be located outside of sidewalk perimeters.
6. 48"x48"x4" Concrete Pad is required when not in a paved area.

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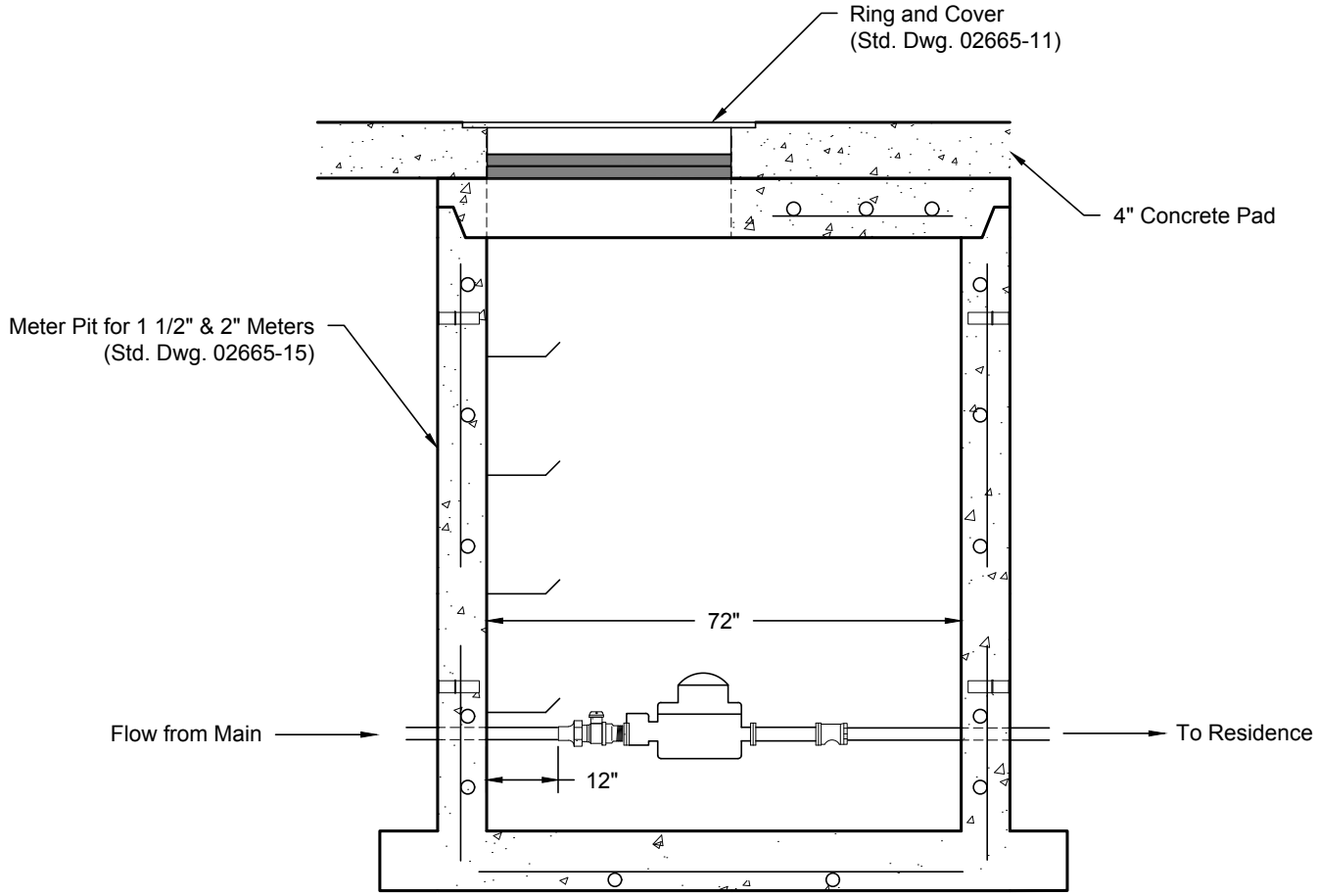
METER PIT FOR 1 ½" & 2" METERS

DATE: MARCH 2012

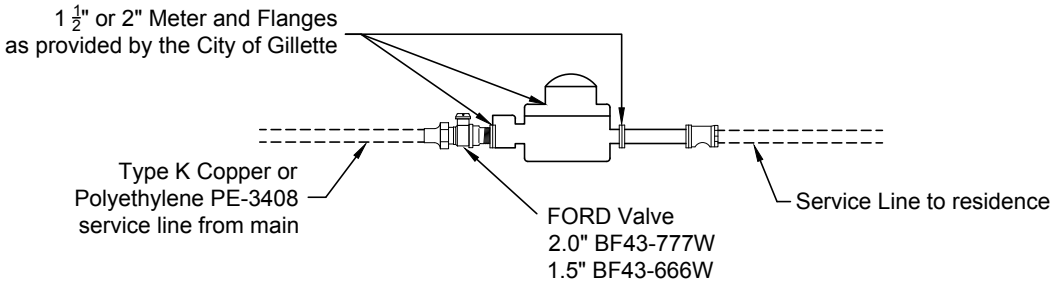
DRAWING NO. 02665–15

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



SECTION



NOTES:

1. Opening in lid to be above steps and valve.
2. 48"x48"x4" Concrete Pad is required when not located within a paved area.
3. Meter Pit installation to be located outside of sidewalk perimeter.

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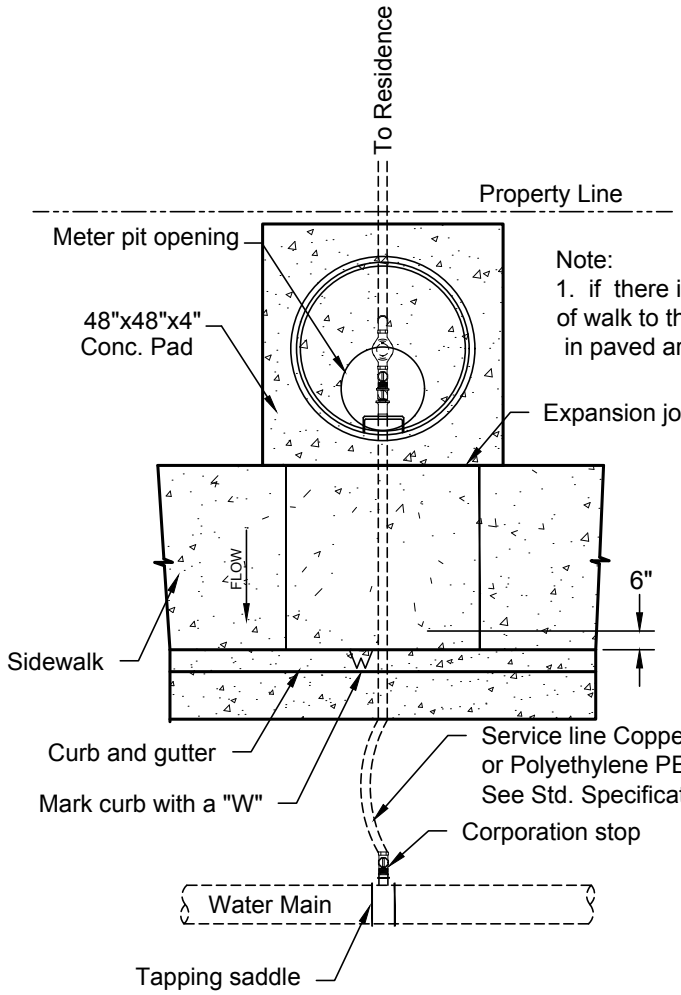
TYPICAL METER INSTALLATION FOR 1 1/2" & 2" METERS

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

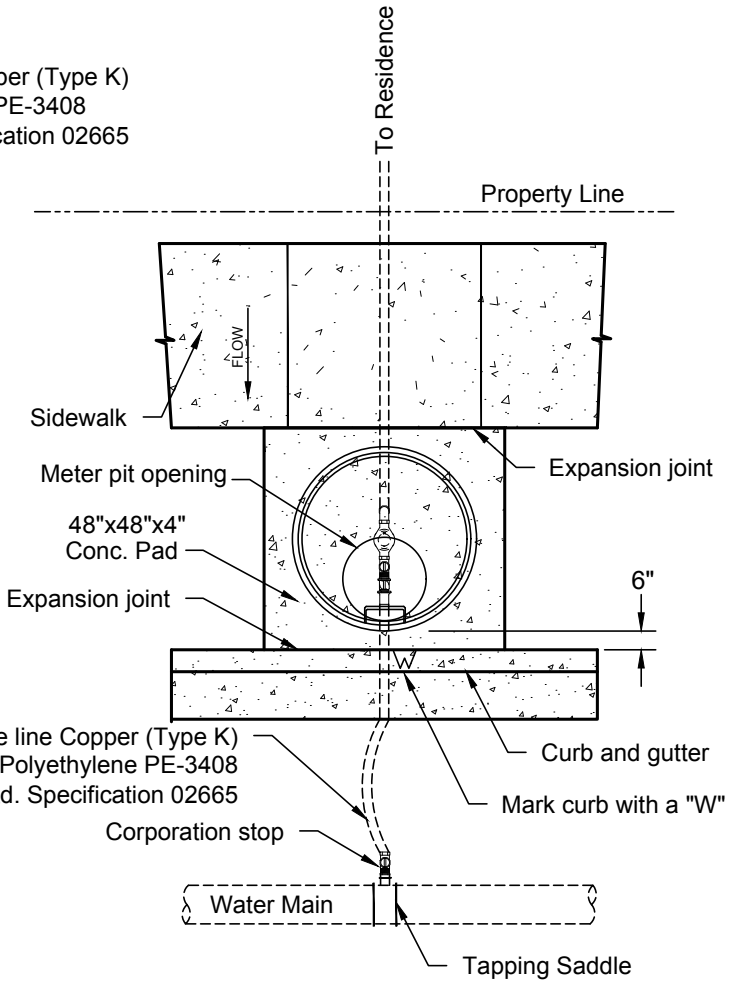
DATE: MARCH 2012

DRAWING NO. 02665-16



Plan View - Attached Sidewalk

Note:
1. if there is not enough distance from Back of walk to the Property Line install Meter Pit in paved area.



Plan View - Detached Sidewalk

NOTE:

1. Not Applicable for Thermal-Coil Meter Pits.

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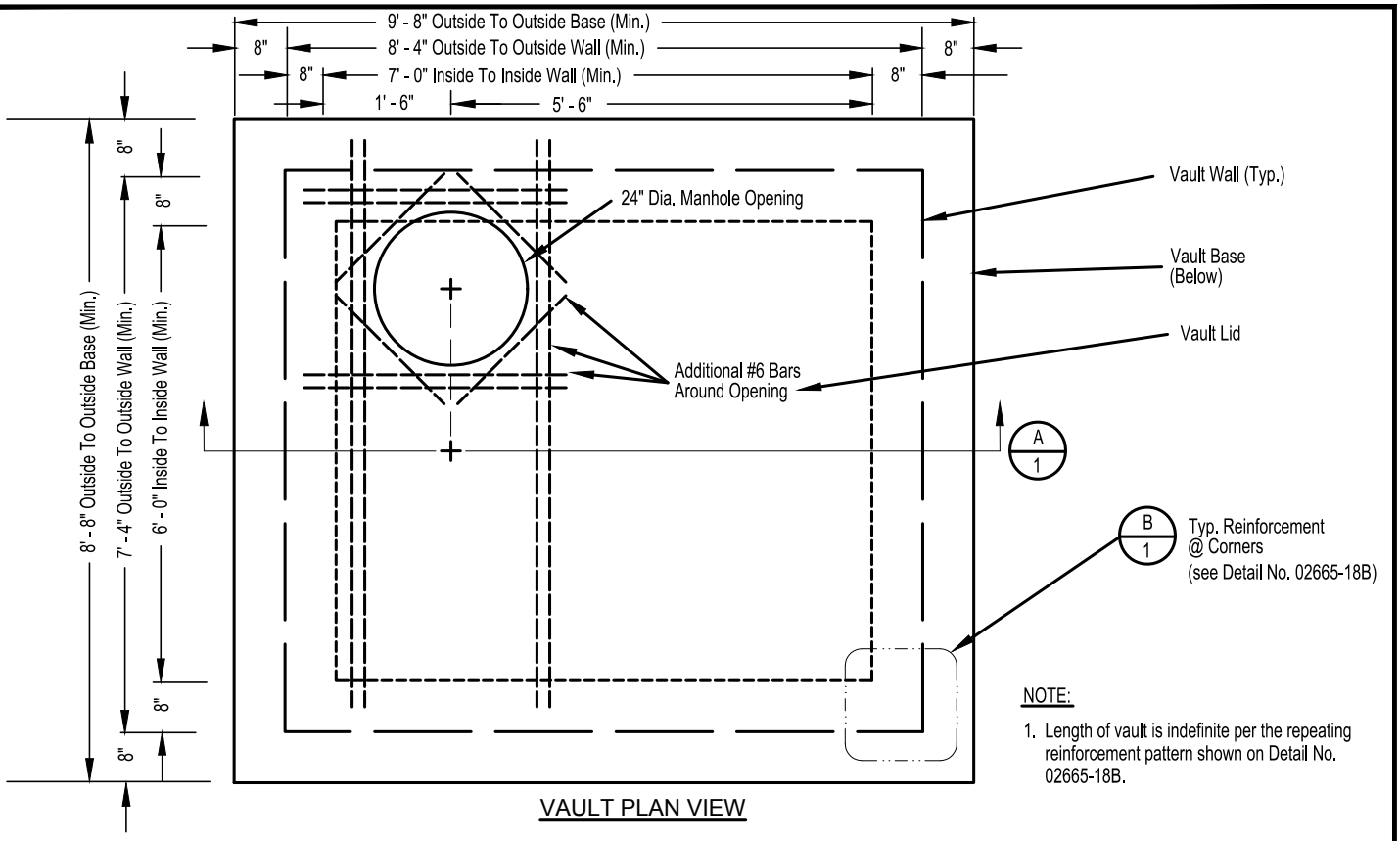
TYPICAL METER PIT PLACEMENT

DATE: MARCH 2012

DRAWING NO. 02665–17

DRAWN BY: CJS

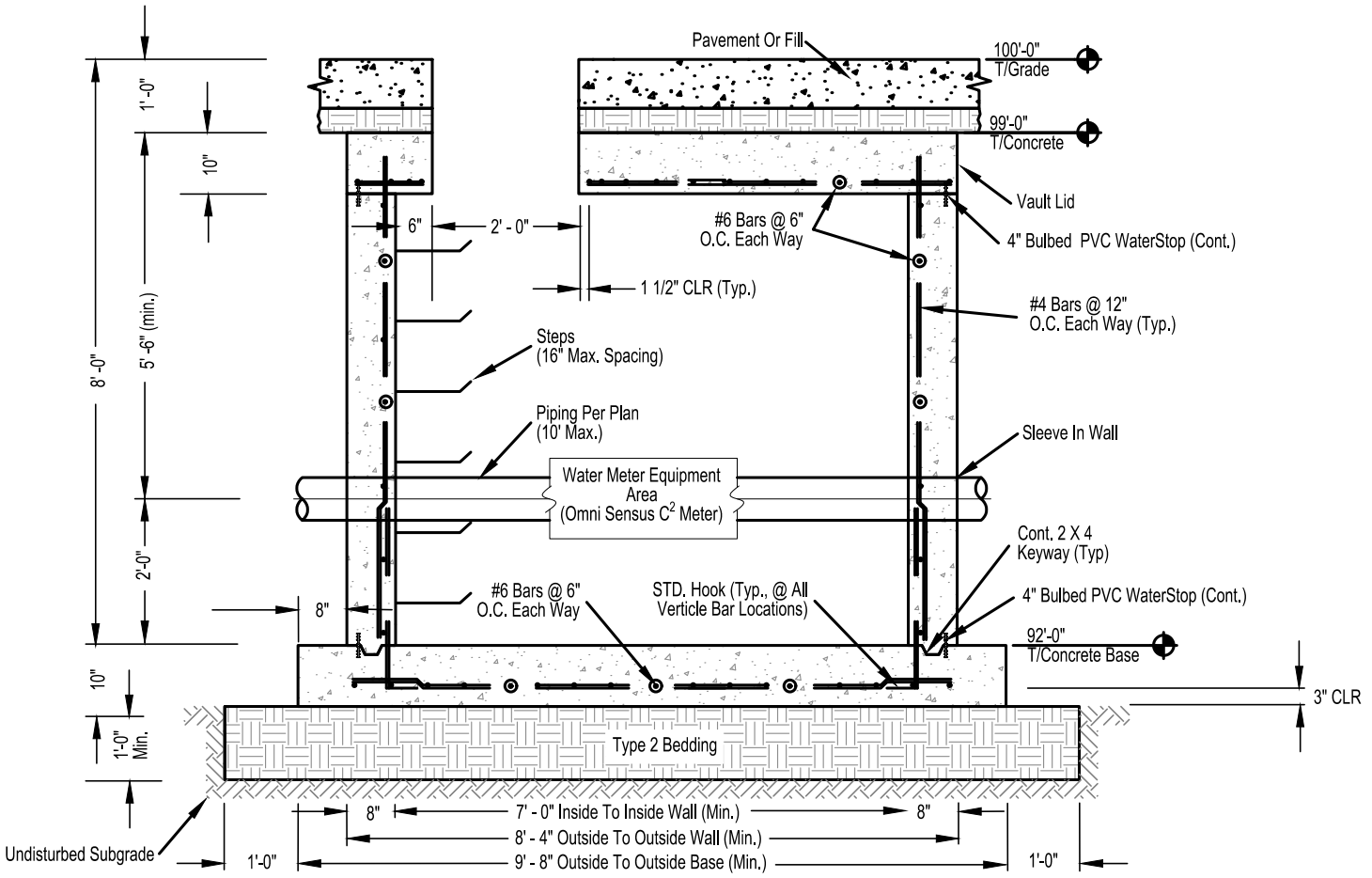
APPROVED BY: CITY ENGINEER HV/KDS



NOTE:

1. Length of vault is indefinite per the repeating reinforcement pattern shown on Detail No. 02665-18B.

VAULT PLAN VIEW



A
1
VAULT SECTION

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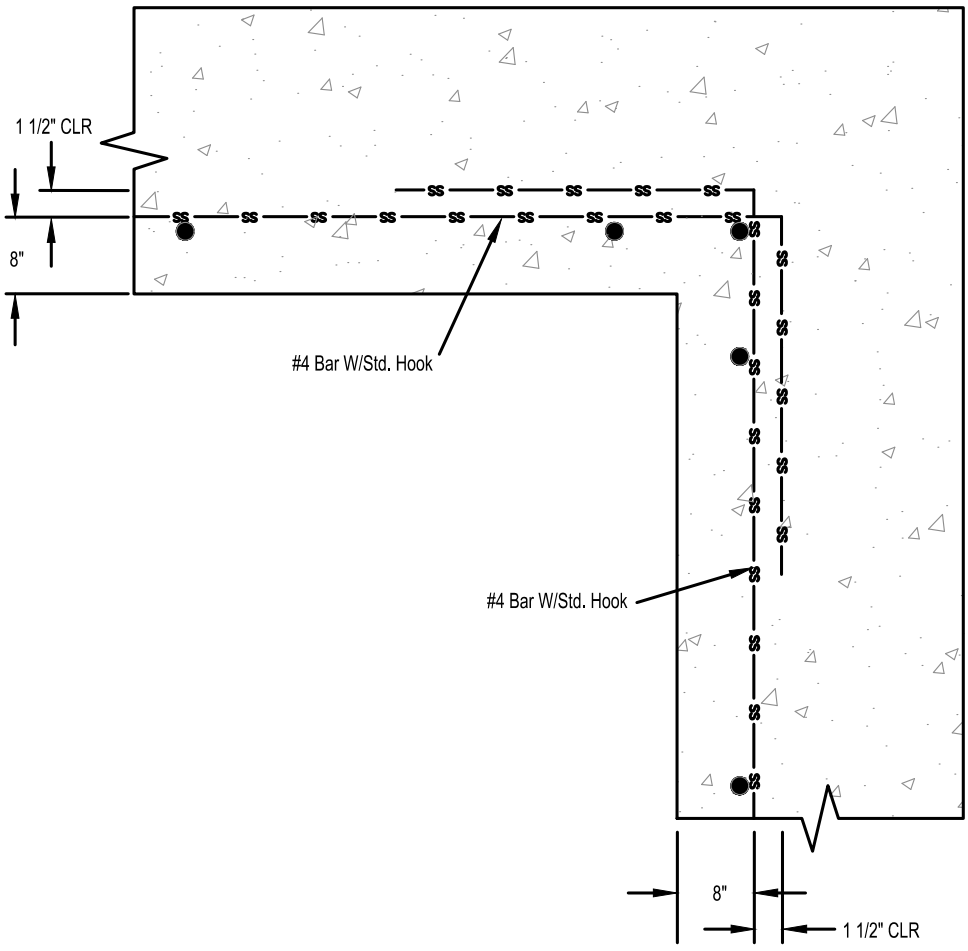
WATER METER VAULT (6' X 7') FOR 3" AND LARGER METERS

DATE: MARCH 2012

DRAWING NO. 02665-18A

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS



B/1 TYPICAL DETAIL @ WALL CORNERS

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GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

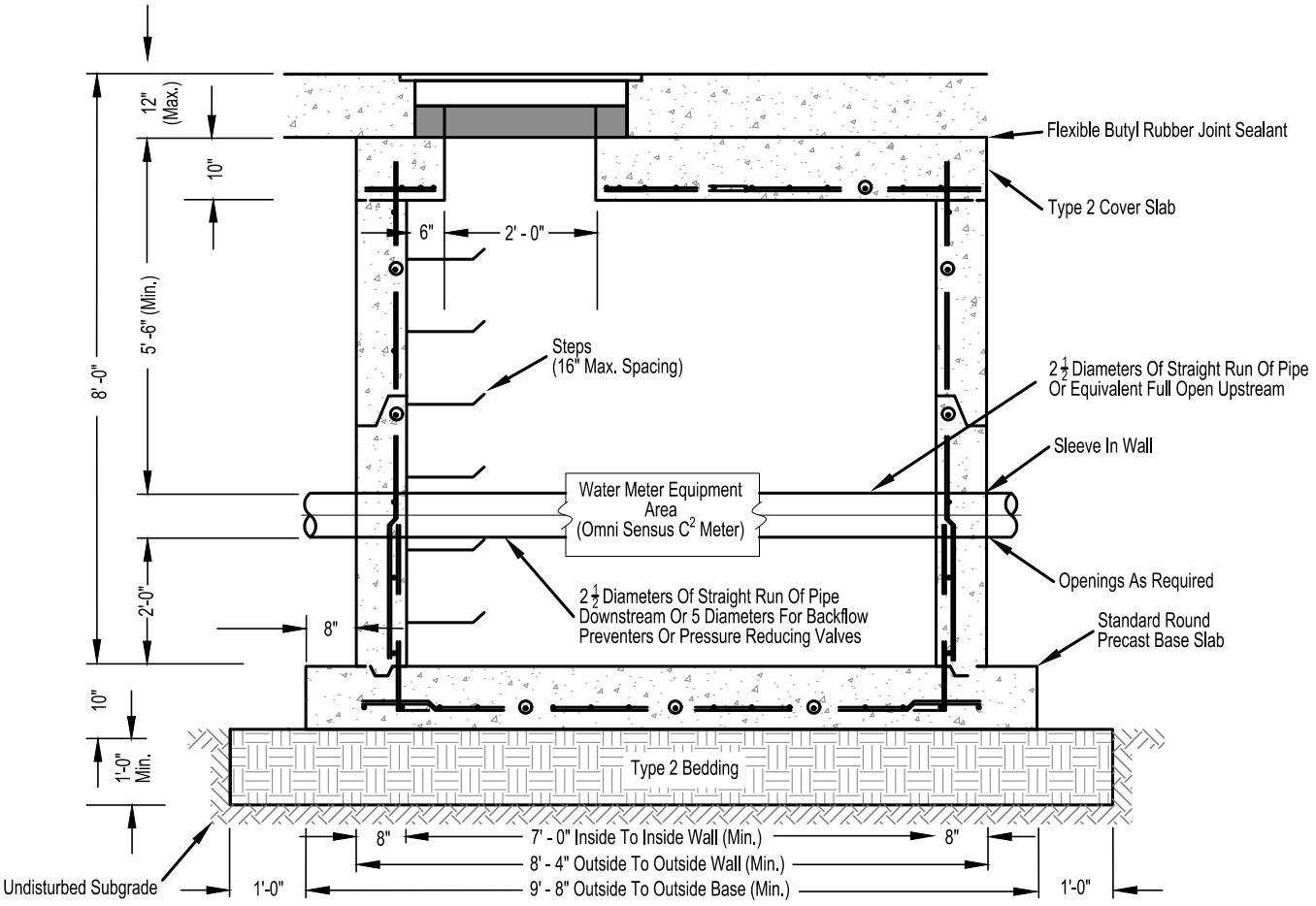
METER VAULT REINFORCEMENT @ WALL CORNERS

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 02665-18B



NOTE:

1. Full Open Gate Valve Included In Straight Run Of Pipe.

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PHONE: (307) 686-5311

FLAT TOP MANHOLE (PRECAST) FOR 3" AND LARGER METERS

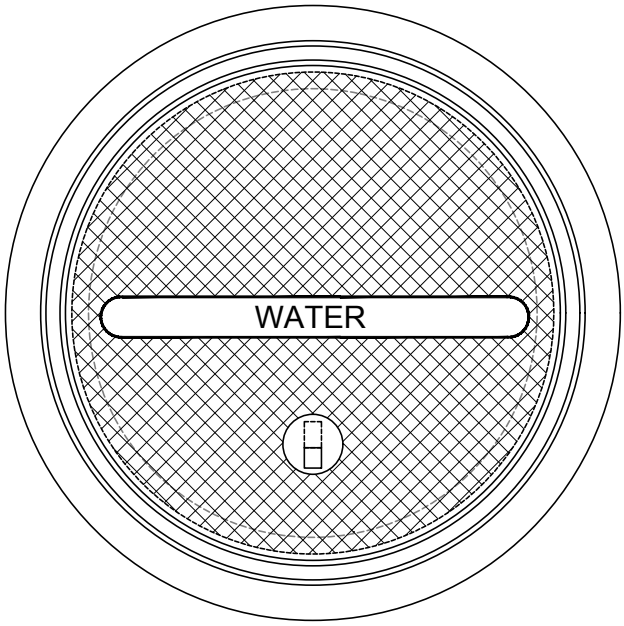
DRAWN BY: KEB

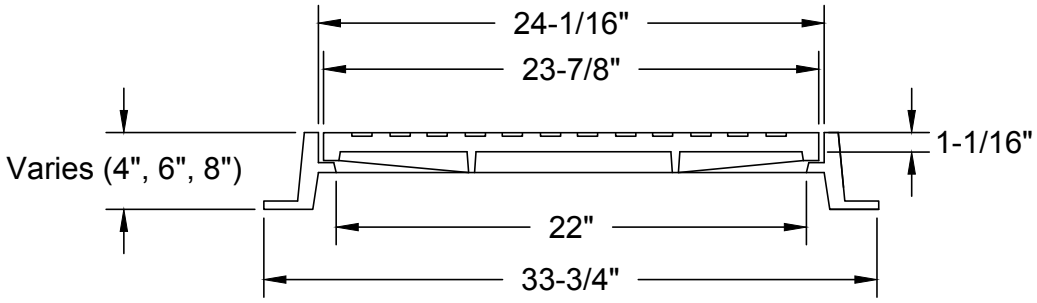
APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 02665-19

MATERIAL: Cast gray iron (ASTM A-48 Class 35B)	LID #: D&L FOUNDRY #A-1161 = Lid (cover) to be used for all rings
	RING #: D&L FOUNDRY #A-1071 (4") = 12" adjusting rings (max.)
FINISH: No paint	RING #: D&L FOUNDRY #A-1043 (6") = 10" adjusting rings (max.)
LID: SELF SEALING	RING #: D&L FOUNDRY #A-1161 (8") = 8" adjusting rings (max.)





NOTES: (all of the following must be specified when ordering)

1. Furnished with machined horizontal bearing surface.
2. "WATER" lettering on cover.
3. All lids shall have a cross-hatched pattern with a closed pick hole.
4. All lids shall be self-sealing.

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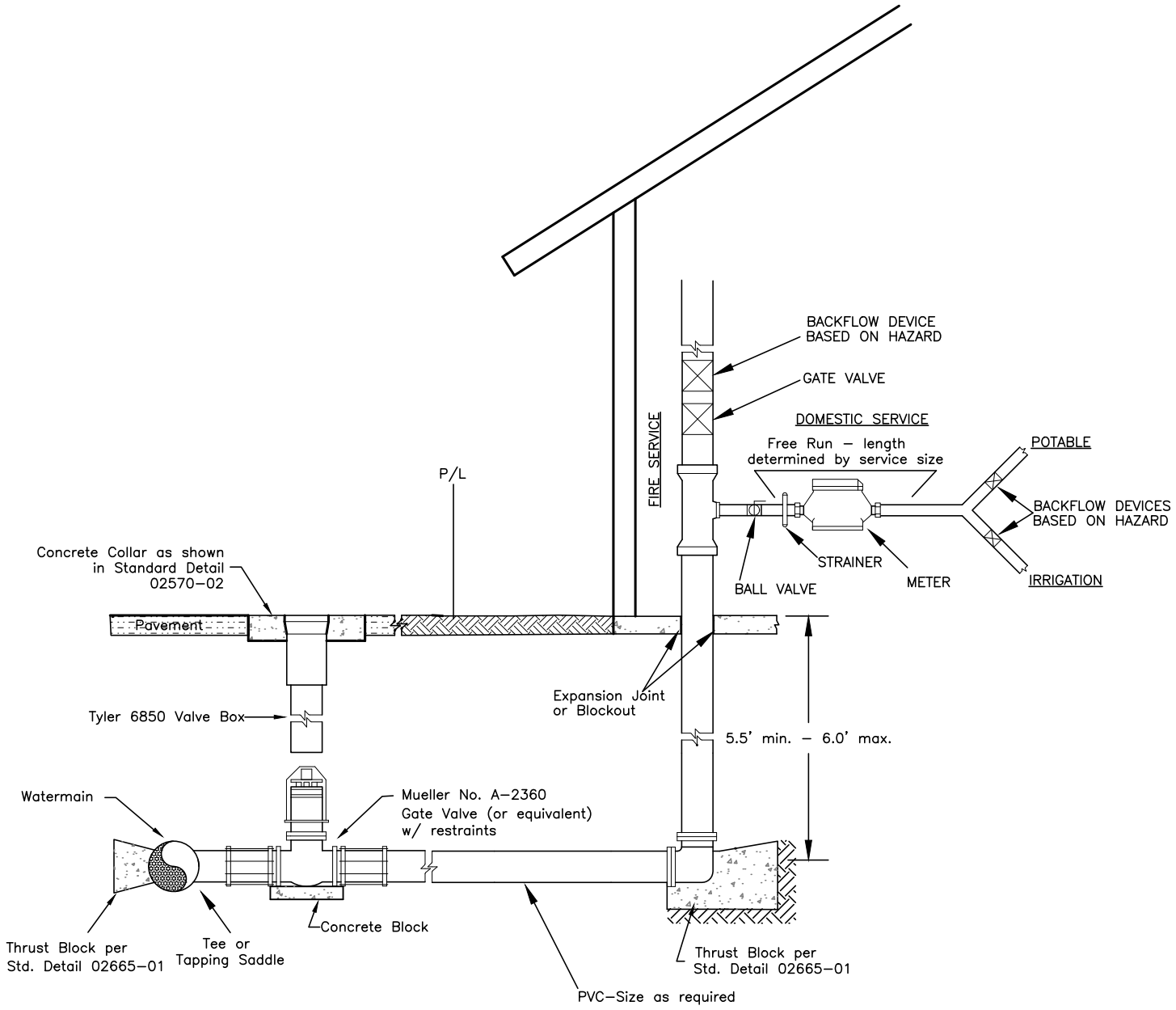
WATER ACCESS MANHOLE RING & COVER

DATE: MARCH 2012

DRAWING NO. 02665-20

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



NOTE:

1. Tapping Saddle shall be Smith-Blair 622 Series, Dresser Style 610, or engineer approved equal.
2. If Tee is used, Valve shall be located 18" - 24" from Tee and be restrained to pipe.
3. Free Runs before and after meter are only required for domestic services 1.5" and larger. The length of the free run shall be determined by the service size.
4. Zinc caps shall be provided for Cathodic protection of all tapping sleeve bolts.

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P.O. BOX 3003, 201 E. 5TH STREET
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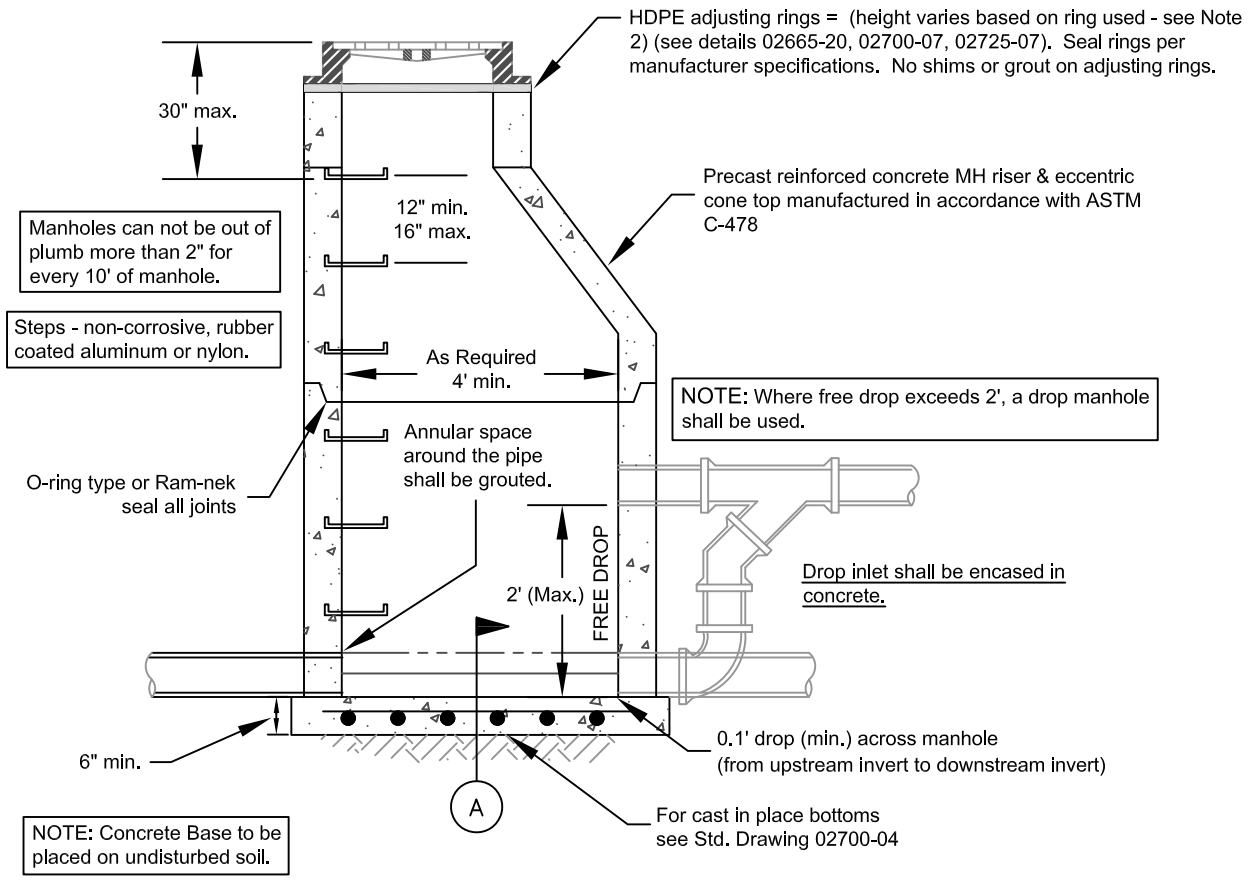
TYPICAL FIRE SERVICE WITH DOMESTIC SERVICES

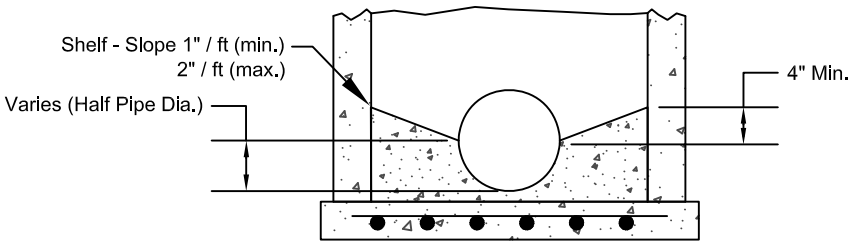
DATE: MARCH 2012

DRAWING NO. 02665-21

DRAWN BY: DLH

APPROVED BY: CITY ENGINEER HV/KDS





SECTION A

NOTES:

1. All Sanitary Sewer MH covers shall be non-ventilated, self-sealing, D&L Foundry A-1161 with closed pick hole and a cross-hatched lid design, or Engineer-approved equal.

2. All rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer-approved equal. The combined height of manhole ring used and adjusting rings shall not exceed 16" total.

3. No grout shall be used anywhere in the interior of the manhole except for the pipe invert.

4. Channelization of flowline between pipe inverts may be formed directly in the concrete of the base or may be a half-pipe laid in concrete.

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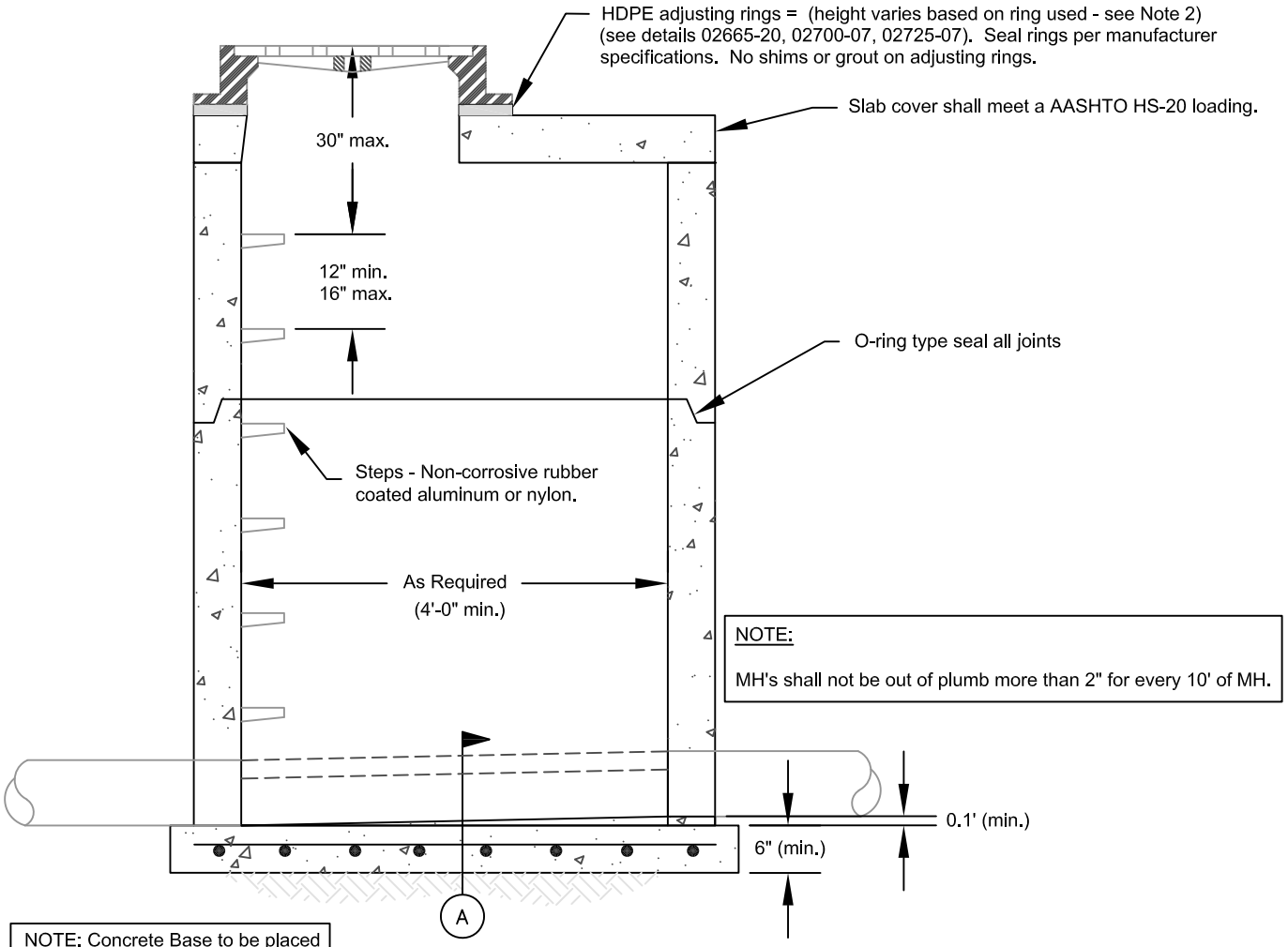
SANITARY SEWER MANHOLE (PRECAST)

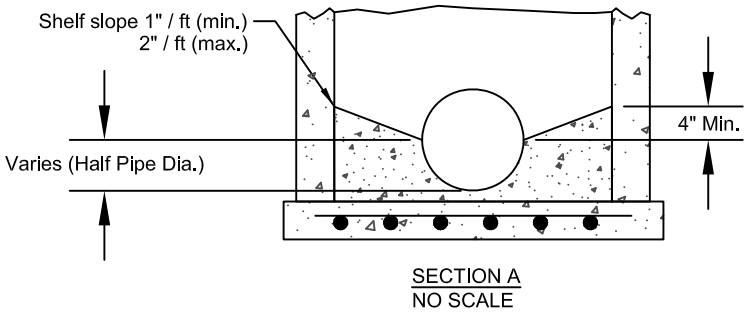
DATE: JANUARY 2019

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER JDS

DRAWING NO. 02700-01





SECTION A
NO SCALE

NOTES:

1. All Sanitary Sewer MH covers shall be non-ventilated, self-sealing, D&L Foundry A-1161 with closed pick hole and a cross-hatched lid design, or Engineer-approved equal.

2. All rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer-approved equal. The combined height of manhole ring used and adjusting rings shall not exceed 16" total.

3. No grout shall be used anywhere in the interior of the manhole except for the pipe invert.

4. Channelization of flowline between pipe inverts may be formed directly in the concrete of the base or may be a half-pipe laid in concrete.

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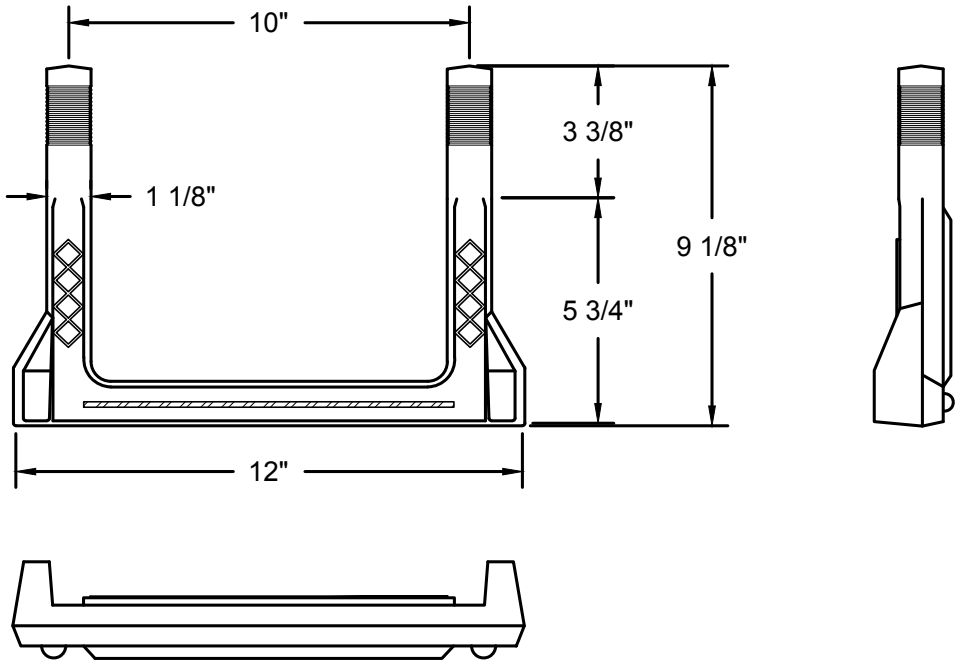
SANITARY SEWER MANHOLE (FLAT TOP)

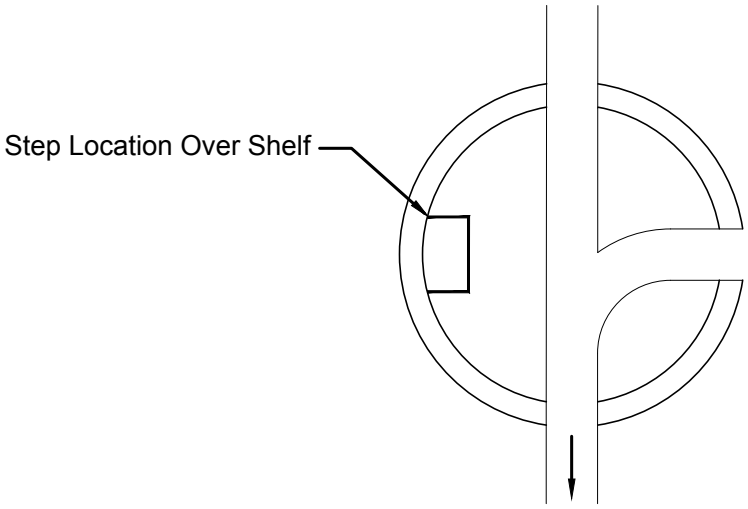
DATE: JANUARY 2019

DRAWING NO. 02700-02

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER JDS





NOTES:

1. Manhole Step PSI-PF, as manufactured by M.A. Industries, Inc. Peachtree City Georgia, 404-487-7761.
2. Copolymer Polypropylene coating meets ASTM D-4101-Latest Revision.
3. Steps meet ASTM C478 requirements and are on a 12" min./16" max. vertical spacing.
4. Step legs are driven into 1" diameter holes in the manhole wall.
5. Steps are nonsparking, nonconducting and nonabrasive.

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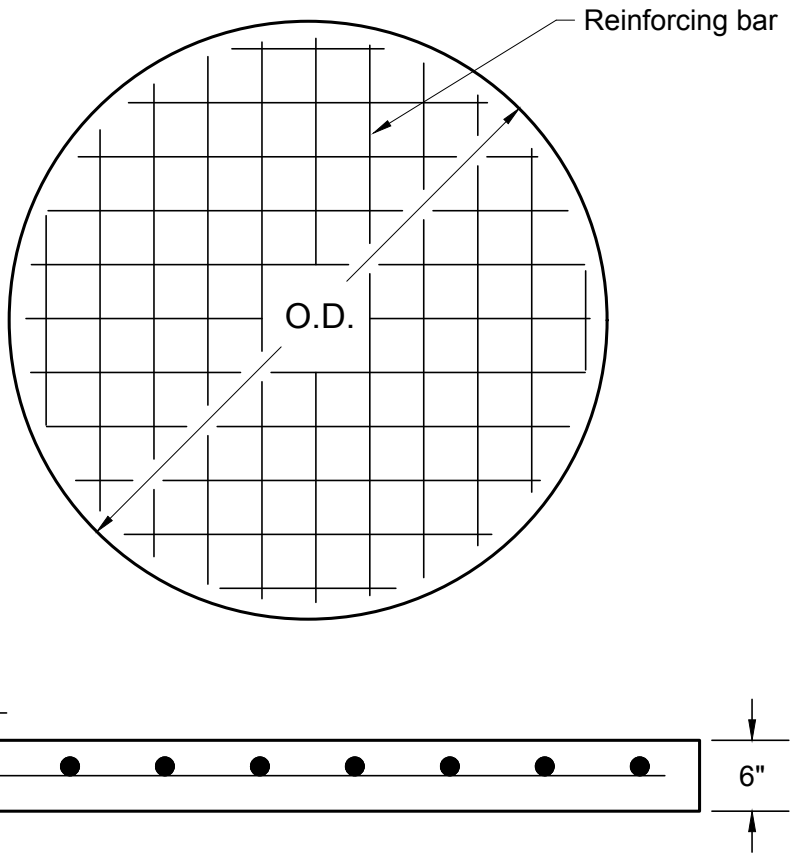
STANDARD STEPS FOR MANHOLES

DATE: MARCH 2012

DRAWING NO. 02700-03

DRAWN BY: E.G.

APPROVED BY: CITY ENGINEER HV/KDS



MANHOLE SIZE	BASE O.D.	BASE REINFORCING	TOTAL WT.
48"	64"	#4@8" EACH WAY	1675+
60"	78"	#4@8" EACH WAY	2409+
72"	92"	#4@6" EACH WAY	3465+

NOTES:

1. Bases may be cast in place or precast.
2. All concrete shall be City Class B.
3. Bases to be placed on undisturbed soil.
4. If over-excavated, shall re-establish elevation with compacted base.

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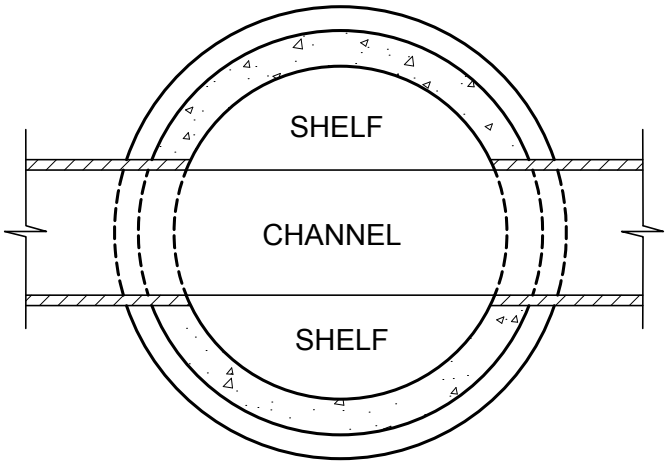
MANHOLE BASES (48", 60", 72")

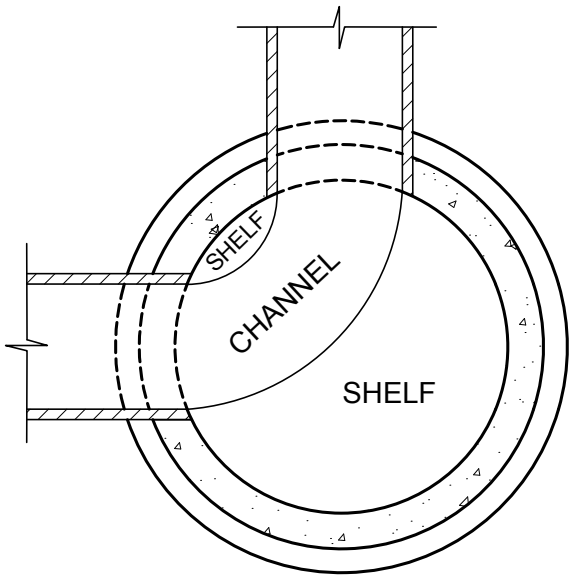
DATE: MARCH 2012

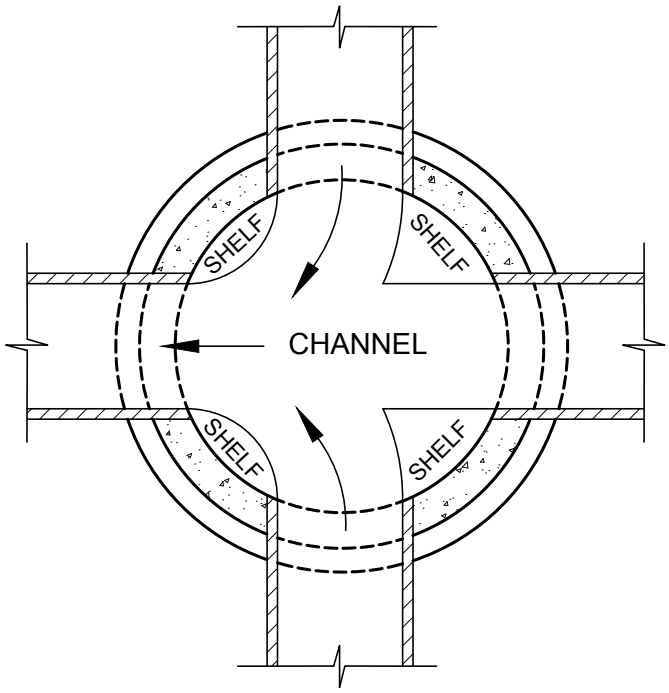
DRAWING NO. 02700-04

DRAWN BY: E.G.

APPROVED BY: CITY ENGINEER HV/KDS







NOTES:

1. Slope all shelves to channel at min. 1" per foot or 2" per foot max.
2. See plan and profile sheets for slope of channel.

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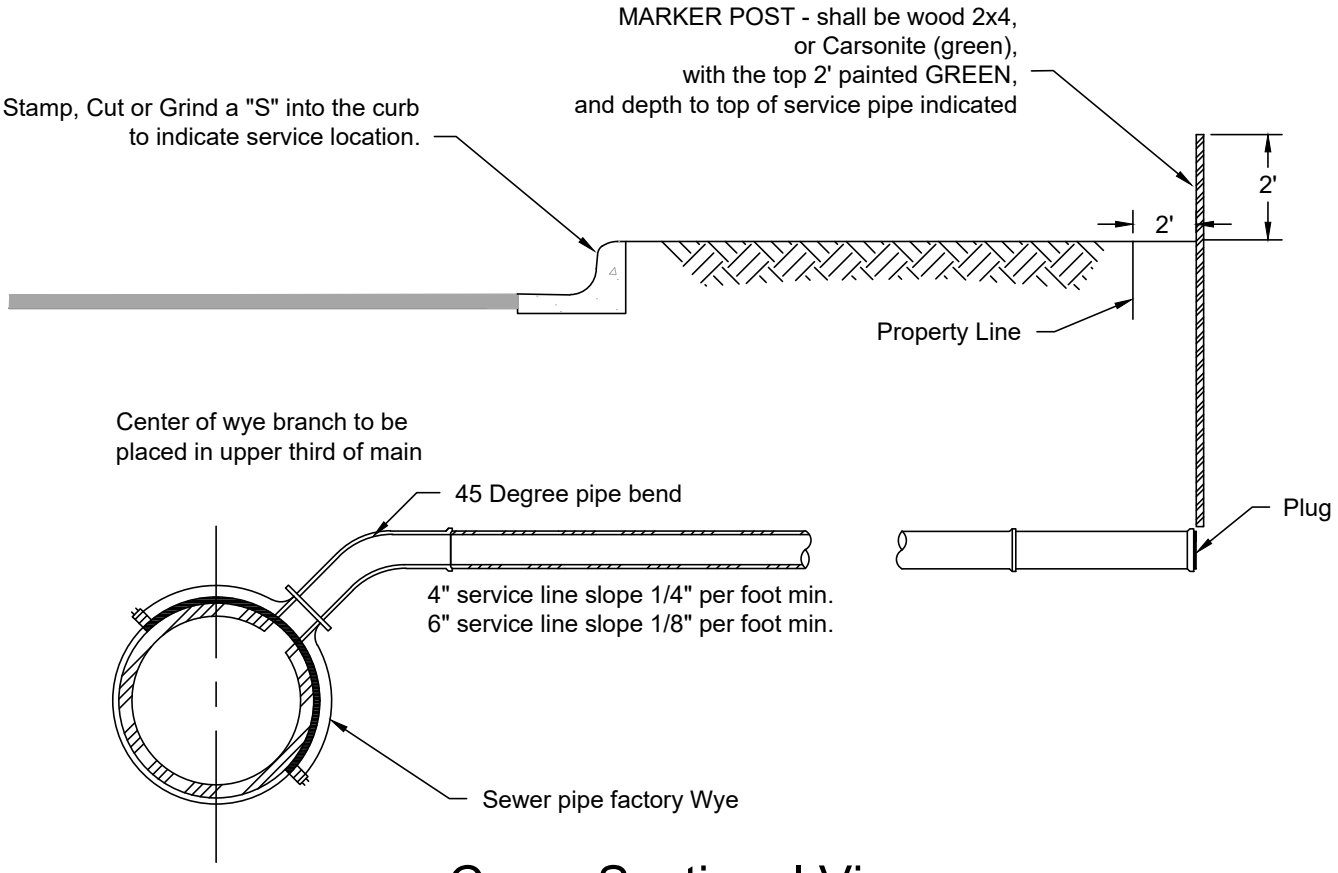
MANHOLE CHANNEL DETAILS

DATE: MARCH 2012

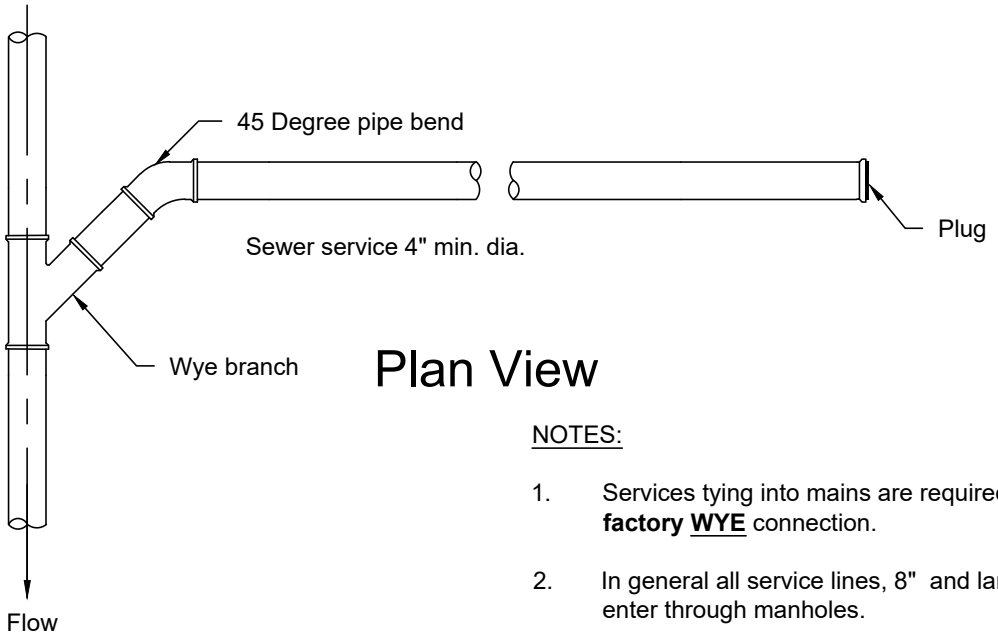
DRAWING NO. 02700-05

DRAWN BY: E.G.

APPROVED BY: CITY ENGINEER HV/KDS



Cross-Sectional View



Plan View

NOTES:

1. Services tying into mains are required to have a **factory <u>WYE</u>** connection.
2. In general all service lines, 8" and larger, should enter through manholes.
3. Fernco-type couplings are **<u>NOT</u>** permitted.
4. Repair saddles may only be used when approved by the wastewater division.

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SANITARY SEWER SERVICE LINE

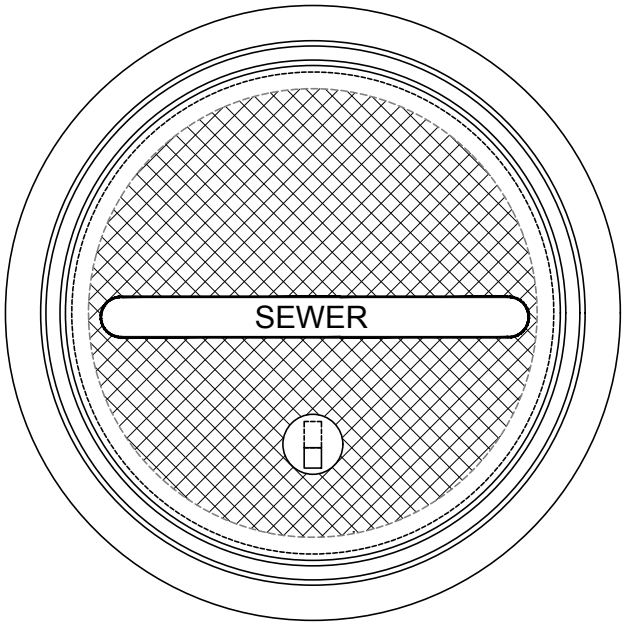
DATE: APRIL 2025

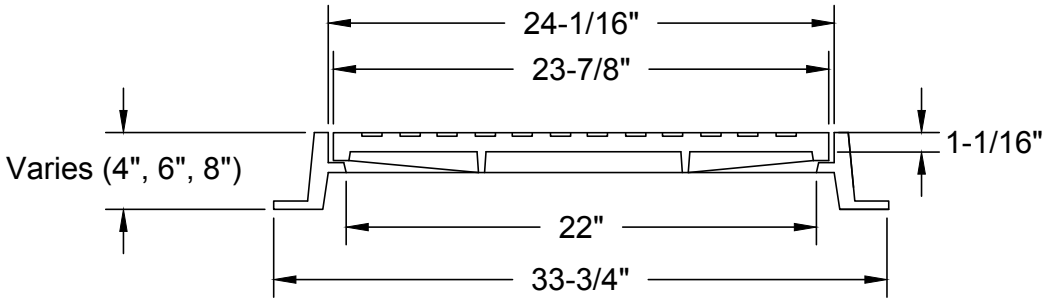
DRAWING NO. 02700-06

DRAWN BY: CS

APPROVED BY: CITY ENGINEER JS

MATERIAL: Cast gray iron (ASTM A-48 Class 35B)	LID #: D&L FOUNDRY #A-1161 = Lid (cover) to be used for all rings
	RING #: D&L FOUNDRY #A-1071 (4") = 12" adjusting rings (max.)
FINISH: No paint	RING #: D&L FOUNDRY #A-1043 (6") = 10" adjusting rings (max.)
LID: SELF SEALING	RING #: D&L FOUNDRY #A-1161 (8") = 8" adjusting rings (max.)





NOTES: (all of the following must be specified when ordering)

1. Furnished with machined horizontal bearing surface.
2. "SEWER" lettering on cover.
3. All lids shall have a cross-hatched pattern with a closed pick hole.
4. All lids shall be self-sealing.

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PHONE: (307) 686-5311

SANITARY SEWER ACCESS MANHOLE RING & COVER

DATE: MARCH 2012

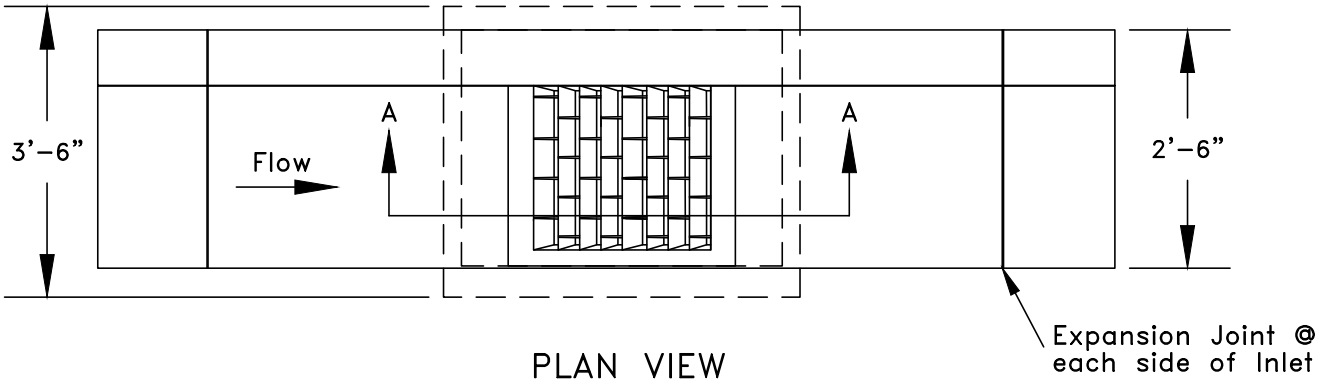
DRAWING NO. 02700-07

DRAWN BY: E.G.

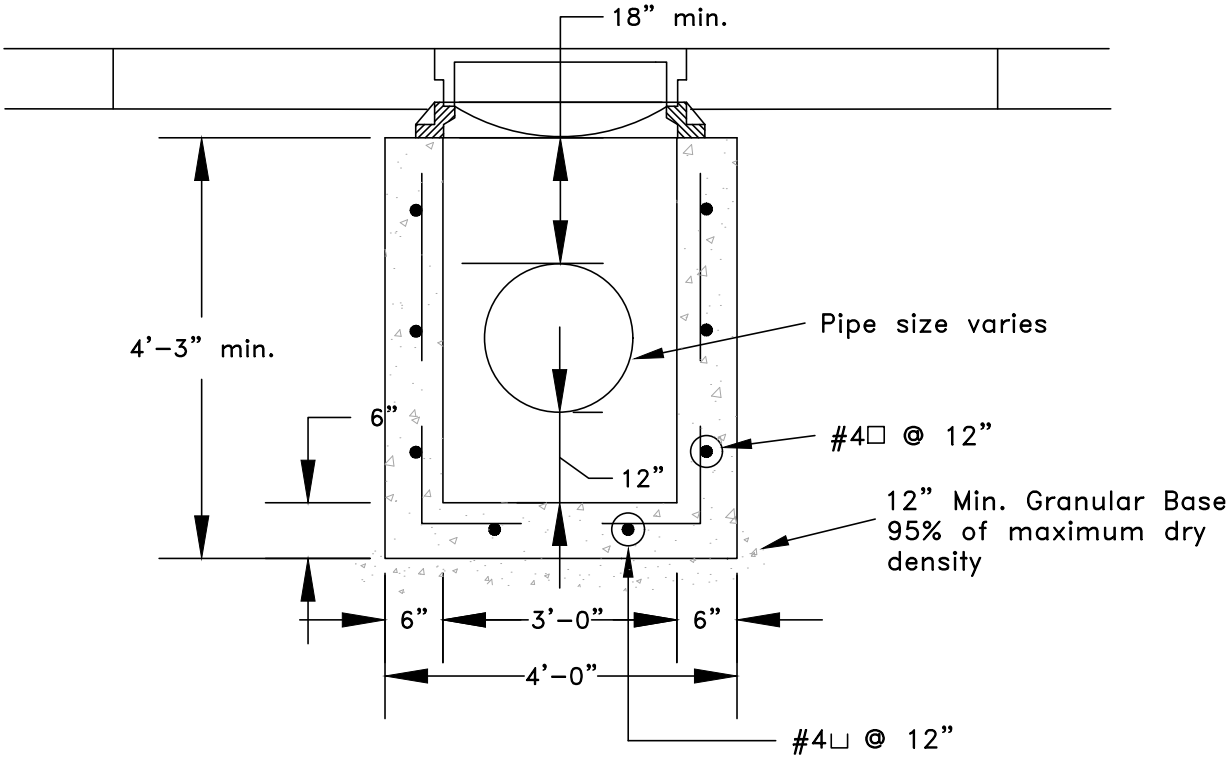
APPROVED BY: CITY ENGINEER HV/KDS

NOTE:

Curb radius point should fall at edge of basin



PLAN VIEW



SECTION A–A

NOTE:

1. Sag condition inlets will require a Type "C" grate.
2. Inlet frames and gratings shall be Neenah R–3246–AL "type L", D & L Foundry I–3520 "type L" or approved equal or as specified in the Special Provision

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SINGLE INLET

DATE: MAY 2017

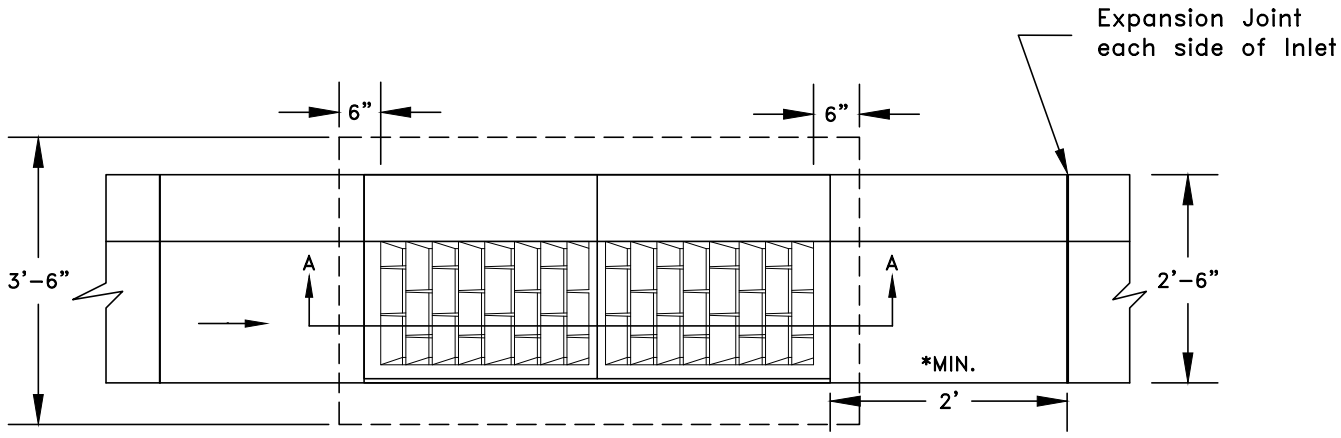
DRAWING NO. 02725-01

DRAWN BY: KEB

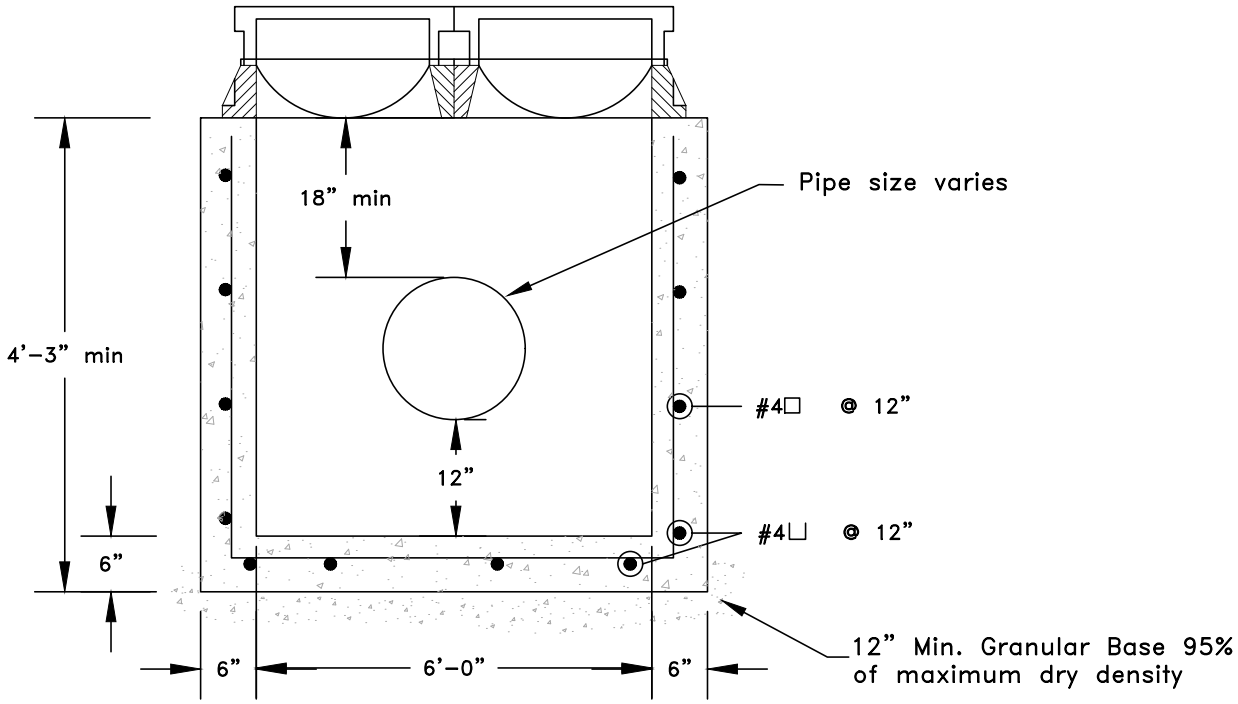
APPROVED BY: CITY ENGINEER HV/KDS

NOTE:

Curb radius point should fall at edge of expansion joint



PLAN VIEW



SECTION A-A

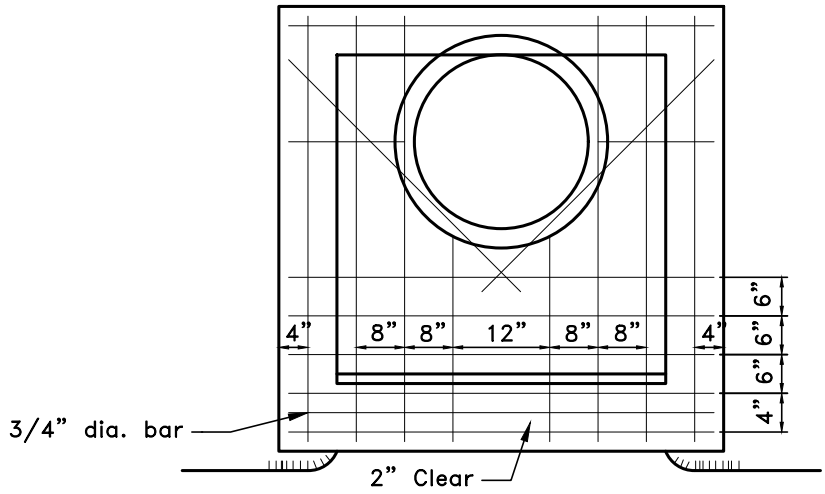
NOTE:

1. Sag condition inlets will require a Type "C" grate.
2. Inlet frames and gratings shall be Neenah R-3293-2 & R-3293-3 "type L", D & L Foundry I-3520 "type L" or approved equal or as specified in the Special Provision

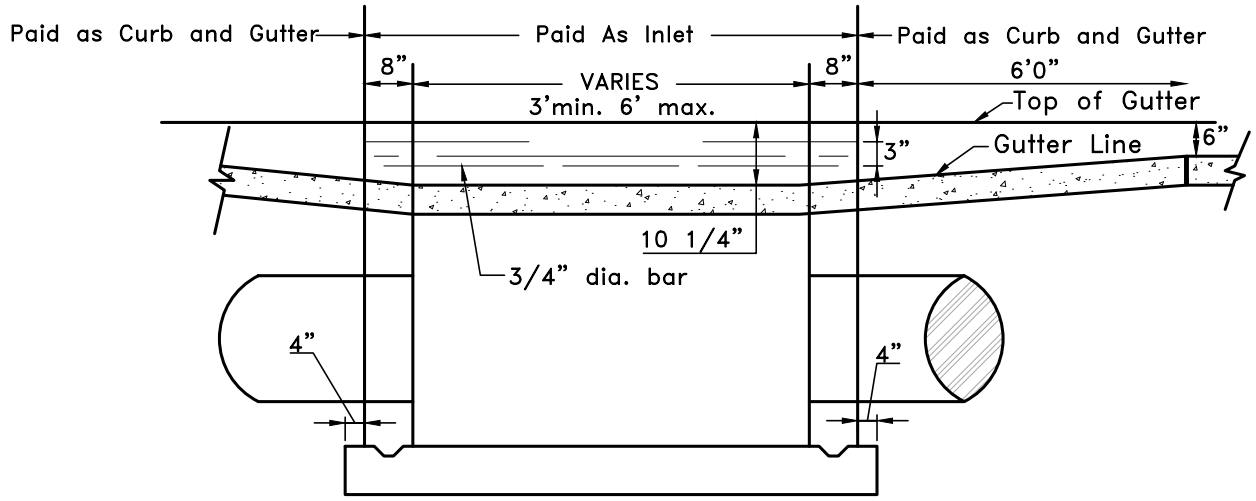
City Of Gillette
ENGINEERING DIVISION
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PHONE: (307) 686-5311

MULTIPLE INLET

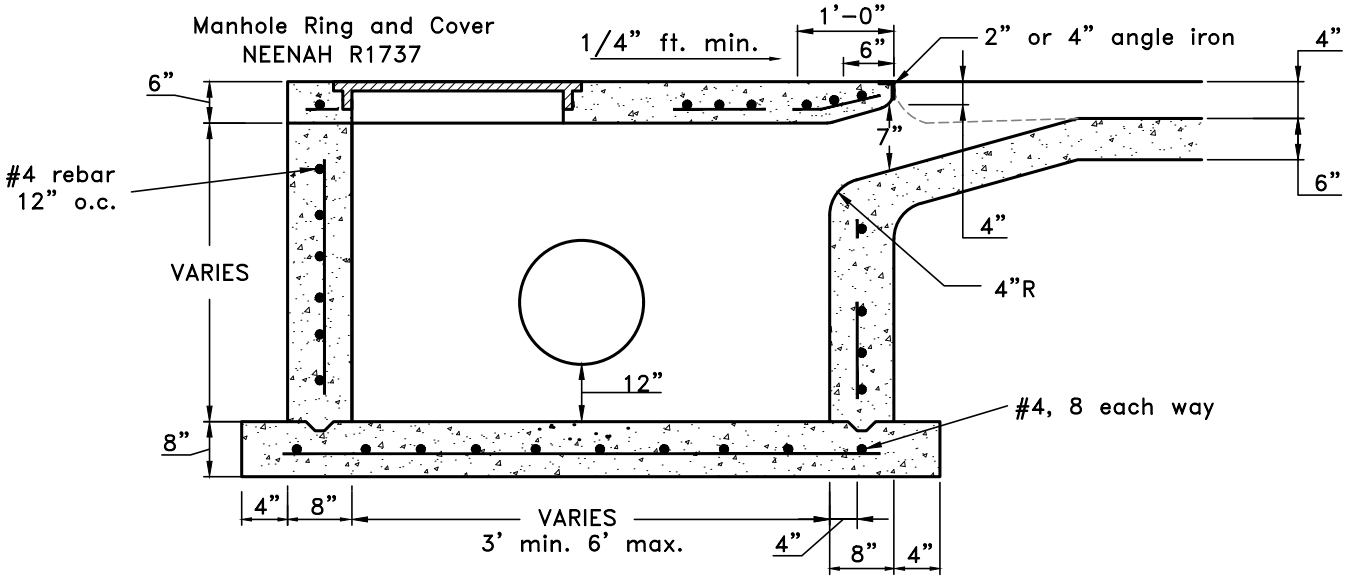
DATE:	
MAY 2017	
DRAWING NO.	
DRAWN BY: KEB	APPROVED BY: CITY ENGINEER HV/KDS
02725-02	



PLAN



ELEVATION

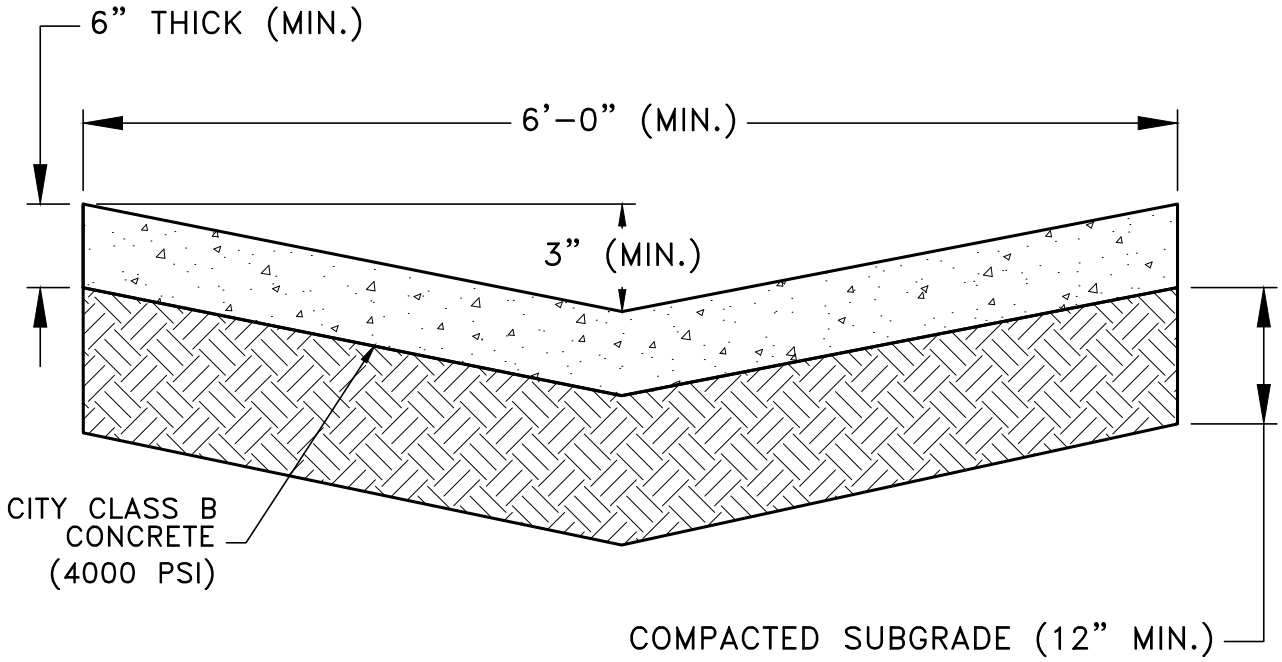


SECTION

City Of Gillette
ENGINEERING DIVISION
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GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

CURB OPENING INLET

DRAWN BY: E.G.	APPROVED BY: CITY ENGINEER HV/KDS
DATE: MARCH 2012	DRAWING NO. 02725-03



NOTES:

1. Bottom width of channel may exceed the 6'-0" (minimum).
2. Tolerances – 1/2" on design grade and 1" on design alignment.
3. Contraction joints cut a maximum of every 10 feet.

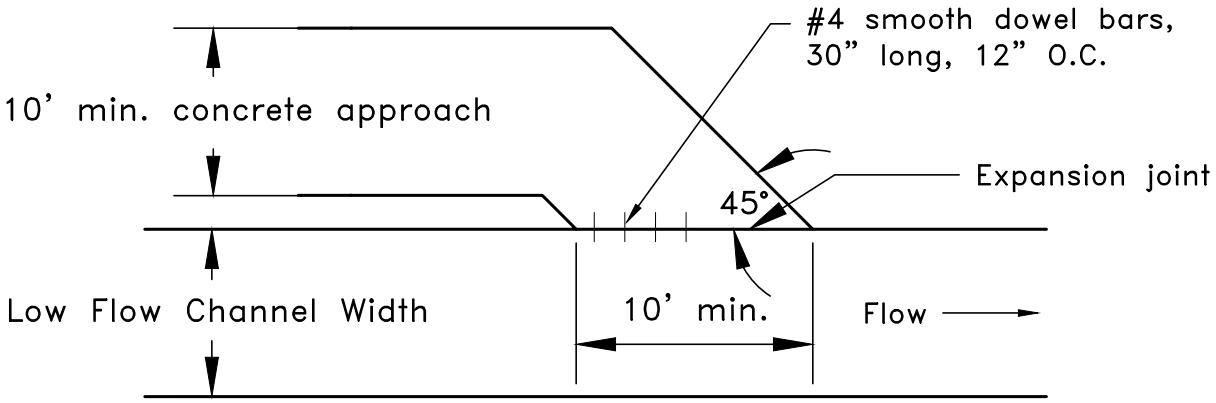
City Of Gillette
ENGINEERING DIVISION
P.O. BOX 3003, 201 E. 5TH STREET
GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

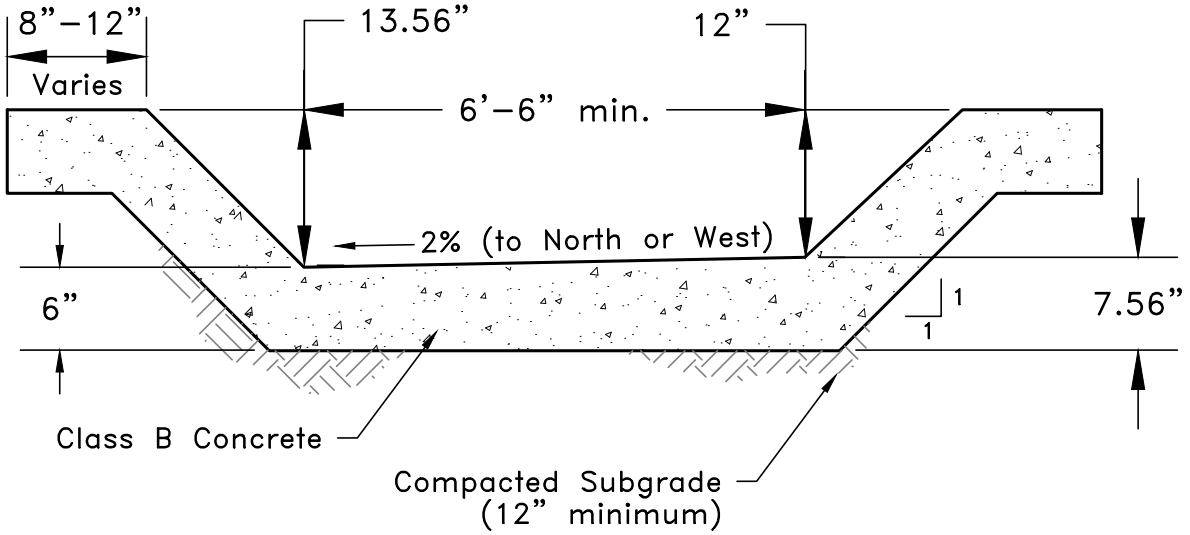
TYPICAL TRICKLE CHANNEL

DATE:	
MARCH 2012	
DRAWING NO.	
DRAWN BY: E.G.	APPROVED BY: CITY ENGINEER HV/KDS
02725-04	

NOTE:

Access to low flow channel will be provided every 400' and one at each street intersection for cleaning purposes. The maximum slope for access to low flow channel shall be 10%.





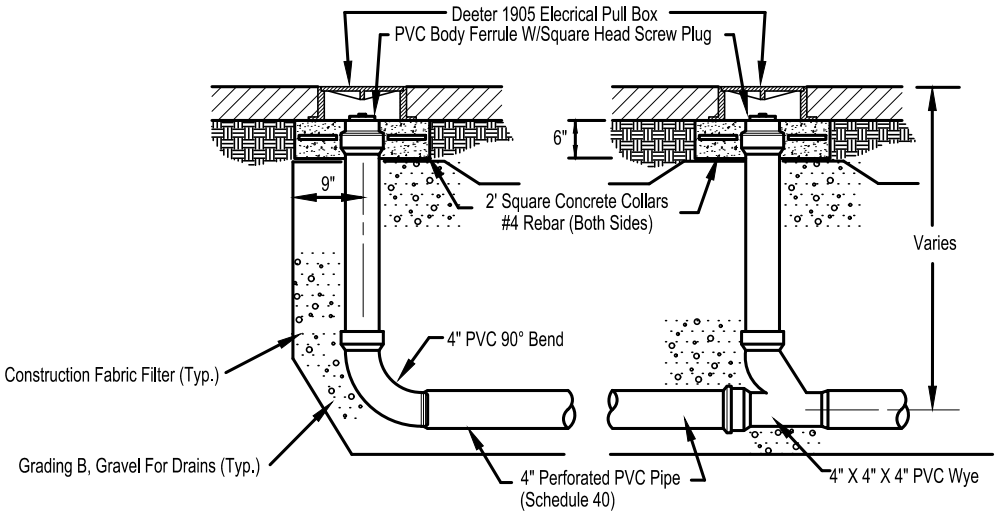
NOTES:

1. Bottom width of channel may exceed the 6'–6" min.
2. Tolerances – 1/2" on design grade and 1" on design alignment.
3. Contraction joints cut a maximum of every 10 feet.

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LOW FLOW CHANNEL

DATE:	
MARCH 2012	
DRAWING NO.	
DRAWN BY: E.G.	APPROVED BY: CITY ENGINEER HV/KDS
02725-05	

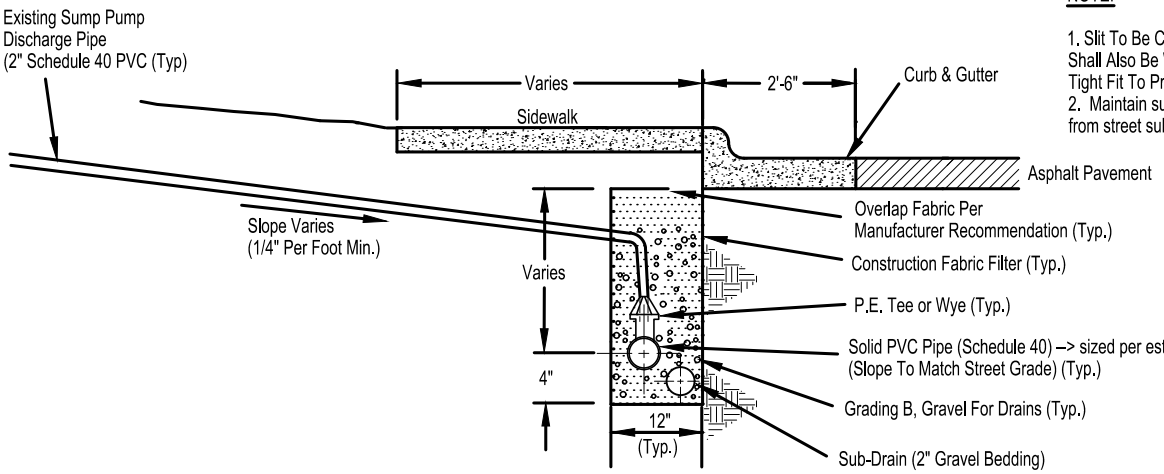


NOTE:

1. A Concrete Collar Shall Be Required On All Sub-Drain Cleanouts In Absence Of Sidewalk (Reference Drawing 02570-02).

2. If Located In The Street, A Non-Ventilated, Self-Sealing, D & L Foundry H-8012 With Closed Pick Hole And Cross-Hatch Lid Design Will Be Required, Or Engineer-Approved Equal.

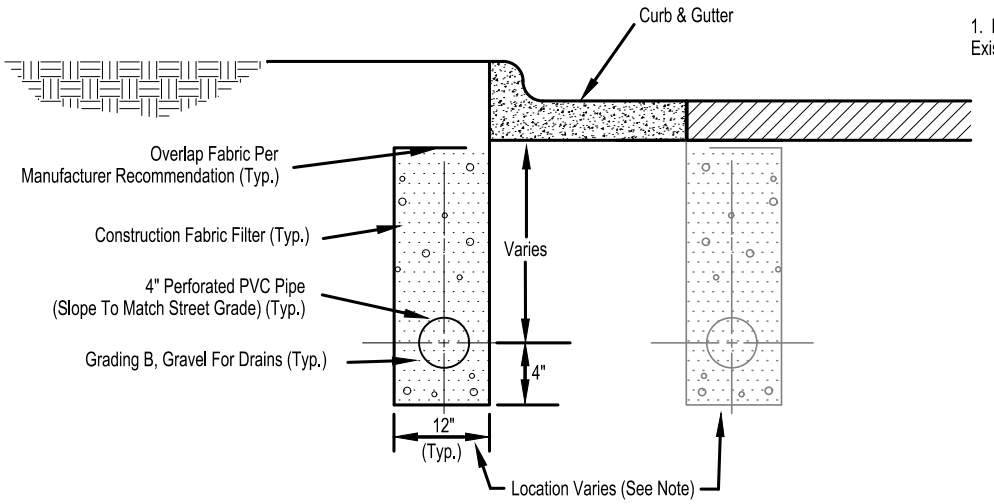
SUB-DRAIN CLEANOUT



NOTE:

1. Slit To Be Cut In Filter. A Small Piece Of Fabric Shall Also Be Wrapped Around Pipe To Ensure A Tight Fit To Prevent Infiltration.
2. Maintain sump pump discharge line separate from street subdrain in all circumstances.

SUB-DRAIN WITH SUMP PUMP DETAIL (where allowed as per outfall storm sewer design flow capacity)



NOTE:

1. Location Varies Per Application. Front Of Curb For Existing Retro-Fit, And Back Of Curb For New Construction.

SUB-DRAIN DETAIL (with or without Curb & Gutter)

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SUB-DRAING DETAIL FOR NEW/EXISTING CONSTRUCTION

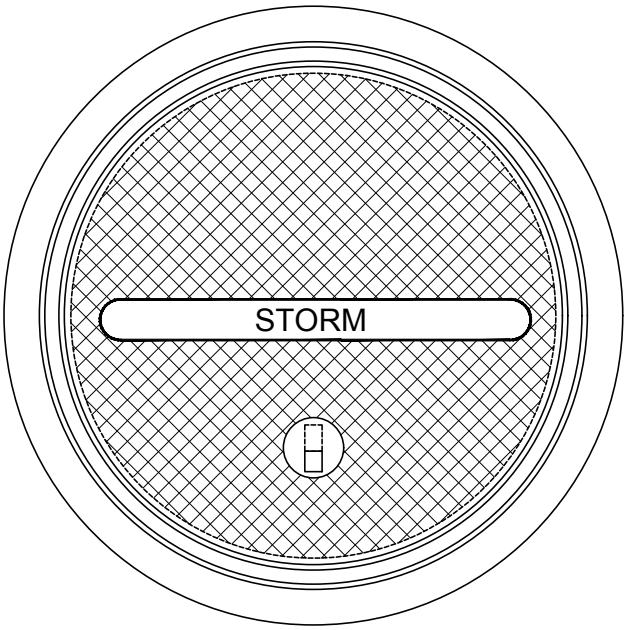
DATE: MARCH 2012

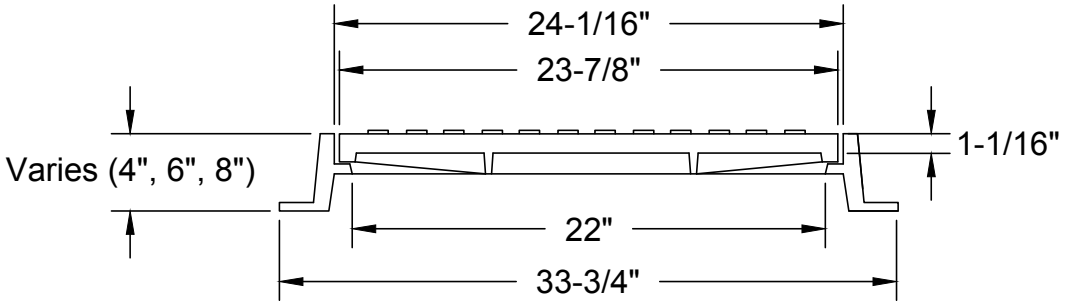
DRAWING NO. 02725-06

DRAWN BY: E.G.

APPROVED BY: CITY ENGINEER HV/KDS

MATERIAL: Cast gray iron (ASTM A-48 Class 35B)	LID #: D&L FOUNDRY #A-1161 = Lid (cover) to be used for all rings
	RING #: D&L FOUNDRY #A-1071 (4") = 12" adjusting rings (max.)
FINISH: No paint	RING #: D&L FOUNDRY #A-1043 (6") = 10" adjusting rings (max.)
LID: SELF SEALING	RING #: D&L FOUNDRY #A-1161 (8") = 8" adjusting rings (max.)





NOTES: (all of the following must be specified when ordering)

1. Furnished with machined horizontal bearing surface.
2. "STORM" lettering on cover.
3. All lids shall have a cross-hatched pattern with a closed pick hole.
4. All lids shall be self-sealing.

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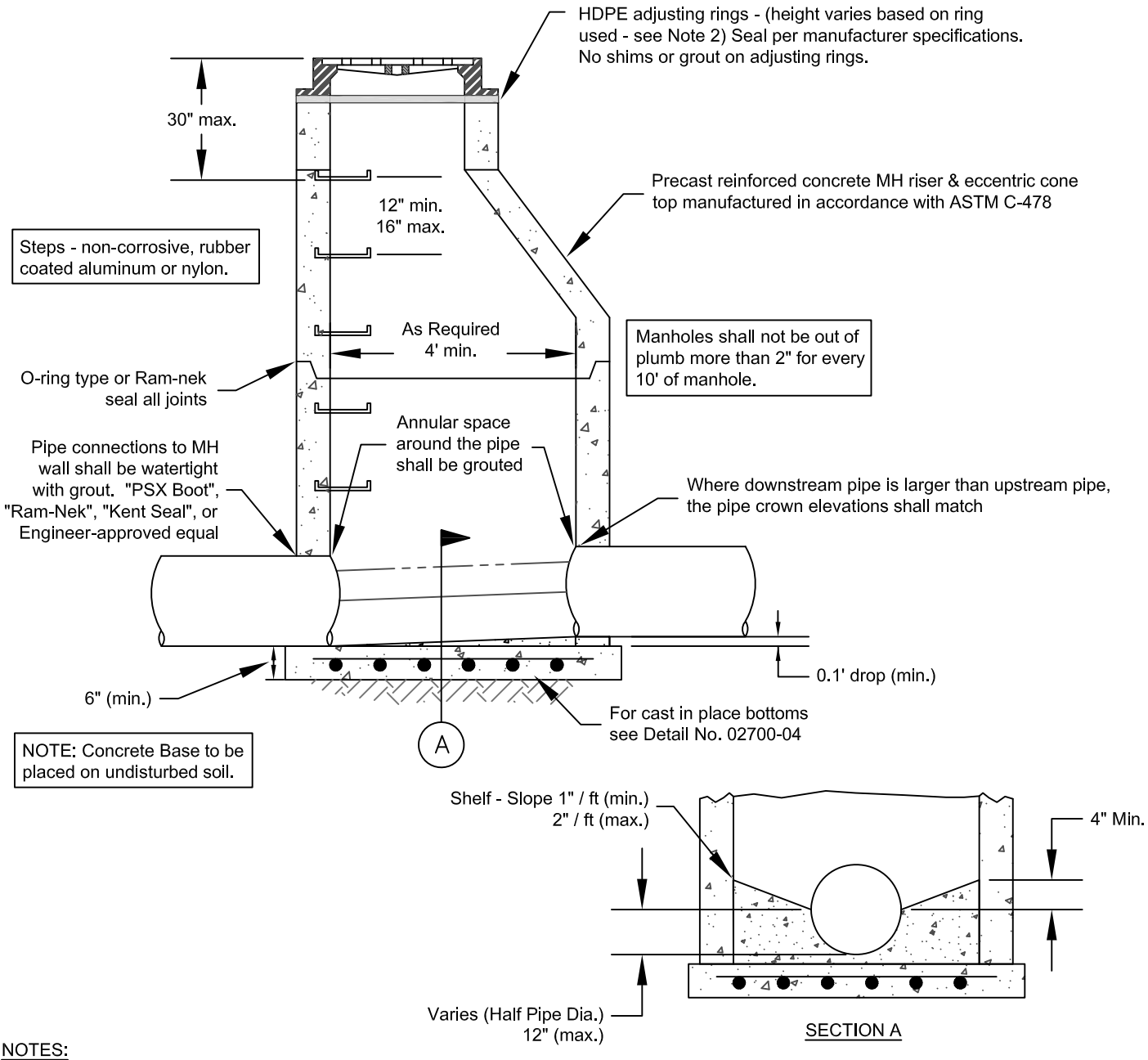
STORM SEWER ACCESS MANHOLE RING & COVER

DATE: MARCH 2012

DRAWING NO. 02725–07

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



NOTES:

1. All Storm Sewer MH covers shall be non-ventilated, self-sealing, D&L Foundry A-1161 with closed pick hole and recessed lug lid design, or Engineer-approved equal.

2. All rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer-approved equal. The combined height of manhole ring used and adjusting rings shall not exceed 16" total.

3. No grout shall be used anywhere in the interior of the manhole except for the pipe invert.

4. Channelization of flowline between pipe inverts may be formed directly in the concrete of the base or may be a half-pipe laid in concrete.

5. Pipe shall protrude into manhole a sufficient distance to accommodate manufacturer's installation instructions for watertight joint sealing material.

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GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

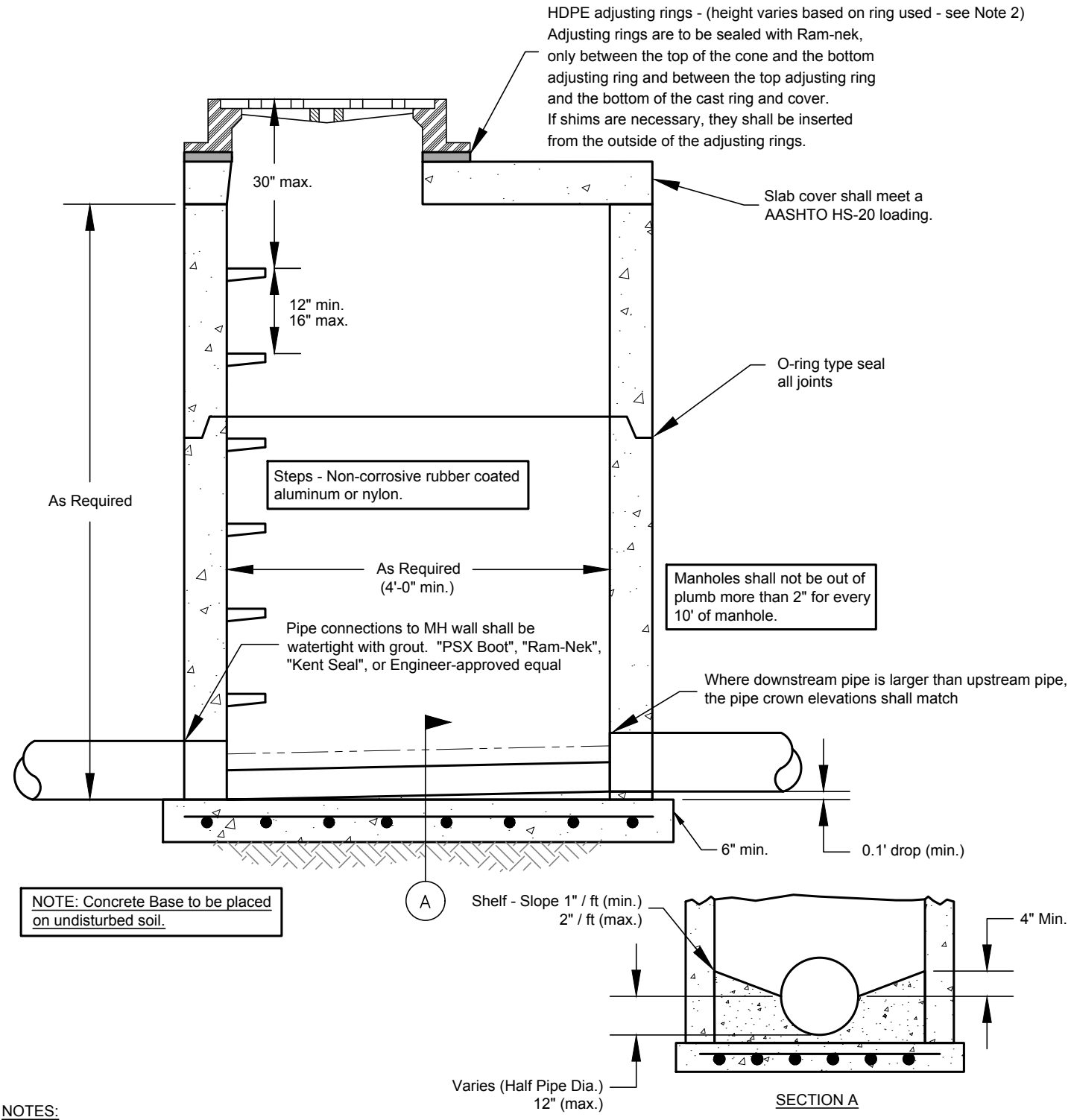
STORM SEWER MANHOLE (PRECAST)

DATE: JANUARY 2019

DRAWING NO. 02725-08

DRAWN BY: KEB

APPROVED BY: CITY ENGINEER JDS



NOTES:

1. All Storm Sewer MH covers shall be non-ventilated, self-sealing, D&L Foundry A-1161 with closed pick hole and recessed lug lid design, or Engineer-approved equal.
2. All rings shall be D&L Foundry A-1071 (4"), A-1043 (6"), A-1161 (8"), or Engineer-approved equal. The combined height of manhole ring used and adjusting rings shall not exceed 16" total.
3. No grout shall be used anywhere in the interior of the manhole except for the pipe invert. NO GROUTING AROUND ADJUSTING RINGS.
4. Channelization of flowline between pipe inverts may be formed directly in the concrete of the base or may be a half-pipe laid in concrete.
5. Pipe shall protrude into manhole a sufficient distance to accommodate manufacturer's installation instructions for watertight seal jointing material.

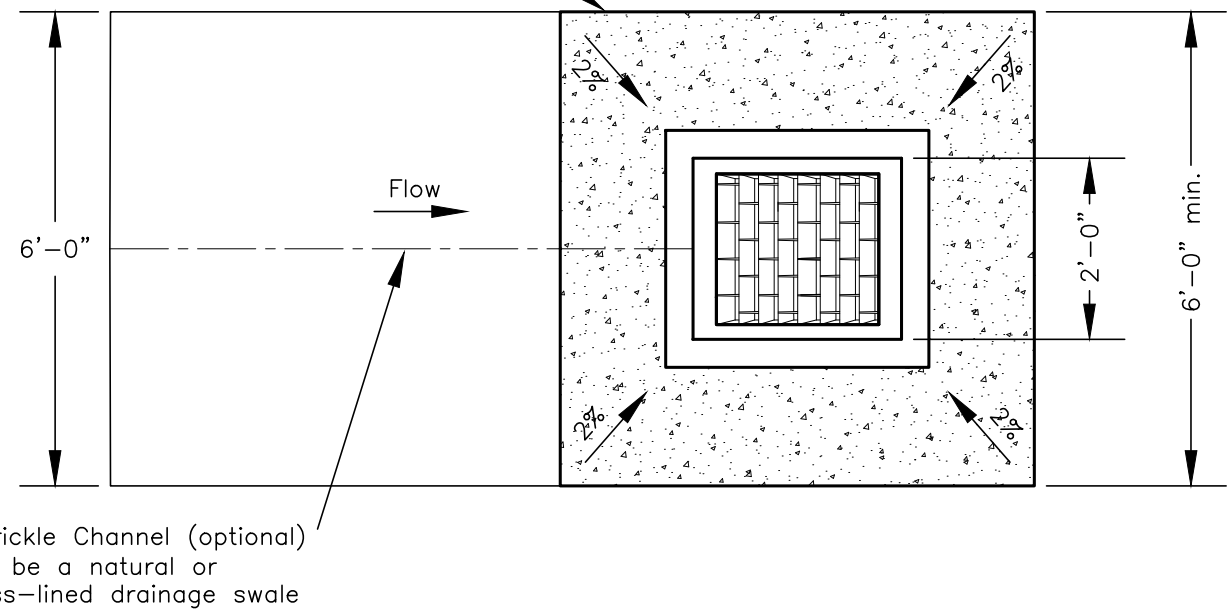
City Of Gillette
ENGINEERING DIVISION
P.O. BOX 3003, 201 E. 5TH STREET
GILLETTE, WYOMING 82717
PHONE: (307) 686-5311

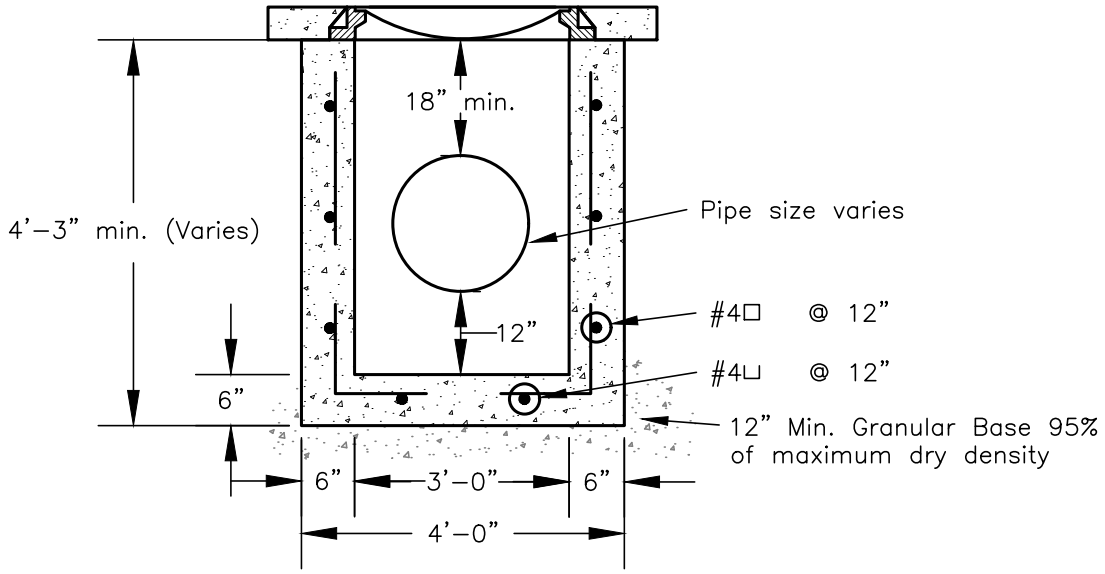
STORM SEWER MANHOLE (FLAT TOP MANHOLE)

DATE:	
AUGUST 2012	
DRAWING NO.	
DRAWN BY: CJS	APPROVED BY: CITY ENGINEER HV/KDS
02725-09	

NOTE:

1. Neenah R–3362–L, Deeter 2501, or D&L Foundry I–3386 inlet frame, grate, or equivalent





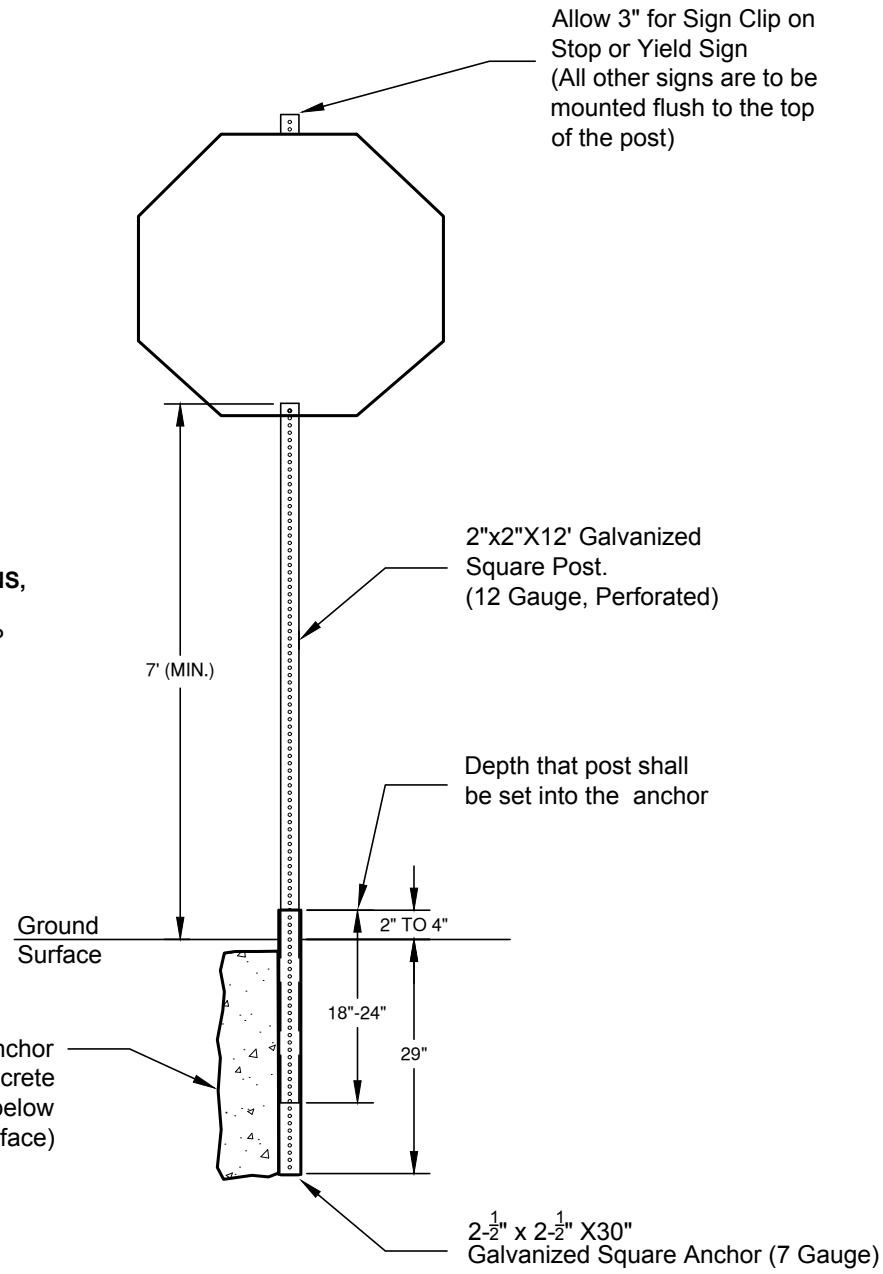
NOTE:

1. Sump condition inlets will require a Type "C" grate.
2. Grate and Frame is available as a double unit.

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SINGLE AREA INLET

DRAWN BY: E.G.	APPROVED BY: CITY ENGINEER HV/KDS	DATE: MARCH 2012
		DRAWING NO. 02725-10



SIGN SURFACING NOTES:

WARNING SIGNS :
Diamond Grade VIP Reflective Sheeting, Type IX

PEDESTRIAN SIGNS, BIKE LANE SIGNS, AND DOWNWARD ARROWS:
Strong Yellow Green Diamond Grade VIP Reflective Sheeting, Type IX

NOTES:

1. Drill or vactor out a 8" diameter hole.
2. Use only High Intensity Prismatic Sheeting for Regulatory Signs (Types III, IV, and X).
3. All signs to be 100 gauge aluminum.
4. All signs to be mounted with 3/8" x 3" grade 5 bolts using NYLOCK nuts, with flat washers on both sides (one on each side).
5. The contractor shall contact the City of Gillette Engineering Traffic Safety Division @ 686-5265 prior to installing signs. The Traffic Safety Division will mark the location of signs and inspect installation upon completion of the installation.

NEW SUBDIVISION SPECIFICATIONS:

1. When an additional information sign is placed directly under the main sign, the distance from the ground surface to the bottom of the lowest sign may be six feet (6').
2. All signs will be **perpendicular to approaching traffic** to allow the street name sign to be legible from the street. (signs shall not be angled or twisted)
3. The City of Gillette Sign Technician will fabricate, provide, and install the street name signs with all the hardware included. The developer is responsible for bearing the cost of all signs associated with the project.
4. Round posts are 2-3/8" x 12' x 10 gauge and can be used for Parking Restriction signs **only**.
5. When necessary to mount signs on street light poles, permission shall be obtained from the City Engineer. Use 5/8" stainless steel banding with the correct hardware for mounting.

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TYPICAL STREET SIGN INSTALLATION

DATE: AUGUST 2012

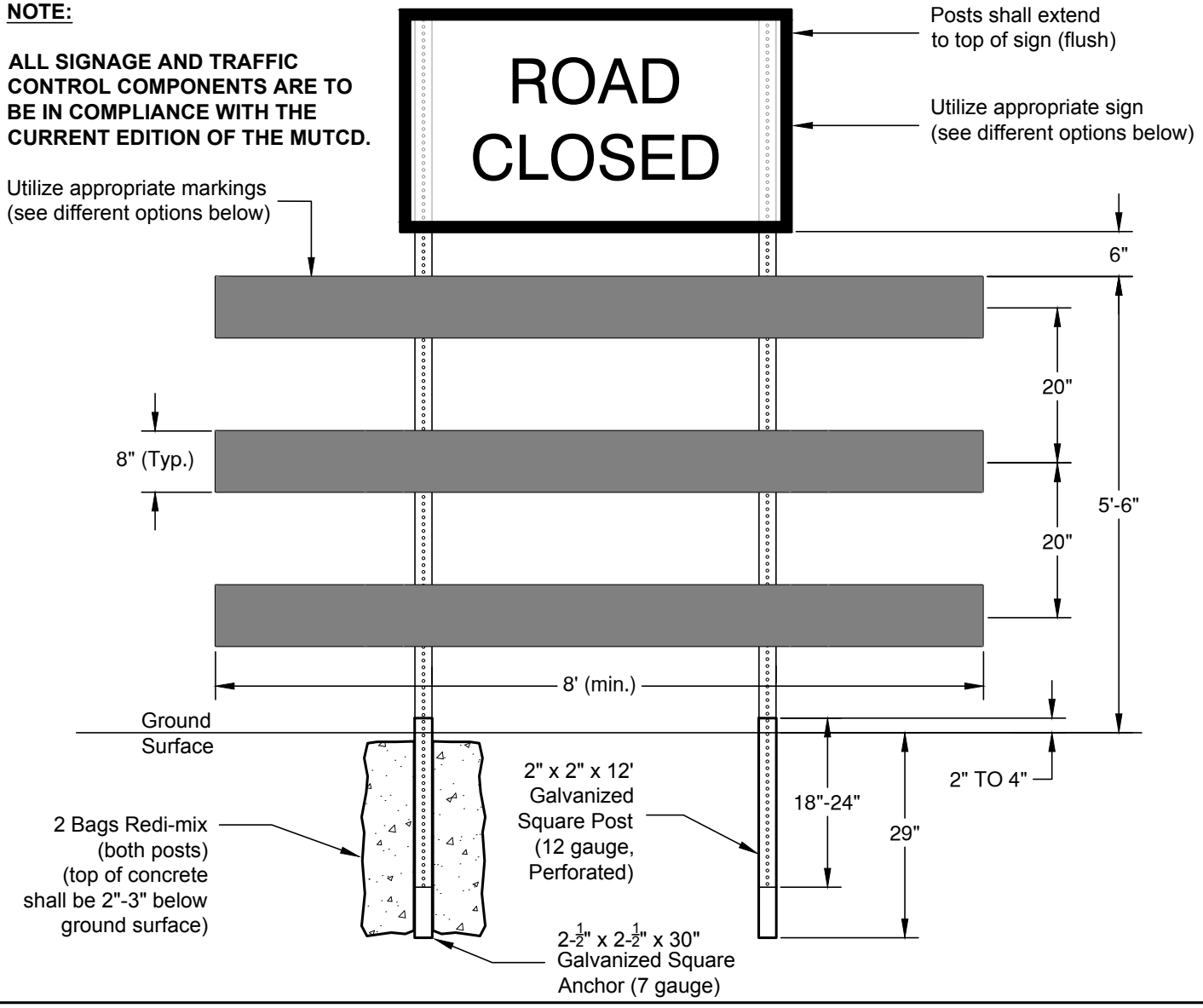
DRAWING NO. 02805-01

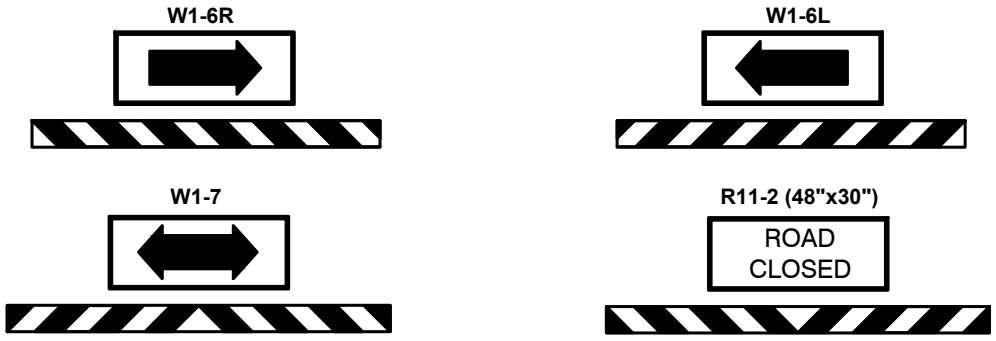
DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS

NOTE:

ALL SIGNAGE AND TRAFFIC CONTROL COMPONENTS ARE TO BE IN COMPLIANCE WITH THE CURRENT EDITION OF THE MUTCD.





NOTES:

1. Use steel telespan 2" x 2" - 12 gauge posts with 2 1/2" x 2 1/2" - 7 gauge anchors.
2. All signs and panels are to be mounted with 3/8" x 3" - grade 5 bolts, using NYLOCK nuts, with flat washers on both sides.
3. Marking for barricade rails shall be alternating between red and white for permanent installations, and orange and white for temporary installations. The stripes shall be 6" wide, sloping downward at an angle of 45 degrees in the direction traffic is to pass. The material shall be High Intensity Sheeting.
4. Barricade panels shall be 96" (length) x 8" (height) x 3/4" (width) - Material: Dapco-Plastic, or aluminum.

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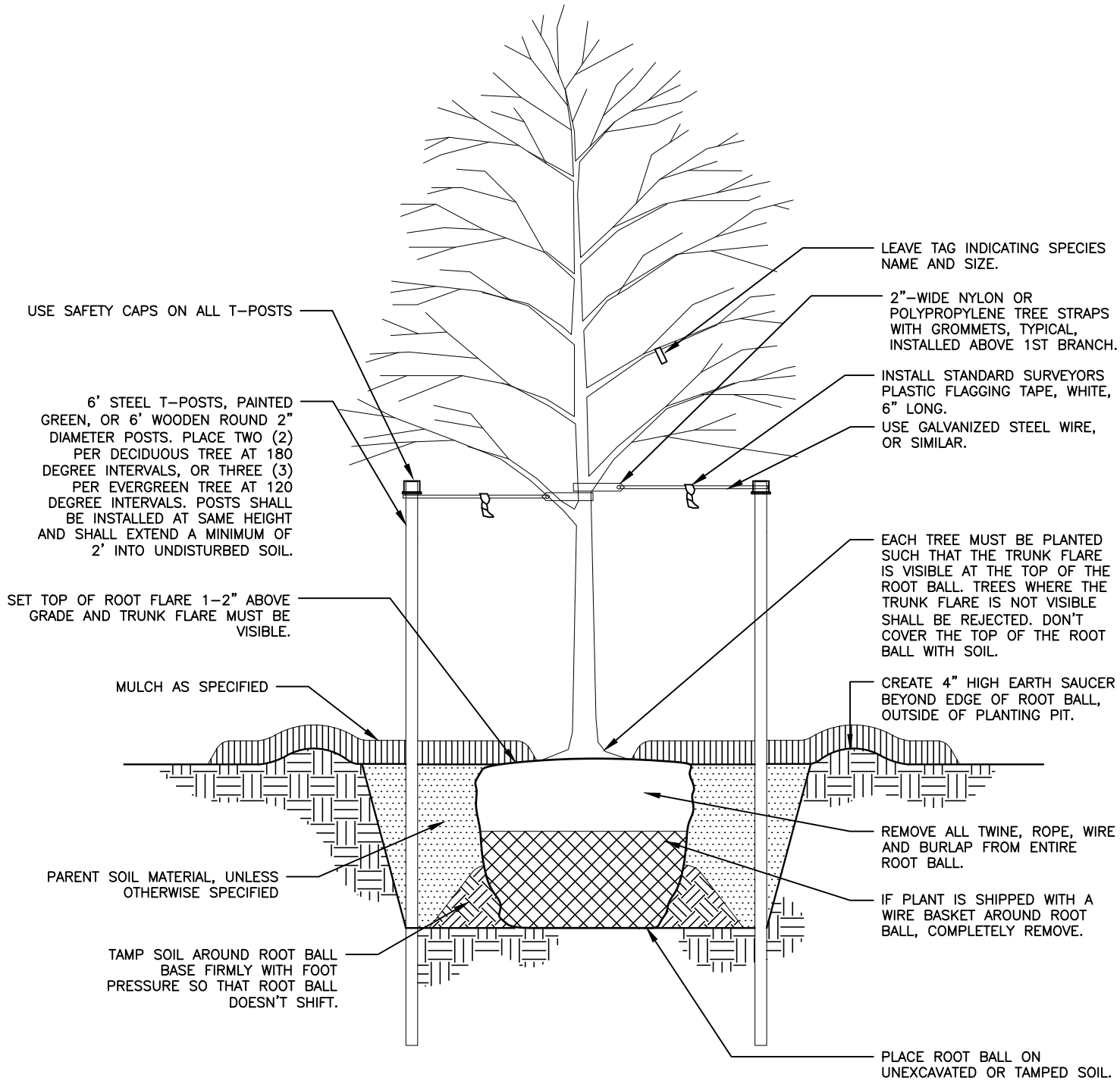
BARRICADE INSTALLATION
TYPE III

DATE: AUGUST 2012

DRAWING NO. 02805-02

DRAWN BY: CJS

APPROVED BY: CITY ENGINEER HV/KDS



NOTES:

1. REMOVE ALL TWINE AND OTHER NON-BIODEGRADABLE MATERIALS ATTACHED TO PLANT OR ROOT MASS, INCLUDING TRUNK PROTECTORS.

2. DO NOT HEAVILY PRUNE THE TREE AT PLANTING. PRUNE ONLY CROSSOVER LIMBS, CO-DOMINANT LEADERS, AND BROKEN OR DEAD BRANCHES. SOME INTERIOR TWIGS AND LATERAL BRANCHES MAY BE PRUNED; HOWEVER, DO NOT REMOVE THE TERMINAL BUDS OF BRANCHES THAT EXTEND TO THE EDGE OF THE CROWN.

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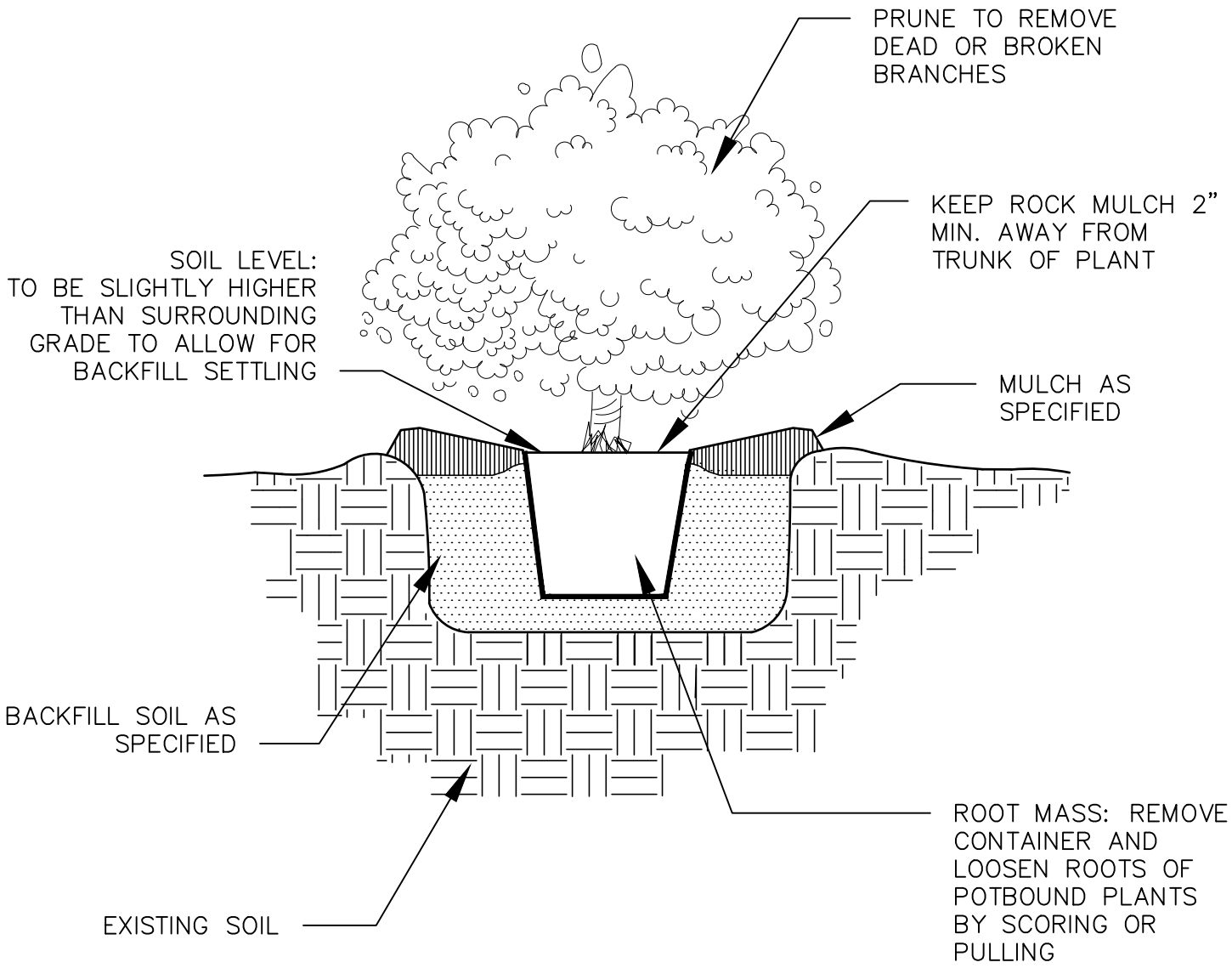
B&B TREE PLANTING WITH STAKING

DATE: MAY 2017

DRAWING NO. 02900–01

DRAWN BY: JB

APPROVED BY: CITY ENGINEER HV/KDS



NOTES:

1. REMOVE ALL TWINE AND OTHER NON-BIODEGRADABLE MATERIALS ATTACHED TO PLANT OR ROOT MASS, INCLUDING TRUNK PROTECTORS.

2. LEAVE TAG INDICATING SPECIES NAME.

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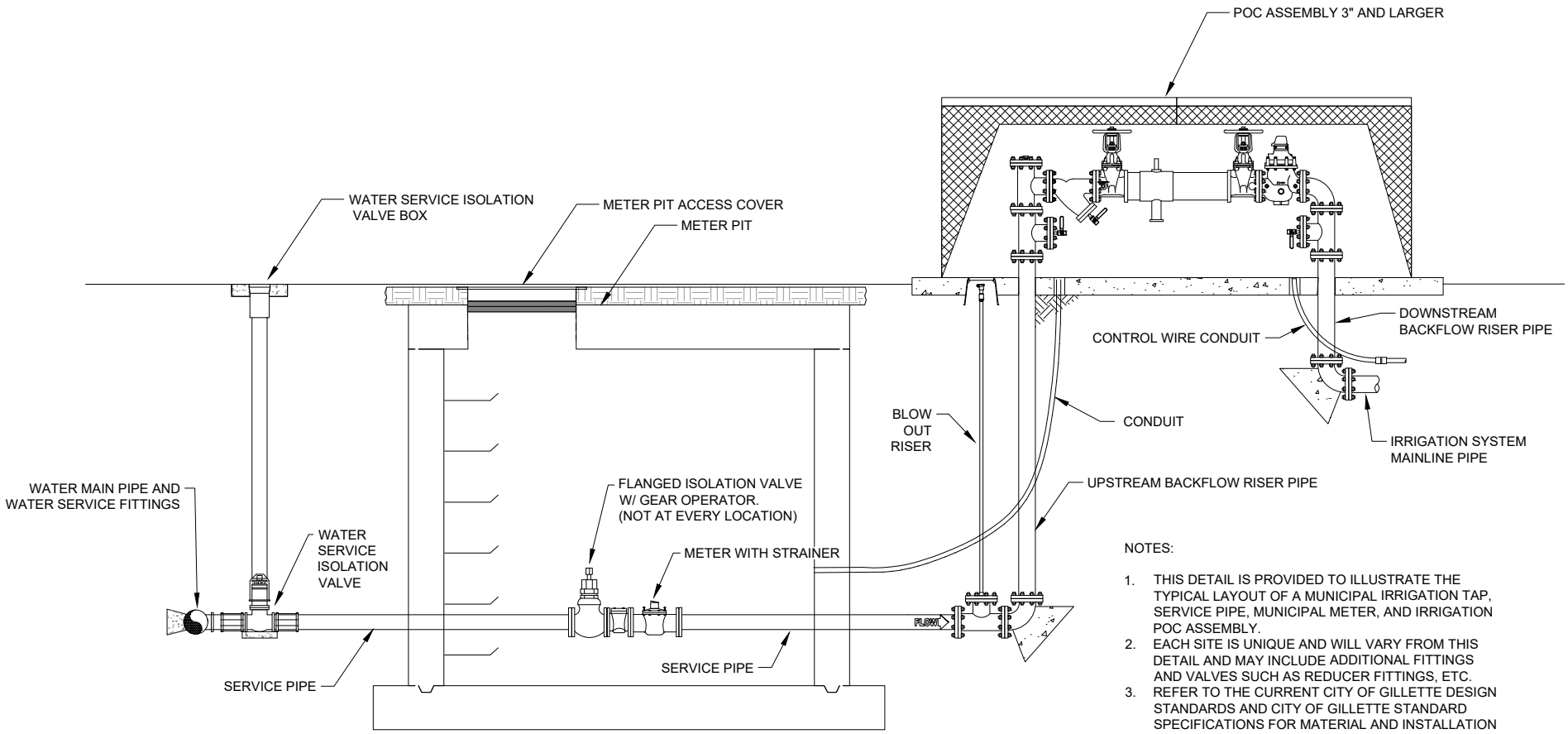
CONTAINER SHRUB PLANTING

DRAWN BY: JB

APPROVED BY: CITY ENGINEER HV/KDS

DATE: MAY 2017

DRAWING NO. 02900-02



NOTES:

1. THIS DETAIL IS PROVIDED TO ILLUSTRATE THE TYPICAL LAYOUT OF A MUNICIPAL IRRIGATION TAP, SERVICE PIPE, MUNICIPAL METER, AND IRRIGATION POC ASSEMBLY.
2. EACH SITE IS UNIQUE AND WILL VARY FROM THIS DETAIL AND MAY INCLUDE ADDITIONAL FITTINGS AND VALVES SUCH AS REDUCER FITTINGS, ETC.
3. REFER TO THE CURRENT CITY OF GILLETTE DESIGN STANDARDS AND CITY OF GILLETTE STANDARD SPECIFICATIONS FOR MATERIAL AND INSTALLATION REQUIREMENTS OF MUNICIPAL WATER TAPS, SERVICE PIPE, ISOLATION VALVES, METER PITS, AND POC ASSEMBLIES.

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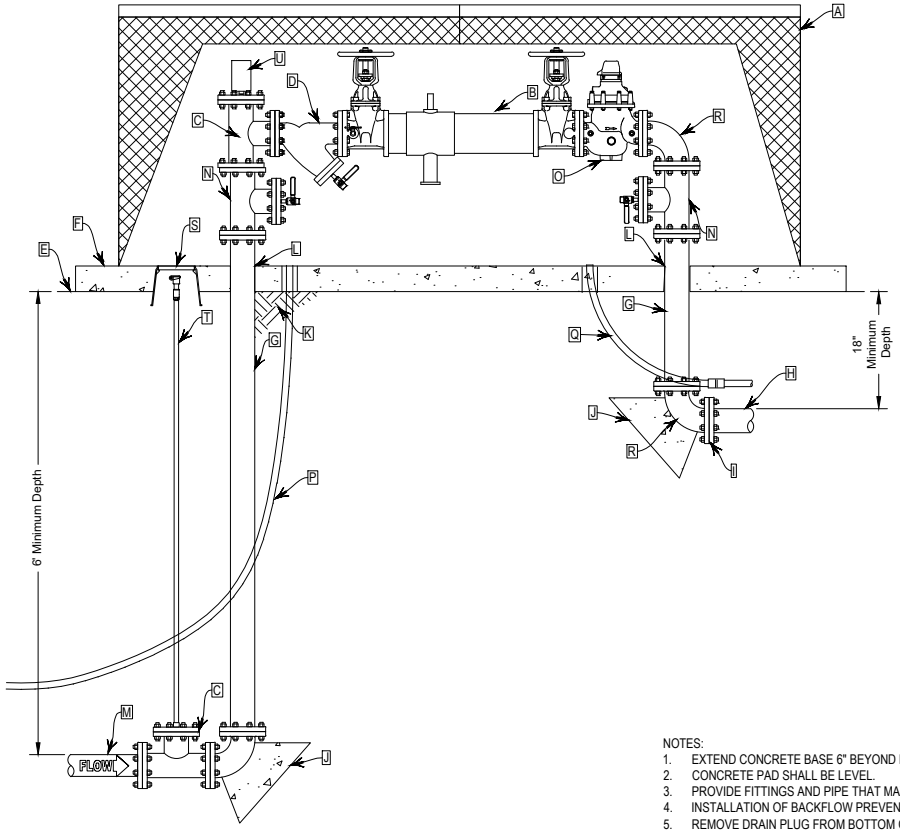
TYPICAL LAYOUT - WATER TAP, METER, AND POC ASSEMBLY (3" AND LARGER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-01



A. ENCLOSURE: GUARDSHACK CLAMSHELL, SIZE AS NEEDED
B. REDUCED PRESSURE BACKFLOW PREVENTER: WATTS 957 WITH NON-RISING STEM GATE VALVES
C. DUCTILE IRON FLANGED TEE W/ 1" TAPPED BLIND FLANGE
D. WYE-STRAINER: ZURN FSC (SAME SIZE AS BACKFLOW)
E. FINISH GRADE
F. 4" CONCRETE BASE (USE 4000 PSI TYPE B CONCRETE)
G. DUCTILE IRON RED PRIME COATED FLANGED PIPE (LENGTH AS REQUIRED)
H. PVC PIPE TO IRRIGATION
I. DUCTILE IRON FL x MJ EL WITH TRANSITION GASKET OR HARCO FLANGE X BELL ADAPTER
J. CONCRETE THRUST BLOCK. MINIMUM SURFACE AREA AGAINST UNDISTURBED SOIL: 3" - 1.52 SF; 4" - 2.49 SF; 6" - 5.39 SF; 8" - 9.16 SF; 10" - 14.21 SF
K. COMPACTED SUB GRADE
L. WRAP PIPE AT PENETRATION WITH 1/4" FELT OR SLEEVE WITH CLASS 200 PVC
M. COATED DUCTILE IRON PIPE FROM WATER METER
N. DUCTILE IRON TEE WITH 1" TAPPED BLIND FLANGE AND BRASS BALL VALVE
O. HYDROMETER: NETAFIM LHM, NORMALLY OPEN, SAME SIZE AS BACKFLOW
P. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO METER PIT
Q. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO 10" ROUND VALVE BOX ADJACENT TO CONCRETE PAD
R. DUCTILE IRON FLANGED EL (1 OF 3)
S. QUICK COUPLING VALVE INSTALLED IN 10" ROUND VALVE BOX SET FLUSH TO TOP OF CONCRETE. ANCHOR QUICK COUPLER WITH HARCO QUICK COUPLER ANCHOR OR APPROVED EQUAL
T. 1" TYPE K COPPER WITH THREADED COPPER MALE ADAPTERS ON EACH END, PIPE LENGTH AS REQUIRED, OR MINIMUM 200 PSI SDR 9 HDPE WITH COMPRESSION X MALE ADAPTERS FOR POTABLE WATER..
U. 1" NETAFIM CONTINUOUS ACTING AIR/VACUUM RELIEF VALVE, MODEL 65ARIS1

NOTES:
1. EXTEND CONCRETE BASE 6" BEYOND ENCLOSURE ON ALL SIDES.
2. CONCRETE PAD SHALL BE LEVEL.
3. PROVIDE FITTINGS AND PIPE THAT MATCH SIZE OF BACKFLOW PREVENTER.
4. INSTALLATION OF BACKFLOW PREVENTER SHALL COMPLY WITH ALL APPLICABLE LOCAL AND STATE CODES.
5. REMOVE DRAIN PLUG FROM BOTTOM CHAMBER OF THE HYDROMETER AND INSTALL A 1/4" BALL VALVE.
6. ENCLOSURE FOR A 3" ASSEMBLY SHALL BE A GUARDSHACK GS-6 AND A 4" ASSEMBLY SHALL BE A GS-7
7. SUBMIT SHOP DRAWINGS SHOWING RELATIVE EQUIPMENT LAYOUT AND SPECIFYING SIZE OF ENCLOSURE, WYE FILTER, BACKFLOW, AND HYDROMETER.
8. BITUMINOUS TAR COATING SHALL NOT BE ACCEPTED FOR ANY DUCTILE IRON COMPONENT.

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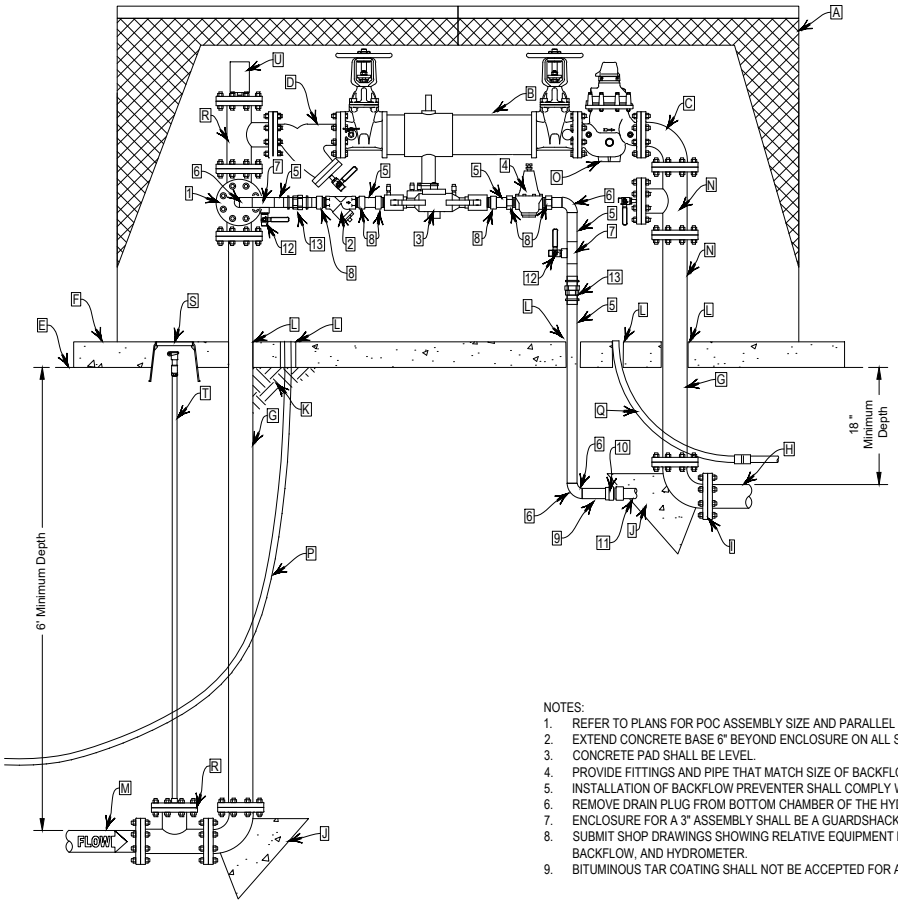
POC ASSEMBLY (3" AND LARGER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-02



A. ENCLOSURE: GUARDSHACK CLAMSHELL, SIZE AS NEEDED
B. REDUCED PRESSURE BACKFLOW PREVENTER: WATTS 957 WITH NON-RISING STEM GATE VALVES
C. CAST IRON FLANGED EL (1 OF 3)
D. WYE-STRAINER: ZURN FSC (SAME SIZE AS BACKFLOW)
E. FINISH GRADE
F. 4" CONCRETE BASE (USE 4000 PSI TYPE B CONCRETE)
G. DUCTILE IRON RED PRIME COATED FLANGED PIPE (LENGTH AS REQUIRED)
H. PVC PIPE TO IRRIGATION
I. DUCTILE IRON FL x MJ EL WITH TRANSITION GASKET OR HARCO FLANGE X BELL ADAPTER
J. CONCRETE THRUST BLOCK. MINIMUM SURFACE AREA AGAINST UNDISTURBED SOIL: 3" - 1.52 SF; 4" - 2.49 SF; 6" - 5.39 SF; 8" - 9.16 SF; 10" - 14.21 SF
K. COMPACTED SUB GRADE
L. WRAP PIPE AT PENETRATION WITH 1/4" FELT OR SLEEVE WITH CLASS 200 PVC
M. COATED DUCTILE IRON PIPE FROM WATER METER
N. DUCTILE IRON TEE WITH 1" TAPPED BLIND FLANGE AND BRASS BALL VALVE
O. HYDROMETER: NETAFIM LHM, NORMALY OPEN, SAME SIZE AS BACKFLOW
P. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO METER PIT
Q. 1" CONDUIT WITH CONTROL WIRING TO HYDROMETER ROUTED WITH SWEEP FITTINGS INTO 10" ROUND JUNCTION BOX ADJACENT TO CONCRETE PAD
R. DUCTILE IRON TEE WITH 1" TAPPED BLIND FLANGE
S. QUICK COUPLING VALVE INSTALLED IN 10" ROUND VALVE BOX SET FLUSH TO TOP OF CONCRETE. ANCHOR QUICK COUPLER WITH HARCO QUICK COUPLER ANCHOR OR APPROVED EQUAL
T. 1" TYPE K COPPER WITH THREADED COPPER MALE ADAPTERS ON EACH END, PIPE LENGTH AS REQUIRED, OR MINIMUM 200 PSI SDR 9 HDPE WITH COMPRESSION BY MALE ADAPTERS FOR POTABLE WATER.
U. 1" NETAFIM CONTINUOUS ACTING AIR/VACUUM RELIEF VALVE, MODEL 65ARIS1

1. COATED DUCTILE IRON FLANGED TEE W/ TAPPED THREADED OUTLET TO MATCH PARALLEL BACKFLOW SIZE
2. WYE-STRAINER: ZURN YBXL, SAME SIZE AS PARALLEL BACKFLOW
3. PARALLEL REDUCED PRESSURE BACKFLOW PREVENTER: FOR POTABLE WATER: WATTS LF009
4. PRESSURE REGULATING VALVE: WATTS LF223 W/ 25-75 PSI OUTLET PRESSURE RANGE. SAME SIZE AS PARALLEL BACKFLOW
5. TYPE K COPPER, LENGTH AS REQUIRED
6. COPPER EL
7. COPPER TEE
8. COPPER MALE ADAPTER
9. COPPER FEMALE ADAPTER
10. PVC MALE ADAPTER
11. PIPE TO DRINKING FOUNTAIN, HYDRANT VALVES, OR OTHER POTABLE FIXTURE.
12. 1" BRASS BALL VALVE
13. NO LEAD BRASS PRESS-TO-CONNECT UNION

NOTES:
1. REFER TO PLANS FOR POC ASSEMBLY SIZE AND PARALLEL BACKFLOW SIZE.
2. EXTEND CONCRETE BASE 6" BEYOND ENCLOSURE ON ALL SIDES.
3. CONCRETE PAD SHALL BE LEVEL.
4. PROVIDE FITTINGS AND PIPE THAT MATCH SIZE OF BACKFLOW PREVENTER.
5. INSTALLATION OF BACKFLOW PREVENTER SHALL COMPLY WITH ALL APPLICABLE LOCAL AND STATE CODES.
6. REMOVE DRAIN PLUG FROM BOTTOM CHAMBER OF THE HYDROMETER AND INSTALL A 1/4" BALL VALVE.
7. ENCLOSURE FOR A 3" ASSEMBLY SHALL BE A GUARDSHACK GS-6 AND A 4" ASSEMBLY SHALL BE A GS-7
8. SUBMIT SHOP DRAWINGS SHOWING RELATIVE EQUIPMENT LAYOUT AND SPECIFYING SIZE OF ENCLOSURE, WYE FILTER, BACKFLOW, AND HYDROMETER.
9. BITUMINOUS TAR COATING SHALL NOT BE ACCEPTED FOR ANY DUCTILE IRON COMPONENT.

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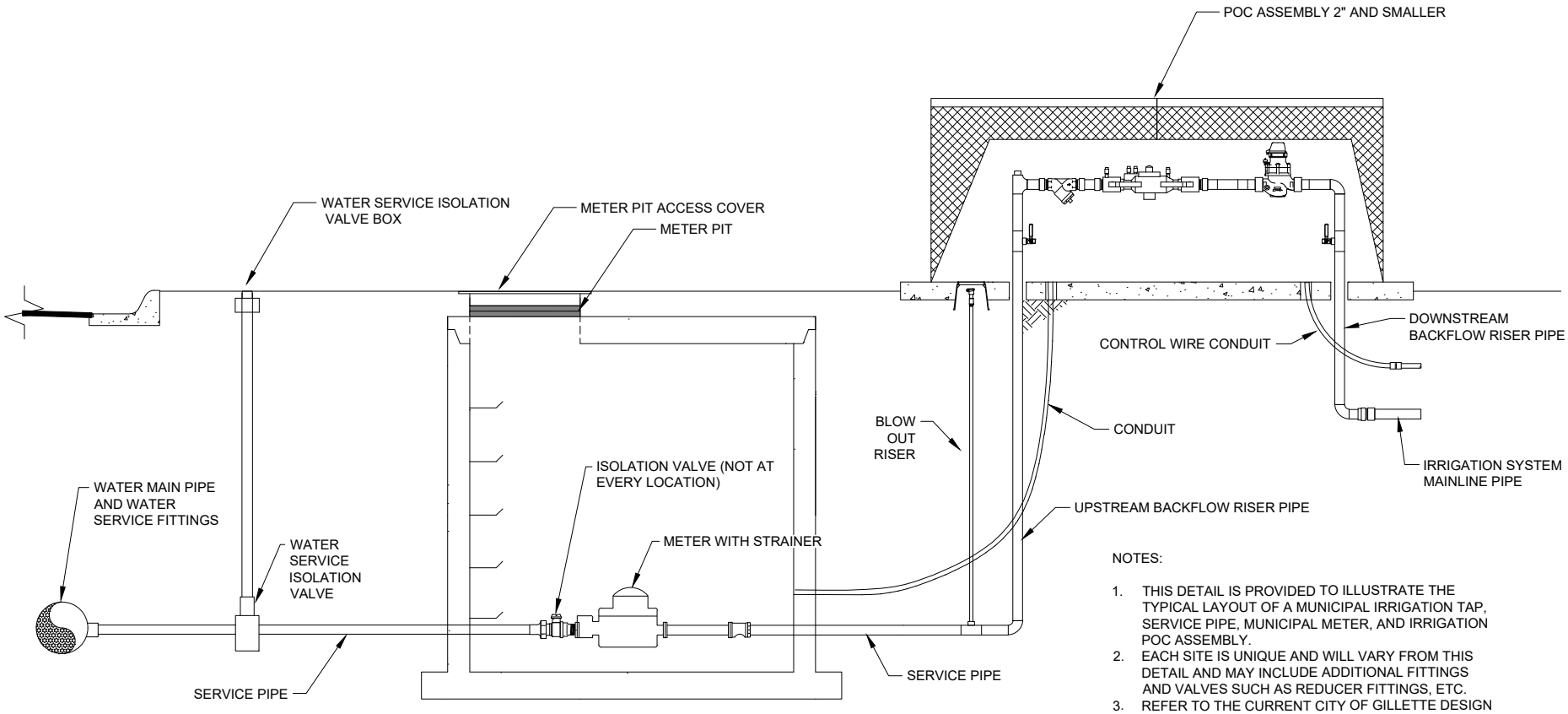
POC ASSEMBLY (3" AND LARGER" W/ PARALLEL BACKFLOW (2" & SMALLER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-03



NOTES:

1. THIS DETAIL IS PROVIDED TO ILLUSTRATE THE TYPICAL LAYOUT OF A MUNICIPAL IRRIGATION TAP, SERVICE PIPE, MUNICIPAL METER, AND IRRIGATION POC ASSEMBLY.
2. EACH SITE IS UNIQUE AND WILL VARY FROM THIS DETAIL AND MAY INCLUDE ADDITIONAL FITTINGS AND VALVES SUCH AS REDUCER FITTINGS, ETC.
3. REFER TO THE CURRENT CITY OF GILLETTE DESIGN STANDARDS AND CITY OF GILLETTE STANDARD SPECIFICATIONS FOR MATERIAL AND INSTALLATION REQUIREMENTS OF MUNICIPAL WATER TAPS, SERVICE PIPE, ISOLATION VALVES, METER PITS, AND POC ASSEMBLIES.

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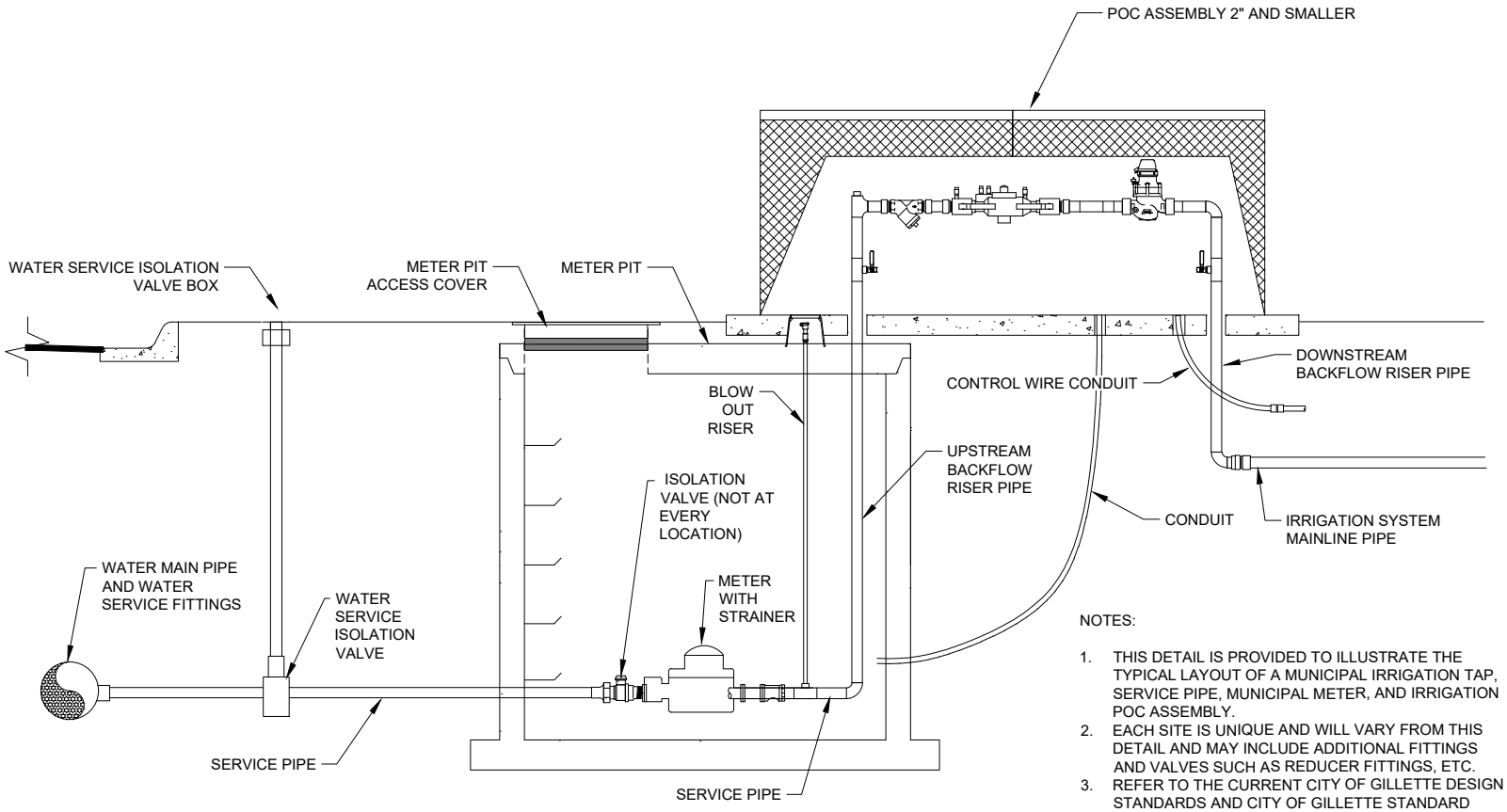
TYPICAL LAYOUT - WATER TAP, METER, AND POC ASSEMBLY (2" AND SMALLER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-04



NOTES:

1. THIS DETAIL IS PROVIDED TO ILLUSTRATE THE TYPICAL LAYOUT OF A MUNICIPAL IRRIGATION TAP, SERVICE PIPE, MUNICIPAL METER, AND IRRIGATION POC ASSEMBLY.
2. EACH SITE IS UNIQUE AND WILL VARY FROM THIS DETAIL AND MAY INCLUDE ADDITIONAL FITTINGS AND VALVES SUCH AS REDUCER FITTINGS, ETC.
3. REFER TO THE CURRENT CITY OF GILLETTE DESIGN STANDARDS AND CITY OF GILLETTE STANDARD SPECIFICATIONS FOR MATERIAL AND INSTALLATION REQUIREMENTS OF MUNICIPAL WATER TAPS, SERVICE PIPE, ISOLATION VALVES, METER PITS, AND POC ASSEMBLIES.

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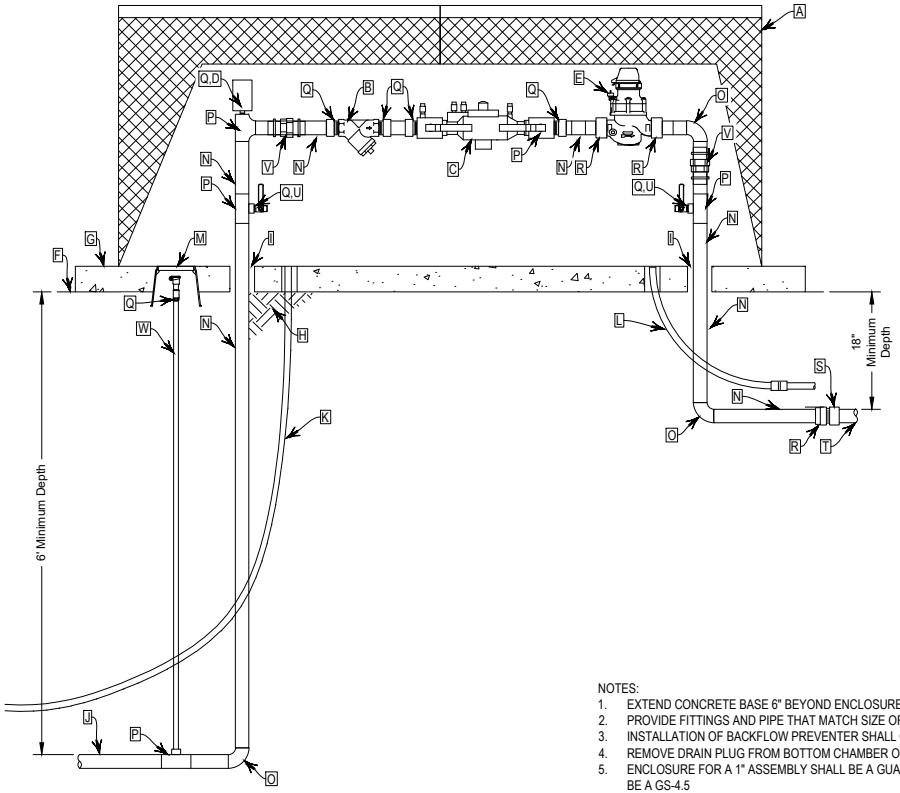
ALTERNATE LAYOUT - WATER TAP, METER, AND POC ASSEMBLY (2" AND SMALLER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-05



A. ENCLOSURE: GUARDSHACK CLAMSHELL, SIZE AS NEEDED
B. WYE-STRAINER: ZURN YBXL, SAME SIZE AS BACKFLOW
C. REDUCED PRESSURE BACKFLOW PREVENTER: WATTS LF009
D. 1" NETAFIM CONTINUOUS ACTIVE AIR/VACUUM RELIEF VALVE, MODEL 65ARIS1
E. HYDROMETER: NETAFIM LHM, NORMALLY OPEN, SAME SIZE AS BACKFLOW FOR 1-1/2" AND 2" BACKFLOWS. USE 1-1/2" HYDROMETER FOR 1" BACKFLOWS AND PROVIDE COPPER OR BRONZE ADAPTERS AS NEEDED.
F. FINISH GRADE
G. 4" CONCRETE BASE, USE 4000 PSI CLASS B CONCRETE
H. COMPACTED SUB GRADE
I. WRAP PIPE AT PENETRATION WITH 1/4" FELT OR SLEEVE WITH CLASS 200 PVC
J. COPPER PIPE FROM WATER METER
K. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO METER PIT
L. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO 10" ROUND VALVE BOX ADJACENT TO CONCRETE PAD
M. QUICK COUPLING VALVE INSTALLED IN 10" ROUND VALVE BOX SET FLUSH TO TOP OF CONCRETE. ANCHOR QUICK COUPLER WITH HARCO QUICK COUPLING VALVE ANCHOR.
N. TYPE K COPPER, LENGTH AS REQUIRED
O. COPPER EL
P. COPPER TEE
Q. COPPER MALE ADAPTER
R. COPPER FEMALE ADAPTER
S. PVC MALE ADAPTER
T. PVC PIPE TO IRRIGATION
U. 1" BRASS BALL VALVE
V. NO LEAD BRASS PRESS-TO-CONNECT UNION
W. 1-INCH TYPE K COPPER WITH THREADED MALE ADAPTERS ON EACH, PIPE LENGTH AS REQUIRED, OR 200 PSI SDR 9 HDPE WITH COMPRESSION BY MALE ADAPTERS FOR POTABLE WATER.

NOTES:
1. EXTEND CONCRETE BASE 6" BEYOND ENCLOSURE ON ALL SIDES.
2. PROVIDE FITTINGS AND PIPE THAT MATCH SIZE OF BACKFLOW PREVENTER.
3. INSTALLATION OF BACKFLOW PREVENTER SHALL COMPLY WITH ALL APPLICABLE LOCAL AND STATE CODES.
4. REMOVE DRAIN PLUG FROM BOTTOM CHAMBER OF THE HYDROMETER AND INSTALL A 1/4" BALL VALVE.
5. ENCLOSURE FOR A 1" ASSEMBLY SHALL BE A GUARD SHACK GS-4, 1-1/2" ASSEMBLY SHALL BE A GS-4.5, AND A 2" ASSEMBLY SHALL BE A GS-4.5
6. SUBMIT SHOP DRAWINGS SHOWING RELATIVE EQUIPMENT LAYOUT AND SPECIFYING SIZE OF ENCLOSURE, WYE FILTER, BACKFLOW, AND HYDROMETER TO VERIFY DIMENSIONS.
7. Bituminous Tar Coating shall not be accepted for any ductile iron component.

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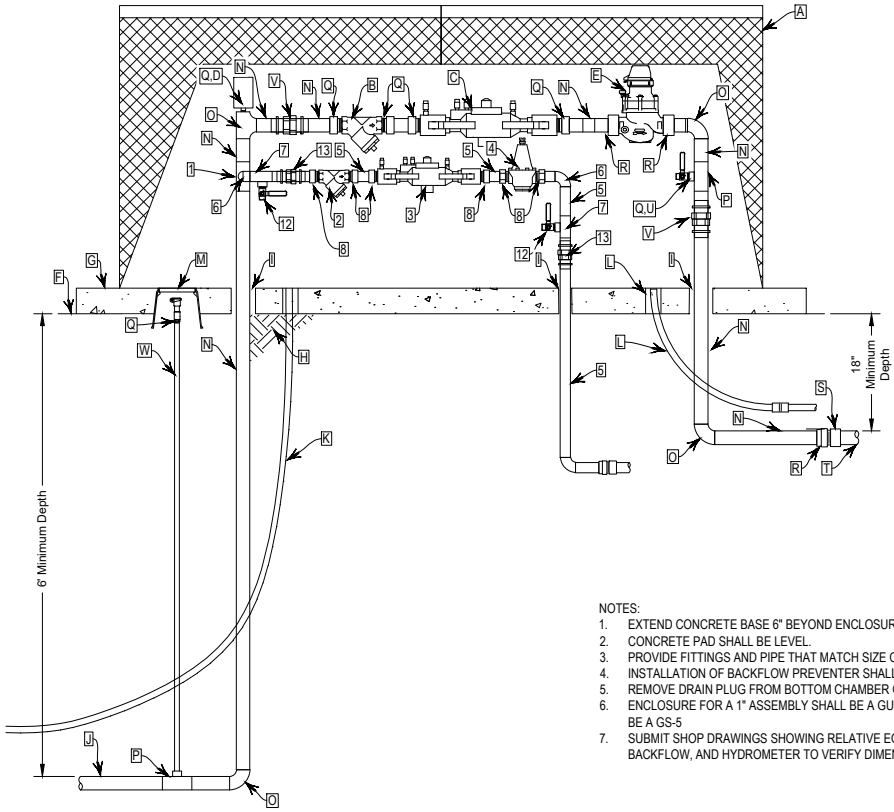
POC ASSEMBLY (2" & SMALLER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-06



A. ENCLOSURE: GUARDSHACK CLAMSHELL, SIZE AS NEEDED
B. WYE-STRAINER: ZURN YBXL, SAME SIZE AS BACKFLOW
C. REDUCED PRESSURE BACKFLOW PREVENTER: WATTS LF009
D. 1" NETAFIM CONTINUOUS ACTIVE AIR/VACUUM RELIEF VALVE, MODEL 65ARIS1
E. HYDROMETER: NETAFIM LHM, NORMALLY OPEN, SAME SIZE AS BACKFLOW FOR 1-1/2" AND 2" BACKFLOWS. USE 1-1/2" HYDROMETER FOR 1" BACKFLOWS AND PROVIDE COPPER OR BRONZE ADAPTERS AS NEEDED.
F. FINISH GRADE
G. 4" CONCRETE BASE, USE 4000 PSI CLASS B CONCRETE
H. COMPACTED SUB GRADE
I. WRAP PIPE AT PENETRATION WITH 1/4" FELT OR SLEEVE WITH CLASS 200 PVC
J. COPPER PIPE FROM WATER METER
K. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO METER PIT
L. 1" CONDUIT ROUTED WITH SWEEP FITTINGS INTO 10" ROUND VALVE BOX ADJACENT TO CONCRETE PAD
M. QUICK COUPLING VALVE INSTALLED IN 10" ROUND VALVE BOX SET FLUSH TO TOP OF CONCRETE. ANCHOR QUICK COUPLER WITH HARCO QUICK COUPLING VALVE ANCHOR.
N. TYPE K COPPER, LENGTH AS REQUIRED
O. COPPER EL
P. COPPER TEE
Q. COPPER MALE ADAPTER
R. COPPER FEMALE ADAPTER
S. PVC MALE ADAPTER
T. PVC PIPE TO IRRIGATION
U. 1" BRASS BALL VALVE
V. NO LEAD BRASS PRESS-TO-CONNECT UNION, SIZE TO MATCH BACKFLOW
W. 1" TYPE K COPPER WITH MALE THREADED ADAPTERS ON EACH END, PIPE LENGTH AS REQUIRED, OR MINIMUM 200 PSI SDR 9 HDPE WITH COMPRESSION X MALE ADAPTERS FOR POTABLE WATER

1. COPPER TEE W/ REDUCER AS REQUIRED.
2. WYE-STRAINER: ZURN YBXL, SAME SIZE AS PARALLEL BACKFLOW
3. PARALLEL REDUCED PRESSURE BACKFLOW PREVENTER: FOR POTABLE WATER: WATTS LF009
4. PRESSURE REGULATING VALVE: WATTS LF223 W/ 25-75 PSI OUTLET PRESSURE RANGE. SAME SIZE AS PARALLEL BACKFLOW
5. TYPE K COPPER, LENGTH AS REQUIRED
6. COPPER EL
7. COPPER TEE
8. COPPER MALE ADAPTER
9. COPPER FEMALE ADAPTER
10. PVC MALE ADAPTER
11. PVC OR HDPE PIPE TO DRINKING FOUNTAIN, HYDRANT VALVES, OR OTHER POTABLE FIXTURE.
12. 1" BRASS BALL VALVE, SIZE TO MATCH PARALLEL BACKFLOW..
13. NO LEAD BRASS PRESS-TO-CONNECT UNION, SIZE TO MATCH BACKFLOW

NOTES:
1. EXTEND CONCRETE BASE 6" BEYOND ENCLOSURE ON ALL SIDES.
2. CONCRETE PAD SHALL BE LEVEL.
3. PROVIDE FITTINGS AND PIPE THAT MATCH SIZE OF BACKFLOW PREVENTER.
4. INSTALLATION OF BACKFLOW PREVENTER SHALL COMPLY WITH ALL APPLICABLE LOCAL AND STATE CODES.
5. REMOVE DRAIN PLUG FROM BOTTOM CHAMBER OF THE HYDROMETER AND INSTALL A 1/4" BALL VALVE.
6. ENCLOSURE FOR A 1" ASSEMBLY SHALL BE A GUARD SHACK GS-5, 1-1/2" ASSEMBLY SHALL BE A GS-5, AND A 2" ASSEMBLY SHALL BE A GS-5
7. SUBMIT SHOP DRAWINGS SHOWING RELATIVE EQUIPMENT LAYOUT AND SPECIFYING SIZE OF ENCLOSURE, WYE FILTER, BACKFLOW, AND HYDROMETER TO VERIFY DIMENSIONS.

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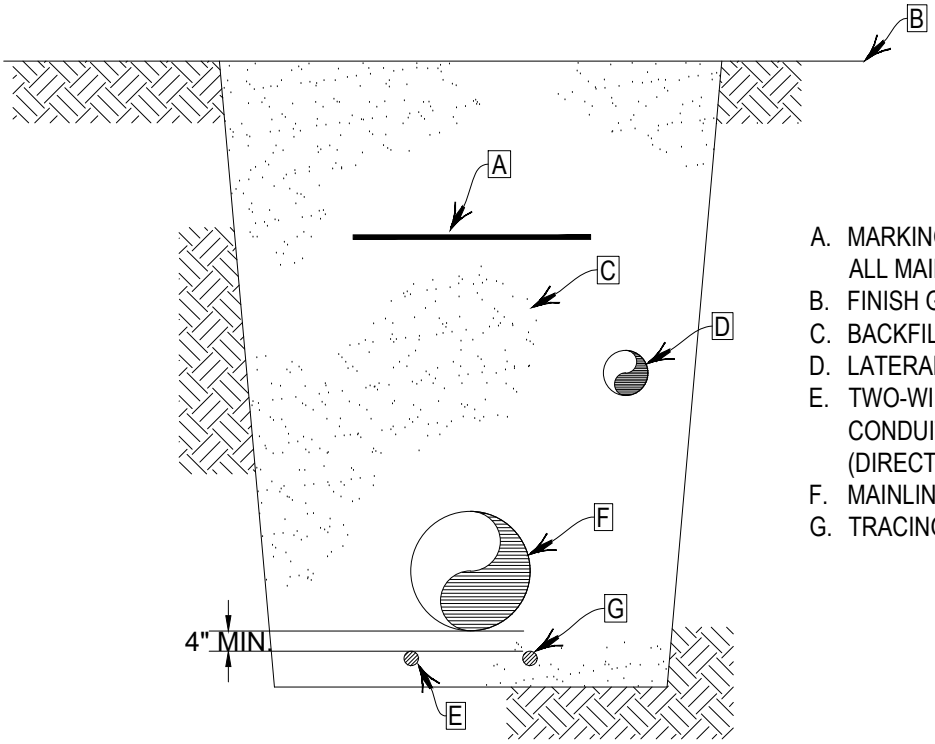
POC ASSEMBLY (2" & SMALLER) W/ PARALLEL BACKFLOW (1" & SMALLER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-07



A. MARKING TAPE (12" ABOVE ALL MAINLINE PIPE)
B. FINISH GRADE
C. BACKFILL
D. LATERAL PIPE
E. TWO-WIRE CABLE (WITHIN CONDUIT) OR CONTROL WIRE (DIRECT BURY)
F. MAINLINE PIPE
G. TRACING WIRE

NOTE:
1. REFER TO IRRIGATION SPECIFICATIONS FOR COVERAGE DEPTH TO BURIED PIPE AND WIRE.

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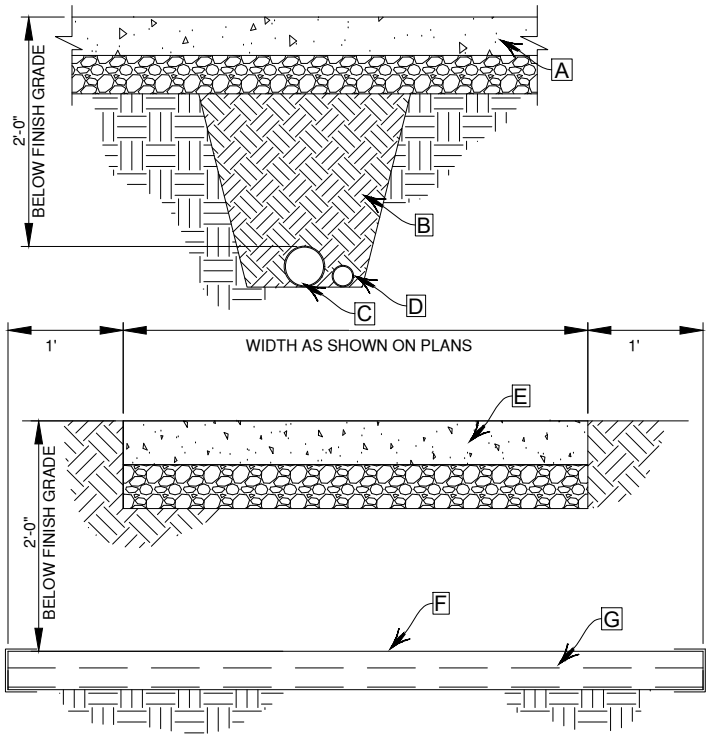
TRENCHING

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-08



A. PAVING AS INDICATED ON DRAWINGS

B. COMPACTED BACKFILL, TYPICAL

C. SCH. 40 PVC IRRIGATION SLEEVE. DIAMETER SHALL BE TWICE (2X) THE NOMINAL SIZE OF IRRIGATION PIPE CARRIED WITHIN. SLEEVE DIAMETER FOR GASKETED PIPE MUST ACCOMODATE OUTSIDE DIAMETER OF JOINT-RESTRAINT CASING SPACES.

D. 2" DIA. SCH. 40 PVC SLEEVE FOR IRRIGATION WIRING, PLACE BESIDE (OR SLEEVE FOR IRRIGATION LINE. EXTEND SLEEVE 1'-0" MIN. BEYOND EDGE OF PAVEMENT, BOTH SIDES.

E. 2-WIRE COMMUNICATION WIRE SHALL HAVE ITS OWN DEDICATED SLEEVE.

F. SCH. 40 PVC IRRIGATION SLEEVE. DIAMETER SHALL BE TWICE (2X) THE NOMINAL SIZE OF IRRIGATION PIPE CARRIED WITHIN. EXTEND SLEEVE 1'-0" MINIMUM BEYOND EDGE OF PAVEMENT, BOTH SIDES.

NOTES:

1. TAPE OR CAP ENDS OF SLEEVES AND MARK SLEEVE LOCATIONS WITH ABOVE GRADE STAKES AT WITH APPROPRIATE ANNOTATION, I.E. "IRRIGATION SLEEVES".
2. IF CONCRETE CONTRACTOR IS INSTALLING THE SLEEVE, THE SURFACE OF THE CONCRETE SHALL BE MARKED WITH "SLV" IN 3" LETTERS ON BOTH SIDES OF SLEEVE CROSSINGS.

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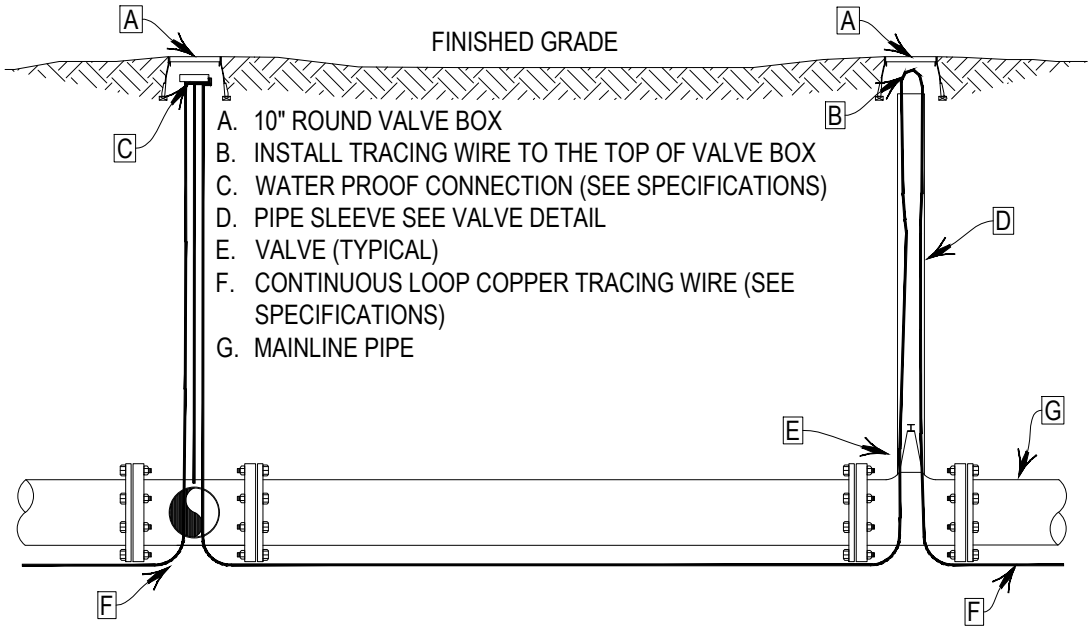
SLEEVING

DATE: Date
March 2025

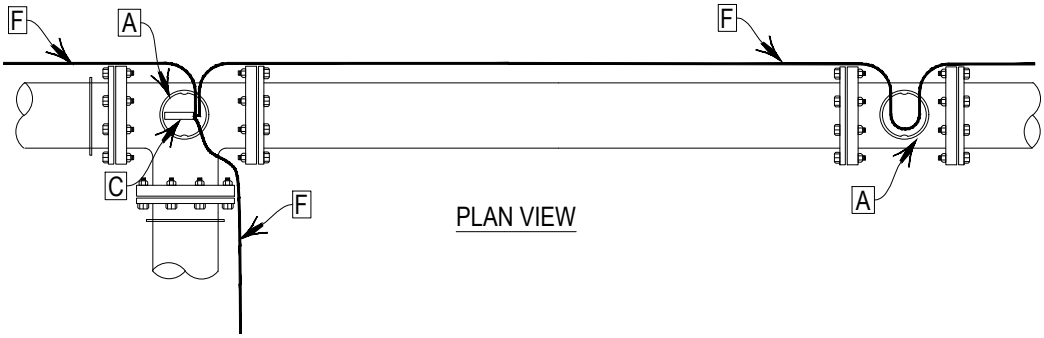
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02920-09



ELEVATION VIEW



PLAN VIEW

NOTE:

1. COPPER TRACING WIRE WILL START AT THE NEAREST VALVE TO THE POC AND WILL BE ROUTED WITH ALL MAINLINE PIPE.
2. SPLICE TRACING WIRE IN IRRIGATION MAINLINE COMPONENT VALVE BOXES WHEN POSSIBLE, OTHERWISE, PLACE SPLICE IN SEPARATE VALVE BOX.

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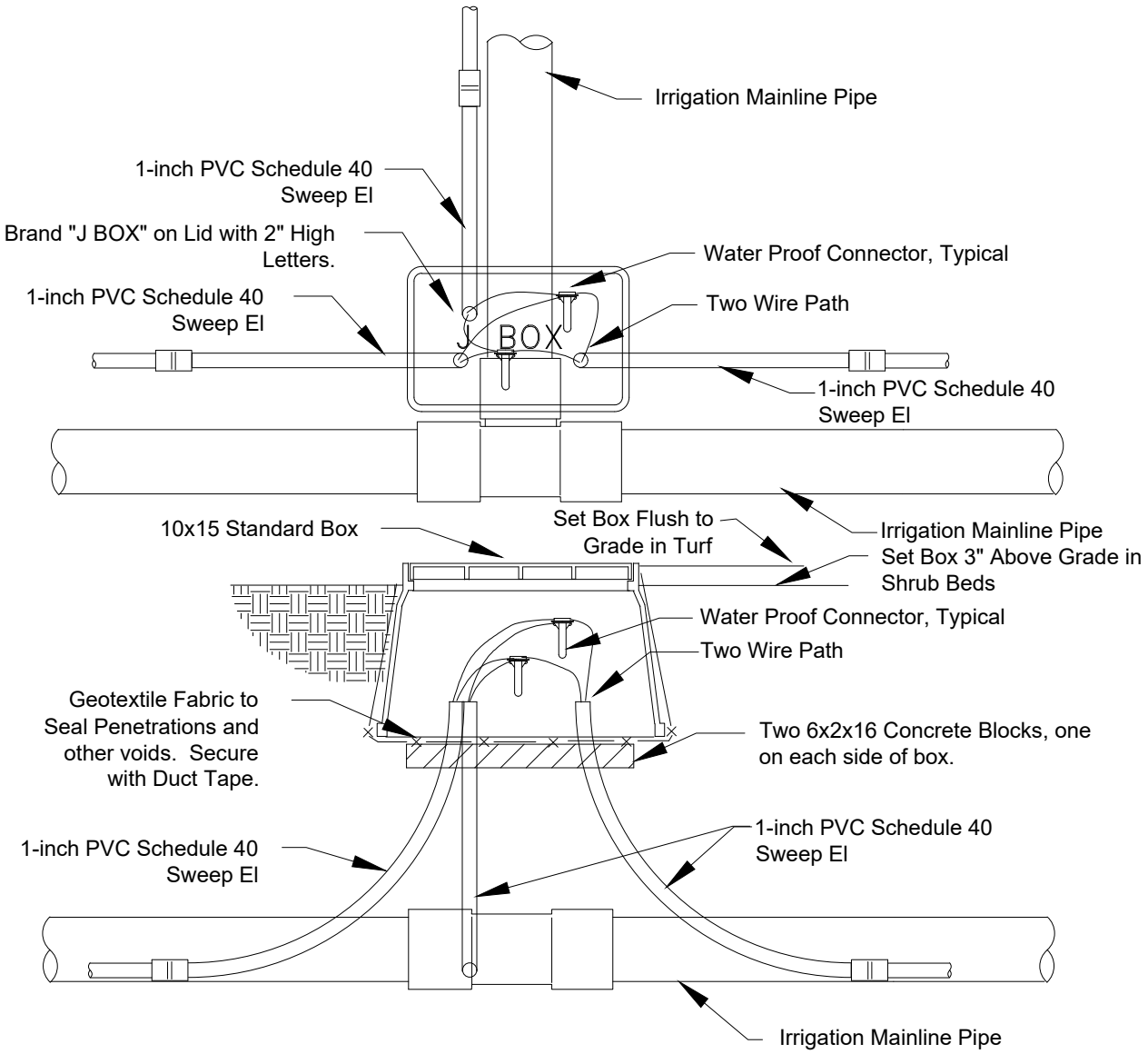
TRACING WIRE

DATE: March 2025

DRAWING NO. 02920-10

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CONTROL WIRE JUNCTION BOX

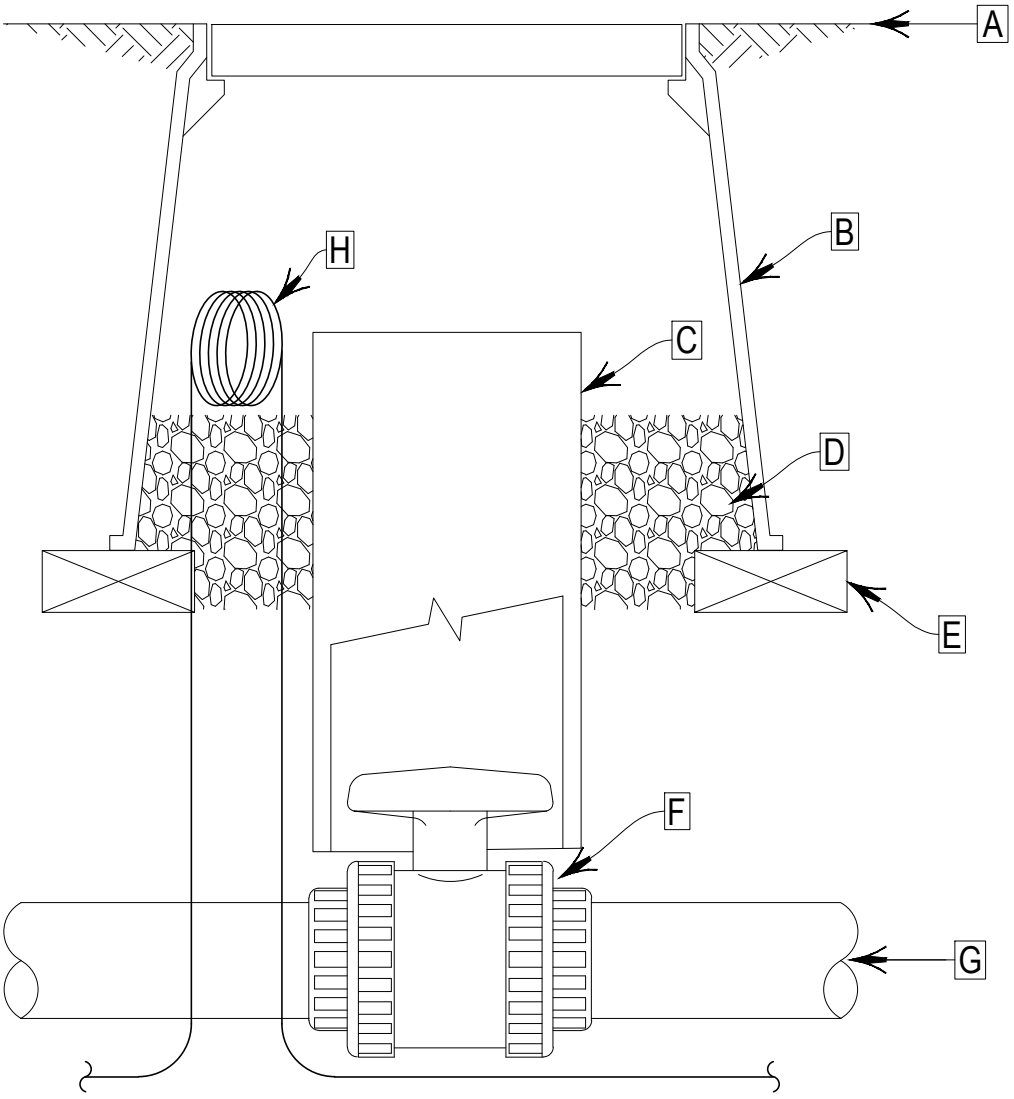
DATE: March 2025

DRAWING NO. 02920-11

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

A. FINISH GRADE/TOP OF MULCH
B. 10" ROUND VALVE BOX WITH COVER
C. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
D. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
E. BRICK (1 OF 2)
F. PVC TRUE UNION BALL VALVE
G. PVC MAINLINE
H. TRACING WIRE



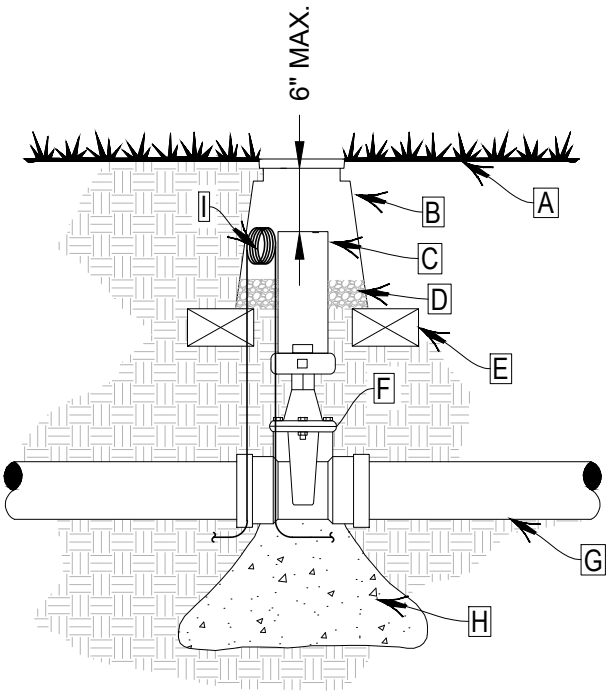
NOTE:
1. NOMINAL SIZE OF VALVE TO MATCH NOMINAL MAINLINE SIZE.

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ISOLATION BALL VALVE ASSEMBLY (2-INCH AND SMALLER)

DATE: March 2025
DRAWING NO. 02920-12

DRAWN BY: Drawn By Initials
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A. FINISH GRADE
B. 10" ROUND VALVE BOX
C. 6" SCHEDULE 40 PVC, LENGTH AS REQUIRED
D. 3/4" WASHED GRAVEL 3" DEEP
E. MINIMUM OF TWO BRICKS, ONE ON EACH SIDE
F. RESILIENT WEDGE GATE VALVE W/ 2" SQUARE OPERATING NUT, SAME SIZE AS PIPE, REFER TO LEGEND FOR MODEL. USE MECHANICAL JOINT RESTRAINTS.
G. MAINLINE PIPE
H. CONCRETE SUPPORT BLOCK. USE A MINIMUM OF 3 CUBIC FEET OF CONCRETE.
I. TRACING WIRE

NOTES:

1. THIS DETAIL IS ONLY TO BE USED FOR VALVES 3" AND LARGER.
2. WRAP VALVE ENDS AND BODY IN 3 MIL. PLASTIC PRIOR TO POURING CONCRETE.
3. CONCRETE SUPPORT BLOCK IS TO BE POURED UNDER ISOLATION GATE VALVE. THE ISOLATION GATE VALVE IS NOT TO BE SET IN THE CONCRETE.
4. ENSURE TRACING WIRE IS FREE FROM SUPPORTING BLOCK.

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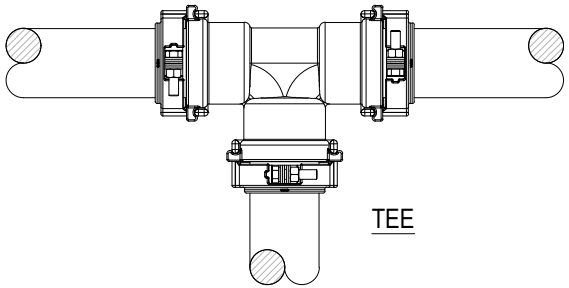
ISOLATION VALVE ASSEMBLY (3" & LARGER)

DATE: October 2025

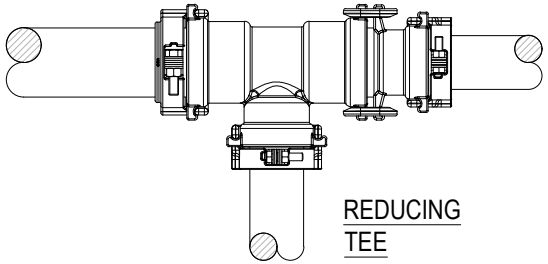
DRAWING NO. 02920-13

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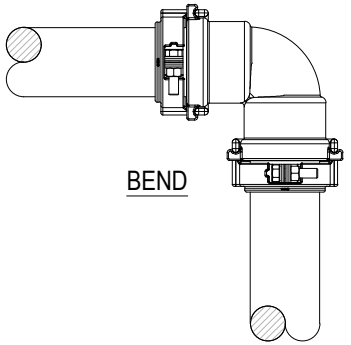
APPROVED BY: CITY ENGINEER JS



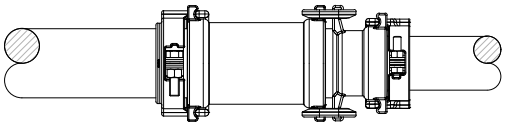
TEE



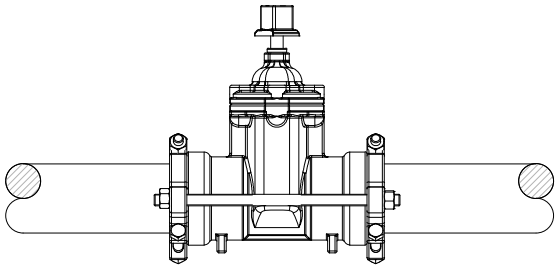
REDUCING TEE



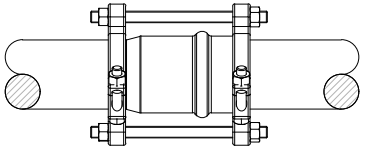
BEND



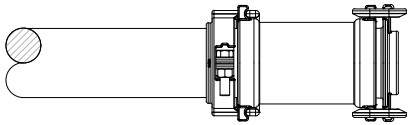
REDUCER



VALVE TO PIPE RESTRAINT



PIPE TO PIPE RESTRAINT



CAP OR DEAD END

MINIMUM RESTRAINED LENGTH REQUIREMENT FOR EACH FITTING OR VALVE BELL							
PIPE SIZE	90 deg BEND	45 deg, 22.5 deg, 11.25 deg BEND	TEE	REDUCER	CAP OR DEAD END	VALVE	
3" & 4"	20'	20'	20'	40'	60'	60'	SEE NOTE 4
6" & LARGER	40'	20'	20'	60'	80'	80'	SEE NOTE 4

NOTES:

1. THE RESTRAINT SCHEMES HERE ARE FOR SYSTEM PRESSURES UP TO 125 PSI.
2. EACH FITTING AND VALVE BELL MUST BE RESTRAINED TO THE LENGTH OF PIPE NOTED IN THE TABLE USING FITTING TO PIPE RESTRAINT, VALVE TO PIPE RESTRAINT, AND PIPE TO PIPE RESTRAINT AS REQUIRED.
3. PIPE JOINTS WITHIN THE RESTRAINED LENGTH REQUIREMENT MUST BE RESTRAINED WITH PIPE TO PIPE RESTRAINTS.
4. SERVICE TEES AND COUPLINGS WITHIN THE RESTRAINED LENGTH REQUIREMENT MUST BE RESTRAINED WITH FITTING TO PIPE RESTRAINTS.
5. FITTING BELLS 4" AND BELOW: HARCO RESTRAINTS SERIES 60-100-XX OR 82XX10.

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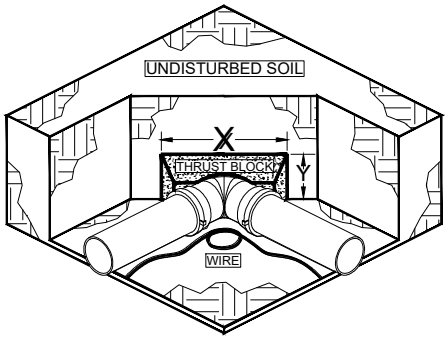
JOINT RESTRAINT DETAIL

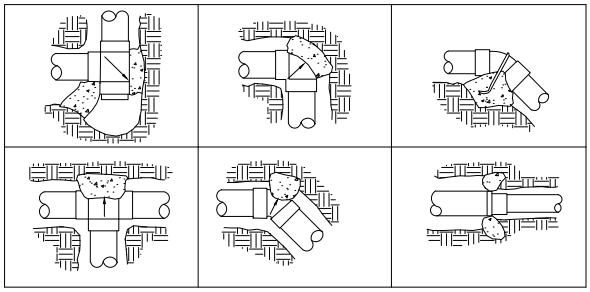
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DATE: March 2025

DRAWING NO. 02920-14





THRUST BLOCK SURFACE AREA (SF) AGAINST UNDISTURBED SOIL (X x Y)= (SF)

FITTING SIZE	11 1/4° BEND(SF)	22 1/2° BEND(SF)	45° BEND (SF)	90° BEND (SF)	TEE OR DEAD END(SF)
3"	0.25	0.48	0.93	1.68	1.20
4"	0.41	0.76	1.52	2.77	1.97
6"	0.87	1.67	3.28	5.98	4.25
8"	1.55	2.93	5.81	30.58	7.52

Notes

1. INSTALL AND TEST MAINLINE ACCORDING TO MANUFACTURER'S INSTALLATION SPECIFICATIONS.
2. REFER TO SPECIFICAITONS FOR ALL PIPE BURIAL DEPTHS.
3. USE NO. 4 REBAR WITH MASTIC COATING WHERE PIPE MUST BE ANCHORED TO THRUST BLOCK.
4. INSTALL THRUST BLOCK SO THE HORIZONTAL (X) AND VERTICAL (Y) DIMENSIONS OF THE THRUST BLOCK AREAPPROXIMATELY EQUAL.
5. INSTALL THRUST BLOCK WITH A MINIMUM THICKNESS FROM THE PIPE TO THE UNDISTURBED SOIL OF TWO TIMES THE DIAMETER OF THE PIPE.
6. THRUST BLOCK SIZING ASSUMES A MAXIMUM OPERATING PRESSURE OF 100 PSI, A MAXIMUM VELOCITY OF 5 FEET PER SECOND, AND A SOIL BEARING CAPACITY OF 1000 LBS/SQFT.

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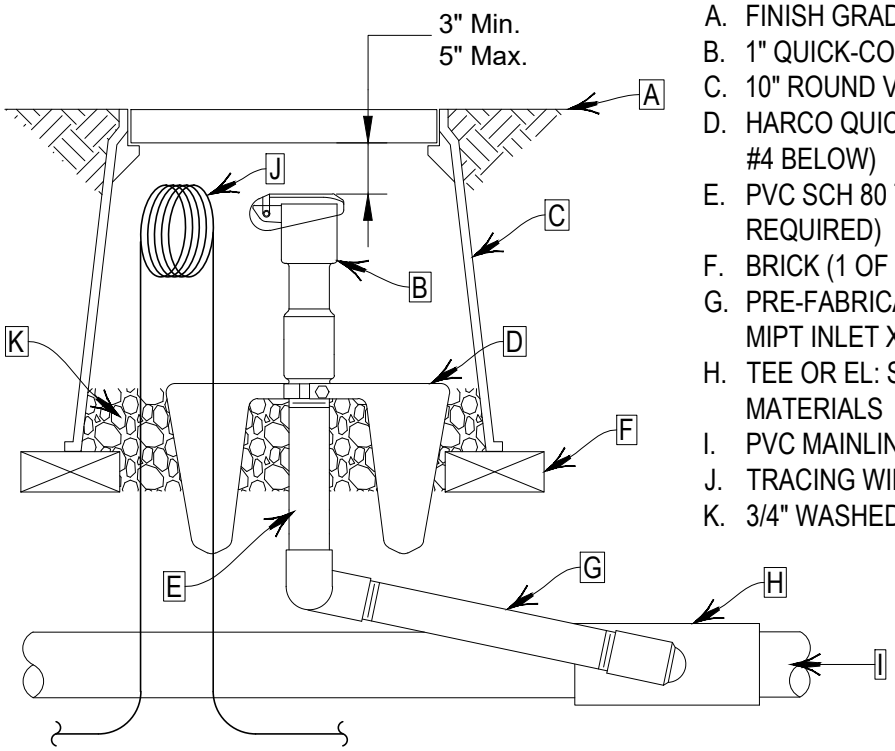
THRUST BLOCKING FOR IRRIGATION MAINLINE FITTINGS

DATE: March 2025

DRAWING NO. 02920-15

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. FINISH GRADE/TOP OF MULCH
B. 1" QUICK-COUPLING VALVE
C. 10" ROUND VALVE BOX WITH COVER
D. HARCO QUICK COUPLER ANCHOR (SEE NOTE #4 BELOW)
E. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
F. BRICK (1 OF 2)
G. PRE-FABRICATED UNITIZED SWING JOINT 1" MIPT INLET X SOC OUTLET
H. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
I. PVC MAINLINE PIPE
J. TRACING WIRE
K. 3/4" WASHED GRAVEL, 3'" DEEP

NOTES:

1. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.
2. INSTALLATION HEIGHT OF QUICK COUPLER VALVE IN VALVE BOX MUST ALLOW PROPER OPERATION OF QUICK COUPLER KEY.
3. INSTALL SWING JOINT LAY ARM BETWEEN 30° AND 45° OF PIPE IN ORDER TO ABSORB DOWNWARD IMPACT.
4. RE-BAR OR OTHER ANCHOR/STABILIZER MAY BE ACCEPTABLE ALTERNATIVES TO THE HARCO QUICK COUPLER ANCHOR. OWNER'S REPRESENTATIVE MUST APPROVE PROPOSED ALTERNATIVE.

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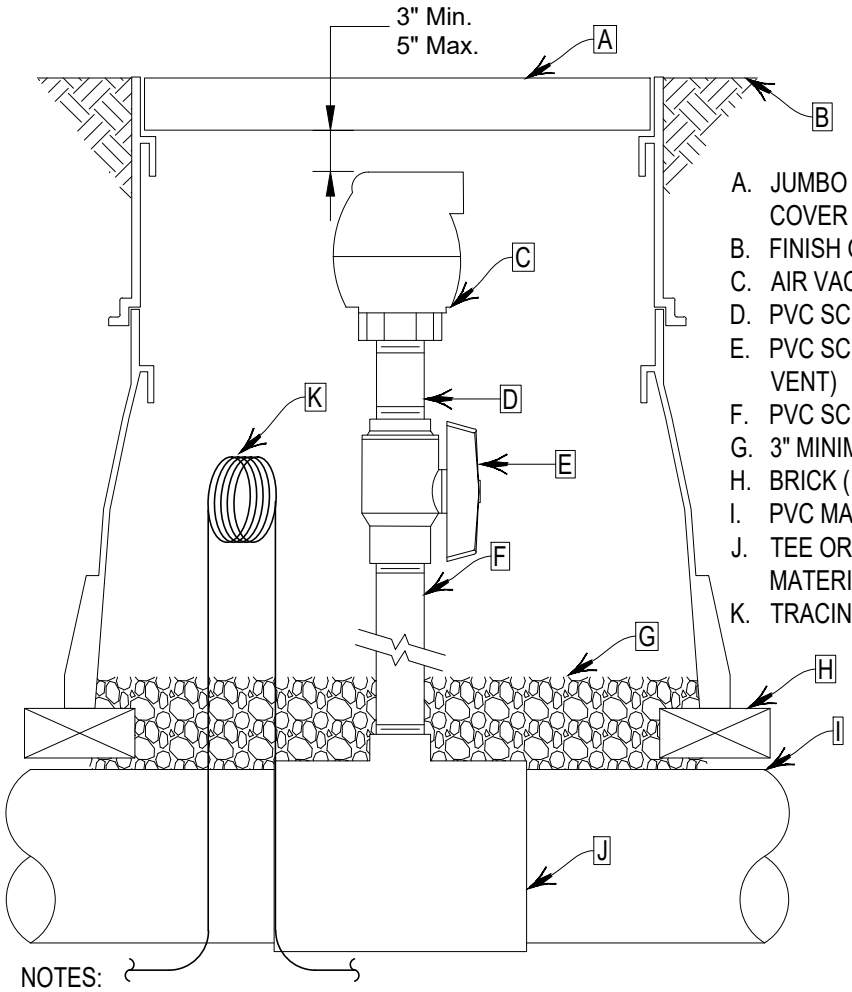
QUICK COUPLING VALVE ASSEMBLY

DATE: March 2025

DRAWING NO. Drawing 02920-16

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. JUMBO VALVE BOX WITH EXTENSION AND COVER (HEIGHT AS REQUIRED)
B. FINISH GRADE/TOP OF MULCH
C. AIR VACUUM RELIEF VALVE
D. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
E. PVC SCH 40 BALL VALVE (MATCH SIZE OF AIR VENT)
F. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
G. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
H. BRICK (1 OF 4)
I. PVC MAINLINE PIPE
J. TEE OR EL: SEE SPECIFICATIONS FOR MATERIALS
K. TRACING WIRE

NOTES:

1. OPEN BALL VALVE IN ASSEMBLY 1/4 TURN UNTIL IRRIGATION SYSTEM IS FULLY CHARGED WITH WATER. OPEN VALVE FULLY ONCE SYSTEM IS COMPLETELY CHARGED.
2. CLOSE VALVE DURING WINTERIZATION AND OPEN 1/2 TURN AFTER WINTERIZATION OF SYSTEM TO PROTECT VALVE DURING FREEZING WEATHER.

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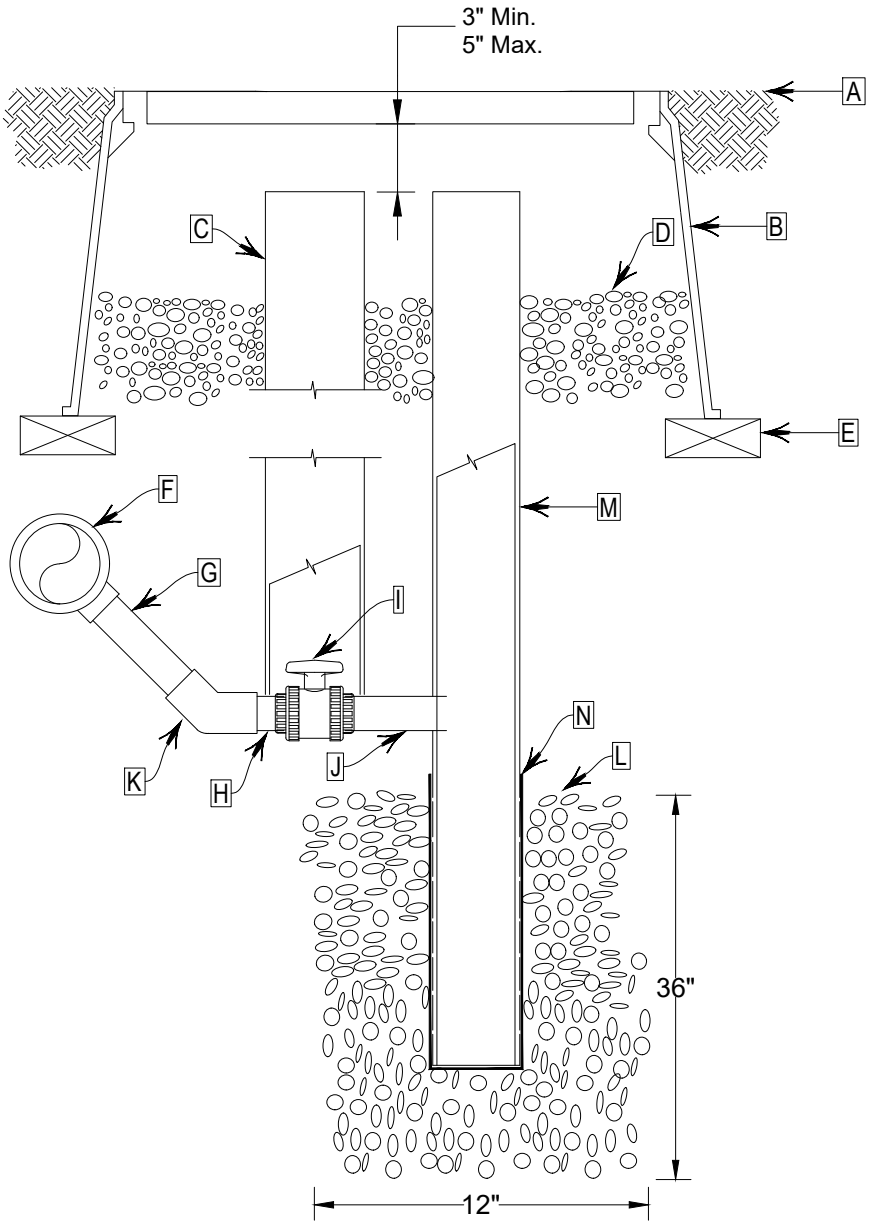
AIR VENT ASSEMBLY

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-17



A. FINISH GRADE/TOP OF MULCH
B. JUMBO VALVE BOX WITH COVER
C. 6" PVC CL 200 PIPE (LENGTH AS REQUIRED)
D. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
E. BRICK (1 OF 4)
F. TEE OR EL ON MAINLINE PIPE
G. PVC SCH 40 PIPE (LENGTH AS REQUIRED)
H. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
I. 1" PVC TRUE UNION BALL VALVE
J. PVC SCH 80 TOE NIPPLE (LENGTH AS REQUIRED)
K. PVC SCH 80 45-DEGREE FITTING
L. SUMP OF 3 CUBIC FEET OF 3/4" WASHED GRAVEL
M. 4" PVC CL 200 PIPE (LENGTH AS REQUIRED), BOTTOM 36" PERFORATED
N. FABRIC SOCK ON PERFORATED PIPE

NOTES:
1. SLEEVE TO BE SET SQUARE OVER VALVE TO ALLOW FOR OPERATION OF VALVE WITHOUT BINDING.
2. FURNISH APPROPRIATE HANDLE AND KEY TO MATCH VALVE.

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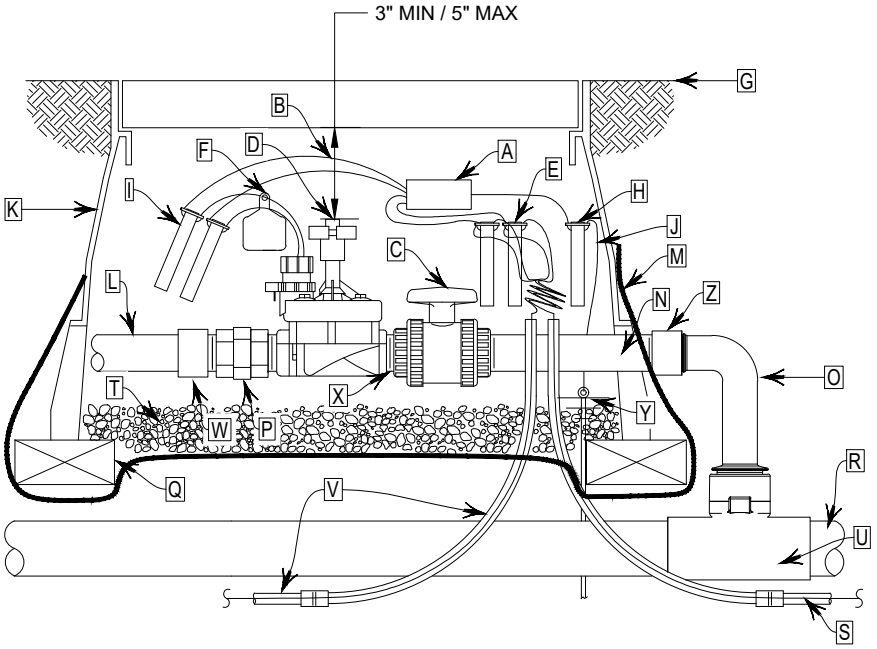
MANUAL DRAIN VALVE ASSEMBLY

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-18



A. DECODER
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. PVC TRUE-UNION BALL VALVE
D. REMOTE CONTROL VALVE
E. WIRE CONNECTOR FROM TWO-WIRE CABLE TO DECODER (1 OF 2)
F. CHRISTY ID TAG
G. FINISH GRADE
H. WIRE CONNECTOR FROM DECODER GROUND WIRE TO BARE COPPER GROUNDING WIRE
I. WIRE CONNECTOR FROM DECODER TO SOLENOID VALVE (1 OF 2)
J. BARE COPPER GROUNDING WIRE TO GROUNDING PLATE/ROD SEE SPECIFICATIONS
K. JUMBO VALVE BOX WITH COVER AND ADDITIONAL BOXES/EXTENSIONS AS REQUIRED.
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. PVC SCH 80 TOE NIPPLE OR NIPPLE (LENGTH AS REQUIRED)
O. HARCO DUCTILE IRON IPS SWIVEL JOINT LATERAL 90-DEGREE (MALE NPT X MALE SWIVEL)
P. PVC SCH 80 UNION
Q. BRICK (1 OF 4)
R. PVC MAINLINE
S. TWO-WIRE CABLE
T. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
U. HARCO DUCTILE IRON IPS SWIVEL JOINT LATERAL CONNECTION TEE
V. 1" PVC SCH 40 CONDUIT AND LONG RADIUS SWEEP EL. (TYPICAL)
W. PVC SCH 40 MALE ADAPTER
X. PVC SCH 80 CLOSE NIPPLE (1 OF 3)
Y. GROUNDING ROD (SEE DECODER GROUNDING SCHEMATIC)
Z. HARCO DUCTILE IRON IPS THREADED COUPLING

NOTES:
1. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
2. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX. FABRIC MUST EXTEND ACROSS BOTTOM OF VALVE BOX BENEATH THE GRAVEL.
3. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
4. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
5. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
6. 30" OF WIRE MUST ME PROVIDED ON BOTH THE INCOMING AND OUTGOING WIRE PATHS. THESE LENGTHS MAY BE COILED TOGETHER OR SEPARATELY.
7. TWO-WIRE CONDUIT STUBS INTO AND OUT OF THE VALVE BOX MUST NOT INTERFERE WITH SERVICING UNION CONNECTIONS, OPERATION OF BALL VALVE OR ACCESS TO SOLENIOD VALVE COMPONENTS.
8. SEE DECODER GROUNDING SCHEMATIC FOR ADDITIONAL DECODER GROUNDING INFORMATION.
9. TWO-WIRE (2-WIRE, 2W) FIELD WIRING SHOWN. DETAIL SHALL ALSO BE USED FOR CONVENTIONALLY WIRED SYSTEMS. TWO-WIRE PATH, DEVICES AND GROUNDING COMPONENTS ARE NOT USED FOR CONVENTIONAL WIRING.

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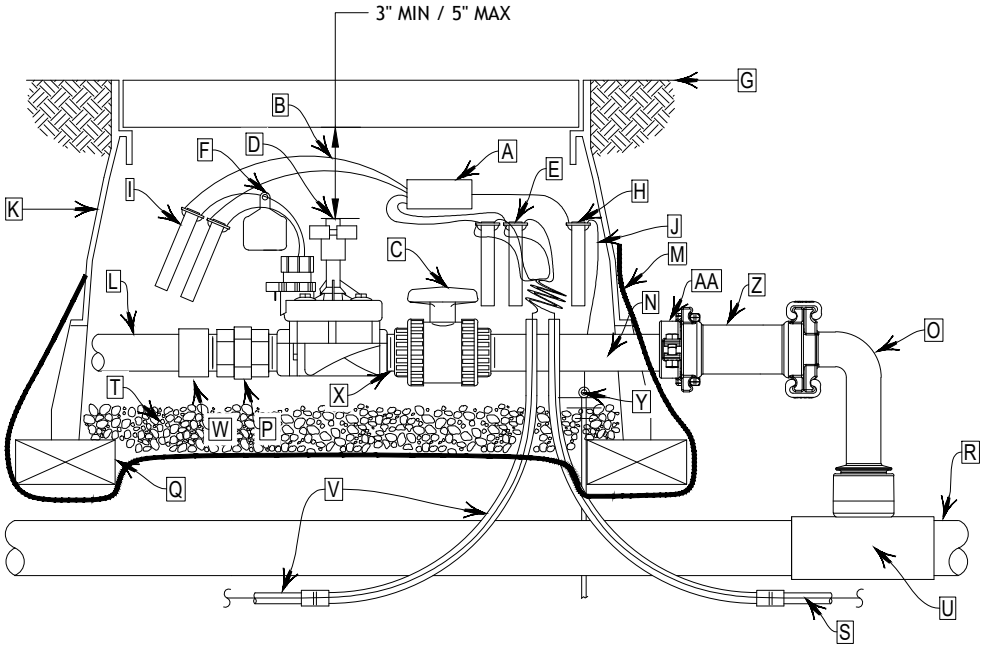
REMOTE CONTROL VALVE ASSEMBLY (MALE NPT X MALE SWIVEL)

DATE: March 2025

DRAWING NO. 02920-19

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



NOTES:

1. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
2. I NSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX. FABRIC MUST EXTEND ACROSS BOTTOM OF VALVE BOX BENEATH THE GRAVEL.
3. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
4. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
5. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
6. 30" OF WIRE MUST ME PROVIDED ON BOTH THE INCOMING AND OUTGOING WIRE PATHS. THESE LENGTHS MAY BE COILED TOGETHER OR SEPARATELY.
7. TWO-WIRE CONDUIT STUBS INTO AND OUT OF THE VALVE BOX MUST NOT INTERFERE WITH SERVICING UNION CONNECTIONS, OPERATION OF BALL VALVE OR ACCESS TO SOLENIOD VALVE COMPONENTS.
8. SEE DECODER GROUNDING SCHEMATIC FOR ADDITIONAL DECODER GROUNDING INFORMATION.
9. TWO-WIRE (2-WIRE, 2W) FIELD WIRING SHOWN. DETAIL SHALL ALSO BE USED FOR CONVENTIONALLY WIRED SYSTEMS. TWO-WIRE PATH, DEVICES AND GROUNDING COMPONENTS ARE NOT USED FOR CONVENTIONAL WIRING.

A. DECODER
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. PVC TRUE-UNION BALL VALVE
D. REMOTE CONTROL VALVE
E. WIRE CONNECTOR FROM TWO-WIRE CABLE TO DECODER (1 OF 2)
F. CHRISTY ID TAG
G. FINISH GRADE
H. WIRE CONNECTOR FROM DECODER GROUND WIRE TO BARE COPPER GROUNDING WIRE
I. WIRE CONNECTOR FROM DECODER TO SOLENOID VALVE (1 OF 2)
J. BARE COPPER GROUNDING WIRE TO GROUNDING PLATE/ROD SEE SPECIFICATIONS
K. JUMBO VALVE BOX WITH COVER AND ADDITIONAL BOXES/EXTENSIONS AS REQUIRED
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. PVC SCH 80 TOE NIPPLE OR SCH 80 PIPE (LENGTH AS REQUIRED)
O. HARCO DUCTILE IRON IPS SWIVEL JOINT LATERAL 90-DEGREE (SPIGOT X MALE SWIVEL)
P. PVC SCH 80 UNION
Q. BRICK (1 OF 4)
R. PVC MAINLINE
S. TWO-WIRE CABLE
T. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
U. HARCO DUCTILE IRON IPS SWIVEL JOINT LATERAL CONNECTION TEE
V. 1" PVC SCH 40 CONDUIT AND LONG RADIUS SWEEP EL. (TYPICAL)
W. PVC SCH 40 MALE ADAPTER
X. PVC SCH 80 CLOSE NIPPLE (1 OF 3)
Y. GROUNDING ROD (SEE DECODER GROUNDING SCHEMATIC)
Z. HARCO DUCTILE IRON IPS KNOCK REPAIR COUPLING SECURED TO LATERAL 90 WITH HARCO DUCTILE IRON IPS LINKS
AA. HARCO DUCTILE IRON IPS KNUCKLE JOINT RESTRAINT

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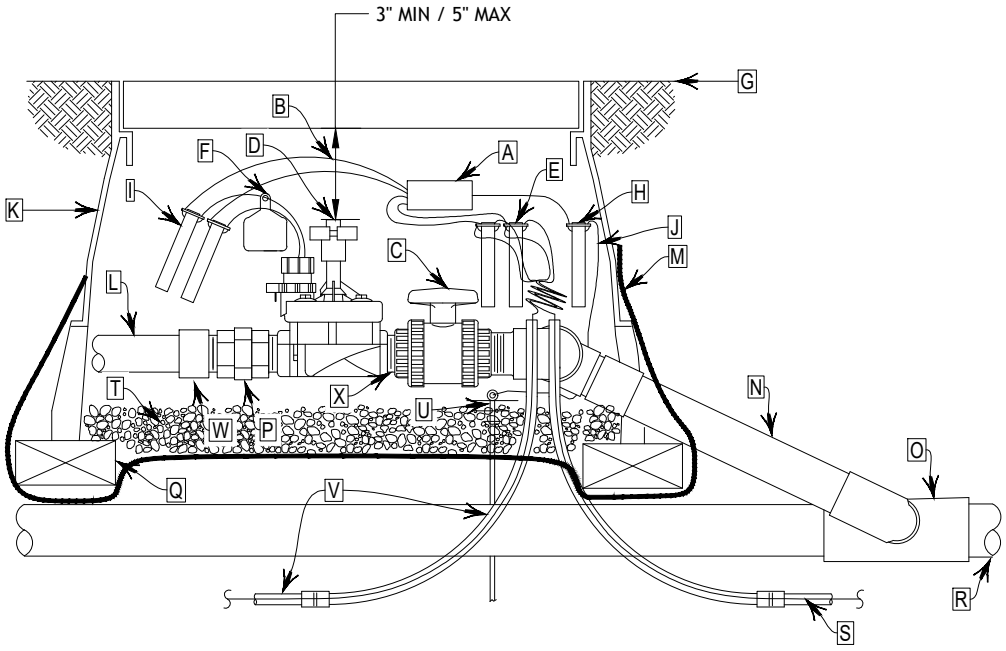
REMOTE CONTROL VALVE ASSEMBLY (SPIGOT X MALE SWIVEL)

DATE: March 2025

DRAWING NO. 02920-20

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. DECODER
B. WIRE FROM DECODER TO VALVE SEE SPECIFICATIONS
C. PVC TRUE-UNION BALL VALVE
D. REMOTE CONTROL VALVE
E. WIRE CONNECTOR FROM TWO-WIRE CABLE TO DECODER (1 OF 2)
F. CHRISTY ID TAG
G. FINISH GRADE
H. WIRE CONNECTOR FROM DECODER GROUND WIRE TO BARE COPPER GROUNDING WIRE
I. WIRE CONNECTOR FROM DECODER TO SOLENOID VALVE (1 OF 2)
J. BARE COPPER GROUNDING WIRE TO GROUNDING PLATE/ROD SEE SPECIFICATIONS
K. JUMBO VALVE BOX WITH COVER AND ADDITIONAL BOXES/EXTENSIONS AS REQUIRED
L. PVC LATERAL PIPE
M. FILTER FABRIC
N. PVC PREFABRICATED SWING JOINT (SIZE TO MATCH VALVE)
O. PVC SCH 40 TEE
P. PVC SCH 80 UNION
Q. BRICK (1 OF 4)
R. PVC MAINLINE
S. TWO-WIRE CABLE
T. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
U. GROUNDING ROD (SEE DECODER GROUNDING SCHEMATIC)
V. 1" PVC SCH 40 CONDUIT AND LONG RADIUS SWEEP EL. (TYPICAL)
W. PVC SCH 40 MALE ADAPTER
X. PVC SCH 80 CLOSE NIPPLE (1 OF 2)

NOTES:
1. NOMINAL SIZE OF ALL COMPONENTS ARE TO BE THE SAME NOMINAL SIZE AS THE SOLENOID VALVE (SIZED AS SHOWN).
2. INSTALL FILTER FABRIC AROUND EXTERIOR OF VALVE BOX. USE DUCT TAPE TO SECURE FABRIC TO PIPE AND VALVE BOX. FABRIC MUST EXTEND ACROSS BOTTOM OF VALVE BOX BENEATH THE GRAVEL.
3. TRANSITION TO PROPER LATERAL PIPE BURIAL DEPTH USING 45° ELBOW FITTINGS DOWNSTREAM OF REMOTE CONTROL VALVE ASSEMBLY.
4. DO NOT CUT OUT ENDS OF VALVE BOX UNNECESSARILY.
5. POSITION VALVE BOX OVER VALVE TO ALLOW ACCESS TO SOLENOID AND PROPER OPERATION OF BALL VALVE.
6. 30" OF WIRE MUST ME PROVIDED ON BOTH THE INCOMING AND OUTGOING WIRE PATHS. THESE LENGTHS MAY BE COILED TOGETHER OR SEPARATELY.
7. TWO-WIRE CONDUIT STUBS INTO AND OUT OF THE VALVE BOX MUST NOT INTERFERE WITH SERVICING UNION CONNECTIONS, OPERATION OF BALL VALVE OR ACCESS TO SOLENIOD VALVE COMPONENTS.
8. SEE DECODER GROUNDING SCHEMATIC FOR ADDITIONAL DECODER GROUNDING INFORMATION.
9. TWO-WIRE (2-WIRE, 2W) FIELD WIRING SHOWN. DETAIL SHALL ALSO BE USED FOR CONVENTIONALLY WIRED SYSTEMS. TWO-WIRE PATH, DEVICES AND GROUNDING COMPONENTS ARE NOT USED FOR CONVENTIONAL WIRING.

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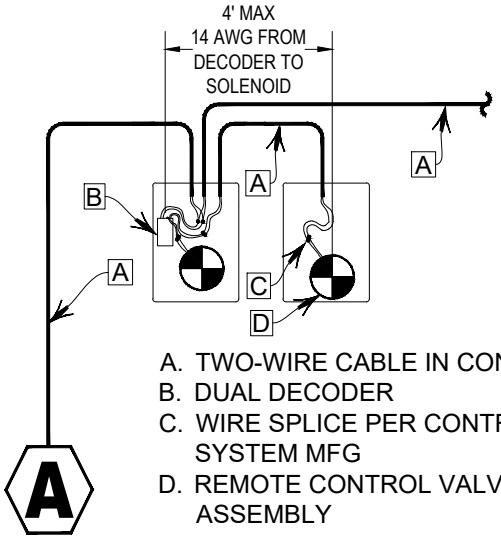
REMOTE CONTROL VALVE ASSEMBLY (SWING JOINT)

DATE: March 2025

DRAWING NO. 02920-21

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. TWO-WIRE CABLE IN CONDUIT
B. DUAL DECODER
C. WIRE SPLICE PER CONTROL SYSTEM MFG
D. REMOTE CONTROL VALVE ASSEMBLY

NOTES:
1. ALL WIRE CONNECTION SHALL BE MADE WITH APPROVED CONNECTORS.
2. MAKE ALL WIRE SPLICES IN VALVE BOXES.
3. PROVIDE 30" OF ADDITIONAL CONTROL WIRE/CABLE ON BOTH THE INCOMING AND OUTGOING WIRE PATHS AT EACH REMOTE CONTROL VALVE ASSEMBLY, TWO WIRE DEVICE, OR OTHER ELECTRICALLY CONTROLLED IN GROUND COMPONENT. THESE LENGTH MAYBE COILED TOGETHER OR SEPARATELY

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TWO STATION DECODER SCHEMATIC

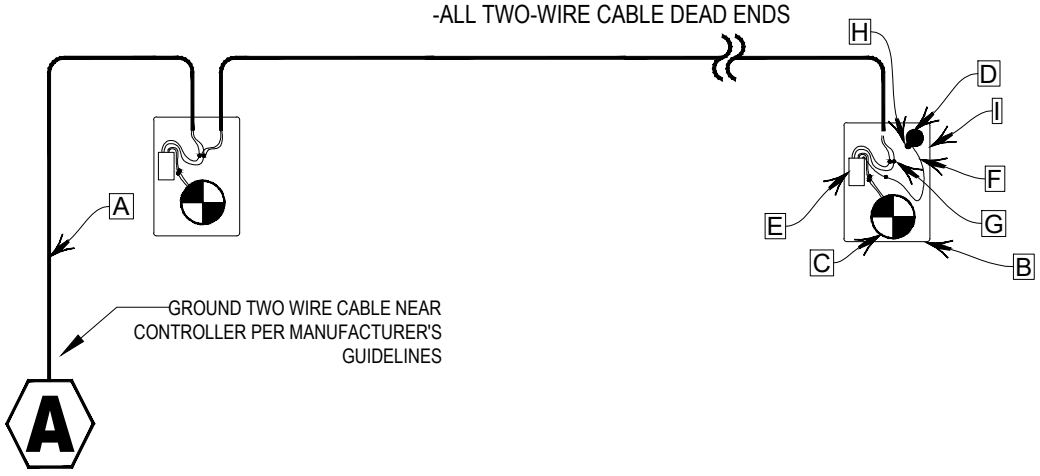
DATE: March 2025

DRAWING NO. 02920-22

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

GROUND RODS TO BE INSTALLED AT:
-THE CONTROLLER
-THE DECODER CLOSEST TO EVERY 300' OF WIRE RUN
-THE LAST DECODER OF EACH WIRE RUN
-ALL TWO-WIRE CABLE DEAD ENDS



NOTES:
1. ALL WIRE CONNECTION SHALL BE MADE WITH APPROVED CONNECTORS.
2. MAKE ALL WIRE SPLICES IN VALVE BOXES.
3. PROVIDE 30" OF ADDITIONAL CONTROL WIRE/CABLE ON BOTH THE INCOMING AND OUTGOING WIRE PATHS AT EACH REMOTE CONTROL VALVE ASSEMBLY, TWO WIRE DEVICE, OR OTHER ELECTRICALLY CONTROLLED IN GROUND COMPONENT. THESE LENGTHS MAYBE COILED TOGETHER OR SEPARATELY..
4. TEST EARTH TO GROUND RESISTANCE AT ALL GROUND POINTS.
5. EARTH TO GROUND RESISTANCE MUST MEET OR EXCEED MANUFACTURER REQUIREMENTS.
6. INSTALL ALL GROUND ASSEMBLIES IN VALVE BOXES.
7. INSTALL GROUNDING EQUIPMENT AS INDICATED ON THE IRRIGATION DOCUMENTS AND AS RECOMMENDED BY THE MANUFACTURER.

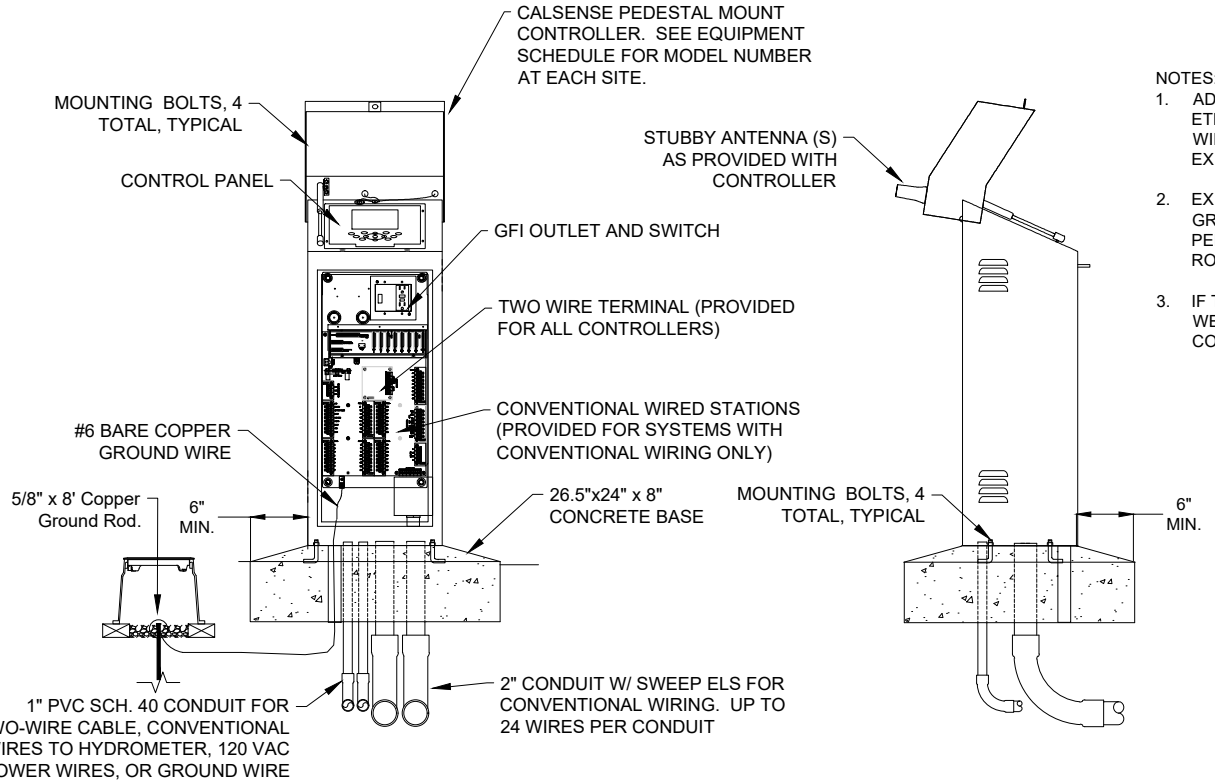
A. TWO-WIRE CABLE
B. RCV VALVE BOX REMOTE CONTROL VALVE
C. 5/8" X 8' U.L. LISTED GROUND ROD
D. DECODER
E. BARE AWG #6 COPPER WIRE
F. WIRE SPLICE PER CONTROL SYSTEM MFG
G. BARE COPPER CONNECTION ("CADWELD")
H. REMOTE CONTROL VALVE ASSEMBLY

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DECODER GROUNDING SCHEMATIC

DATE: March 2025
DRAWING NO. 02920-23

DRAWN BY: Drawn By Initials
APPROVED BY: CITY ENGINEER JS



NOTES:

1. ADDITIONAL CONDUITS MAY EXIST OR BE REQUIRED FOR AN ETHERNET CABLE, MASTER VALVE WIRING, RAIN BUCKET WIRING, OR OTHER DEVICE. PROVIDE AND/OR MODIFY EXISTING AS REQUIRED.
2. EXISTING GROUND RODS CAN BE USED. VERIFY THAT THE GROUND ROD HAS A RESISTANCE OF LESS THAN 10 OHMS PER CALSENSE REQUIREMENTS. INSTALL A NEW GROUND ROD OR GROUND PLATE IF REQUIRED.
3. IF THE EXISTING GROUND ROD IS USABLE, INSTALL A CAD WELD CONNECTION AT THE GROUND ROD TO THE #8 BARE COPPER WIRE.

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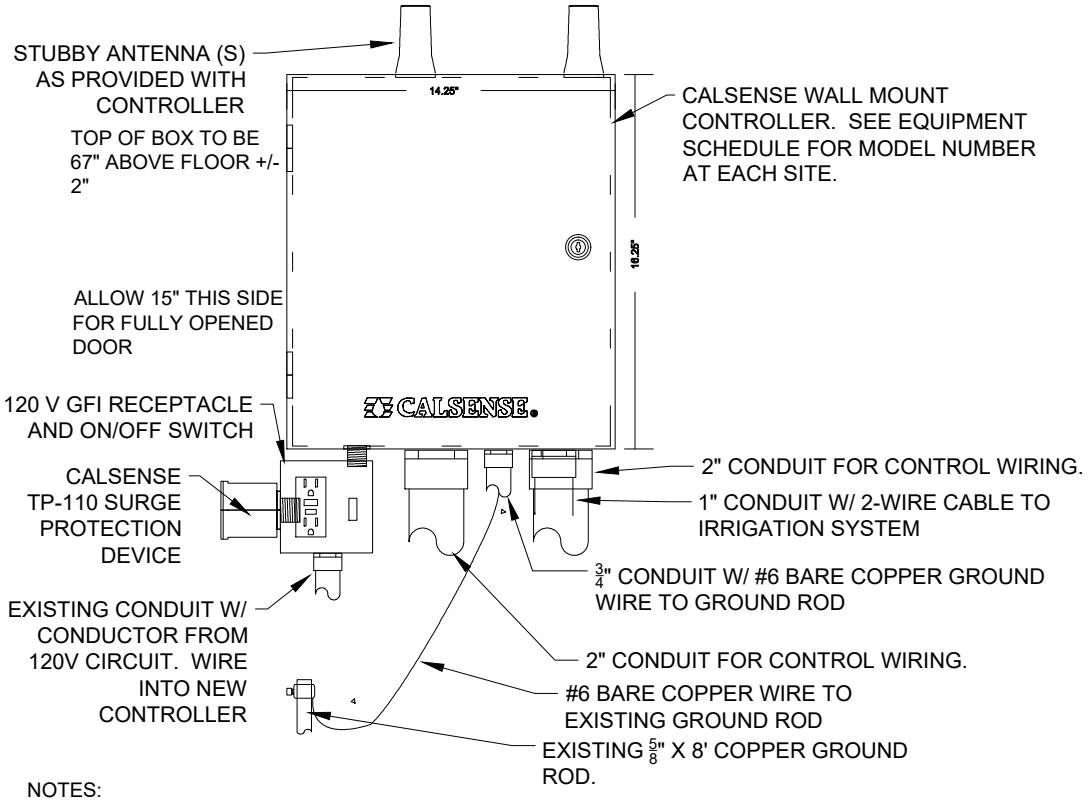
PEDESTAL MOUNTED CONTROLLER ASSEMBLY

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-24



NOTES:

1. ADDITIONAL CONDUITS MAY EXIST OR BE REQUIRED FOR AN ETHERNET CABLE, MASTER VALVE WIRING, RAIN BUCKET WIRING, OR OTHER DEVICE. PROVIDE AND/OR MODIFY EXISTING AS REQUIRED.

2. EXISTING GROUND RODS CAN BE USED. VERIFY THAT THE GROUND ROD HAS A RESISTANCE OF LESS THAN 10 OHMS PER CALSENSE REQUIREMENTS. INSTALL A NEW GROUND ROD OR GROUND PLATE IF REQUIRED.

3. IF THE EXISTING GROUND ROD IS USABLE, INSTALL A CAD WELD CONNECTION AT THE GROUND ROD TO THE #8 BARE COPPER WIRE.

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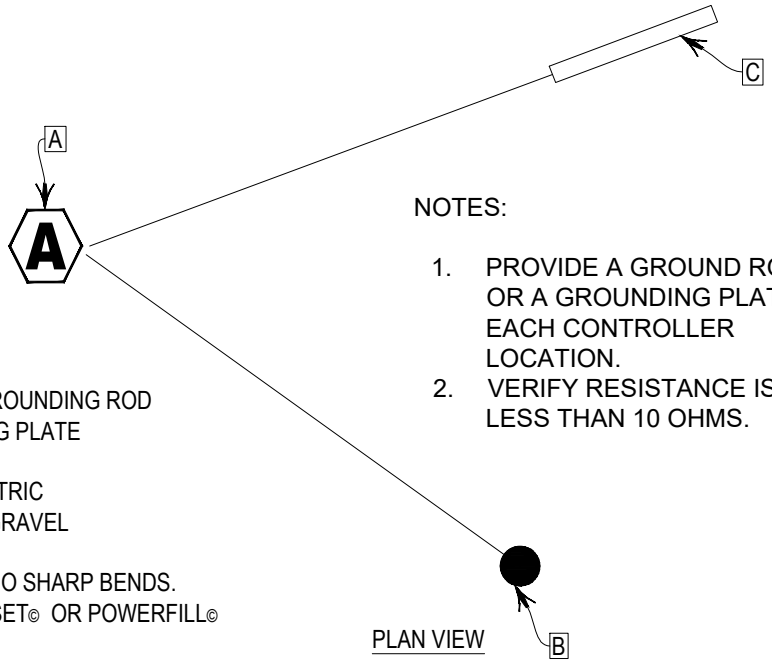
WALL MOUNTED CONTROLLER ASSEMBLY

DATE: March 2025

DRAWING NO. 02920-25

DRAWN BY: Drawn By Initials

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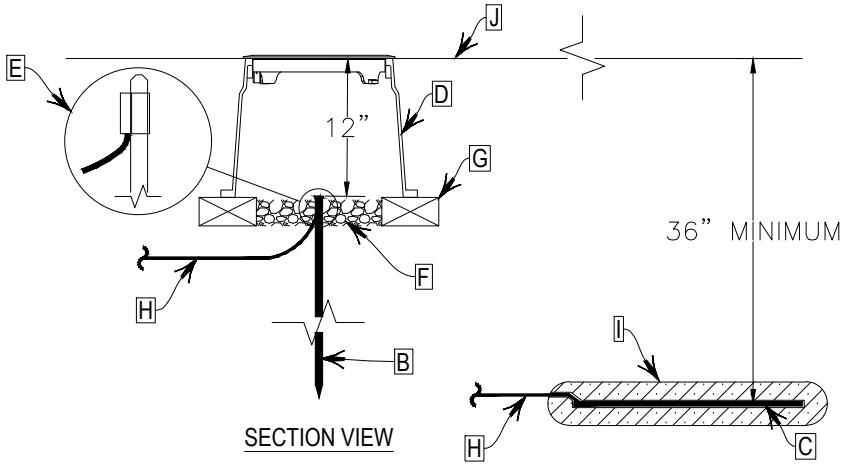


PLAN VIEW

NOTES:

1. PROVIDE A GROUND ROD OR A GROUNDING PLATE AT EACH CONTROLLER LOCATION.
2. VERIFY RESISTANCE IS LESS THAN 10 OHMS.

A. IRRIGATION CONTROLLER ASSEMBLY
B. UL LISTED 5/8" X 10' COPPER-CLAD GROUNDING ROD
C. UL LISTED 4" X 8' COPPER GROUNDING PLATE
D. 10" ROUND VALVE BOX WITH COVER
E. CADWELD CONNECTION: PAIGE ELECTRIC
F. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
G. BRICK (1 OF 4)
H. #6 AWG BARE SOLID COPPER WIRE. NO SHARP BENDS.
I. EARTH CONTACT MATERIAL, POWERSET© OR POWERFILL© DEPENDING ON SOIL CONDITIONS
J. FINISH GRADE



SECTION VIEW

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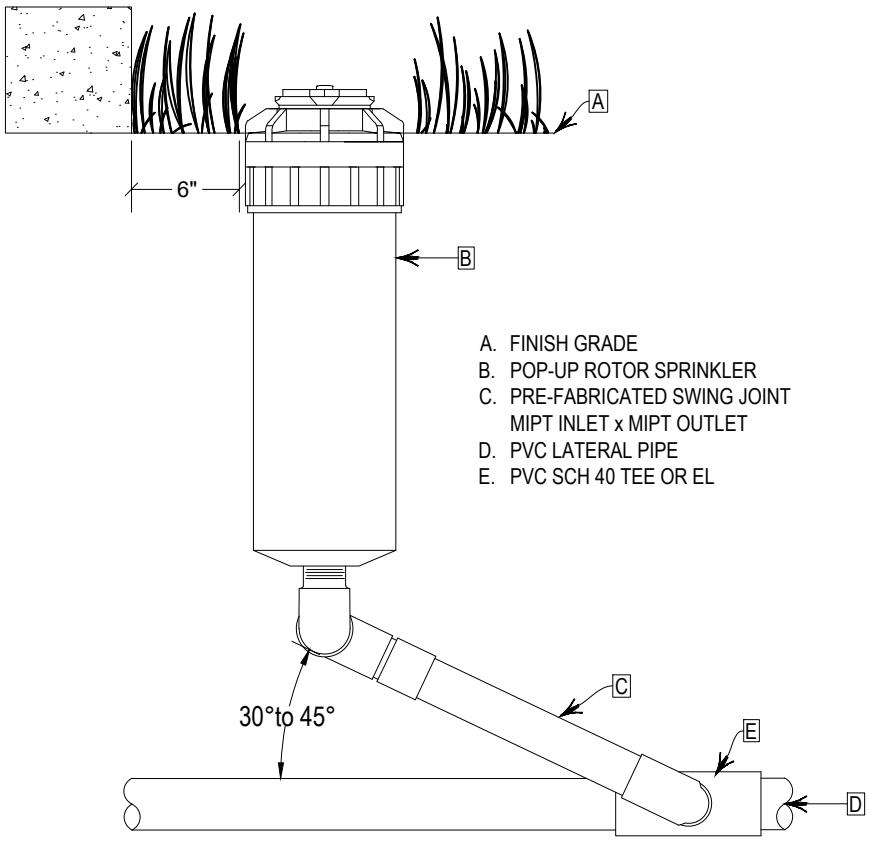
CONTROLLER GROUNDING

DATE: March 2025

DRAWING NO. 02920-26

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. FINISH GRADE
B. POP-UP ROTOR SPRINKLER
C. PRE-FABRICATED SWING JOINT
MIPT INLET x MIPT OUTLET
D. PVC LATERAL PIPE
E. PVC SCH 40 TEE OR EL

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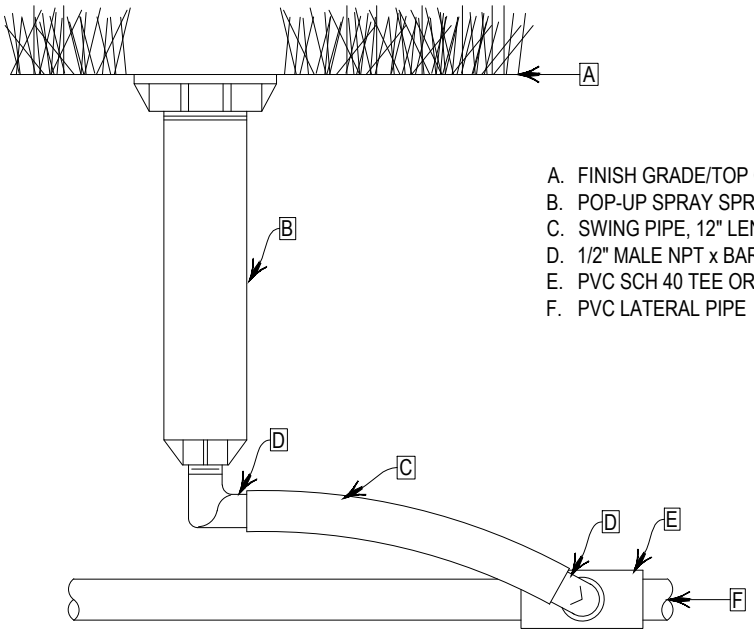
POP-UP ROTOR SPRINKLER ASSEMBLY

DATE: March 2025

DRAWING NO. 02920-27

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. FINISH GRADE/TOP OF MULCH
B. POP-UP SPRAY SPRINKLER
C. SWING PIPE, 12" LENGTH
D. 1/2" MALE NPT x BARB EL
E. PVC SCH 40 TEE OR EL
F. PVC LATERAL PIPE

NOTES:
1. CHECK VALVE AND PRESSURE REGULATION REQUIRED ON ALL SPRAY SPRINKLERS.
2. 6" MINIMUM POP-UP HEIGHT.
3. 12" POP-UP HEIGHT FOR PLANTERS AND SHRUB BEDS.

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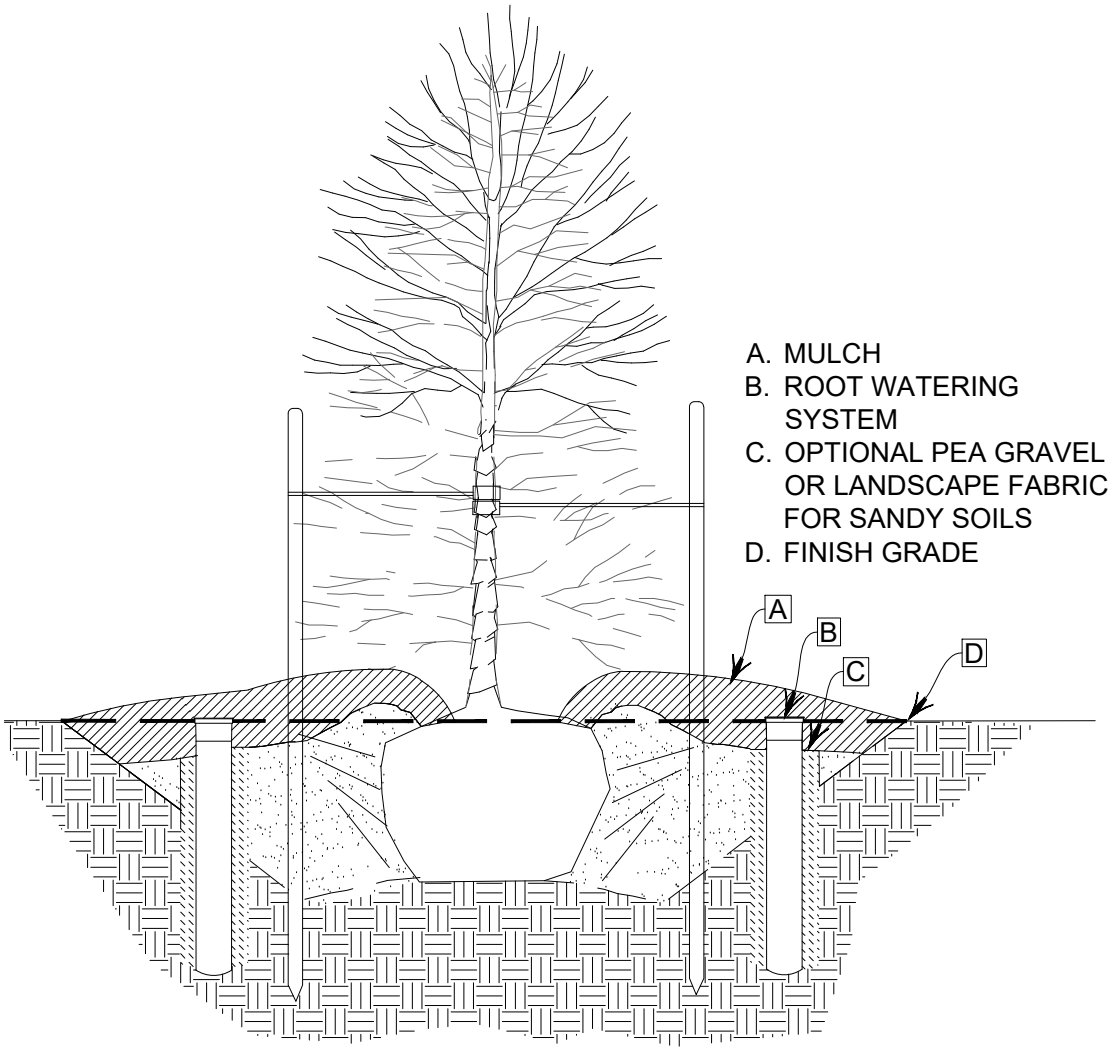
POP-UP SPRAY SPRINKLER ASSEMBLY

DATE: March 2025

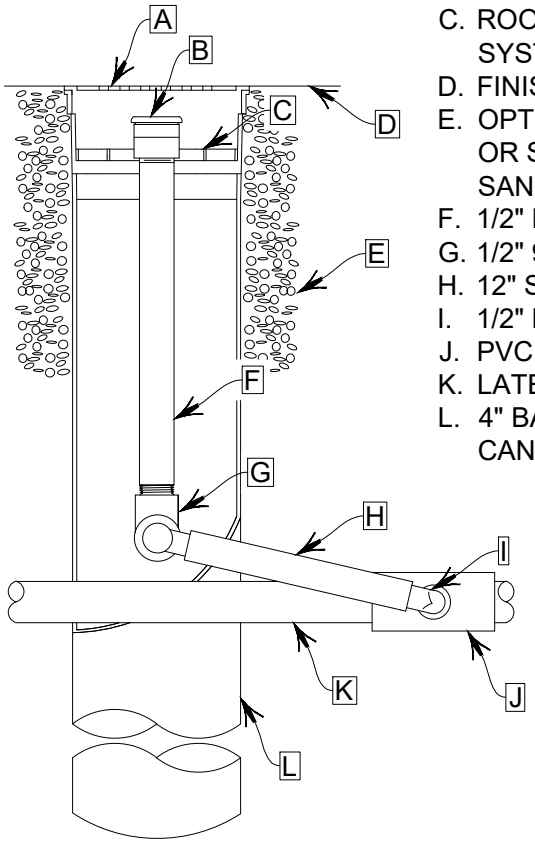
DRAWING NO. Drawing 02920-28

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS



A. MULCH
B. ROOT WATERING SYSTEM
C. OPTIONAL PEA GRAVEL OR LANDSCAPE FABRIC FOR SANDY SOILS
D. FINISH GRADE



A. 4" GRATE
B. BUBBLER W/ CHECK VALVE
C. ROOT WATERING SYSTEM
D. FINISH GRADE
E. OPTIONAL PEA GRAVEL OR SAND SOCK FOR SANDY SOILS
F. 1/2" PVC SCH 80 NIPPLE
G. 1/2" 90-DEGREE ELBOW
H. 12" SWING ASSEMBLY
I. 1/2" MALE NPT INLET
J. PVC SCH 40 TEE OR EL
K. LATERAL PIPE
L. 4" BASKET WEAVE CANISTER

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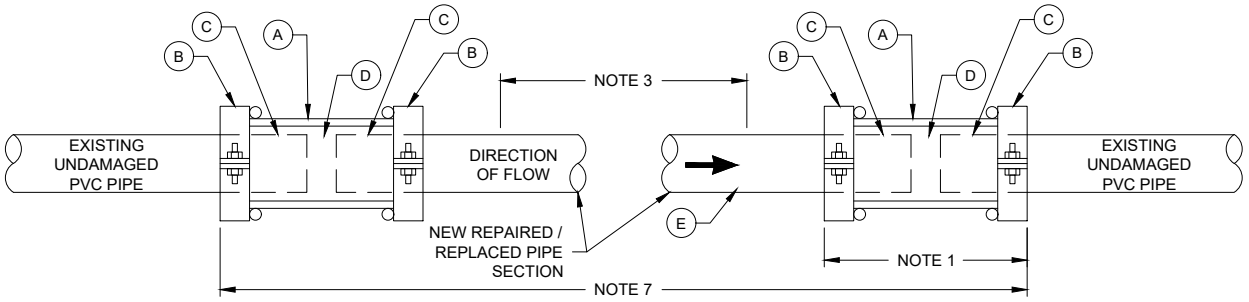
TREE ROOT WATERING ASSEMBLY

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-29



NOTES:

1. ACTUAL FITTING DIMENSIONS MAY VARY, REFER TO MANUFACTURER INSTRUCTIONS.
2. FOR PVC PIPE SIZES GREATER THAN 2-1/2-INCHES IPS, GASKETED BELL END PIPE MAY BE USED.
3. PROVIDE ADDITIONAL PIPE TO PIPE RESTRAINT PER MANUFACTURER'S SPECIFICATIONS AS REQUIRED FOR GASKETED PIPE. SEE JOINT RESTRAINT DETAIL.
4. USE DEEP BELL DUCTILE IRON FITTINGS OF GRADE 65-45-12 IN ACCORDANCE WITH ATSM A536.
5. USE FOR PVC PIPE GREATER THAN OR EQUAL TO 2-INCHES IPS.
6. KNUCKLE STYLE RESTRAINTS SHOWN MAY SUBSTITUTE FOR CLAMSHELL STYLE.
7. IF PIPE RUN "E" IS LESS THAN 20 CONTINUOUS LINEAR FEET, MAY SUBSTITUTE ONE ITEM "A" FOR SCHEDULE 40 PVC SLIPxSLIP COUPLING.

(A) HARCO REPAIR COUPLING SIZED TO MATCH EXISTING PIPE SIZE

(B) HARCO FITTING TO PIPE RESTRAINT (SEE NOTE 6)

(C) MINIMUM PENETRATION OF 3 INCHES INTO COUPLING

(D) MAXIMUM GAP OF 3.5 INCHES PIPE END TO PIPE END

(E) REPLACED / REPAIRED PIPE LENGTH WILL VARY

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IN-LINE MAINLINE/LATERAL PIPE FAILURE REPAIR (2 - INCH AND LARGER)

DRAWN BY: Drawn By Initials

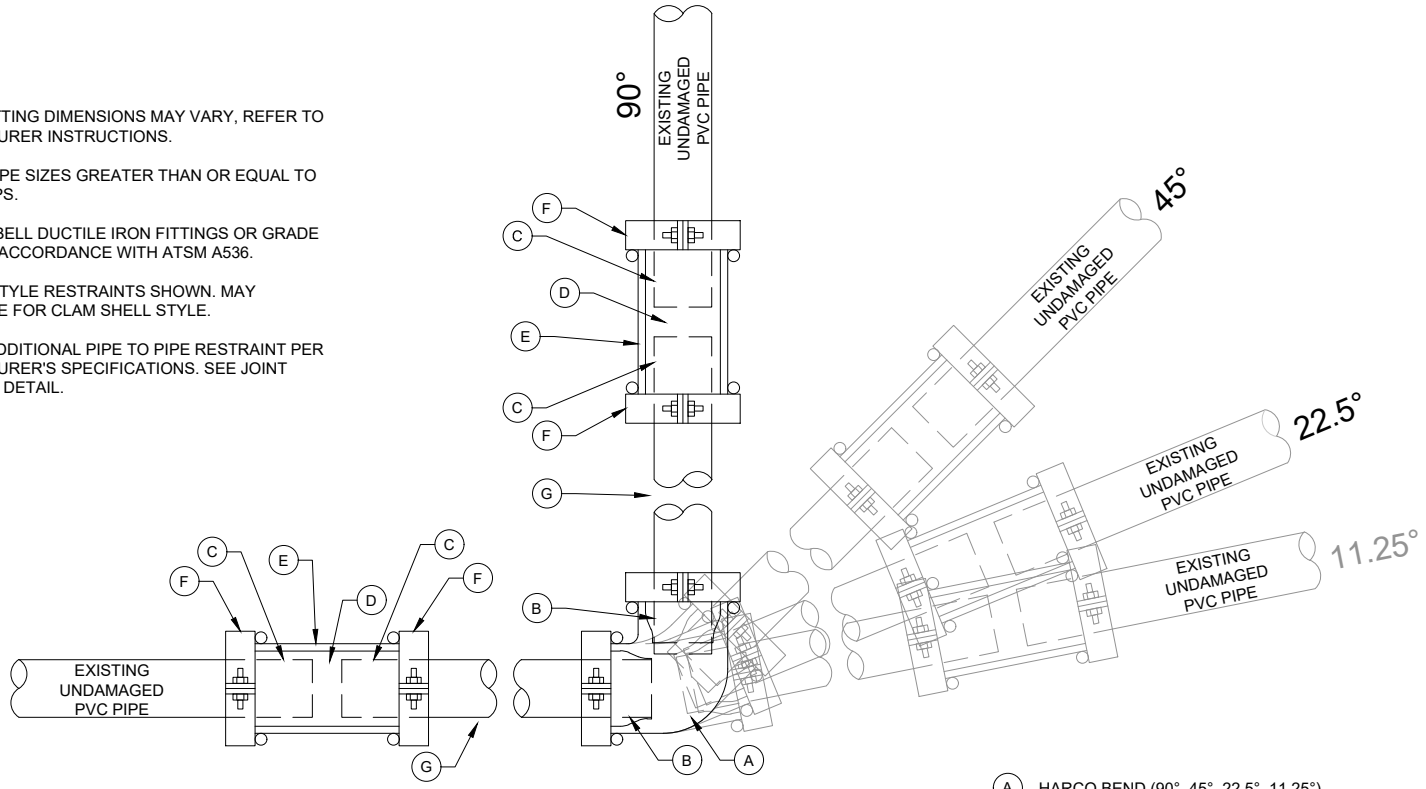
APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-30

NOTES:

1. ACTUAL FITTING DIMENSIONS MAY VARY, REFER TO MANUFACTURER INSTRUCTIONS.
2. USE FOR PIPE SIZES GREATER THAN OR EQUAL TO 2-INCHES IPS.
3. USE DEEP BELL DUCTILE IRON FITTINGS OR GRADE 65-45-12 IN ACCORDANCE WITH ATSM A536.
4. KNUCKLE STYLE RESTRAINTS SHOWN. MAY SUBSTITUTE FOR CLAM SHELL STYLE.
3. PROVIDE ADDITIONAL PIPE TO PIPE RESTRAINT PER MANUFACTURER'S SPECIFICATIONS. SEE JOINT RESTRAINT DETAIL.



- (A) HARCO BEND (90°, 45°, 22.5°, 11.25°)
- (B) PENETRATION OF PIPE INTO BELL ENDS WILL VARY, MAINTAIN MAZIMUM GAP OF 1/2 INCH BETWEEN PIPE END AND BELL STOP
- (C) MINIMUM PENETRATION OF 3 INCHES INTO COUPLING
- (D) MAXIMUM GAP OF 3.5 INCHES PIPE END TO PIPE END
- (E) HARCO REPAIR COUPLING SIZED TO PIPE IN PLACE X 2
- (F) HARCO JOINT RESTRAINT KNUCKLE X 6
- (G) REPLACED / REPAIRED PVC PIPE LENGTH AS REQUIRED

City Of Gillette
ENGINEERING DIVISION
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PHONE: (307) 686-5311

BEND MAINLINE/LATERAL PIPE FAILURE REPAIR (2 - INCH AND LARGER)

DRAWN BY: Drawn By Initials

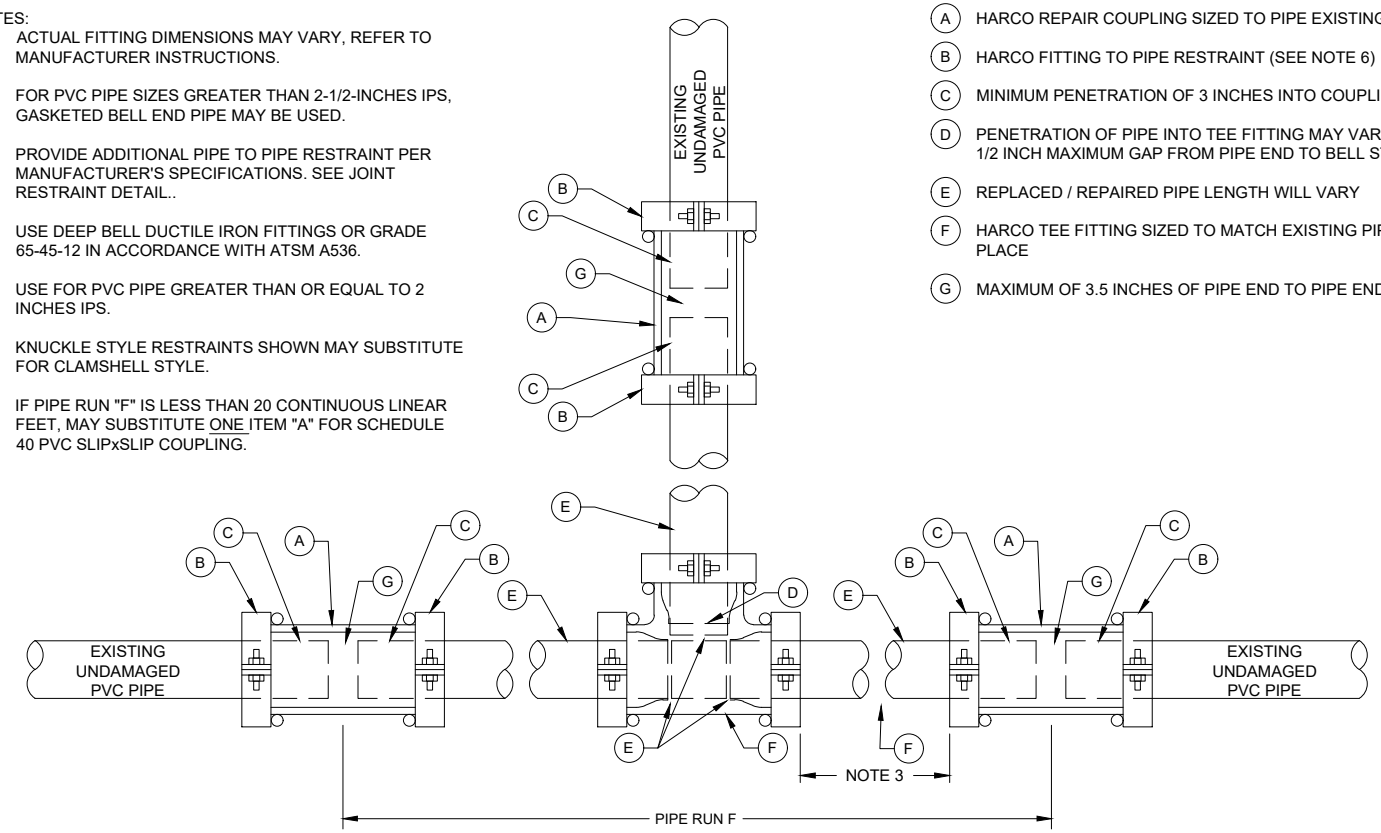
APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-31

NOTES:

1. ACTUAL FITTING DIMENSIONS MAY VARY, REFER TO MANUFACTURER INSTRUCTIONS.
2. FOR PVC PIPE SIZES GREATER THAN 2-1/2-INCHES IPS, GASKETED BELL END PIPE MAY BE USED.
3. PROVIDE ADDITIONAL PIPE TO PIPE RESTRAINT PER MANUFACTURER'S SPECIFICATIONS. SEE JOINT RESTRAINT DETAIL..
4. USE DEEP BELL DUCTILE IRON FITTINGS OR GRADE 65-45-12 IN ACCORDANCE WITH ATSM A536.
5. USE FOR PVC PIPE GREATER THAN OR EQUAL TO 2 INCHES IPS.
6. KNUCKLE STYLE RESTRAINTS SHOWN MAY SUBSTITUTE FOR CLAMSHELL STYLE.
7. IF PIPE RUN "F" IS LESS THAN 20 CONTINUOUS LINEAR FEET, MAY SUBSTITUTE ONE ITEM "A" FOR SCHEDULE 40 PVC SLIPxSLIP COUPLING.



(A) HARCO REPAIR COUPLING SIZED TO PIPE EXISTING IN PLACE

(B) HARCO FITTING TO PIPE RESTRAINT (SEE NOTE 6)

(C) MINIMUM PENETRATION OF 3 INCHES INTO COUPLING

(D) PENETRATION OF PIPE INTO TEE FITTING MAY VARY, MAINTAIN 1/2 INCH MAXIMUM GAP FROM PIPE END TO BELL STOP

(E) REPLACED / REPAIRED PIPE LENGTH WILL VARY

(F) HARCO TEE FITTING SIZED TO MATCH EXISTING PIPE SIZE IN PLACE

(G) MAXIMUM OF 3.5 INCHES OF PIPE END TO PIPE END

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TEE MAINLINE/LATERAL PIPE FAILURE REPAIR (2 - INCH AND LARGER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-32

NOTES:

1. FOR PVC MAINLINE PIPE SIZES GREATER THAN 2-1/2-INCHES IPS.
2. RCV ASSEMBLY SHOWN CORRESPONDS TO REMOTE CONTROL VALVE ASSEMBLY DETAILS.
3. DRAWING ASSUMES EXISTING LATERAL LINE GREATER THAN OR EQUAL TO 2-1/2-INCHES IPS. IF INSTALLING TO LATERAL LINE LESS THAN OR EQUAL TO 2-INCH IPS, ELIMINATE ITEM M.
4. PROVIDE ADDITIONAL PIPE TO PIPE RESTRAIN PER MANUFACTURER'S SPECIFICATIONS. SEE JOINT RESTRAINT DETAIL.
5. USE DEEP BELL DUCTILE IRON FITTINGS OF GRADE 65-45-12 IN ACCORDANCE WITH ATSM A536.
6. KNUCKLE STYLE RESTRAINTS SHOWN MAY SUBSTITUTE FOR CLAMSHELL STYLE.
7. IF PIPE RUN "F" IS LESS THAN 20 CONTINUOUS LINEAR FEET, MAY SUBSTITUTE ONE ITEM "A" FOR SCHEDULE 40 PVC SLIPxSLIP COUPLING.

(A) HARCO SWIVEL TEE SIZED TO EXISTING MAINLINE PIPE

(B) HARCO FITTING TO PIPE RESTRAINT (SEE NOTE 6)

(C) HARCO REPAIR COUPLING X 3

(D) MINIMUM PIPE PENETRATION OF 3 INCHES

(E) MAXIMUM 3.5 INCH GAP PIPE END TO PIPE END

(F) HARCO SWIVEL LATERAL 90 (MALE NPTxMALE SWIVEL)

(G) PVC SCHEDULE 80 NIPPLE, LENGTH AS REQUIRED (MINIMUM 6 INCHES), TBE

(H) PVC TRU-UNION BALL VALVE WITH STAINLESS STEEL REINFORCING ENDS

(I) PVC SCHEDULE 80 CLOSE NIPPLE, TBE

(J) REMOTE CONTROL VALVE MAXIMUM 2 INCH

(K) PVC SCHEDULE 80 UNION

(L) PVC LATERAL PIPE SIZED TO MATCH RCV (ITEM J) LENGTH AS REQUIRED NO TO EXCEED 20 LINEAR FEET

(M) HARCO SPIGOTxBELL END REDUCER SIZED TO EXISTING LATERAL AND RCV IF NECESSARY

(N) PENETRATION OF PIPE INTO BELL ENDS MAY VARY, MAINTAIN 1/2 INCH MAXIMUM GAP BETWEEN PIPE END AND BELL STOP

(O) HARCO RESTRAINT LINKS X 2

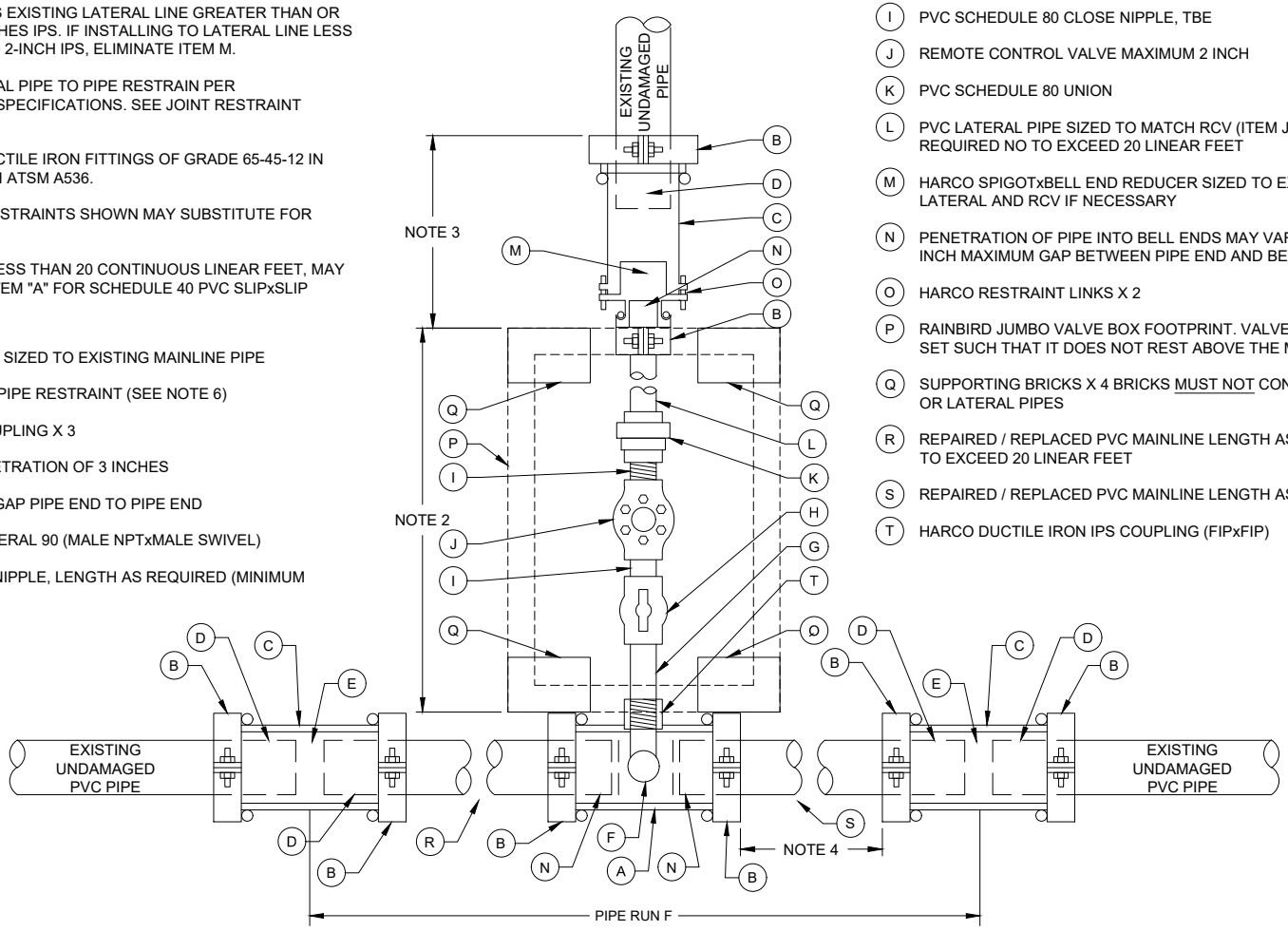
(P) RAINBIRD JUMBO VALVE BOX FOOTPRINT. VALVE BOX MUST BE SET SUCH THAT IT DOES NOT REST ABOVE THE MAINLINE PIPE

(Q) SUPPORTING BRICKS X 4 BRICKS MUST NOT CONTACT MAINLINE OR LATERAL PIPES

(R) REPAIRED / REPLACED PVC MAINLINE LENGTH AS REQUIRED NOT TO EXCEED 20 LINEAR FEET

(S) REPAIRED / REPLACED PVC MAINLINE LENGTH AS REQUIRED

(T) HARCO DUCTILE IRON IPS COUPLING (FIPxFIP)



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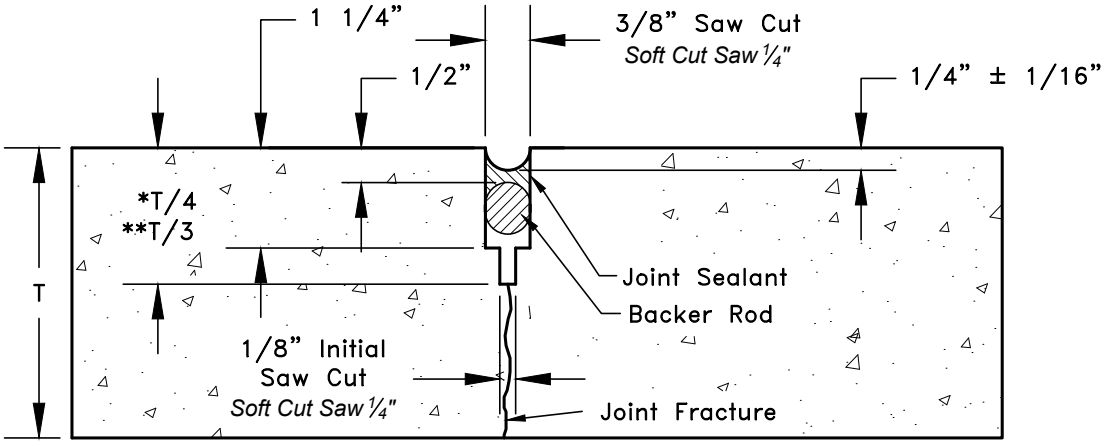
REMOTE CONTROL VALVE REPLACEMENT (2-INCH AND LARGER)

DRAWN BY: Drawn By Initials

APPROVED BY: CITY ENGINEER JS

DATE: March 2025

DRAWING NO. 02920-33

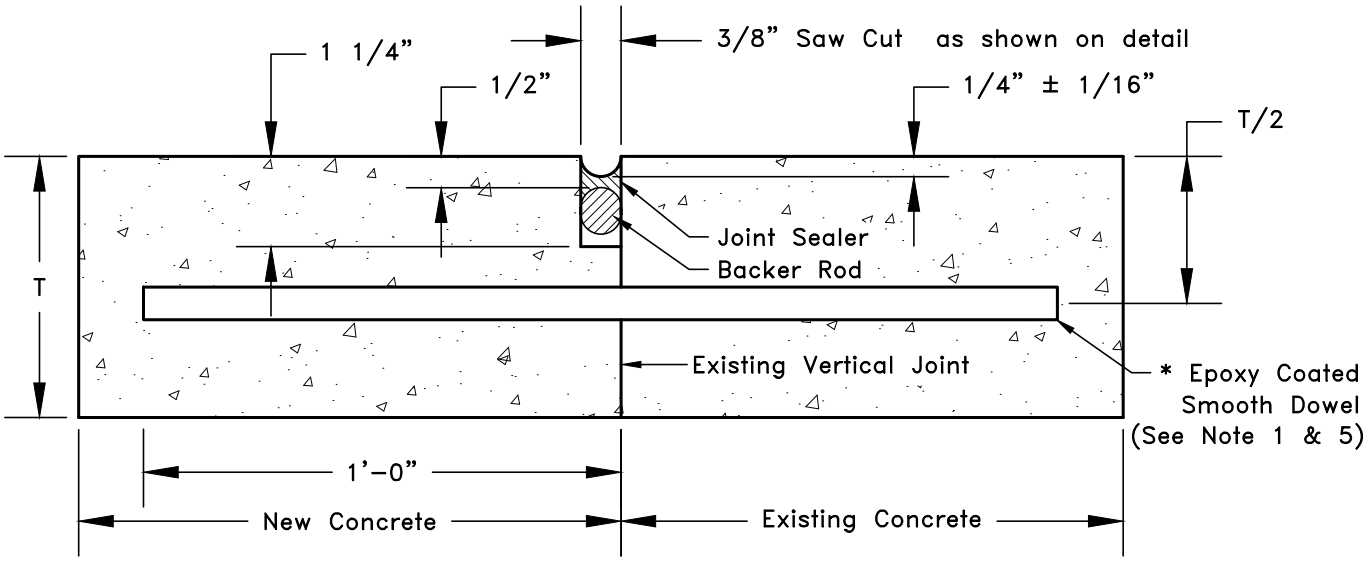


CONSTRUCTION AND NEW CONTRACTION TRANSVERSE WEAKENED PLANE JOINTS
(FOR INSTALLATION OF CONCRETE PAVING SECTIONS LESS THAN 7" IN THICKNESS)

* Slab Thickness Less Than 7": T/4
**Slab Thickness More Than 7": T/3

NOTES:

1. The initial saw cut may be 3/8" wide for the full T/3 and T/4 depth at the contractor's option.
2. See Typical Sections details for values of T.
3. All joint sealant shall be as specified in the specifications or special provisions.
4. If the transverse joints do not fracture at the joint on the outer edges of the slab, the ENGINEER may direct that the saw cut depth be increased for no additional payment.



CONSTRUCTION AND NEW CONTRACTION TRANSVERSE JOINTS
(FOR INSTALLATION OF CONCRETE PAVING SECTIONS 7" THICK & GREATER)
OR ON SECTIONS < 7"WHEN REQUIRED

NOTES:

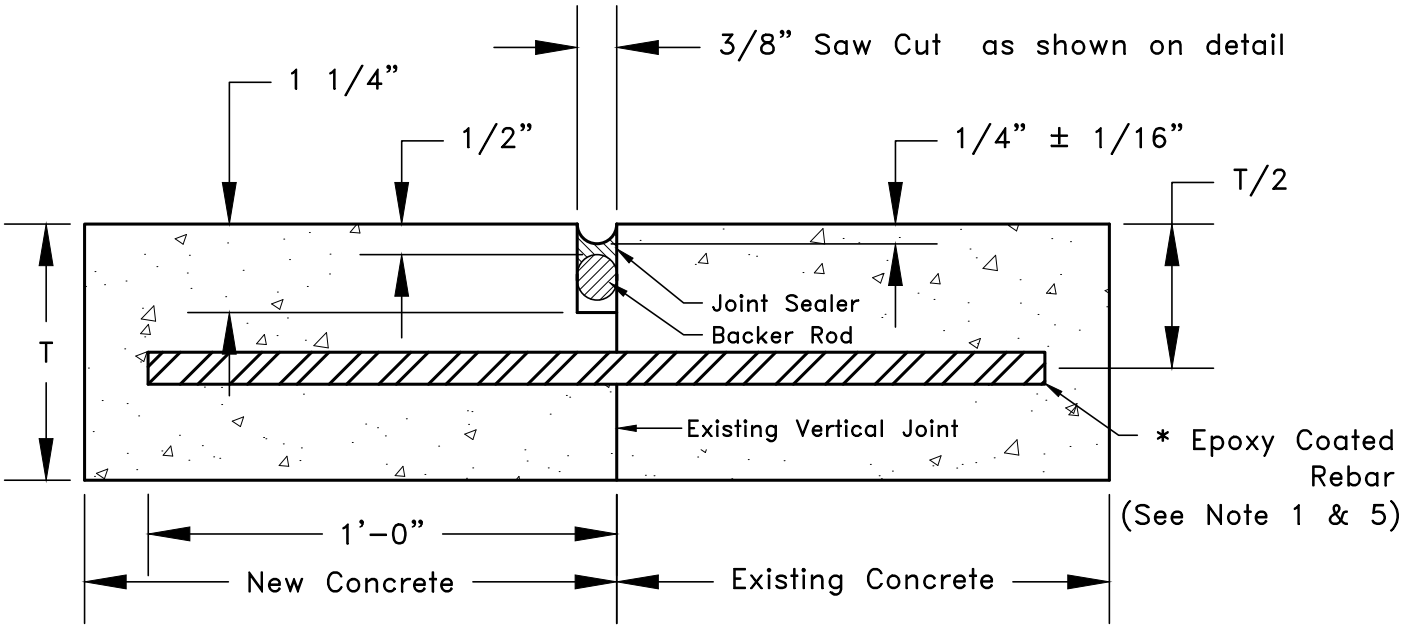
1. Drill hole for 1 $\frac{1}{4}$" Dia. x 24" steel *epoxy-coated Smooth Dowel Bars, (lightly greased on one end), @ 24" centers. Use #4 steel *epoxy-coated Smooth Dowel Bars for pavement sections < 7".
2. The first dowel bar shall be 6" from any concrete edge parallel to bar.
3. All joint sealant shall be as specified in the specifications or special provisions.
4. All backer rod shall be 1/2" closed cell polyethylene foam.

*5. Refer to Standard Construction Specs. Sections 2520 and 3200 for epoxy coating requirements.

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TRANSVERSE JOINT DETAILS

DRAWN BY: KEB
APPROVED BY: CITY ENGINEER HV/KDS
DATE: MAY 2017
DRAWING NO. 03251-01



* To be utilized for Mid-Panel Repair Joints

LONGITUDINAL CONTRACTION (NEW) AND/OR CONSTRUCTION JOINTS

NOTES:

1. Drill hole for #4 x 24" *epoxy-coated Rebar on 24" centers
2. All backer rod shall be 1/2" closed cell polyethylene foam.
3. The first tie bar shall be 6" from any concrete edge parallel to bar.
4. All joint sealant shall be as specified in the specifications or special provisions.

*5. Refer to Standard Construction Specs. Sections 2520 and 3200 for epoxy coating requirements.

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LONGITUDINAL JOINT DETAILS

DRAWN BY: E.G.

APPROVED BY: CITY ENGINEER HV/KDS

DATE: MARCH 2012

DRAWING NO. 03251-02

ADOPTING ORDINANCE

Gillette, Wyoming, Ordinance No. 4067

Approved by the Gillette City Council August 4, 2025.